Dementia and Chronic Disease

Management of Comorbid Medical Conditions

Angela Georgia Catic
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Chapter 1
Dementia and Chronic Disease in the Elderly

Angela Georgia Catic

Main Points

- As dementia progresses, many older adults require assistance performing activities of daily living and instrumental activities of daily living. Assistance from formal and informal caregivers is instrumental in helping the patient manage their health as independently as possible for the longest possible time.
- Many older adults suffer from one or more chronic diseases. In the setting of dementia, they often encounter difficulty performing disease self-management, which may exacerbate their chronic conditions.
- Patient priority–directed care aims to manage disease in a manner that is consistent with patient health outcome goals. Care plans are formulated according to what patients are able and willing to do to achieve their health outcome goals. As dementia progresses, the plan of care will need to be adjusted based on the patient's declining cognitive and functional abilities.
- Medical providers should be aware of and screen for caregiver burden, as well as positive aspects associated with providing care for older adults with dementia.

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Case Vignette: Mr. AC
Mr. AC is an 81-year-old man with past medical history significant for type 2 diabetes mellitus complicated by chronic kidney disease, hypertension, and hyperlipidemia. He lives alone in the community and is independent in his activities of daily living, light housekeeping, and medication management. He quit driving 6 months ago after having two minor accidents within 4 months. The Montreal Cognitive Assessment was performed following the accidents and Mr. AC scored 21/30 points. Of note, he completed 4 years of college and worked as an accountant. On pre-clinic labs, his medical provider notes that Mr. AC's hemoglobin A1C has increased from 6.5% 6 months earlier to 7.8%. Reviewing vital signs, prior to seeing the patient, the provider notes that the patient's blood pressure is poorly controlled, also a new concern. Going into the exam room, the provider is already considering increasing Mr. AC's antihypertensive and diabetic regimens.

Introduction

Dementia, also termed major neurocognitive disorder, is characterized by a decline in cognition from a prior level of function, which results in impairment in daily activities. Deficits may be noted in one or more areas of cognition including learning and memory, language, executive function, complex attention, perceptual-motor, and social cognition. Common etiologies of dementia in the elderly population include Alzheimer's disease, vascular dementia, Lewy body disease, Parkinson disease with dementia, and frontotemporal dementia. Reversible or partially reversible causes of dementia are less likely but, as there is the opportunity for improvement following treatment, it is important to evaluate for thyroid abnormalities, vitamin B12 deficiency, neurosyphilis, and normal pressure hydrocephalus.

The prevalence of dementia is staggering with ~50 million individuals living with the disease in 2017 [1]. It is anticipated that this number will double every 20 years and reach 131.5 million by 2050 [1]. As the disease progresses, individuals require increasing care leading to high economic and caregiving costs. In 2010, the estimated worldwide costs of dementia were $604 billion [2].

Chronic medical conditions are also common in older adults, with three of four individuals aged 65 years or older suffering from at least one chronic condition [3]. Chronic medical conditions are defined as those (1) lasting 1 year or longer and (2) requiring ongoing medical attention or limiting the activities of daily living [4]. Chronic medical conditions are more common in the geriatric population given the growing older adult population. Caring for individuals with chronic medical conditions is associated with a substantial healthcare cost, with those with multiple medical conditions accounting for 93% of total Medicare spending [5].

Older adults suffering from dementia and chronic medical conditions often face a variety of challenges, including changes in their abilities to perform daily

activities and to perform disease self-management. In addition, individuals with dementia will likely require the resources of supported care at some point in the disease trajectory. When caring for patients with dementia, healthcare providers should carefully consider each of these areas, including the impact on the patient and caregiver. The healthcare plan will need to be adapted throughout the course of dementia as disease severity increases and patient goals of care evolve.

Daily Functioning in Dementia

The ability to care for oneself is something most adults take for granted. However, it can be significantly impacted by dementia and chronic conditions. When considering the functional state of an older adult with dementia, it is important to clarify their living situation (i.e., single-family home versus supported living environment, single story dwelling versus need to utilize stairs, living with others versus independently). In addition, providers should confirm if older adults are independent, require assistance, or are dependent in activities of daily living (ADLs) and instrumental activities of daily living (IADLs) (Table 1.1) [6, 7]. During the course of cognitive decline, older adults often begin requiring increasing assistance with IADLs, often beginning with the need for assistance in financial management as mild cognitive dementia progresses or cognitive issues progress to mild dementia [8]. It is important for providers to recognize that many individuals with cognitive deficits lack insight, or may be entirely unaware, that they are having difficulty managing their IADLs. This can result in significant negative impacts including financial mismanagement, medication errors, and automobile accidents. If possible, it is beneficial for family members or friends to accompany older adults with cognitive concerns to visits so that they can provide corroborating information regarding the individual's daily function. As older adults with dementia begin to have difficulty managing their medications, it can have significant impacts on their overall health and chronic disease self-management. For example, individuals with dementia may take more than the prescribed dose of medication because they forget taking it previously or may fail to take medication. As a result, patients can present with

Table 1.1 Activities of daily living and instrumental activities of daily living

Activities of daily living	Instrumental activities of daily living
Bathing	Ability to use telephone
Dressing	Shopping
Toileting	Food preparation
Transferring	Housekeeping
Continence	Laundry
Feeding	Mode of transportation
	Responsibility for own medications
	Ability to handle finances

apparent poor control of chronic conditions (i.e., hypo or hyperglycemia, hypo or hypertension) leading providers to assume that adjustments are needed to the medication regimen. However, prior to adjusting medications, it is important for providers to evaluate for cognitive issues, especially deficits in executive function, which may be making it difficult for older adults to take their medications or engage in other self-care tasks as directed. In cases where cognitive issues are making it difficult for the patient to follow instructions, it is often helpful to simplify the treatment (i.e., changing from short-acting insulin with meals to an oral hypoglycemic) or, as the dementia progresses, enlisting the help of caregivers or visiting nurses to assist with medication management.

While older adults who require assistance with IADLs are often able to remain in their homes with appropriate supports, it is much more challenging for an individual to remain independent once they require assistance with ADLs. Dependence in basic ADLs, especially loss of continence, is a common reason for older adults to be transitioned to a long-term care facility with 65% of caregivers citing the older adult's "need for more skilled care" as the reason for institutionalization [9]. In cases where transfer to a supported care environment is not consistent with the patient/family goals, it is important for providers to work with caregivers to obtain appropriate home supports (i.e., visiting nurses, nonskilled services) as well as simplify medical care as consistent with patient goals for the ease of both the older adult and caregiver.

Management of Chronic Medical Conditions in Older Adults with Dementia

Providers caring for older adults with comorbid dementia and chronic medical conditions often face challenges regarding declining ability to perform disease self-management, modification of disease management based on patient priorities, and challenges regarding surrogate decision-making. However, consistent consideration of the patient's cognitive deficits and overall goals during formulation of the medical plan will enable providers to provide individualized, patient-centered care to older adults with dementia.

As cognitive deficits progress in older adults with mild cognitive impairment or dementia, they often encounter increasing challenging with disease self-management. This is because, from a cognitive perspective, self-management is a complicated task requiring complex physical, emotional, and cognitive abilities [10]. Lorig and Holman have organized self-management into five core processes: (1). problem solving – identifying problems and generating solutions, (2). decision-making – acting in response to changes in disease condition, (3). finding and utilizing appropriate resources, (4). working with healthcare professionals to make decisions about treatment, and (5). taking action [11]. Cognitive impairment can result in difficulties with all these processes, leading to significant negative impacts on chronic disease self-management. In addition, older adults with dementia often lack awareness of increasing difficulties with self-care tasks and medical providers

often over-estimate a patient's ability to manage their health until the dementia is significantly progressed [10]. Instead of assuming an older adult is non-adherent or has poor disease control, providers should evaluate for underlying cognitive impairment as a contributor to suboptimal management of chronic health conditions. In individuals with known dementia, providers should continuously evaluate the impact cognition is having on disease self-management and adjust treatment decisions accordingly throughout the course of cognitive decline.

When caring for an older adult with dementia and chronic comorbidities, it is important for providers to continually adjust medical care to ensure it is aligned with patient priorities. When possible, this should occur in conjunction with the older adult, but, as dementia progresses, patient priority–directed decision-making will often occur in conjunction with the surrogate decision maker. Patient priority–directed care – an alternative to disease-based care which often results in care that is fragmented and lacking accountability, of uncertain benefit and potential harm, burdensome, and may not focus on the patient priorities – aims to manage disease in a manner consistent with patient health outcome goals (e.g., function, social activities, symptom relief) [12]. Care plans are developed based on what patients are able and willing to do to achieve their health outcomes goals. While health outcome goals are often consistent over time, for example, an individual identifying remaining as independent as possible as a personal value, specific sub-goals regarding this and the impact of healthcare will change as dementia progresses. In the scenario of remaining independent, an individual may transition from a complex insulin regimen to oral hypoglycemics when diagnosed with mild cognitive impairment and later require assistance from family to organize a pill box as their dementia progresses.

Surrogate decision makers play an important role in the care of older adults with dementia as decision-making capacity declines and the severity of dementia increases [13]. Early in the disease process, it is typical for family to support the older adult in decision-making through rewording medical explanations, talking through risks/benefits, and helping them to consider various treatment options [14]. As dementia progresses, or older adults experience other life-threatening conditions, surrogates often assume the role of primary decision maker with approximately one in three older Americans requiring a surrogate to make decisions at the end-of-life [15]. In advanced dementia, surrogates will be required to make all medical decisions. Common decisions made by surrogates on behalf of older adults with dementia near the end-of-life included transfer to the hospital, diagnostic testing, and feeding tube placement [16]. Even in advanced dementia, many surrogates report that it is difficult to limit treatment and evaluation, but 80% reported finding guidance from previously completed advance directive documents helpful in decision-making [16]. This highlights the importance of completing advance directives, including choosing a surrogate decision maker and documenting end-of-life wishes, when adults with cognitive issues still have capacity to make these decisions. Additionally, aligning care with patient priorities can help surrogates feel confident that they are supporting the previously identified values of the older adult through their healthcare decisions.

Supported Care in Dementia

For many older adults, remaining as independent as possible, within the bounds of their cognitive and physical functionality, is important to their sense of self. Early in the course of cognitive decline, many older adults will continue to be able to manage their daily activities and healthcare needs with minimal, if any, assistance. As the disease progresses, increasing support with ADLs, IADLs, and disease self-management will be required, and many individuals will need supported care. Supported care options for older adults with dementia include adult day programs, in-home caregiving, assisted living facilities, long-term care facilities, and hospice care.

Adult day programs can be based on a medical model, social model, or combined model [17]. Services offered typically include assistance with ADLs, care of psychosocial health, meals, and interactive programs [18]. Some adult day programs also include resources to address medical needs (i.e., nursing, physical therapy). Studies have identified benefits of adult day programs for individuals with dementia as well as their informal caregivers. Attendees have increased socialization, independence, and stimulation while caregivers benefit from respite and decreased feelings of isolation and worry [19]. Fields et al. also determined that adult day programs can prepare caregivers for future institutionalization of their loved one with dementia thus leading to an easier care transition [20].

In-home caregiving can be provided by informal or formal caregivers. Informal caregivers are unpaid individuals, often a family member or close friend, who assist the older adult with daily activities and medical tasks. In the United States, approximately 34.2 million individuals provide unpaid care to an adult aged 50 years or older on an annual basis, with 15.7 million informal caregivers assisting an older adult with dementia [21]. Formal caregivers, typically through home health services, often include nurses and physical therapists. Nursing assistance with disease monitoring and medication monitoring can be beneficial to older adults living independently with early cognitive decline or in assisting informal caregivers in caring for loved ones with more advanced disease.

As dementia progresses, many older adults will require a degree of services that cannot be provided at home and transition to an assisted living or long-term care facility. About 47.8% of long-term care residents have a diagnosis of dementia [22]. Factors associated with long-term care placement include behavioral and psychological symptoms of dementia, poorer cognition, impairment in ADL performance, and increased caregiver burden. In addition, the effects of community support services were variable with the highest level of placement occurring in individuals with the highest and lowest amounts of community services [23]. Toot et al. speculate that a high level of services is likely related to a high level of patient need [23]. However, a low degree of community support services may reflect minimal need or an unrecognized level of unmet need.

Dementia is the sixth leading cause of death in the United States, and the number of individuals dying of this disease is anticipated to continue increasing over the coming decades [24]. Enrollment of individuals with dementia in hospice, which

provides clinical and psychosocial services to Medicare beneficiaries who have an expected life expectancy of <6 months, has increased significantly from 3.3% of hospice beneficiaries in the late 1990s to 14.8% in 2014 [25, 26]. Despite this increase, a significant number of terminal dementia patients are not enrolled in hospice due to barriers including difficulty recognizing dementia as a terminal condition, estimating prognosis, and accessibility of hospice in long-term care facilities [27]. Due to these challenges, patterns of hospice use in individuals with hospice differ from those with other terminal illnesses. Those with dementia tend to be enrolled in hospice for a very short (≤1 week) or a very long (>6 months) period, and are more likely to be disenrolled prior to death [26, 27]. Overall, family members of older adults with dementia are positive regarding the support received through hospice, and providers should consider if a hospice referral is appropriate in individuals with advanced dementia.

Caregiving in Older Adults with Dementia

Informal caregivers, an integral component of care for older adults with dementia and other comorbid chronic conditions, providing 83% of help, are far larger than compensated care services [28]. About 23% of older adults with dementia receive care from three or more informal caregivers, and only 8% do not receive informal care. The three primary reasons informal caregivers cite for providing care to a loved one with dementia are 1. the desire to keep the individual at home, 2. proximity to the individual with dementia, and 3. a perceived obligation as spouse or partner. Informal caregivers of older adults with dementia assist with an average of two ADLs and five IADLs. In addition, they are more likely to monitor health of the care recipient, critical for management of comorbid disease, compared to caregivers of individuals without dementia (79 versus 66 percent) [29].

When providing care for older adults with dementia and chronic diseases, providers should also be aware of the impact of caregiving on family and friends. As dementia worsens, the increasing amount of care and supervision required can result in increased stress and depression, declining caregiver health, and financial hardships due to employment gaps and out-of-pocket expenses. About 59% of family caregivers of older adults with dementia rate the stress of caregiving as high or very high and 40% suffer from depression. As individuals with dementia reach the end-of-life, 59% of caregivers reported feeling "on duty" 24 hours per day and 72% reported feelings of relief when the person with dementia died [30]. Medical providers should regularly screen for caregiver stress using a validated tool, such as the Caregiver Burden Inventory, as well as refer them to appropriate support resources including social work, the Alzheimer's Association, and local Area Agencies on Aging [31]. In addition to supporting dementia caregivers, it may be helpful to work with the caregiver to identify positive caregiving experiences. Commonly identified positive aspects of caregiving include 1. a sense of personal accomplishment and gratification, 2. feelings of mutuality in a dyadic relationship, 3. an increase in family cohesion and functionality, and 4. a sense of personal growth and purpose in live [32].

Case Vignette Continued: Mr. AC
Entering the exam room, Mr. AC's provider is concerned regarding his worsening blood pressure and diabetes management. In the past, the patient was meticulous with recording his blood glucose levels and was aware of the indication for each medication in his regimen. In conversation with Mr. AC, the provider discovered that he was checking blood glucose levels only intermittently and his log was disorganized. In addition, the patient seemed confused regarding his medications. Based on these findings, the provider is concerned that the worsening control of Mr. AC's chronic medical conditions is secondary to difficulty in disease self-management related to progression of his cognitive decline. A repeat Montreal Cognitive Assessment is performed, and the patient's score has decreased to 17/30. He scores 0/5 points on the visuospatial/executive portion. The provider arranges for a visiting nurse to assist with medication management. In addition, with permission from Mr. AC, the provider contacts the patient's daughter to discuss concerns regarding the increasing impact of the patient's cognitive issues on his ability to perform IADLs and perform disease self-management. The daughter verbalizes that she will be able to check on her father more frequently and assist as needed. When Mr. AC returns to clinic 3 months later, his daughter accompanies him. The patient verbalizes his appreciation for the home skilled services and increased assistance from his daughter. His blood pressure is once again well controlled and his hemoglobin A1C is improved to 6.6%.

Conclusion

As it progresses, dementia has significant impacts on the ability of individuals to perform their ADLs, IADLs, and chronic disease self-management. Providers should consider services such as adult day programs, visiting nurses, or mores supported care environments, which can assist the older adult with dementia in managing their comorbid chronic diseases in a manner which is aligned with their care priorities. When dementia becomes advanced, hospice services can be beneficial in supporting the patient and family members. As important members of the healthcare team, informal caregivers should be screened on a regular basis for caregiver stress and referred for supportive services as appropriate.

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Chapter 2
Management of Physical Function in Older Adults with Dementia

Issam El-Bizri and Angela Georgia Catic

Main Points

- Cognitive and functional decline have a bidirectional relationship in older adults due to common pathways including chronic inflammation, hormonal alterations, cardiovascular risk factors, and lifestyle.
- While the evidence is mixed, most research suggest that exercise can be beneficial in reducing the risk of Alzheimer's dementia. The impact of physical activity on cognitive decline in individuals already suffering from dementia is less clear.
- Even if the evidence for exercise slowing cognitive decline in individuals is mixed, experts agree that maintaining physical activity is important for overall health and well-being. Patients, caregivers, primary care providers, and physical therapists/physiatrists should work together to develop an exercise routine that meets the patient's cognitive and physical needs.

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Cast Vignette
Mr. HM is an 86-year-old man with past medical history significant for mild Alzheimer's dementia without behavioral issues, hypertension, and hyperlipidemia, who lives at home with his wife. He is independent in his activities of daily living (ADLs) but requires assistance with all of his instrumental activities of daily living (IADLs) except using the telephone. He recently scored 22/30 on the Montreal Cognitive Assessment, with deficits in executive function, abstraction, and delayed recall. Mr. HM has suffered two falls over the last year. In the first instance, he reports that he tripped over a curb at dusk. He attributes this to "being clumsy" and poor lighting. More recently, he slipped on the wet tiles following a shower. Thankfully, he did not sustain injuries with either fall. No loss of consciousness. No preceding symptoms. He currently ambulates without an assistive device. At his primary care visit today, his wife has questions regarding the impact of exercise on physical and cognitive function. She has read online that physical activity might be helpful in preventing further falls in Mr. HM as well as maintaining his cognitive function. In addition to wondering if this information is accurate, she questions what would be an ideal exercise routine for her husband.

Introduction

Among older adults ≥85 years, cognitive and gait disorders have a prevalence of 50%, exceeding the anticipated accumulation with aging and implying a causal relationship [1–3]. While walking is often considered an automated motor task, in actuality it is a complex process that requires intact input from the nervous, sensory, musculoskeletal, and cardiorespiratory systems. Gait can be significantly impacted by changes in multiple areas of cognition, including the frontal subcortical circuits, attention, and executive function [4]. Research suggests that there is a bidirectional relationship between physical and cognitive decline in older adults with common pathways including chronic inflammation, hormonal alterations, cardiovascular risk factors, and lifestyle [4]. Low-grade chronic inflammation, often termed "inflamm-aging", has been proposed as an etiology of cognitive and physical decline in older adults [5–7]. Mechanisms for this include atherosclerosis and chronic inflammation that may directly impact the central nervous system with the development of neurofibrillary tangles and amyloid plaques [8, 9]. Hormonal alterations, particularly downregulation of insulin-like growth factor, occur with aging and may also contribute to cognitive and functional decline [4]. Cardiovascular risk factors are associated with an increased incidence of periventricular white matter disease, which can negatively impact cognition and gait. Finally, a healthful diet with adequate protein and engaging in regular physical activity may be useful in maintaining cognitive and physical function in older adults.

In addition to the proposed common pathways between cognition and physical function, research suggests that poor gait performance is predictive of dementia

[3, 10, 11]. In a meta-analysis by Beauchet and colleagues, gait abnormalities preceded the development of dementia by 3–9 years [3]. Understanding motoric cognitive risk (MCR) syndrome and how to evaluate for it in clinical practice is important in assessing the risk of cognitive issues in older adults. In patients with dementia, considerations regarding physical function include the physical effects of mild cognitive impairment and dementia; the impact of physical exercise on functional and cognitive decline; and practical advice for maintaining physical activity in older adults with dementia.

Motoric Cognitive Risk Syndrome

MCR syndrome, defined as slowness of gait in older adults with subjective cognitive concerns but without any form of dementia or mobility disability, has a prevalence of ~10% [12]. Risk factors for MCR syndrome include older age, cardiovascular risk factors (i.e., stroke and diabetes), obesity, depression, and a sedentary lifestyle [13, 14]. Providers can diagnose it using the following criteria: 1. subjective cognitive complaints assessed using responses relating to cognitive status on standardized questionnaires; 2. slow gait, defined as one standard deviation or more below age and sex appropriate mean gait speed values; 3. ability to ambulate; and 4. absence of dementia [12, 15, 16].

While slow gate and gait abnormalities have been linked to the subsequent development of dementia, study results regarding the utility of MCR syndrome in predicting specific dementia etiologies have varied. In the Einstein Aging Study, MCR syndrome was a strong predictor of vascular dementia while, in another study evaluating multiple cohorts from different countries, it was a stronger predictor of the development of Alzheimer's dementia [4]. While most prior studies have evaluated the progression of dementia in subjects meeting the overall criteria for MCR syndrome, a more recent study by Verghese and colleagues evaluated the association of cognition (cognitive test performance, cognitive complaints, and clinical rating of cognitive status) versus slow gait on progression to dementia [17]. In evaluation of 610 subjects age ≥65 years, cognitive status predicted transition to dementia while gait speed was not predictive. Providers should continue to asses both cognition and gait in individuals in whom they are considering MCR syndrome as well as follow the research for ongoing findings regarding the predictive value of this syndrome for the various etiologies of dementia.

Physical Impacts of Dementia

Cognitive impairment can have significant physical impacts in older adults, including increased gait instability and falls. Mild cognitive impairment (MCI), defined as objective memory impairment beyond what would be anticipated with aging alone

that has little or no impact on activities of daily living, is present in 16% of adults >70 years of age [18, 19]. MCI is associated with a 10–15% annual progression to dementia [20]. Given that gait abnormalities have been previously associated with MCI, Bahureksa and colleagues performed a systematic literature review evaluating the ability of instrumented assessment of gait and balance parameters to discriminate between patients with MCI and those who are cognitively intact [18]. The following single-task conditions were effective in discriminating between subjects with MCI versus normal cognition: velocity ($p < 0.01$), stride length ($p < 0.01$), stride time ($p = 0.02$), and coefficient of variation ($p < 0.01$). Dual-task gait testing (i.e., walking while simultaneously performing a cognitive challenge) further increased the discriminative power of gait variables with counting tasks having increased sensitivity compared to tasks of verbal fluency. Other studies have linked slow performance on dual-task gait testing with progression from MCI to dementia (155 per 1000 person-years) [21].

In addition to the general association of MCI and dementia with gait disorders, spatiotemporal gait parameters are affected according to the stage and type of cognitive impairment. Among cohorts from seven countries participating in the Gait, Cognition, and Decline (GOOD) initiative, subjects with non-amnestic MCI have been noted to have more disturbed gait parameters than those with amnestic MCI [22]. All individuals with MCI, regardless of subtype, had better gait performance than those with dementia. Like the findings in MCI, subjects with non-Alzheimer's dementia had worse gait performance than those with Alzheimer's disease (AD). Gait parameters were noted to have a progressive, homogenous degradation throughout cognitive decline until the moderate stage of dementia. Gait abnormalities become more heterogeneous in the later stages of dementia.

Understanding the association of cognitive decline with gait abnormalities, providers should encourage maintenance of physical activity in all older adults, but especially in those with cognitive decline. Among individuals with dementia, physical activity is associated with maintenance of independence and prolonged survival [23]. However, providers should also be attuned to the progressive gait degradation that occurs as dementia progresses, as it has been associated with poor clinical outcomes including institutionalization, higher cost of care, functional decline and mortality [24, 25]. In addition, older adults with cognitive impairment are twice as likely to have suffered a fall compared to their cognitively intact peers [26]. Commonly employed interventions aimed at reducing falls in older adults with MCI or dementia include exercise (i.e., tai chi, balance training, strength, gait training), night lights, and telehealth and cognitive training [27]. The impact of anti-dementia medications (acetylcholinesterase inhibitors and memantine) on gait and falls has also been evaluated. While one study found an improvement in mental imagery of gait among subjects taking anti-dementia drugs, the results of these medications on actual gait has been mixed [28]. Although another study of subjects with mild-to-moderate AD and non-AD dementia did not demonstrate any change in gait performance with anti-dementia drugs, other analyses of older adults with AD noted an improvement in stride time among subjects on memantine and an improvement in gait variability during dual-task behavior among those taking an acetylcholinesterase inhibitor [28–30].

Impact of Physical Activity on Functional and Cognitive Decline

The positive impact of exercise, including improved cognitive and physical function, is well established in healthy older adults [31–33]. However, until recently, prior literature examining the impact of exercise on physical function in older adults with dementia was difficult to interpret secondary to heterogeneous study populations, many non-randomized trials, and a variety of outcome measures [34]. To address these limitations, Lam and colleagues performed a systematic review of the evidence present regarding the effect of exercise on physical function and quality of life in individuals with cognitive decline [34]. Exercise was found to improve strength, step length, balance, Timed Up and Go (TUG), gait speed, and endurance in individuals with MCI or mild-to-moderate dementia. Evidence was weak regarding exercise leading to an improvement in flexibility or activity of daily living performance. Subjects experienced few adverse effects secondary to exercise. The authors were not able to draw conclusions regarding the impact of exercise on falls as the majority of trials collected fall data during the intervention period but the effect of the exercise intervention on falls may not be appreciable until later [35–37]. Although a study of older adults with dementia residing in long-term care included longer-term monitoring of falls among participating subjects (4 month intervention period and 12 month follow-up), a high-intensity functional exercise program did not prevent falls compared to an attention control group [38].

The impact of physical activity in delaying or preventing dementia, as well as slowing cognitive decline, has long been an area of interest among researchers, medical practitioners, and patients. Literature suggests that physical activity and the management of cardiovascular risk factors, of which exercise is an important component, reduce the risk of cognitive decline and may decrease the incidence of dementia [39–41]. To further contribute to the literature regarding the impact of high and moderate physical activity on all-cause dementia, AD, vascular dementia, and cognitive decline, Guure and colleagues conducted a meta-analysis of prospective studies [42]. They determined that the risk of developing dementia is reduced by high and moderate physical activity (21% versus 24%). The reduction in risk is significant in AD (38% in high intensity exercise and 29% in moderate intensity exercise), but there was no statistically significant reduction in development of vascular dementia. The authors hypothesize that this may be due to the lower number of vascular dementia cohorts and the need to address other modifiable risk factors [42]. Among individuals engaging the physical activity, the risk reduction of AD was noted to be higher among men compared to women and the risk reduction of cognitive decline to be greater in women than in men.

The results of research regarding the impact of exercise on cognition, neuropsychiatric symptoms, and quality of life in individuals with dementia has been mixed [43, 44]. More recent studies have attempted to clarify this issue with

limited success. In the recent multicenter, randomized, controlled Dementia and Physical Activity trial evaluating the impact of 4 months of supervised exercise and support for ongoing physical activity, subjects in the intervention group had a slightly greater, though statistically insignificant, increase in their cognitive decline than individuals in the control group [45]. Differing results were found in a meta-analysis evaluating the impact of physical activity and exercise interventions in patients with AD where those in the intervention group had a statistically significant improvement in cognition compared to controls [46]. Positive results were also found in a meta-analysis by Karssemeijer and colleagues in which they evaluated the impact of combined cognitive and physical exercise on global cognitive function in individuals with dementia and noted a positive small-to-medium effect [47]. Exercise interventions have been found to reduce neuropsychiatric symptoms of dementia, as well as caregiver distress, in a variety of settings [48–50].

Practical Advice for Physical Activity in Older Adults with Dementia

Despite some limitations in the literature and mixed results regarding the impact of physical activity on fall risk, cognitive decline, and neuropsychiatric symptoms in older adults with dementia, most experts would recommend maintaining a regular exercise program as long as possible in individuals with cognitive decline. Regarding specific recommendations that providers should make to patients with cognitive impairment and their caregivers, the evidence suggests that regular multimodal exercise, including resistance, aerobic activity, balance, flexibility, and functional training, should be performed for approximately 60 minutes per day, 2–3 days per week to improve lower extremity strength, mobility, balance, and walking endurance [34].

The development of a physical activity program in older adults with cognitive issues should ideally be collaborative in nature involving the patient, caregiver, primary care provider, and, in most instances, a physical therapist or physiatrist. The primary care provider plays an important role in encouraging regular physical activity as part of the treatment plan for the patient's cognition as well as any other chronic comorbidities. In addition, they can help guide the development of an activity plan that considers any medical limitations (i.e., osteoarthritis, cardiac issues, visual limitations). If patients have not been active throughout their lifespan or their dementia is moderate, it will be beneficial for them to have a physical therapy or physiatry assessment to determine an exercise program which fits their physical and cognitive limitations. Of note, since 1989, the American Board of Physical Therapy Specialties has offered specialist

certification in the area of geriatrics and providers with this advanced specialization are especially skilled in working with older adults with cognitive impairment [51].

In MCI and the early stages of dementia, older adults can often maintain the physical activities they enjoyed prior to the diagnosis of cognitive decline. They may also enjoy learning new types of physical activity, which provides the additional benefit of cognitive activity. If possible, patients should be encouraged to attend group exercises where they will have the advantage of social interaction. This can also have the benefit of providing caregivers with a respite period. In general, exercise classes for older adults with cognitive decline should incorporate the following principles [52]:

1. Repetition with variation: Each exercise session should follow a basic sequence of events and activities (i.e., introduction; exercise and rest periods; conclusion), allowing participants to become comfortable with what to expect. However, variation of the specific exercises is important to maintain interest.
2. Functional movements that are progressive: Movement sequences related to daily activities should be incorporated into the exercise class. Ideally, participants start with simple movements that become progressively more complex.
3. Step-by-step instructions: Clear, step-by-step instructions optimize understanding and participation by reducing cognitive demand.
4. Incorporation of participant goals: Prior to beginning the program, older adults and/or their caregivers should be queried regarding their goals for participation so this information can be incorporated into the exercise. For example, some individuals may wish to focus on lower extremity strengthening to improve gait while others may wish to improve their flexibility to make dressing less onerous.
5. Social interaction: Social interaction should be encouraged through circle-based activities.

In individuals with more advanced dementia, exercise routines will need to be modified to meet their cognitive needs. Many individuals with this stage of dementia will benefit from chair exercise, which reduces the risk of falling when exercising. Exercise training in older adults should ideally be supervised, either by a caregiver in individuals with MCI or mild dementia or a trained professional in those with more advanced dementia.

If older adults are accustomed to using an assistive mobility device, this should be maintained to decrease the risk of falls. In addition, individuals with MCI will most likely be able to adapt to a mobility device with instruction from a physical therapist. However, research suggests that using to learn an assistive device (cane or rollator) leads to significant cognitive demand in individuals with AD resulting in adverse gait effects including decreased gait velocity and increased stride time variability [53, 54].

Case Vignette Continued
Given that Mr. HM has a diagnosis of dementia, his provider explains that he is at an increased risk for falls, evidenced by the two he has already sustained. The provider shares with Mr. HM and his wife that it is important for him to engage in regular physical activity as there is evidence this can improve strength, balance, and endurance. While the evidence regarding the impact on falls is mixed, it is worth referring Mr. HM to a physical therapist or physiatrist to develop a personalized exercise program. The provider counsels that studies suggest physical activity can be beneficial for cognition in older adults with dementia. The provider discusses that a group exercise program for individuals with dementia which incorporates the principles of repetition with variation, functional movements, step-by-step instructions, incorporation of participant goals, and social interaction. The provider suggests referral of Mr. HM to a physical therapist to consider if he would be able to successfully utilize an assistive device given his stage of cognitive decline and recent falls.

Conclusion

There is a well-established, bidirectional relationship between cognitive and gait disorders in older adults which is most likely multifactorial in nature due to chronic inflammation, hormonal alterations, cardiovascular risk factors, and lifestyle. Providers should be aware of the gait implications, including increased fall risk, in individuals with cognitive concerns. While there is evidence that physical activity can improve some gait parameters (i.e., strength, step length, balance, gait speed) in individuals with cognitive decline, the impact on falls is mixed among patients with dementia. In addition, the impact of exercise on cognition and neuropsychiatric symptoms among older adults with dementia is mixed. However, experts agree that physical activity should be encouraged in individuals with MCI and dementia in an attempt to maintain function and quality of life. A physical activity program should be developed through a collaborative process and, ideally, be supervised by a caregiver or as part of a formal exercise program.

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Chapter 3
Management of Cognitive Function in Older Adults with Dementia

Angela Georgia Catic

Main Points

- Treatment of dementia should be individualized based on patient preferences and comorbidities with consideration given to memory specific mediations, management of cardiovascular risk factors, and nonpharmacologic measures.
- Behavioral and psychological symptoms of dementia are common and often have significant implications including institutionalization, increased morbidity and mortality, and significant caregiver burden.
- Nonpharmacologic management is the mainstay of treatment for behavioral and psychological symptoms of dementia. Management plans should be customized to each patient and include generalized and targeted interventions.
- Delirium is more common in older adults with dementia and should be considered within the differential when there is an acute change in cognitive status.

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Case Vignette
Mrs. CB is an 82-year-old lady with past medical history significant for vascular dementia without behavioral issues, hypertension, and hypothyroidism, who transitioned into a long-term care facility 2 weeks ago. Prior to that time, she was living at home with her daughter. Due to increasing issues with urinary incontinence, Mrs. CB's daughter was no longer able to care for her mother at home. Since transfer to the long-term care facility, the patient is experiencing increasing verbal agitation (calling out), particularly in the evening hours, as well as a reversal of her sleep-wake cycle. Her daughter questions if Mrs. CB's dementia is acutely worsening or if there is another condition else impacting her cognition.

Introduction

Older adults are at increased risk of cognitive dysfunction, with dementia and delirium being among the most common etiologies. Dementia, a general term that encompasses a chronic, progressive decline in cognition (i.e., learning and memory, language, executive function, complex attention, perceptual-motor, and social cognition) which impairs daily function, impacts 1 in 10 individuals over age 65 years or older in the United States [1]. Management of cognitive function in older adults with dementia includes pharmacologic and nonpharmacologic treatment, addressing behavioral and psychological symptoms of dementia, and managing sundowning. When older adults with dementia suffer an acute decline in cognition, it is important to consider the possibility of concurrent delirium. Delirium, defined as an acute disorder of attention and cognition, is more common in patients with dementia and results in significant morbidity and mortality.

Dementia

Epidemiology

Among older adults, common causes of dementia include Alzheimer's disease, vascular dementia, Parkinson's disease with dementia, Lewy body disease, and frontotemporal dementia. Alzheimer's disease (AD) is the most common etiology of dementia, accounting for 60 to 80% of cases [2]. While rare cases of inherited AD can occur in younger adults, AD is primarily a disease of the aged affecting 15% of individuals ≥65 and 45% of those ≥85 years of age. The relationship between AD and vascular dementia, the second most common cause (10 to 20% of cases), is poorly understood and a significant number of patients suffer from mixed-etiology

of mixed dementia [3]. Parkinson's disease with dementia (PDD) and dementia with Lewy bodies (DLB) account for up to 30% of dementias [4, 5]. Dementia in patients with Parkinson's disease is classified as PDD versus DLB based on onset in relationship to the onset of motor symptoms (tremor, rigidity, bradykinesia). Dementia developing at least 1 year after the onset of motor symptoms is defined as PDD while dementia developing prior to or within 1 year of the onset of motor symptoms is classified as DLB. Frontotemporal dementia (FTD) is the fourth leading cause of dementia in older adults [6].

Pharmacologic and Nonpharmacologic Treatment

The most commonly utilized pharmacologic treatments for dementia are acetylcholinesterase inhibitors and memantine. Acetylcholinesterase inhibitors (AChEIs) were developed as a result of the cholinergic hypothesis of cognitive decline and function by increasing cholinergic transmission by inhibiting cholinesterase at the synaptic cleft [7]. Donepezil, rivastigmine, and galantamine are approved by the Food and Drug Administration (FDA) for early to moderate AD while donepezil and the rivastigmine patch are also approved in severe AD [2]. In patients with AD, treatment with AChEIs has been associated with improvement in cognitive function, global clinical status, and performance of activities of daily living (ADLs) [8–10]. AChEIs are also first-line treatment in PDD and DLB and, in these subtypes of dementia, studies have indicated they are more efficacious than in AD with positive effects on cognition, psychotic symptoms, and parkinsonian symptoms [11]. This is likely due to the greater cholinergic deficit present in PDD and DLB [12]. While not FDA approved, AChEIs are often used in individuals with vascular dementia. Results of studies evaluating the efficacy have demonstrated small benefits in cognition of uncertain clinical significance [13]. Medications targeting the cholinergic system have not shown significant benefit in FTD [14]. Possible side effects of AChEIs include anorexia, nausea, diarrhea, and bradycardia due to AV block [15]. There is limited empirical evidence regarding discontinuation of AChEIs and considerable variability among practice guidelines [16]. Decisions regarding discontinuation should be made on an individual basis based on patient/family preference, side effects, and financial burden. If treatment is discontinued, the medication should be tapered and cognition reassessed within 3 months so therapy can be reconsidered if a significant decline is detected, understanding that patients may not regain their prior level of function [17].

Memantine, an antagonist at the N-methyl-D-aspartate (NMDA) receptor, was developed secondary to the hypothesized role of the glutamatergic system in neurodegeneration [18]. Memantine is approved for use in patients with moderate to severe AD and, when used in this population, has demonstrated improved cognition, global function, and performance of ADLs [19, 20]. These effects have been demonstrated irrespective of concurrent AChEI therapy [21]. The same benefits have not been demonstrated in patients with mild AD. Among older adults with mild to

moderate vascular dementia, there is low to moderate certainty evidence that memantine results in a small clinical benefit in cognitive function [21]. The evidence for memantine in other etiologies of dementia, including PDD and DLB, is limited. Possible side effects associated with memantine include increased anxiety or agitation, dizziness, and GI symptoms (nausea, vomiting, and diarrhea) [22]. Similar to the AChEIs, discontinuation of memantine should be considered on an individual basis and the medication should be tapered with follow-up assessment of cognition.

Control of cardiovascular risk factors is important in all individuals with cognitive concerns. However, this should be customized to each patient considering their functional status and goals of care. Studies evaluating the impact of statins on preventing cognitive decline or dementia have been mixed. In a review of two randomized controlled trials including 26,340 subjects with moderate to high vascular risk and 11,610 who were ≥ 70 years of age, no difference in individuals developing cognitive decline or dementia was noted between those taking statins versus placebo [23]. Other studies have demonstrated that statins may decrease the risk of developing dementia, especially with long-term use and increasing age [24, 25]. A recent study by Peter and colleagues evaluated the use of statins in 44,920 Swedish dementia patients and determined that individuals on statins had a 22% lower risk of mortality compared to older adults not on statins [26]. The protective effect was more pronounced in younger compared to older individuals (27% versus 20%) and men compared to women (26% versus 17%).

Encouraging meaningful activities in individuals with dementia is important, both for their well-being and that of caregivers. Older adults with cognitive impairment should be encouraged to remain mentally, socially, and physically active. One option for encouraging engagement is attendance at an adult day program. Possible benefits of attendance for the individual with dementia include increased socialization, independence, and simulation based on person-centered activities [27]. Caregivers of older adults attending day programs have demonstrated decreased stress, comfort in the knowledge that their loved one was in a secure environment, and benefit from increased supportive services [28].

Behavioral and Psychological Symptoms of Dementia

Behavioral and psychological symptoms of dementia (BPSD) are defined by the International Psychogeriatric Association as "symptoms of disturbed perception, thought content, mood, and behavior frequently occurring in patients with dementia" [29]. These symptoms are common, impacing 60% of individuals living in the community and 80% residing in long-term care facilities [30–32]. When evaluating BPSD, they can be divided into those with psychotic features and nonpsychotic behaviors (Table 3.1). Medical providers should screen for BPSD during all encounters with older adults with dementia given the significant impact of these symptoms on older adults with dementia and their caregivers. Patients suffering from BPSD

Table 3.1 Behavioral and Psychological Symptoms of Dementia

Psychotic Features	Nonpsychotic Behaviors
Hallucinations Wakeful sensory experiences of content that is not actually present Auditory and visual are most common in patients with dementia	Agitation and irritability
Delusions Strongly held false beliefs that are not typical of a person's religious or cultural beliefs	Inappropriate sexual behavior
Delusional misidentification syndrome Consistent misidentification of persons, places, objects, or events	Sleep disturbances
	Wandering
	Repetitive vocalizations
	Intrusiveness
	Physical aggression

experience increased functional impairment, emotional distress, hospitalization, abuse and neglect, and have decreased survival [33]. Caregivers of individuals with BPSD have increased stress, depression, and economic burden [33, 34]. BPSD is frequently the primary reason for long-term care placement in older adults.

Evaluating Behavioral and Psychological Symptoms of Dementia

Treatment of BPSD begins with taking a thorough medical history and carefully describing the behavior. Providers should inquire regarding medication changes, recent illnesses, mental health issues, substance use, the underlying etiology of dementia, the cognitive baseline, and the functional baseline. A physical exam should be performed and patients should be assessed for the presence of delirium. The importance of describing the behavior is highlighted by the DICE approach (1. Describe the problematic behavior, 2. Investigate possible causes, 3. Create a treatment plan, and 4. Evaluate the outcome of the plan) to manage behavioral symptoms in patients with dementia [33, 35]. Details that should be obtained include a detailed description of the behavior, context, timing, precipitants, and consequences. Providers should also enquire if similar behaviors occurred in the past and what, if any, intervention was effective. While most of the history will be obtained from caregivers, the patient should also be questioned about the episode to see if they can provide further insight into the behavior.

Next, providers should investigate for possible underlying and modifiable causes of the behavior including patient, caregiver, and environmental factors. Patient-related factors include cognitive decline, medication changes, undertreated pain, sleep abnormalities, acute medical issues (i.e., untreated infection, metabolic derangement), sensory deprivation, urinary retention, constipation/fecal impaction, and psychiatric comorbidities. Possible caregiver factors include personal health

issues, substance abuse, and burnout. In addition, a lack of understanding of the disease course and how to most effectively communicate with individuals with dementia may contribute to BPSD. Environmental factors which frequently contribute to BPSD include over or under stimulation, changes in routine, new environment, and lack of meaningful activities.

Nonpharmacologic Treatment of Behavioral and Psychological Symptoms of Dementia

In addition to addressing identified medical issues (i.e., undertreated pain, infection, psychiatric illness, etc.), non-pharmacologic interventions are the primary treatment of BPSD. The medical provider should work with the caregiver and, when possible, the older adult with dementia to develop an individualized management plan that includes generalized and targeted interventions. Generalized interventions focus on improving the environment and caregiver skills [33, 35]. Environmental strategies include removing clutter, reducing loud noises, installing clear lighting, and using simple visual reminders to assist the older adult with common tasks (i.e., picture of the individual on the door to their room, picture of a toilet on the bathroom door). Caregiver strategies include using a caring tone of voice, maintaining a daily routine, avoiding reasoning, and providing simple instructions. Oftentimes, caregivers will benefit greatly from education regarding dementia and BPSD including how to most effectively communicate with older adults with dementia and understanding that behaviors are not intentional. Providers may have resources for caregiver education within their office or can refer caregivers to community resources including the Alzheimer's Association or Area Agencies on Aging. Technology-based intervention, including telehealth technology through which dementia care experts provide in-home support and web-based caregiving interventions, can improve caregiver well-being [36, 37].

Targeted interventions, essential to reducing BPSD, are patient-specific and are essential to reducing BPSD and include cognitive/emotion-oriented interventions, behavioral management techniques, sensory stimulation interventions, and exercise interventions. Some of the most commonly utilized cognitive/emotion-oriented interventions include cognitive stimulation therapy and reminiscence therapy. Cognitive stimulation therapy employs a range of activities (i.e., games, music, dancing, art, gardening, cooking, etc.) to stimulate thinking, memory, and concentration [38, 39]. Evidence suggests that cognitive stimulation therapy may improve memory, thinking, communication, quality of life, and, while data is mixed, possibly reduce BPSD including dementia and anxiety [38, 40, 41]. Reminiscence therapy, an ordered process of reflection on significant life events, uses memory aids (i.e., photographs, music, videos, movies, etc.) to help older adults with dementia recall past events [42]. It can be helpful in reducing symptoms of depression as well as improving communication, retaining, identity, and maintaining self-worth [43, 44].

While a wide variety of behavioral management techniques are used in the treatment of BPSD (i.e. token economies, habit training, positive reinforcement, etc.), the antecedent-behavior-consequence analysis is the basis for the intervention. In this model, the antecedent to the behavior is analyzed and can then either be modified to prevent the undesirable behavior or, if the individual is exhibiting desired behavior, a positive consequence can be used to promote continuation of this behavior. In general, caregivers should focus on reinforcing desirable behavior with positive consequences as this is much more effective and pleasant for the patient and caregiver.

Sensory stimulation interventions, including music therapy, massage, and doll/pet/toy therapy, are frequently used to treat BPSD in older adults with dementia. Music therapy, including music with movement, use of musical instruments, and listening to music, has been associated in some studies with reduced anxiety and agitation, enhanced communication, and increased cognitive functions including speech and attention [45, 46]. Providers can direct caregivers to develop playlists containing music that the older adults enjoy, which can be used to support various activities (soothing versus motivating). Generally, older adults are often most engaged by music that was popular when they were young adults although, as dementia progresses, they may respond most to music from their childhood. While the results of studies evaluating the impact of massage on BPSD are mixed, several have demonstrated decreased stress and agitation among older adults with dementia [47, 48]. While studies evaluating doll/pet/toy therapy in older adults with BPSD are quite heterogenous, overall results have been positive with evidence of improved quality of life (pet therapy), decreased agitation, and increased pleasure [45].

Physical exercise, defined as planned, repetitive physical activity, is often used in the treatment of BPSD. In a systematic review and meta-analysis of tenty studies evaluating the effect of exercise on BPSD, reduced depression and aberrent motor behaviors were noted [49]. Medical providers should encourage caregivers to assist older adults with dementia in engaging in regular physical activity as allowed by their functional status.

Pharmacologic Treatment of Behavioral and Psychological Symptoms of Dementia

Pharmacologic treatment for BPSD should be considered second-line, only to be considered if nonpharmacologic interventions have failed or the patient's behaviors represent a risk to themselves or others. No pharmacologic therapy is approved by the US Food and Drug Administration (FDA) for the treatment of BPSD and, if providers are going to initiate a pharmacologic therapy, they should start the lowest possible dose and reevaluate tapering or discontinuing the medication on a regular basis. Medications most commonly used in the treatment of BPSD include antipsychotics, benzodiazepines, and antidepressants. Despite the FDA black box warning regarding the use of antipsychotics in older adults with dementia and findings that

they provide modest, if any, benefit compared to placebo, 14.6% of long-stay nursing home residents were being treated with antipsychotics in 2018 [50–52]. If providers initiate antipsychotic therapy for BPSD, it is recommended that they follow the American Psychiatric Association 2016 practice guidelines, which include reserving the medications for when symptoms are severe and dangerous, when non-pharmacologic treatments have already been used, and to taper off the medication in a timely manner (4 weeks in patients with no response and 4 months in patients with a response) [53].

In almost all cases, benzodiazepines should be avoided in older adults with BPSD due to the significant risk of adverse effects including increased confusion, agitation, and gait instability. Possible exceptions include the use of clonazepam for REM behavior disorder and closely supervised use of low-dose lorazepam in cases of significant agitation or aggression resulting in a risk of harm to the patient or others [51].

Althoug antidepressants are commonly used in the treatement of BPSD, evidence regarding their efficacy for anxiety, depression, apathy, cognition, or care burden is limited [54]. While one study demonstrated a reduction in agitation, the treatment group experienced an increased incidence of cardiac and cognitive side effects [55]. Although mirtazapine is frequently used in older adults in an attempt to improve appetite and sleep, a recent study evaluating the impact of 15 mg of mirtazapine compared to placebo in Alzheimer's patients with sleep disorders demonstrated increased daytime sleepiness but no improvement in duration or efficiency of nocturnal sleep among the treatment group [56]. In addition, the subjects receiving mirtazapine had no improvement in cognition or functional status.

In addition to the more traditionally used pharmacologic therapies, cannabinoids have been suggested as an alternative treatment for BPSD due to activity on the CB1 receptors in the central nervous system. In a systematic review of twelve studies assessing the use of cannabinoids in treating older adults aged 65 year or older with BPSD, observational studies demonstrated improvement in symptoms, but the included randomized controlled trial did not demonstrate an improvement in behaviors [57]. Sedation was the most commonly reported adverse drug event. Future study is warranted before cannabinoids should be considered a standard treatment option for BPSD.

Sundowning

Sundowning, the occurrence of worsening of neuropsychiatric symptoms of dementia in the late afternoon or early evening, is common in older adults with dementia impacting up to 66% of individuals with Alzheimer's disease living at home [58]. Among patients with dementia in long-term care, it is the second most common type of disruptive behavior [59]. Like other dementia-associated behaviors, sundowning is a significant cause of increased caregiver burden and institutionalization. While the pathophysiology of sundowning has not been clearly defined, there are several hypotheses regarding possible etiologies, and experts agree that it is

most likely multifactorial in nature. Possible contributors include alterations in circadian rhythm, degeneration of the cholinergic system, decreased light exposure during the day, afternoon fatigue, reduced caregiver availability in the later afternoon and evening, and certain medications including antipsychotics and antidepressants [59].

While there are currently no validated screening tools for sundowning, it can generally be diagnosed through caregiver history of increased late afternoon/evening behaviors which recur over time and are non-acute in onset [59]. A careful exam to evaluate for physical causes of the behavior, such as pain, should be performed. As in generalized BPSD, nonpharmacologic measures are the first-line treatment for sundowning. Common environmental interventions include light therapy during the afternoon and evening, reduction of excess auditory and visual stimuli, adhering to a routine, and avoiding daytime naps. Caregiver education can also be beneficial so that they are aware of possible sundowning triggers and how to most effectively engage with the older adults with dementia. As in BPSD, pharmacologic therapy for sundowning should only be considered when nonpharmacologic measures have been ineffective. There are no FDA-approved therapies. While melatonin has been noted to reduce sundowning behaviors in older adults with dementia in open-label studies and case series, these studies were heterogeneous and had possible biases [59–63]. There is no evidence to support the use of antipsychotics, benzodiazepines, or hypnotics in the treatment of sundowning [59].

Delirium

Epidemiology

Although increased age is often cited as the key risk factor for dementia, preexisting dementia is also an important independent risk factor associated with a two to five times increased risk of delirium [64]. Impacting up to 50% of hospitalized older adults, delirium is associated with increased cognitive and functional decline as well as institutionalization [65]. In addition, delirium is associated with a significant risk of mortality with patients who are delirious at the time of admission to post-acute care, having a five-times increased risk of mortality at 6 months [66].

Relationship of Dementia and Delirium

While dementia is recognized as an important risk factor for the development of delirium, the relationship between the two conditions is not as well defined. Delirium may unmask previously unrecognized dementia or, secondary to exposure of the brain to noxious stimuli, it is possible that delirium could lead to dementia [65]. Mechanisms proposed for how delirium could lead to permanent neuronal damage include neurotoxicity, inflammation, neuronal damage, accelerated dementia

Table 3.2 Predisposing and Precipitating Factors for Delirium

Predisposing Factors	Precipitating Factors
Age (≥75 years)	Medications
Dementia	Infection
History of delirium	Undertreated pain
Functional impairment	Trauma
Sensory impairment (auditory, visual)	Metabolic abnormalities
History of stroke	Surgery
Comorbidity	Restraints
Depression	Lack of assistive devices (glasses, hearing aids, etc.)

pathology, and diminished cognitive reserve [65]. While the relationship of delirium to the development of dementia remains unclear, studies have demonstrated that individuals with dementia who develop delirium have worse outcomes (i.e., hospital readmission, institutionalization, increased mortality) than those who do not develop delirium [65].

Risk Factors and Diagnosis

In older adults, delirium is almost always multifactorial in nature, depending on the interaction of predisposing and precipitating factors (Table 3.2) in vulnerable individuals [64]. Understanding the risk factors for delirium can be helpful as providers counsel patients and families regarding the risk of delirium during scheduled admissions or implement preventative care plans during unanticipated admissions.

Delirium is a clinical diagnosis characterized by an acute onset and fluctuating course of symptoms, inattention, impaired consciousness, and disturbance of cognition [67]. Multiple diagnostic interments are available including the Confusion Assessment Method (CAM) and the 4 A's Test [68, 69]. Both of these instruments have been validated in older adults and can be administered in a relatively short time in the clinical setting. In a study of 236 patients ≥70 years of age admitted to a geriatric medicine ward, the 4AT had a sensitivity of 89.7% and a specificity of 84.1% for detection of delirium [70].

Prevention and Treatment

Nonpharmacologic

The most effective way to prevent the development of delirium in older adults is through the implementation of nonpharmacologic multicomponent approaches.

Common approaches include the Hospital Elder Life Program (HELP) and proactive geriatric consultation [64, 71]. HELP is a multicomponent intervention strategy that implements targeted interventions to address cognitive impairment, sleep deprivation, immobility, dehydration, and vision or hearing impairment. Studies have demonstrated that the program is effective in preventing delirium and functional decline [64, 71]. Proactive geriatric consultation as a means to prevent delirium was studied in patients ≥65 years admitted for emergent repair of hip fracture. Structured consultation addressed the following areas: adequate oxygen delivery, fluid/electrolyte balance, pain management, elimination of unnecessary medications, bowel/bladder regulation, adequate nutrition, early mobilization, prevention and treatment of postoperative complications, appropriate environmental stimuli, and treatment of agitated delirium. Compared to the usual treatment group, patients receiving proactive geriatric consultation had a reduced incidence of delirium (relative risk 0.64) [72]. The cornerstone of delirium treatment is addressing the underlying etiologies. In addition, nonpharmacologic supportive measures, including frequent reorientation, supported mobility, reorientation, and sleep protocols should be employed.

Pharmacologic

There is no convincing evidence that pharmacologic treatment is effective in preventing delirium [64, 73]. In addition, the majority of studies have not demonstrated that pharmacologic therapy decreases the duration or severity of delirium [74]. In a systematic review of the use of antipsychotics for treatment of delirium in older adults, there was no decrease in delirium incidence, duration, or severity and no reduction in mortality [75]. If providers chose to use pharmacologic therapy, it should be reserved for patients who are exhibiting severe agitation which places them or those around them at risk.

Case Vignette Continued

Providers at the care facility appreciate the feedback from Mrs. CB's daughter that, prior to admission, she was not calling out and had been sleeping well at night. On assessment, the patient is attentive. Given that her verbal agitation occurs primarily in the evening hours, staff suspect she is suffering from sundowning, primarily related to her recent change in environment. Over the next several days, they make a concerted effort to ensure Mrs. CB is up and engaged in activities during the day, getting a good amount of bright light in the later afternoon and early evening, and having a soothing bedtime routine including herbal tea. With these nonpharmacologic interventions, the patient's behaviors resolve and she successfully adjusts to the long-term care facility.

Conclusion

When managing older adults with dementia, providers should be vigilant for factors impacting their cognitive function. Treatment considerations include memory specific medications, control of cardiovascular risk factors, and nonpharmacologic therapies. Caregivers are a critical component of dementia care and screening for caregiver concerns, including BPSD, should occur at every visit. As BPSD are a common cause of institutionalization, providers should monitor for any behavioral concerns and, if these occur, implement a nonpharmacologic management plan including generalized and targeted interventions. Older adults with dementia are at increased risk of delirium. Providers should counsel patients and caregivers regarding this risk prior to any hospitalization and, if an acute admission occurs, implement multifaceted nonpharmacologic prevention measures.

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Chapter 4
Medication Management in Older Adults with Dementia

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Main Points

- Polypharmacy and the use of potentially inappropriate drugs are common in patients with dementia and associated with increased risk of hospitalization and mortality.
- Deprescribing, the planned and supervised dose reduction or discontinuation of a medication that may be causing harm or not helping can reduce adverse effects and pill burden.
- Medication nonadherence in patients with dementia can lead to poor health outcomes; many approaches to promoting medication adherence are available, though research on their effects on outcomes is limited.
- Transitions from one level of care to another present both challenges and opportunities for patients with dementia and require coordination between multiple prescribers, pharmacists, and others.

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Case Vignette
LE is a 77-year-old male who is being discharged from acute care after an 8-day stay for volume overload due to heart failure with preserved ejection fraction, for which he has been treated with furosemide and lisinopril. It is his third heart failure–related hospitalization in the last 6 months and, from his refill history, it is questionable how adherent he is with his furosemide regimen. He also has moderate dementia (Montreal Cognitive Assessment score of 13/20), well-controlled type 2 diabetes (A1C = 6.7%), and insomnia. In addition to the diuretic and angiotensin-converting enzyme inhibitor, his prescribed medications include donepezil, memantine, glyburide and simvastatin. He also takes ibuprofen and doxylamine over the counter. He typically lives at home with his son who works full-time. At this time, he is being discharged to a skilled nursing facility for physical therapy with an anticipated length of stay of 14 days.

Introduction

Medication management in patients with dementia can be challenging and complicated. Because dementia is strongly age-related and concomitant diseases are nearly always present, polypharmacy is the norm. Furthermore, patients with dementia are frequently susceptible to medications that further worsen cognitive status. Memory loss and other cognitive deficits can make adherence to prescribed regimens challenging, and the often complex medication schedules and diminished mental capabilities seen in patients with dementia can make transitions from one level of care to another particularly difficult.

Polypharmacy and Deprescribing

Polypharmacy is a growing phenomenon in older adults with and without dementia, likely due to the prevalence of complex comorbid conditions and advances in treatment options [12, 14]. Data from the National Health and Nutrition Examination Survey (NHANES) conducted in the United States revealed that the proportion of non-institutionalized adults aged 65 and older taking five or more medications tripled from 12.8% to 39% between 1988 and 2010 [14]. After accounting for differences in age, sex, and comorbidities, polypharmacy is higher in patients with dementia compared to their cognitively intact peers. [3, 15, 35]. Adverse consequences from polypharmacy include increased use of potentially inappropriate medications (PIMs), medication adverse effects, disability, healthcare utilization, and mortality [31, 38, 41, 43, 44]. Patients with dementia are particularly vulnerable

to these unfavorable outcomes due to impaired decision-making capacity, poorer adherence, and communication challenges [10].

Potentially inappropriate prescribing is common in the United States and Europe, ranging from 12% in community-dwelling older adults to 40% in nursing home residents [22]. In a cross-sectional study of over 5000 nursing home residents with advanced dementia, 54% received at least one medication with questionable benefit including cholinesterase inhibitors, memantine, and lipid-lowering agents [63]. Antipsychotics are also commonly prescribed off-label for the management of behavioral and psychological symptoms of dementia (BPSD), despite evidence-based recommendations and federal regulations discouraging routine use [21, 30, 56].

Several clinical tools using criteria that are implicit (judgment based), explicit (criterion based), or a combination of both are available to help identify PIMs for older adults in a variety of clinical settings [33]. The Beers criteria [2] and the Screening Tool of Older Person's Prescriptions (STOPP)/Screening Tool to Alert doctors to Right Treatment (START) [49] criteria are two well-known, validated tools.

The most recent update of the Beers criteria provides evidence-based recommendations by an interdisciplinary expert panel addressing the following categories: (1) PIMs in older adults, (2) PIMs to avoid with certain conditions, (3) medications to be used with considerable caution, (4) medication combinations that may lead to harmful adverse effects, and (5) medications that should be avoided or dosed cautiously in patients with poor renal function [2].

STOPP version two consists of 80 indicators including drug–drug and drug–disease interactions, therapeutic duplication, and drugs that increase the risks of cognitive decline and falls [49]. Conversely, START is a list of 22 considerations to minimize the possibility that older patients do not receive pharmacotherapy that may be indicated and beneficial.

It is important to note that these tools do not specifically address the complex needs of patients with dementia, particularly with end-of-life considerations in advanced disease. Future studies are needed to provide a framework for identifying PIMs throughout the spectrum of the illness [28, 37, 43].

Strategies to combat high-risk prescribing have been described in various settings including pharmacist medication review, involvement of a geriatrics specialist service, computerized alerts and clinical decision support tools, educational programs, and regulatory policies [1, 23, 34]. Diverse approaches were employed in these studies, making it difficult to assess the clinical effectiveness and sustainability of individual interventions. A systematic review conducted by Spinewine and colleagues revealed that studies incorporating geriatrics services, pharmacist involvement, and computerized clinical decision support resulted in considerable reduction in PIM use, while those focused on educational interventions had inconsistent results [61].

Because of the progressive nature of dementia, medication profiles must be reviewed and revised on a regular basis with careful consideration of the risks relative to potential benefits, life expectancy, and patient values and preferences [58].

Deprescribing methods applying patient-centered approaches have been shown to be safe and feasible and may improve patient outcomes [50, 55, 58]. In 2015, Scott and colleagues published a simplified five-step deprescribing protocol: (1) obtain a thorough medication history including indications, (2) ascertain individual patient risk to determine the appropriate intensity of a deprescribing intervention, (3) identify medications eligible for discontinuation if no valid indication, ineffective, or risk outweighs clinical benefit over patient's lifespan, (4) prioritize medications for discontinuation or taper that have the lowest benefit–harm ratio and likelihood of adverse withdrawal reactions, and (5) close monitoring, shared decision-making between patient and provider, caregiver support, and documentation of outcomes [58].

Deprescribing Antipsychotics

As a specific example, antipsychotic use in patients with dementia has been linked to significant adverse effects including mortality, and little evidence of long-term clinical benefit exists [6, 17, 32, 57]. For the management of BPSD, international guidelines advocate for non-pharmacologic interventions as a first-line alternative when feasible. These interventions, which should be applied using a patient-centered approach to maximize overall benefit, include but are not limited to cognitive and sensory stimulation, music therapy, environmental modifications, and caregiver support and education [8, 39, 45, 56]. In some instances, behavioral changes may signal an underlying condition that needs medical attention such as uncontrolled pain. Routine assessment of pain and effective management may reduce BPSD and the need for antipsychotics [18, 29]. Furthermore, the dementia subtype will likely influence treatment choices. For example, patients with Lewy body or Parkinson's dementia may have more severe adverse effects with antipsychotics, including worsening cognitive and motor function compared to individuals with other dementia subtypes [62]. In cases where non-pharmacologic interventions are inadequate or patients demonstrate symptoms of severe agitation posing a considerable risk of harm to themselves or others, pharmacologic treatment may be considered at the lowest effective dose [8, 39, 45, 56]. Emerging evidence suggests that deprescribing antipsychotics can be accomplished safely in some patients with minimal withdrawal symptoms. The direct link of antipsychotic discontinuation to long term outcomes such as improved quality of life, mortality reduction, or cost savings needs to be further elucidated [11, 26, 65].

As a part of the Deprescribing Guidelines for the Elderly Project, a Canadian team of pharmacists, family physicians, specialists, and medical researchers developed an evidence-based algorithm for deprescribing antipsychotics in BPSD. For patients stabilized on at least 3 months of treatment, the recommendation is to taper slowly with a 25–50% dose reduction on a biweekly basis. Patients and caregivers should be engaged in the determination of taper regimens and monitoring plans. If BPSD relapses, it is recommended to incorporate non-pharmacologic interventions and re-attempt a trial of deprescribing in 3 months [8].

Deprescribing Cholinesterase Inhibitors and Memantine

Four drugs are currently approved and marketed in the United States for management of symptoms of dementia: the cholinesterase inhibitors donepezil, rivastigmine, and galantamine, and the N-methyl-D-aspartate (NMDA) receptor antagonist memantine. These agents are widely prescribed despite their modest benefit [7, 42]. While they do not alter the underlying pathophysiology, they can provide clinically significant symptomatic improvement in some individuals.

As the underlying dementia progresses, family and prescribers often struggle with the decision to discontinue these agents. Similar to the previously mentioned algorithm for antipsychotics, the Deprescribing Guidelines for the Elderly Project has also published an algorithm to provide guidance for deprescribing cholinesterase inhibitors and memantine [54]. In the absence of adverse effects, a diagnosis significantly limiting expected lifespan, patient/family unwillingness or inability to continue the medication, or certain other criteria, a year or more of treatment with a cholinesterase inhibitor or memantine is reasonable. Beyond that point, an attempt at deprescribing is reasonable in patients who have experienced a significant loss of cognitive function in the previous 6 months, end-stage dementia (e.g., inability to interact with their environment or near complete reliance on others for activities of daily living), or if no perceived benefit is being seen. Tapering of the cholinesterase inhibitor or memantine is recommended, and the patient and caregivers should be assessed at least monthly.

Barriers to Deprescribing

Optimizing medication therapy in patients with dementia can be challenging due to shifting goals of care along the spectrum of disease severity. Patients may be psychologically attached to chronic medications, and discontinuation may signal the perception of inadequate care, deteriorating medical condition, or coincidental terminal illness [5]. Behavioral and psychological symptoms of dementia are common, complex, and can be difficult to manage. The profound impact these symptoms have on patients, families, and caregivers have led to an overreliance on the use of psychotropic medications [26]. Resistance from patients or caregivers due to perceived benefit of medications may decrease the likelihood of deprescribing and, in some cases, damage the patient–provider relationship. Furthermore, the fear of destabilizing a patient or causing unfavorable sequela by discontinuing medications prescribed by a specialist or another clinician may be a deterrent to successfully withdrawing medications [24]. Lastly, there is a paucity of high-quality evidence-based guidelines supporting safe deprescribing practices [5, 58].

Deprescribing should be integrated into routine clinical practice to improve care and promote rational medication use in patients with dementia. Successful deprescribing requires open communication, shared decision-making, and continuous engagement of patients, families, and caregivers. Further research is warranted to develop evidenced-based systematic approaches for safe deprescribing.

Improving Medication Adherence in Patients with Dementia

Adherence to prescribed medications is low in the general population, even lower in older patients, and especially poor in individuals with a diagnosis of mild cognitive impairment or dementia [66]. Nonadherence increases the risk of several clinically important outcomes including hospital admissions, nursing home placement, and mortality. Nonadherence also correlates with increased healthcare costs [36]. While a precise, standardized definition of adherence does not exist, it is generally accepted that taking <80% of prescribed doses is suboptimal and significantly increases the risk of poor outcomes.

Older patients with dementia face specific challenges to their ability to be adherent above and beyond those that are typical. Deficits in various areas of cognition can contribute to these challenges. For example, deficits in executive function may contribute to patients' inability to devise and follow through on plans to take medications as prescribed [40]. Declines in memory and attention can also negatively impact adherence. A decreased willingness to take medications and undergo other medical interventions as is sometimes seen in patients with dementia is also problematic. Finally, decreases in motor function, which are especially common in patients with more advanced cognitive impairment, can adversely impact patients' ability to take medications even if they are otherwise willing to do so. This is especially true for devices such as metered dose inhalers and dry powder inhalers that require a degree of dexterity to use properly [40].

"Low-Tech" Options

Streamlining medication regimens is an important step in increasing adherence for the simple reason that the fewer medications and doses are prescribed, the more likely it is that the patient will be adherent [20, 36]. This streamlining includes stopping medications that are no longer needed, duplicative, or are more likely to cause harm than provide benefit, as mentioned in the deprescribing section of this chapter.

Only a limited number of studies have identified approaches to improve adherence specifically in patients with dementia. Regimens consisting of medications given no more than twice per day, simple pill boxes, increased caregiver involvement, and provision of blister packs of medications with the involvement of a pharmacist to deliver education and answer questions are among the interventions with documented effectiveness [66]. Furthermore, use of devices such as inhalers as opposed to a nebulizer to deliver inhaled drugs appears to adversely affect adherence [40]. Evidence also exists that patients are more adherent to transdermal rivastigmine than an oral cholinesterase inhibitor, though the significantly higher acquisition cost for the transdermal dosage forms as well as the modest effectiveness of all currently available treatments for dementia must also be considered [36].

"High-Tech Options"

A number of more technologically elaborate approaches to increasing medication adherence in patients with dementia have also been evaluated. These include pill boxes, telehealth interventions, automated dispensing devices, and smartphone applications. Pill boxes with alarms that signal when a dose of medication is due may be useful in some individuals but, depending on the severity of cognitive impairment, these often require that a caregiver or healthcare professional fill and program them. [36] This is a relatively low-cost choice, with many options costing under $100.

Telehealth interventions consisting of either regular automated telephone calls or actual people (generally pharmacists) contacting patients to remind them when a dose is due and/or provide education and encouragement regarding their regimen have proven to be successful in some studies [13, 60].

Automated dispensing devices that release dose(s) at a specific time and signal the patient that a medication dose is due are available. Several different options exist; for some the equipment is purchased outright and others are a subscription service that is paid for monthly. In either case, as is true for most interventions designed to increase adherence, help from a caregiver or other individual is needed to stock the machine with appropriate medications and program it correctly is needed. Prices vary widely; upfront costs range from free to nearly $1700; monthly fees can be as low as $0 for certain products purchased outright to as much as $80 [59].

Smartphone applications that notify the patient/caregiver when a dose is due are also available. These also will generally require someone to program them as well as verify that doses are being taken as prescribed. Examples include Medisafe and Pill Reminder. Costs for these applications range from free to a few dollars.

Overall, nearly 200 studies evaluating interventions intended to increase medication adherence have been performed; only a small number have specifically enrolled patients with dementia [48]. Even in groups of patients who do not have the specific challenges and barriers to adherence that patients with dementia face, the evidence supporting specific interventions is weak. Still, strategies to improve medication adherence remain vitally important both for management of the underlying dementia as well as comorbid conditions.

Transitions in Care in Patients with Dementia

Caring for patients with underlying dementia presents healthcare practitioners and caregivers with many challenges, especially when they are transitioning them from outpatient to inpatient settings and vice versa. In one study, greater than 40% of hospital admissions in older patients were due to drug-related issues [25]. This begs the question of how efficient the healthcare system is when conducting medication

reconciliation at every point where patients are seen. Caring for the elderly, regardless of care setting, can be challenging as these patients have many pathophysiologic and physiologic changes related to comorbidities and aging [64]. In addition to the normal changes that occur with aging, a patient with dementia may have difficulty comprehending instructions as well as remembering when to take medications without some type of additional help as discussed above [27].

In a study done in Australia, researchers found that patients with dementia are about twice as likely to be admitted to a hospital than a patient without dementia (25% vs. 12%). [4]. Studies have also shown that as dementia progresses, the rate of utilization of inpatient nursing facilities progressively increases; however, close to 50% of patients will return home at some point with or without formalized nursing services. Many patients will have at least one transition from a skilled nursing facility before reaching their long-term living situation. Every transition in care carries with it an opportunity for miscommunication between the patient or caregiver and health care providers regarding goals of care and medication changes [16].

Transitions in care pose a challenge to both caregivers and healthcare professionals because medication changes may be warranted due to the acute illness itself or as a result of abrupt cognitive status changes leading to an increase in the risk of medication errors. Acute declines in cognitive status can linger for some time after illness before returning to baseline. In some instances, the patient may establish a new cognitive baseline resulting in changes in medication needs as well as the appropriate level of care for them. Often, a baseline decrease in executive function before illness can negatively affect the recovery process as patients are less likely to fully participate in physical rehabilitation [52]. Because approximately 30% of adults over the age of 65 years are taking at least 5 medications, this creates more room for error and increases the importance of determining the need and appropriateness of each medication prescribed [53].

In a systematic review, between 0.4–51.2% of patients experienced medication-related harm after discharge from a hospital. Of these incidents, between 35–59% were found to be preventable [51]. Preventing medication-related issues while patients are transitioning between different levels of care has been a focus of National Patient Safety Goals for medical accrediting bodies, including the Joint Commission, for many years. Establishing best practices in transitions of care is something on which healthcare providers and institutions continue to spend significant time and resources [46, 47].

Patients with multiple co-morbidities are often prescribed medications from several providers. However, changes due to acute illness or in overall health status are not always communicated to all prescribers. A qualitative study conducted in Sweden showed that there were five important themes identified from multiple focus groups involving trained healthcare providers who cared for patients with dementia transitioning between levels of care.([9]) Because providers don't always have contact with the other providers caring for a patient with dementia, a good working relationship with the next of kin or caregiver that is routinely interacting with the patient living with dementia is vital. This is as important during the early stages of disease as it is in the more advanced stages. Next of kin and caregivers can provide important information and history regarding disease progression and

medication use. They are also able to share goals of care discussions that may have occurred within families and ensure that the patient's goals and wishes are being respected [9].

Medication reconciliation remains a large part of transitions in care and, because it is a highly involved and detail-oriented process, many issues can be overlooked and mistakes can be made. Thorough assessment in combination with detailed documentation can also aid health care practitioners in making educated decisions regarding medication changes. Communication between inpatient and outpatient providers can also help to ensure smoother transitions in care. Short hospital stays and rapid discharge planning often leave little time for a thorough process that ensures accurate reconciliation occurs. Inpatient practitioners often reach out to outpatient providers when a patient is hospitalized, but there may be lag time in response due to clinic responsibilities, leaving the inpatient provider to make decisions with only the information they have on hand. Likewise, providers who are on the receiving end of a patient, whether it be in an outpatient clinic or rehabilitation center, face similar challenges getting in contact with inpatient providers to find out more about what may have happened during an inpatient stay. Involving family members, caregivers, or the patient's regular pharmacist can be helpful in this area. Inpatient pharmacists can also play a role in ensuring accurate records are being utilized while decisions are being made [19].

Discussion of Clinical Case

LE is experiencing medication management issues in all of the areas discussed in this chapter with polypharmacy/potentially inappropriate medication prescribing and poor adherence contributing to his frequent hospitalizations. He is also now transitioning to a different level of care, further increasing the risk for medication misadventures. Furthermore, opportunities for deprescribing are also present.

The causes or factors contributing to LE's non-adherence to his prescribed diuretic should be elucidated. If it is related to his underlying dementia, simple reminders such as a pill box or more complicated approaches such as setting an alarm as a reminder may be indicated. It may also be necessary for the prescriber to broach the subject of the patient receiving additional help from caregivers in order to improve adherence, either now or in the near future. However, it should not be assumed that the dementia is the only or even the main cause of the non-adherence. Reinforcing the purpose of the medication and the possibility that taking the regimen as prescribed may prevent hospitalizations could prove helpful, as often patients discontinue medications from which they do not perceive a benefit. The strong diuresis from loop diuretics can also be a challenge in patients with limited mobility who find it difficult to reach the restroom before voiding; if this is the case with LE, interventions such as a bedside urinal or commode could be warranted.

Discontinuing unnecessary or potentially inappropriate medications could decrease LE's pill burden and improve adherence to the rest of the regimen as well as decrease the risk for adverse effects. The use of the long-acting sulfonylurea

glyburide should be revisited, as it has a fairly high risk of causing hypoglycemia in elderly patients and is specifically mentioned in both the Beers criteria and STOPP. Metformin, if not contraindicated, may be appropriate as it does not cause hypoglycemia when used as monotherapy. Due to his age, comorbidities, and good glycemic control, non-pharmacologic approaches alone could also be reasonable. A discussion of the risks and benefits of simvastatin in this older patient with no history of cardiovascular events would be worthwhile. Finally, doxylamine and ibuprofen are potentially inappropriate due to their anticholinergic and gastrointestinal/renal toxicities, respectively, and should be replaced with safer alternatives including possibly non-pharmacologic options.

Transitioning from acute care to a skilled nursing facility and then back home is fraught with potential issues for LE. Medications started while in an acute care setting that are not needed in the long term, such as prophylaxis for deep venous thrombosis, sliding scale insulin, or proton pump inhibitors, should be discontinued. Furthermore, a thorough medication reconciliation should be performed at each transition of care. Patient and caregiver education covering both chronic and recently started medications, including the name, schedule, purpose, and potential adverse effects, should be provided, and barriers to the patient's ability to adhere to the prescribed regimen should be determined and dealt with to the extent possible.

Conclusion

Medication management is always challenging and is even more so in individuals with dementia. Great caution is called for when initiating, modifying, or even discontinuing a drug in this population, but many patients can have their medication regimen streamlined or otherwise improved by reducing or replacing potentially inappropriate medications. Although little data on improving adherence in patients with dementia exists, some simple or technological approaches are available and may be of benefit. Finally, increasing awareness of the potential pitfalls and stumbling blocks in medication management in patients transitioning from one level of care to another can potentially decrease medication-related problems in this highly vulnerable population.

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Chapter 5
Management of Heart Failure in Older Adults with Dementia

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Main Points

- Cognitive impairment is highly prevalent in patients with heart failure (HF) and adds significant complexity to the management and may worsen outcomes.
- The presence and impact of cognitive impairment should be considered when developing a management plan for heart failure.
- It is of critical importance to involve a caregiver in the treatment plan and provide adequate education to the patient and caregiver as well in order to improve the outcomes.
- Heart failure management in a patient with cognitive impairment should be personalized according to goals of care and what are the available resources to improve the care provided.

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Case Vignette: Mrs. SJ

Mrs. SJ is an 84-year-old pleasant woman who presents to the clinic following a recent hospitalization due to decompensation of chronic congestive heart failure (CHF). Her medical history includes atrial fibrillation, coronary artery disease with remote history of stents, ischemic cardiomyopathy with ejection fraction 25% and defibrillator in place, transcatheter aortic valve implant 3 years ago, chronic kidney disease stage 2, and dementia diagnosed a year ago. She is accompanied by her daughter who is the caregiver. Over the last 1 year, she had more than five hospital admissions due to recurrent CHF exacerbation. Since she was discharged 6 days ago, she is having more difficulty walking with progressive shortness of breath and worsening lower extremity edema. She is unable to get enough sleep at night due to frequent urination every 1–2 hours. She is occasionally light headed and had one fall in the past year with minor bruising. Her current medication regimen includes apixaban, clopidogrel, atorvastatin, metoprolol, lisinopril, digoxin, amlodipine, melatonin, and different dosage and frequency of furosemide, which has been changed after each hospitalization. She lives with her daughter in a one-story house, able to ambulate with a walker, and self-sufficient in activities of daily living but depends on her to manage finances and medication refills. Daughter, who works full-time, has noticed progressive functional and cognitive decline in her mother. Both are extremely fatigued due to the complex medication regimen and frequent hospitalizations and wondering about appropriate weight for her and how frequent it should be checked, and possible changes in her diet or medication regimen.

On physical exam, Mrs. SJ appears frail but in no distress. She is aware of her medical history but relies on daughter for details. Her blood pressure is 110/85 mmHg, heart rate 85/min and irregular, weight is 130 lbs, which is 10 lbs up from discharge weight. Neck veins are mildly distended. Chest exam reveals reasonable air entry bilateral, no rales, irregular rhythm, grade 2 by 6 systolic murmur at left lower sternal border with soft ejection systolic murmur over aortic area. There is 1+ pedal and tibial edema.

On cognitive examination, her Montreal Cognitive Assessment (MoCA) score is 20/30. She has deficits in memory, naming, and in clock-drawing task. She has no deficits in activities of daily living (ADLs), and has deficits in instrumental activities of daily living (IADLs) in managing medications, transportation, shopping, housework, and finances. She meets the definition of frailty with frequent exhaustion and fatigue, weakness, and very slow gait using her walker. She has low albumin levels consistent with protein-calorie malnutrition.

Epidemiology of Heart Failure

Definition

American College of Cardiology defines HF [1] as a complex clinical syndrome that results from any structural or functional impairment of ventricular filling or ejection of blood. The cardinal manifestations of HF are dyspnea and fatigue, which may limit exercise tolerance, and fluid retention, which may lead to pulmonary and/or splanchnic congestion and/or peripheral edema. Some patients have exercise intolerance but little evidence of fluid retention, whereas others complain primarily of edema, dyspnea, or fatigue.

Incidence and Prevalence of HF

Recent analyses have shown discordant evidence about incidence and prevalence of HF in the United States. The largest outpatient cohort studies, i.e., Framingham Heart study [2] and Olmsted County Study [3], reveal that incidence of HF has remained stable over time since 1950s for both men and women with perhaps a slight decline in incident HF in women. A study on elderly Medicare population showed that incidence of heart failure declined from 32 per 1000 person-years in 1994 to 29 per 1000 person-years in 2003 ($P < 0.01$) with a more sharp decline seen among beneficiaries aged 80 to 84 years (from 57.5 to 48.4 per 1000 person-years, $P < 0.01$) [4] However, the trends noted for the elderly in managed care population from 1970s to 1990s show higher incidence among persons aged ≥65 years by as much as 14% [5]. A more contemporary elderly cohort in the Health, Aging and Body Composition Study showed similar high incidence and poor prognosis once diagnosed with HF [6].

The prevalence of HF continues to rise over time with the aging population. Annual cost of HF in the United States is $39.2 billion. An estimated 6.2 million American adults ≥20 years of age (2.2%) had HF between 2013 and 2016 compared with an estimated 5.7 million between 2009 and 2012 [7]. This number is expected to rise to 8.5 million by 2030 [8]. Prevalence of HF goes up with increasing age. Recent data also show that, for adults ≥60 years, 6.9% of males and 4.8% of females have HF, and in adults ≥80 years this almost doubles for men (12.8%) and triples for women (12.0%) [7]. The NHLBI-sponsored Cardiovascular Lifetime Risk Pooling Project indicates that HF incidence is about 21 per 1000 population after age 65 years, and overall at age 45 years through 95 years, lifetime risks for HF are high (20–45%) [9].

HF is a complex heterogeneous state, and disease prevalence increases with age. Among different methods of classifying HF, the most common is by echocardiographic assessment of ejection fraction (EF). HF with reduced EF (HFrEF), or systolic dysfunction, is defined as EF <40–50%, and HF with preserved EF (HFpEF,)

or diastolic dysfunction, is defined as EF >50%. The discussion on newly introduced category of HF with mid-range EF (40–49%) is beyond the scope of this chapter and largely a debated topic with insufficient evidence. For the purpose of discussion, the management should focus on currently available management of HFrEF. Coronary artery disease remains the number one cause for HFrEF. Compared with HFrEF, patients with HFpEF tend to be older, women, and die more often from non-cardiovascular-related causes partially explained by a higher co-morbidity burden with age [10]. HF remains the single most common cause of hospitalization among individuals aged ≥65 years. Most of these are attributable to acute on chronic decompensation states where HFrEF and HFpEF share the incident hospitalization by half. Analysis of CMS data indicates that 25% of patients are readmitted within 30 days of initial hospitalization [11]. Survival is 50% at 5 years and 10% at 10 years after the diagnosis of HF. Age adjusted mortality is high in both Framingham (59% in men and 45% in women during the time period 1990–1999) and Olmsted County (50% in men and 46% in women during the time period 1996–2000) cohorts. Community-based data of older adults in The Cardiovascular Health Study reported 1-, 5-, and 10-year mortality rates of 19%, 56%, and 83% following the onset of HF [12].

Prognosis in Heart Failure

Prognosis of the elderly population with HF is poor, where age itself is associated with higher risks of cardiovascular events and mortality at both short- and long-term follow-up [13]. Prognostication is even more complex in the large elderly population with HFpEF and high co-morbidity burden. Patients with HFrEF have poor survival rates compared to patients with preserved EF. Higher New York Heart Association (NYHA) class portends a worsened prognosis, and recurrent hospitalizations are strongly associated with worsening mortality. Issues related with low functional status, frailty, cognitive impairment and dementia play a significant role. Several risk prediction models [1] are available to define prognosis with modest to good discrimination. The Heart Failure Survival Score (HFSS) and the Seattle Heart Failure Model (SHFM) are the two most commonly used prediction tools and have been validated in several cohorts but none of these incorporate cognition, dementia, or frailty and may underestimate severity of illness in this population of older adults [14]. In summary, the management of older adults with HF and cognitive impairment must be individualized to give personalized care based on functional status and patient preferences.

Prevalence and Risk of Cognitive Impairment in HF Patients

Systemic review and meta-analysis studies have been done to identify the risk of dementia with heart failure. A history of coronary artery disease is associated with 27% increased risk of dementia [relative risk 1.27(1.07–1.50)], while heart failure is associated with 60% increased dementia risk [relative risk 1.6 (1.19–2.13)] [15].

As expected with the increased risk, cognitive impairment is very common in older adults with heart failure. The prevalence of cognitive impairment in hospitalized patients with heart failure ranges from 23% to 67.7% [16, 17]. In the ambulatory setting, the prevalence of mild cognitive impairments in HF patients has been published as 45.6% while 23.4% have severe cognitive impairment [18].

Many factors contribute to cognitive impairment in patients with heart failure, including stroke and cerebrovascular disease; arterial hypertension; atrial fibrillation; chronic or intermittent cerebral hypoperfusion related to reduced cardiac output and low systolic blood pressure; reduced physical activity; undernutrition; depression; medical comorbidities (e.g., diabetes, anemia, atherosclerosis); metabolic and hormonal abnormalities (e.g., increased homocysteine, elevated brain natriuretic peptide (BNP); hyponatremia; and low serum albumin [19].

Cognitive impairment is a broad term that includes mild, moderate, and severe symptoms. Various cognitive domains have been documented as commonly affected in patients with heart failure that include attention, memory, judgment, executive functioning, language, visual-spatial ability, processing speed, and learning [20, 21]. Due to the high prevalence of cognitive impairment in older adults with heart failure, it is important to have a low threshold to screen all patients with heart failure and especially those who seem to be medically "non-compliant," have difficulties managing their treatment plan, or have frequent emergency department or hospital visits. Different screening tools for cognitive impairment are available in the outpatient clinical practice. While the Mini-Mental State examination (MMSE) is well-known and frequently used in multiple studies [19, 22], the MMSE does not evaluate executive function. The Montreal Cognitive Assessment (MoCA) and the Saint Louis University Mental Status Examination (SLUMS) are well-validated cognitive assessments that do include measures of executive function, and they should be used in patients with heart failure who frequently have executive dysfunction [22]. A more convenient 3-minute screen for cognitive impairment, the Mini-Cog screen, may be used as a first-line screen in adults over age 65 years to help clarify the need for more in-depth cognitive assessment (www.Mini-Cog.com).

Diagnosis of Heart Failure

Detailed history and physical exam are fundamental in assessment of a patient with heart failure. A high degree of patience and familiarity with common signs and symptoms of heart failure are required when dealing with older adults with cognitive impairment as they may not always be able to give a detailed description. Whenever possible, involving family, friends, and caregivers and always eliminating any language barrier is crucial to obtaining an accurate history. Diagnosis is suspected with eliciting a spectrum of the following symptomatology and should be confirmed with detailed assessment with echocardiogram.

Dyspnea is the most common complaint. However, older sedentary patients may not manifest this unless in an acutely decompensated state. It is important to determine the functional status of the patient by asking direct, simple questions. The determination of ambulatory status and independence in ADLs versus partial or complete

dependence directly impact prognosis. For more ambulatory patients, assess exertional symptoms of dyspnea, shortness of breath, and chest pain. The resting symptoms of orthopnea and paroxysmal nocturnal dyspnea (PND) are also extremely important. Inquiring about number of pillows used to sleep is a very basic question, but, if not present, try to elicit additional details like inclined head end of bed and sitting/sleeping in a recliner. Nocturnal cough can present as PND. Edema of the lower extremities can be from HF or chronic venous insufficiency and varicose veins.

Dizziness, lightheadedness, pre-syncope, or syncope can present secondary to a variety of etiologies including narrow pulse pressure in advanced heart failure, medication side effects, or autonomic neuropathy. Each of these etiologies of light headedness merits distinction as the management differs.

Very elderly patients can have subtle and atypical symptomatology including lack of energy and appetite; gastrointestinal symptoms like bloating, easy satiety, and constipation; worsening fatigue; and generalized body aches.

The exam should start with carefully taken vital signs, and provider should have a low threshold for checking orthostatic vitals. Detailed cardiac exam, with assessment of jugular venous pressure, rhythm, heart sounds, gallops (signify increased filling pressures), and murmurs, should be performed. Lung exam for any areas of lack of air entry or rales (though very nonspecific sign) and wheeze or rhonchi should be elicited. Abdominal exam for hepatomegaly from congestion and peripheral edema and pulses should all be checked.

EKG on index visit and subsequently as needed for rhythm, electrolyte and medication effect, pacer and ICD function should be done. Echocardiogram for left ventricular EF assessment must be performed at least once and then as needed depending upon the change in clinical status. Chest X-ray initially and then as needed as part of evaluation of shortness of breath and to rule out a different pulmonary pathology.

Frailty and functional ability should be objectively assessed for prognostication. While the Fried phenotype of frailty is the most commonly used measure of frailty in HF studies, the measurement of hand grip strength and gait speed are more difficult in clinical practice. The Clinical Frailty Scale (CFS) is a simple assessment to be performed by the clinician in coordination with the patient and family [23]. The CFS was found to correlate well with more lengthy measures of frailty in a HF population [24]. HF functional class as assessed by New York Heart Association guidelines is the most commonly used tool (Table 5.1) and is based on the heart failure symptoms and functional limitations.

Care should be coordinated with the cardiologist for further management as needed and tolerated by the patient. As dementia progresses, additional clinic visits may be extremely burdensome for the patient and caregivers. Thus, in these cases, it may be best for more interprofessional discussions and with patients visiting specialists only as required.

Management of Heart Failure

Heart failure is a disease of age. Management of HF in the elderly should encompass a comprehensive and integrated approach that can adequately address the key

Table 5.1 New York Heart Association Functional Classification for Congestive Heart Failure

I	Cardiac disease without resulting limitations of physical activity. Ordinary physical activity does not cause undue fatigue, palpitations, dyspnea, or anginal pain.
II	Cardiac disease resulting in slight limitations of physical activity. Comfortable at rest. Ordinary physical activity results in fatigue, palpitations, dyspnea, or anginal pain.
III	Cardiac disease resulting in marked limitations of physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitation, dyspnea, or anginal pain.
IV	Cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of heart failure present even at rest. If any physical activity is undertaken, discomfort is increased.

Adapted from The Criteria Committee of the New York Heart Association. Nomenclature and criteria for diagnosis of disease of heart. 9th ed. Boston (MA): Little Brown; c1994

dimensions of multi- morbidity of age, cognitive impairment, and frailty. It is paramount that physicians assess the social situation, involve family and friends, and communicate with consultants taking care of other conditions.

The burden of multi-morbidity is expansive where 90% of older adults have at least three comorbid conditions [25] and 50% have at least five additional disease processes [26]. This burden is higher in HFpEF where the phenotype is typical of an elderly woman with obesity, diabetes mellitus type 2, hypertension, chronic kidney disease, and lung disease, all playing a significant pathophysiological role. Realization of the comorbidity burden leads to understanding with issues of polypharmacy (use of ≥5 mediations) and associated risks. Keeping above issues in mind, we will discuss the pharmacological and non-pharmacological management of HF.

Pharmacotherapy

The elderly population is underrepresented in most randomized clinical trials investigating drugs for heart failure. Moreover, there is much less established, evidence-based treatments for HFpEF, which is found in a larger proportion of HF in older adults. Current Guideline-Directed Medical Therapy (GDMT) for HF is comprised of diuretics for symptom control and neurohormonal blockade of the renin-angiotensin-aldosterone system (RAAS) pathway, which has revolutionized the care of HF in recent era. Neurohormonal blockade with angiotensin converting enzyme inhibitors (ACEi), angiotensin receptor blockers (ARB), angiotensin receptor-neprilysin inhibitors (ARNi), mineralocorticoid receptor antagonists (MRA) and beta blockers is the cornerstone of treatment with proven outcomes data in patients with HFrEF. Overwhelming evidence exists that the use of GDMT consistently improves outcomes and reduces mortality [1]. Patients with HFpEF are treated for their underlying risk factors along with GDMT. No drug trials to date have shown a clear reduction in mortality.

See the attached Table 5.2 for Guideline-Directed Medical Therapy for HF. It is evident that the number of recommended medications is at least three, and as many

Table 5.2 Guideline-Directed Medical Therapy (GDMT) for Heart Failure

Drug	Initial daily dose(s)*	Maximum dose(s)	Indications/key points	Contraindications	Precautions	Adverse reactions	RR reduction in mortality (%)
Angiotensin Converting Enzyme Inhibitors (ACEi)							
Captopril	6.25 mg thrice	50 mg thrice	Block activation of the renin-angiotensin system. May be safely initiated even if systolic blood pressure is as low as 90 mm Hg. Risk of hypotension increased with hypovolemia; consider decreasing diuretic dose prior to ACEI initiation or titration.	Angioedema Hyperkalemia (greater than 5.5 mm/L) off potassium supplement	Renal impairment (creatinine greater than 3.0) Do not start ACEI, if GFR less than 30 ml/min Mild hyperkalemia (greater than 5.0 mm/L) off potassium supplement Hypovolemia (consider decreasing diuretic dose if applicable) / Hypotension Renal artery stenosis	Dizziness Nausea Headache Hyperkalemia Fatigue Orthostatic hypotension Diarrhea Renal impairment Upper respiratory symptoms Angioneurotic edema Cough	17
Enalapril	2.5 mg twice	10–20 mg twice					
Fosinopril	5–10 mg once	40 mg once					
Lisinopril	2.5–5 mg once	20–40 mg once					
Perindopril	2 mg once	8–16 mg once					
Quinapril	5 mg twice	20 mg twice					
Ramipril	1.25–2.5 mg once	10 mg once					
Trandolapril	1 mg once	4 mg once					

Angiotensin Receptor Blockers (ARB)							
Candesartan	4–8 mg once	32 mg once	May be considered as an alternative when ACE inhibitor results in significant cough (seen in less than 10%), or rash. Have been proven to improve symptoms, decrease hospital readmissions, and decrease mortality in patients in heart failure. However, in clinical trials ACE inhibitors remain superior for treatment of heart failure.	ACEi-induced angioedema	Renal impairment Renal artery stenosis	Dizziness Hyperkalemia Elevated creatinine	
Losartan	25–50 mg once	50–150 mg once					
Valsartan	20–40 mg twice	160 mg twice					

(continued)

Table 5.2 (continued)

Drug	Initial daily dose(s)*	Maximum dose(s)	Indications/key points	Contraindications	Precautions	Adverse reactions	RR reduction in mortality (%)
Angiotensin Receptor-Neprilysin Inhibitors (ARNi)							
Sacubitril/valsartan	49/51 mg BID (sacubitril/valsartan) (therapy may be initiated at 24/26 mg BID)	97/103 mg BID (sacubitril/valsartan)	ARNi	ACEi-induced angioedema	Should not be administered concomitantly with ACEi or within 36 hours of last dose of ACEi.	Hypotension/renal insufficiency	20
Beta Blockers							
Bisoprolol	1.25 mg once	10 mg once	Block neurohormonal effects of the sympathetic nervous system. Do not initiate beta blockers for patients with acute heart failure, hemodynamic instability regardless of NYHA class, until they are clinically stabilized for at least 2–4 weeks. A low dose should be started at clinic visit and slowly titrated to target dose. Specialty referral for initiation and titration may be used.	High-degree heart block Cardiogenic shock Decompensated heart failure	Avoid abrupt cessation Use with caution in patients with any of the following: Sinus bradycardia (HR less than 55) Hypotension (systolic BP less than 90 mm Hg) Decompensated heart failure Hepatic dysfunction Surgery Diabetes Hyperthyroidism Bronchospastic disease	Fatigue Dizziness Rash Depression GI upset Dyspnea Bradycardia Cold extremities Palpitations Heart Failure Edema Syncope Chest pain Hypotension Bronchospasm Heart block Angina	34
Carvedilol	3.125 mg twice	50 mg twice					
Carvedilol CR	10 mg once	200 mg once					
Metoprolol succinate extended release (Metoprolol CR/XL)	12.5–25 mg once	200 mg once					

Hydralazine and isosorbide dinitrate							
Fixed-dose combination	37.5 mg hydralazine/20 mg isosorbide dinitrate thrice daily	75 mg hydralazine/40 mg isosorbide dinitrate thrice daily	May be considered when symptomatic hypotension, azotemia, or hyperkalemia results from use of an ACEi/ ARB/ ARNi. Also demonstrated of value in addition to ACEi in African-American population.	*Isosorbide dinitrate:* None *Hydralazine:* Active ischemia	*Isosorbide dinitrate:* Hypotension Volume depletion Hypertrophic cardiomyopathy *Hydralazine:* Severe renal impairment Stroke Aortic aneurysm Aspirin hypersensitivity	*Isosorbide dinitrate:* Headache Flushing Dizziness Weakness Orthostatic hypotension Paradoxical bradycardia Rash *Hydralazine:* Lupus-like reaction (more often with doses greater than 200 mg/day) Tachycardia Angina Headache Edema Orthostatic hypotension Peripheral neuritis Flushing GI disturbances Nasal congestion Lacrimation Rash Blood dyscrasias	43
	thrice daily						
Hydralazine and isosorbide dinitrate	Hydralazine: 25-50 mg, 3 or 4 times daily, and isosorbide dinitrate: 20–30 mg 3 or 4 times daily	Hydralazine: 300 mg daily in divided doses, and isosorbide dinitrate: 120 mg daily in divided doses					

(continued)

Table 5.2 (continued)

Drug	Initial daily dose(s)*	Maximum dose(s)	Indications/key points	Contraindications	Precautions	Adverse reactions	RR reduction in mortality (%)
Aldosterone Antagonists							
Spironolactone	12.5–25 mg once	25 mg once or twice	Used in patients in NYHA Class III-IV symptoms.	Significant hyperkalemia (K+ greater than 5.5) Renal impairment (creatinine greater than 3.0)	Hyponatremia	Hyperkalemia Drowsiness Drug fever Hyponatremia Headache Ataxia Gynecomastia Rash Impotence GI disturbances Confusion Hirsutism Voice deepening	30
Eplerenone	25 mg once	50 mg once					
Digoxin							
Start dose at 0.125 mg or less daily for all patients.	Goal therapeutic level 0.5–0.9ng/ml	•No more than 0.125 mg for patients greater than 65 years Monitoring/Labs	Has been shown to improve symptoms and decrease hospitalizations in patients with NYHA Class III/IV heart failure or ACC/AHA Stage C or D. Also used in patients with atrial fibrillation.	History of ventricular fibrillation	Renal dysfunction (decrease dose) Toxicity risk increased by hypokalemia, hypomagnesemia, & hypercalcemia, hypothyroidism.	Heart block and other arrhythmias GI effects (anorexia, nausea, vomiting, diarrhea) CNS effects (visual or mental disturbances, confusion, headache, weakness, dizziness, apathy)	No mortality benefit /Modest reduction in HF hospitalizations
If Channel Inhibitor							
Ivabradine	5 mg BID	7.5 mg BID	On background therapy of max tolerated dose of beta blockers, in sinus rhythm with heart rate 70/min or greater	High degree AV block/Atrial fibrillation/Acute decompensated HF/Severe hepatic impairment/ Hypotension			No mortality benefit /reduction in HF hospitalization

Diuretics							
1. *Loop diuretics are generally recommended to begin diuresis.*							
∗Furosemide (Lasix) ORAL/IV	Start with 10–40 mg daily but may increase as needed. (Scored tab sizes 20 mg, 40 mg, 80 mg)	480 mg in single or divided doses	Diuretics should be used to maintain appropriate total body salt and water homeostasis only after proper sodium and fluid restriction instruction has been given. Diuresis should be started either in conjunction with or after afterload reduction therapy.	Anuria Hepatic coma or precoma For metolazone: sulfonamide allergy	Renal and hepatic dysfunction Gout Arrythmias SLE Diabetes	*Loop diuretics:* Excessive diuresis Fluid or electrolyte imbalance GI upset Dizziness Vertigo Paresthesia Orthostatic hypotension Hyperglycemia Syncope Jaundice Hyperuricemia Rash Photosensitivity Tinnitus or hearing loss Blood dyscrasias	
∗Bumetanide (Bumex) ORAL/IV/IM	Start with 0.5–1 mg daily but may increase as needed. (Scored tab sizes 0.5 mg, 1 mg, 2 mg)	10 mg in single or divided doses					
∗Torsemide (Demadex) ORAL/IV	Start at 5 mg daily but may increase as needed. (Scored tab sizes 5 mg, 10 mg, 20 mg, 100 mg)	200 mg in single or divided doses				*Metolazone:* Electrolyte/metabolic disturbances (especially hypokalemia) Hyperglycemia Hyperuricemia Hypercalcemia Orthostatic hypotension Photosensitivity GI disturbances Blood dyscrasias Chest or joint pain Cutaneous vasculitis	
2. *If resistance to diuresis develops, or patient continues gaining weight after being placed on moderate to high doses of loop diuretics, try to change to a different loop diuretic or add a thiazide diuretic or metolazone to augment diuresis with close monitoring of renal function and electrolytes.*							

as seven, in addition to the medications required for the other concurrent illnesses. This can be problematic for an elderly patient, especially in the context of cognitive impairment. Issues related to adverse reactions, drug–drug interactions, and accidental over- or underdosing are all common. This highlights the importance of deprescribing when relevant, individualizing care plans, and weighing risk versus benefit. It is also important to keep in mind that age by itself should never be a reason to alter or discontinue an otherwise evidence-based therapy. Deprescribing, in contrast to ageism, is a methodological framework where patient, caregiver, and physician are involved in a shared decision-making process.

GDMT should not be withdrawn on patients who recover their EF to 40–50%. A recently done single-center, randomized, control trial demonstrated that approximately 40% of patients with recovered EF who are currently asymptomatic on good regimen will have a relapse of cardiomyopathy within 6 months of treatment withdrawal [27].

In very elderly patients who are otherwise doing well from HF standpoint and are euvolemic, it is reasonable to lower the dose of diuretics or dose only as needed to avoid dizziness and hypotension and prevent electrolyte fluctuations. Supplemental potassium should always be adjusted according to diuretics and laboratory monitoring. Digoxin should be avoided in very elderly patients or used in a low dose (0.125 mcg daily) because of a longer half-life due to reduced renal function and reduced volume of distribution associated with age secondary to reduced lean body mass and increased adipose tissue. However, in patients who are already on digoxin and otherwise doing well, it may be continued with caution with periodic monitoring for changes in renal function. Withdrawal of digoxin should be deliberate with observation for decompensation of HF.

RAAS antagonism and beta blockers should only be removed for refractory hypotension, palliative illness, and end-stage disease. Dose reduction usually helps with mild hypotension, bradycardia, and dizziness.

Ischemic evaluation and revascularization of underlying CAD should be performed according to guidelines in symptomatic patients.

Device Therapy and Advanced Heart Failure Management

Implantable cardioverter defibrillators (ICDs) reduce all-cause mortality and sudden cardiac death in patients with HFrEF, but elderly patients were underrepresented in seminal trials. Given an invasive, expensive procedure in a population with a significant competing risk of death from a non-cardiac cause, ACC/AHA and ESC guidelines do not recommend implantation in patients whose expected survival is less than a year. Similar recommendations are true for cardiac resynchronization therapy (CRT), which has shown to improve symptoms, exercise tolerance, and survival in selected patients with HFrEF [28].

Recently, the FDA has approved a percutaneous mitral valve repair device, MitraClip, for moderate to severe mitral regurgitation secondary to severe LV dysfunction in patients who are symptomatic on maximally tolerated GDMT. The COAPT trial demonstrated 47% reduction in HF hospitalization and 37% reduction

in the mortality at 2 years compared to the control group [29]. The severity of dementia and the ability of the patient to tolerate an invasive procedure should be carefully weighed when considering any device-related HF management interventions. Even a "simple" procedure and admission to the hospital place the patient at significant risk for delirium and other adverse outcomes related to hospitalization.

Mechanical circulatory support (MCS) is evolving for end-stage cardiomyopathy and age is usually not a factor for otherwise healthy, functional older adults when other end organ function is preserved. Mild cognitive impairment, thought to be due to poor cerebral perfusion, often improves or resolves after MCS. However, advanced neurological disease, such as dementia and terminal illness, is a contraindication for implantation.

The International Society for Heart and Lung Transplantation recommends 70 years as the upper age limit for heart transplant. Centers that transplant older patients usually have stringent patient selection criteria.

Nonpharmacological Therapy and Patient Education

It is crucial that patients and caregivers learn about proper nutrition, including salt and fluid restriction. Sodium intake restricted to 2–3 g/day is as important to maintain volume status as diuretics. Patients and their caregivers should be given educational resources and information so they can learn to read nutrition labels. They should be counselled to avoid canned, frozen foods, premixed seasonings, and premade sauces and salsa. It is important to teach flavor substitution generally with fresh ground spices, garlic, etc. Fluid restriction to 2–2.5 l/day, or even stricter criteria, may be required if volume is still not managed, but providers should be aware that this is very difficult to follow. Unnecessary restriction should be avoided to maintain quality of life. Potassium salt substitutes should also be restricted for patients on mineralocorticoid receptor antagonists (MRAs) and ACEi/ARB/ARNi because they can result in potassium retention. With underlying CKD, dangerous hyperkalemia can occur.

Patients should be referred to cardiac rehabilitation at least once after the diagnosis of HF, especially in those with MCI or mild dementia. However, insurance does not cover cardiac rehabilitation in HFpEF.

As arthritis is common in older population, it is important to note that nonsteroidal anti-inflammatory agents (NSAIDs) should be avoided at all cost and are listed as potential for harm class III in HF guidelines. NSAIDs impair renal blood flow, decrease GFR, and can result in sodium and water retention.

Patient and Caregiver Preferences

To ensure successful management of heart failure in a patient with cognitive impairment, caregivers should be involved in the discussion of management and treatment plans; decisions regarding what is possible given the extent of their resources; and

to elicit priorities of care. Much work is being done to help clinicians discuss and establish patient priorities in care (https://patientprioritiescare.org/resources/publications/). These priorities for healthcare must also be discussed with caregivers in patients with dementia. Depending on the level of cognitive impairment, patients may be able to discuss who they have trusted the most for healthcare decisions and determine healthcare proxies. However, decisions that are complex and risk-benefit decisions considering aggressive medical care and end-of-life care should involve family and caregivers. Clinicians should inquire and examine the patient for the worsening symptoms of heart failure as well as functional and cognitive changes at every clinic visit. Only with vigilant attention to progression of disease state and functional status can clinicians support patients and caregivers in making decisions on priorities for their care and give the best information regarding prognosis.

Self-Care Challenges in Heart Failure

Self-care represents an important aspect in management of acute and chronic illness, particularly in the heart failure patient with cognitive impairment. Both heart failure and cognitive impairment add to the unique challenges of taking care of an aging patient. The medical care of older adults is more complex due to the heterogeneity of seniors in regard to functional and health status, life expectancy, living situation, degree of caregiver support, and preferences and expectations. Each of these factors associated with aging will impact heart failure management and goals of treatment, while cognitive impairment increases the complexity in both management and setting appropriate goals of care.

HF management is complex and requires high levels of executive cognitive function to comply with post-discharge directives [30, 31]. Memory and executive functioning need to be intact in order to be able to recognize worsening symptoms, adhere to the treatment plan, follow instructions regarding dietary restrictions as well as medication instructions, and keeping clinic appointments [22]. Unfortunately, in patients with cognitive impairment, those major domains usually affected will affect the outcome of heart failure management [32].

While self-care and patient engagement are considered as critical for successful outcomes in HF patients, factoring in the impact of cognitive impairment has been underappreciated in most heart failure readmission reduction and management programs. Hospital readmissions have been shown to be increased in older HF patients with cognitive impairment shortly after discharge from post-acute care facilities where medical care is managed by facility staff [16]. Multiple cross-sectional and prospective studies showed a strong association between cognitive impairment and higher mortality, morbidity, and hospital readmission in heart failure patients [22, 33–37]. Specifically, the coexistence of HF and cognitive

impairment is associated with a twofold increase in 30-day mortality and readmissions [35], and approximately a fivefold increase of 1-year mortality [37]. Even mild cognitive impairment may impact and interfere with adherence to self-care practice [38, 39].

Cognitive impairment limits abilities for self-care. However, identification of cognitive impairment and involvement of family and caregivers provides an immense opportunity to improve heart failure care, reduce readmissions, and improve outcomes. Personalized care for those with impaired cognition as well as caregiver engagement are critical steps in optimal heart failure management.

Difficulty Understanding and Monitoring Symptoms of Heart Failure

Understanding the symptoms and how to monitor symptoms of heart failure usually requires frequent health education to the patient and caregiver. Before providing and starting an education program, the clinician should consider baseline educational status of both the patient and the caregiver [40]. The education program should include a written instruction about recognition of the worsening symptoms and explain actions to take when symptoms occur. Those symptoms may include, for example, shortness of breath, persistent cough or wheezing, lack of appetite and nausea, fluid overload in different body sites, and tiredness and worsening fatigue with minimal physical activity. The clinician should emphasize the importance of monitoring weight daily or very frequently since sudden changes may be a sign of oncoming HF exacerbation. Specific instructions are required for the caregiver on how to monitor weight, for example, how the patient should check weight every day at the same time using the same scale to ensure an accurate reading and the weights should be recorded in a log that is shared with the clinical providers. Establishing and providing home health nursing can help and assist in the education and monitoring of symptoms at home.

Medication Management

A cornerstone of heart failure management is adherence to the medication regimen, which may be a challenging task for a patient with cognitive impairment. Involvement of family members or caregivers by providing education and information on the medication regimen, dosing schedule, the basic reason for specific medications, expected side effects, and requesting patient and caregivers to read and interpret the instructions from a prescription medication bottle could improve medication adherence. Important advice and interventions to increase the likelihood of medication

compliance include the following: simplify the medication regimen as much as possible, utilize different tools to simplify and to ensure administration [40] (e.g. multidose packs, blister packs, pillboxes, smartphone apps, wall calendars, alarms, and reminders), use one pharmacy to help coordinate medications, and request medication refills 7–10 days in advance. The clinician should also review the timing of medications closely to avoid inadvertent use of diuretics at night leading to increasing nocturia or drops in blood pressure that may occur after administration of all the anti-hypertensive medications at once.

Adherence to Lifestyle and Treatment Plans

The dietary restrictions required in HF are very challenging for all patients and especially those with cognitive impairment who may have difficulty following the recommendations if they cook, and frequently do not cook or shop, and are dependent on others to provide meals. Patients and caregivers should be given resources to become aware of sodium content in their diet and tips to comply with the restriction of total daily intake. Patient with cognitive impairment may have significant difficulties and might develop complications with the combination of fluid restriction and diuretic use. So, avoiding fluid restriction when feasible is typically best in frail older adults to prevent possible complications (e.g. dehydration, electrolytes imbalance, and confusion).

Management of Other Medical Conditions

Management of other co-morbid medical conditions by involving multispecialty and multidisciplinary teams may be needed to provide better management of other medical conditions that may hinder self-care management [40]. Table 5.3 describes some of the challenges and key practice points in self-care management of heart failure related to cognitive impairment.

Heart Failure Management in Specific Living Situations

Understanding and identifying the available resources for the patient regarding the caregiver depends on different living situations and represents an important and crucial part in the management of heart failure. The living situation will have a direct impact on the adherence to the treatment plan. Table 5.4 describes important considerations and strategies to manage heart failure in cognitively impaired individuals based on living situation.

Table 5.3 Unique Challenges of Heart Failure in Older Adults and Cognitive Impairment

Distinct feature	Practice points
Cognitive impairment interferes with heart failure self-care.	Involve caregivers in discussions regarding the feasibility of and barriers to treatment plans. Seek social work consultation to assist with caregiver burden and resource allocation. For patients with advanced cognitive impairment, discuss a focus on maximizing quality of life above prolongation of life expectancy.
Difficulty understanding and monitoring symptoms of heart failure.	Clinicians should consider baseline education status of the patient and caregiver before starting an education program. The education program should include: Written instructions and interventions about recognizing worsening symptoms (e.g. SOB, worsening fatigue, fluid overload) by daily weighing, medication compliance, following specific dietary restrictions, implementing medication changes and seeking medical help when needed. Employ communication solutions to allow easy access to healthcare, who/when or why they need to seek assistance. Order home health nursing to assist in education, symptom monitoring, including frequent weights and care at home. Frequent follow-up appointments if possible in a specific pattern regarding day and time to have a routine that does not vary.
Adherence to lifestyle and treatment	Provide education for patient and caregivers on sources of sodium content in diet and how to comply with the restrictions. Emphasize the importance of sodium moderation in consumption. Establish care with a dietitian and provide information on available alternatives in diet (e.g. alternative spices, food flavorings), and provide resources for recipes with AHA. Avoid fluid restrictions if possible to prevent possible dehydration and electrolyte imbalance with the use of diuretics. Provide home health to assist with diet recommendations.
Medication management	Provide education for patient and caregivers on the medication regimen, dosing schedule, basic reasons for specific medications, and expected side effects. Ask patient and caregivers to demonstrate the ability to read and interpret the instructions from a prescription medication bottle. Simplify the medication regimen and avoid complex dosing as much as possible. Avoid diuretics in evenings if possible to reduce nocturia and risk of falls and poor sleep. Utilize different tools to simplify and ensure medication administration (e.g. multi-dose packs, blister packs, pill boxes, smartphone apps, wall calendars, alarms, and reminders). Request medication refills 7–10 days in advance. Provide home health to assist with medication compliance – may fill pill boxes, check on usage, monitor side effects..
Management of other medical conditions	Clinicians should be aware of preexisting conditions and diseases that may hinder self-care management. Involvement of multidisciplinary and multispecialty may be needed to provide better management of other medical conditions.

Modified from M. Munshi, 2019

Table 5.4 Heart failure Care Strategies Based on Living Situations in Residents with Cognitive Impairment

Living situation	Important considerations	Strategies for heart failure care
Independent, community	Patient will need caregiver support for diet and medication adherence. Complex regimens can be dangerous if patient/caregiver has difficulty managing multiple medications and doses. Acute illness can lead to further cognitive decline; monitor progress.	Re-educate patient and caregivers on each follow-up visit. Evaluate medication non-adherence, treatment burden, and caregiver fatigue. Simplify complex regimens based on patient/caregiver preference.
Assisted living facility	Residents are frequently more cognitively impaired and may need more assistance with ADL/IADLs. Inadequate heart failure education for staff and inability to modify care for individual residents. Patient unlikely to have control over the content of daily fluid or sodium intake.	Engage assisted living facility or caregiver to manage or supervise medications. Perform cognitive testing routinely to monitor progression of cognitive dysfunction. Monitor for treatment failure during acute illness and adjust medication regime based on clinical response. Home health nursing may still be helpful to monitor volume status and symptoms, which would not be monitored by assisted living staff.
Short-term skilled nursing facility	Goal is to return to permanent living situation. Patient will not have control over the content of daily sodium intake or overdosing of medications.	Order facility to help with daily/scheduled weight checks. Order SNF to monitor closely for worsening symptoms and unstable vitals. Simplify medication regimen upon discharge.
Long-term care	Patient has a limited life expectancy with high burden of comorbidities. May be fully dependent on all ADLs/IADLs and HF management. Higher rate of heart failure exacerbations and worsening symptoms due to greater comorbidities, higher risk of adverse effects of medications, delirium, and acute illness. Medications fully managed by medical team. Patient will not have control over the content of daily sodium intake. Inadequate heart failure education for staff. High staff turnover can increase risk of adverse events.	Focus on quality of life and harm reduction. Re-educate nursing staff frequently on warning signs of worsening symptoms and unstable vitals. Avoid evening time for diuretics administration to provide better sleep quality. Facility should help with recording weights at least 3 times per week.

Modified from M. Munshi, 2019

Case Vignette: Mrs. SJ

In summary, Mrs. SJ is an 84 year old female with heart failure and dementia who has had frequent hospitalizations due to heart failure exacerbations, has had progressive functional decline, and depends on her daughter for most of her IADLs but is home alone most of the time while her daughter works. Only 6 days after discharge from the hospital, she is experiencing symptoms of uncontrolled heart failure again. Due to her time alone, Mrs. SJ heats pre-prepared frozen meals in the microwave and takes her own medications during the day. She checks her weight but has not been keeping a log of the results. Home health was ordered after discharge but they have not seemed helpful in her care. The following changes could be implemented in the care plan to improve heart failure management:

- Provide frequent education for both the patient and caregiver on each clinic visit.
- Simplify the medication regimen – consider removal of amlodipine which is not part of GDMT for HF. The ongoing use of digoxin should be closely monitored with a goal to discontinue given her kidney disease, but should not be hastily discontinued now with her HF symptoms, low EF, and history of atrial fibrillation. Check if there are over-the-counter or herbal medications adding to her medication regimen that should be removed. Furosemide should be dosed only in the morning to avoid nocturia.
- Identify available resources and utilize tools to improve medication adherence. Her pharmacy will provide her medications in packets for the time of day so that she can simply take what is designated as morning or mid-day medications and avoid having to work with ten individual prescription bottles. Home health nursing, if ordered to do so, will assist in filling pill boxes weekly as well and can work to teach the daughter tips for managing medications. For example, she may help administer most of the medications before she leaves for work in the morning.
- The daughter should be instructed to help the patient record her weight every morning in a log that is monitored by the home health nurse and by the primary care doctor on visits. A clear plan will need to be established around dosing diuretics depending on amount of weight gained or lost daily.
- The patient's mid-day meals are delivered weekly as frozen meals by "Meals on Wheels". Many Meals on Wheels organizations will provide low-sodium meals and this should be requested. The daughter and patient may benefit from a dietitian referral for practical tips on managing daily sodium intake.
- Frequent follow-up appointments should be scheduled to ensure adherence to treatment plan and assist in early recognition of worsening symptoms.

– Refer the patient and her daughter to the social worker for counseling for caregiver stress; help with advanced care planning needs and connection to community resources.
– The patient's priorities of care need to be discussed. Mrs. SJ related that she gets very fearful and upset with each hospital admission and would like to avoid hospital stays, but she cannot tolerate the shortness of breath that comes with her HF exacerbations. It may be feasible that over a few visits, the daughter and patient can agree that their main goal is to control symptoms of HF so that they can avoid hospitalization. With discussion, they may agree that if her HF progresses to where they cannot avoid hospitalizations, they may consider a palliative-only goal of care at that time so that she can be comfortable in her home.

Conclusion

Cognitive impairment is highly prevalent in patients with heart failure (HF) and adds significant complexity to the management and may worsen outcomes.

It is of critical importance to involve a caregiver in the treatment plan and provide adequate education to the patient and caregiver in order to improve the outcomes. The AHA has developed guideline directed medical therapy (GDMT) that should be utilized in all patients with or who have had HFrEF to improve outcomes, but GDMT may be personalized as needed for other medical conditions and restrictions in care. The patient's HF symptoms, and the degree of cognitive impairment, as well as frailty and functional status should be evaluated frequently and related to prognosis and planning in accordance with the patient and caregiver's priorities of care.

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Chapter 6
Type 2 Diabetes Mellitus Management in Older Adults with Dementia

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Main Points

- Diabetes is a metabolically distinct disease in older adults and is associated with increased risk of cognitive impairment.
- Cognitive impairment impacts risk of hypoglycemia, glycemic control, and quality of life in older adults with diabetes.
- Glycemic goals should be individualized to each patient's comorbid medical conditions, overall health status, estimated life expectancy, and goals of care.
- The presence and impact of cognitive impairment should be considered when developing a management plan for diabetes.

Case Vignette: Mrs. GD

An 89-year-old woman presents to clinic following a recent hospitalization due to hypoglycemia. Her past medical history includes vascular dementia and type 2 diabetes (HbA1c 7.8%). Her current diabetes regimen is metformin 500 mg daily, glyburide 10 mg extended release daily, glargine 10 units at night, and meal-time insulin sliding scale with each meal and at bedtime.

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Over the past 2 years, she has had progressive functional and cognitive decline and has been hospitalized three times for hypoglycemia. She lives with her daughter and is dependent on her for personal care, meal preparation, and medication management. She has reduced mobility and falls several times per month. She has lost 15% of her body weight in the past 3 months, eats irregularly, and tends to eat "bad foods" when daughter is out of the house. She frequently declines glucose checks and insulin injections, which is stressful for her daughter. Her finger-stick glucose readings show low blood sugars in the early mornings (68–120 mg/dl) and very high levels in the afternoons (180–300 mg/dl). The patient appears withdrawn, drowsy, and speaks very little during the interview.

Prevalence and Economic Cost of Diabetes Mellitus in Older Adults

There has been an unprecedented growth in the number of older adults in recent years due to the aging of the "baby boomer" generation. In 2016, older adults composed 15% of the US population. By 2060, The Census Population Projections Program estimates that nearly 25% of the US population will comprise of older adults [1]. Diabetes prevalence is approximately 27% in older adults compared to 12.2% in younger age group [2]. The number of Americans with diabetes is expected to nearly triple from 2014 to 2060, with the greatest increase in future diabetes diagnoses in adults 65 years and older [3]. Patients with diabetes are living longer in part due to advances in diabetes management. The incidence of cognitive impairment also increases with age. The Census Population Projections Program estimates that the number of Americans with Alzheimer's disease alone will nearly triple by 2060 to roughly 14 million people [4]. Currently, approximately 80% of patients with Alzheimer's dementia may have impaired glucose tolerance [5].

Pathophysiology and Interaction Between Diabetes and Cognitive Dysfunction in Aging

Pancreatic Dysfunction and Insulin Resistance in Aging

Older adults are more susceptible to developing diabetes due to increase in insulin resistance with concurrent decline in pancreatic function with aging [6, 7]. Figure 6.1 shows the interaction of impaired insulin action caused by insulin resistance and impaired insulin secretion resulting from pancreatic islets dysfunction. Insulin resistance is an impaired response of the body to metabolize glucose for a given insulin level and is marked by both hyperglycemia and hyperinsulinemia. The

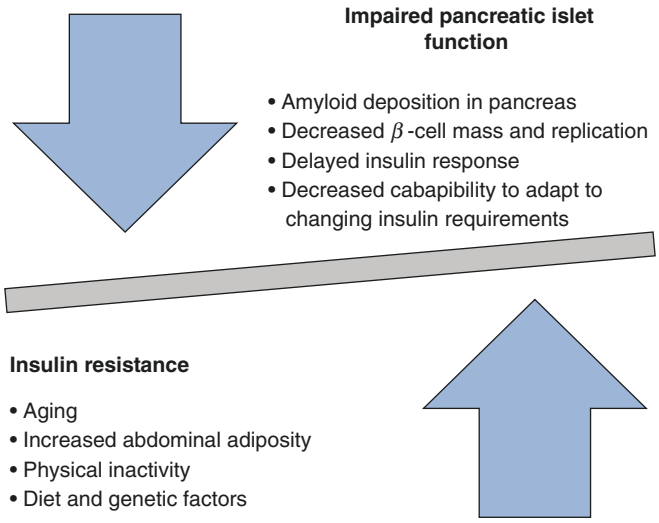

Fig. 6.1 Interaction of impaired insulin action and impaired insulin secretion with aging

etiology of insulin resistance in older adults is multifactorial and may involve interaction between physical inactivity, obesity, sarcopenia, abdominal adiposity, genetic factors, and age [7–9]. In addition, pancreatic islet dysfunction in the face of increasing insulin demands from insulin resistance predisposes older adults to diabetes [6]. Several mechanisms are implicated. In younger patients with insulin resistance, the islet of Langerhans undergoes β-cell replication in order to meet increased insulin demands. However, β-cell replication is markedly impaired with aging, ultimately leading to β-cell deficiency. Additionally, amyloid deposition with aging is well documented in older adults with diabetes and leads to further β-cell degeneration [10]. Fewer functioning islet cells result in decreased pancreatic plasticity and impaired insulin secretion in response to hyperglycemia [6]. Thus, aging is associated with a diminished regenerative, adaptive, and secretory capacity of the pancreas to higher glucose levels.

The Interplay Between Diabetes and Cognitive Impairment

Similar to diabetes, cognitive impairment is a leading cause of morbidity and mortality in the United States [11]**.** These two disease entities have a complex and entangled bidirectional relationship. Cognitive impairment can be both a consequence and a cause of poor glycemic control. Similarly, diabetes is an independent risk factor for cognitive impairment. A review of eighteen prospective and epidemiological studies performed in 2014 demonstrated that community-dwelling older adults with diabetes have a 1.5–2.5-fold increased risk of cognitive impairment as compared to patients without diabetes [12].

Diabetes increases risk of both Alzheimer's disease and vascular dementia, the two most common subtypes of cognitive impairment. The review reported a pooled hazard ratio of 1.6 (95% CL, 1.4–1.8) for Alzheimer's disease and a pooled hazard ratio of 2.2 (95% CL, 1.7–2.8) for vascular dementia in patients with diabetes. In addition, diabetes is also thought to accelerate the progression of mild cognitive impairment (MCI) to dementia [13]. Furthermore, cognitive dysfunction in patients with diabetes develops approximately 2 years earlier and is associated with a higher mortality rate and shorter survival time than in patients without diabetes [14]. Figure 6.2 depicts the complex relationship between poor glycemic control and cognitive impairment.

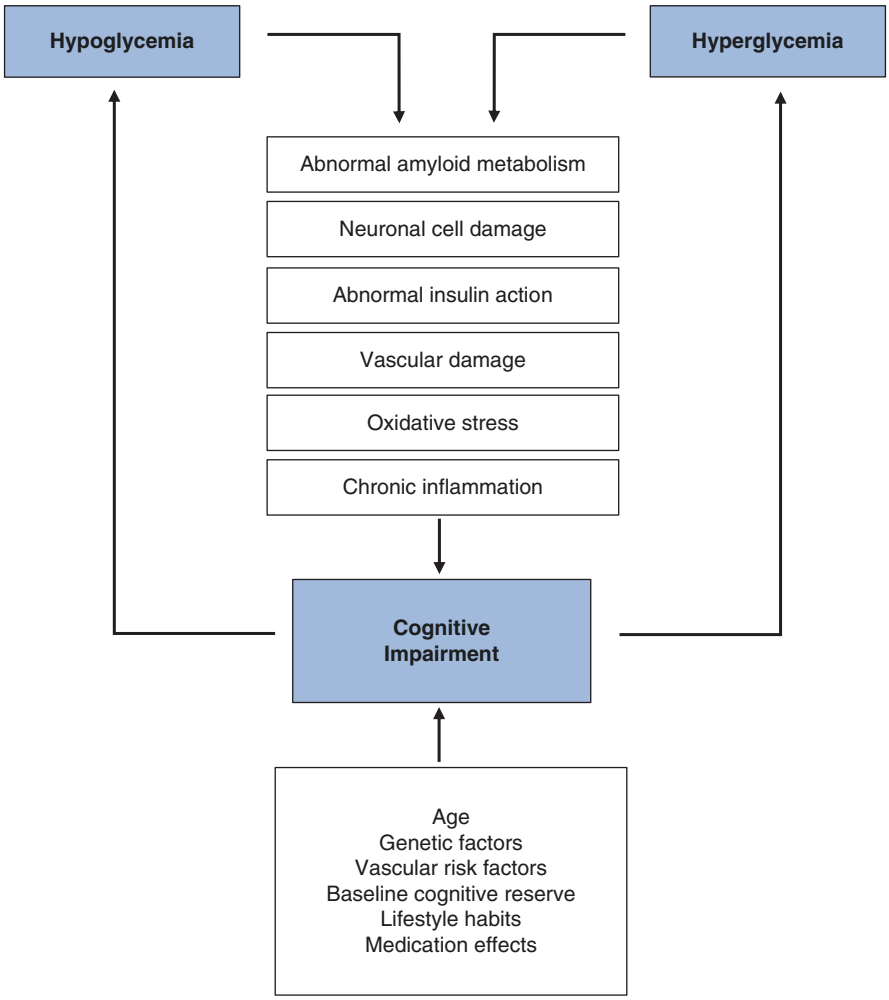

Fig. 6.2 Complex interaction between hypoglycemia, hyperglycemia, aging, and cognitive impairment

Diabetes and Vascular Risk Factors of Cognitive Impairment

Biological mechanisms linking diabetes and cognitive impairment are likely multifactorial and synergistic in nature. Known cardiovascular risk factors such as hypertension, atherosclerosis, and obesity increase the risk of stroke and subsequent vascular dementia. Recently, the Atherosclerosis Risk in Communities study assessed whether presence of vascular factors at midlife impacts risk of developing MCI or dementia in late life [15]. The study measured change in cognitive performance after a 20-year follow-up in approximately 6500 participants with several vascular risk factors and found that diabetes and hypertension at midlife were associated with dementia in late life. Additionally, participants with higher burden of vascular risk factors at midlife had poorer cognitive performance at midlife compared to participants with a lower burden of risk factors, and a lower cognitive function score at midlife was associated with dementia 20 years later.

Role of Hypoglycemia

Hypoglycemia is an independent risk factor for cognitive impairment in individuals with diabetes. A large longitudinal cohort study showed correlation between severity and recurrence of hypoglycemia and cognitive impairment [16]. In this study, the risk of cognitive impairment increased by 26% (HR 1.26; 95% Cl, 1.10–1.49) after one episode of severe hypoglycemia, by 80% (HR 1.94; 95% Cl 1.37–2.36) after a second episode, and by 95% (HR 1.94, 95% Cl 1.42–2.64) after three or more occurrences. Another population-based study reported that one episode of hypoglycemia in those with diabetes doubled the risk of cognitive dysfunction compared to those without hypoglycemia during a 12-year follow-up period [17]. Several hypotheses underlying this relationship are implicated. Hypoglycemia causes neuronal death, possibly due to transient ischemia, oxidative stress, and inflammation. It also impairs synaptic function [18]. The hippocampus, cortex, basal ganglia, and substantia nigra are especially vulnerable to hypoglycemia and subsequent permanent neuronal damage compared to other parts of the brain [19].

Another important contributing factor that mediates poor outcomes in older adults with cognitive impairment is hypoglycemia unawareness. In younger patients, there is an activation of sympathetic nervous system when the hypoglycemic threshold is reached, resulting in classic symptoms of palpitation, sweating, and tremors. With aging, this response is attenuated, leading to delayed awareness or absence of hypoglycemic symptoms [20, 21]. Often, older adults present with atypical symptoms of hypoglycemia. They may experience neuroglycopenic symptoms such as confusion, weakness, delirium, dizziness or lightheadedness, and visual changes. These symptoms are often misdiagnosed as another condition and can delay recognition and treatment of hypoglycemia in older adults with cognitive impairment. Small studies have shown that hypoglycemia unawareness is common in older

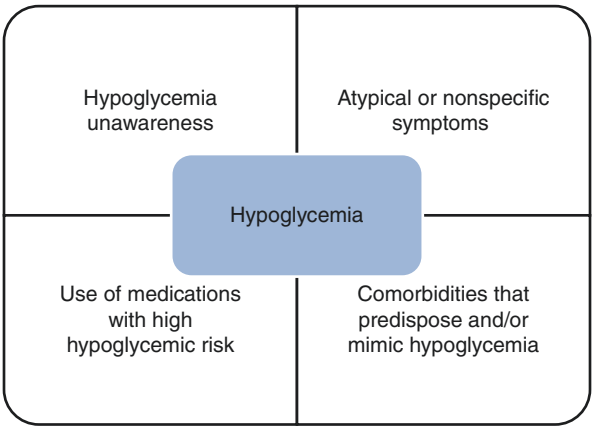

Fig. 6.3 Age-related factors contributing to the risk of hypoglycemia

adults [22]. Medications such as beta-blockers and hypnotics are commonly prescribed to older adults and can further dampen the perception of hypoglycemia [23]. Figure 6.3 shows overlapping factors leading to high risk of hypoglycemia and poor outcomes.

Role of Hyperglycemia

Poor glycemic control (hyperglycemia) also plays a role in varying degrees in the pathogenesis of Alzheimer's disease and vascular dementia in older adults with diabetes, though underlying mechanisms remain poorly understood. It is hypothesized that advanced glycation end-products resulting from hyperglycemia may correlate with higher levels of neurofibrillary tangles and amyloid plaques in the brain [24]. Specifically, hyperglycemia after a glucose load may increase the risk of Alzheimer's disease [25]. As already known, hippocampal and amygdalar atrophy occurs early in Alzheimer's disease [26]. Recent studies show that diabetes may be associated with these changes in addition to microvascular disease [27]. Furthermore, similarly to hypoglycemia, persistent hyperglycemia increases oxidative stress and chronic inflammation, which may facilitate the neuronal apoptosis [28].

Role of Insulin

It is well understood that peripheral insulin resistance influences insulin signaling in the brain. Insulin impacts cognition by modulating synaptic signaling, and impaired insulin activity in the brain may be associated with Alzheimer's disease [29]. Notably, patients with Alzheimer's dementia have lower levels of insulin in the cerebrospinal fluid and fewer insulin receptors in the hippocampus and cortex. This

abnormal insulin action negatively impacts cognitive function. Additionally, peripheral hyperinsulinemia is implicated in disrupted amyloid degradation and accumulation in the brain [30]. Thus, chronic hyperglycemia and abnormal insulin signaling may impair synaptic function, cause hippocampal and amygdalar atrophy, and induce neurodegenerative processes in the brain.

Unique Challenges of Managing Diabetes in Older Adults with Cognitive Impairment

Both diabetes and cognitive impairment add to the unique challenges of taking care of an aging patient. The challenges are compounded by the heterogeneity of this population in terms of health status, life expectancy, living situation, degree of caregiver support, preferences and expectations, and ability to follow instructions. All of these factors impact diabetes care and goals of treatment, while cognitive impairment adds another layer of complexity. Tasks such as preparing a carbohydrate-controlled meal, recognizing and managing hypoglycemia, and adjusting insulin dose based on glucose levels rely on intact executive functioning, attention, and recall [31]. Impaired cognitive function may result in erratic adherence to medications and diet, which can worsen glycemic control. It can also increase risk of catastrophic hypoglycemia [32]. For example, a cognitively impaired patient may take an incorrect dose or forget that he or she has taken the hypoglycemic medication and repeats the dose. Although there is a lack of evidence-based recommendations to manage patients with diabetes and cognitive impairment, expert guidance recommends that clinicians highlight quality of life, minimize hypoglycemia risk, and prioritize patient and caregiver preferences over a more target-driven plan. Figure 6.4 depicts the important steps in developing diabetes management plans in patients with cognitive impairment.

Screening for Cognitive Impairment in Older Adults with Diabetes

As diabetes is associated with an increased risk of developing cognitive impairment, screening and early detection of any cognitive dysfunction is recommended [33]. A high index of suspicion should be present since patients may not recognize or report new and subtle cognitive problems [32]. If clinicians fail to detect cognitive dysfunction, they may inadvertently prescribe a treatment regimen that may be too complicated for a patient with cognitive impairment to follow [34]. It is important to have a low threshold to screen all patients who have new difficulties in managing a well-established treatment plan or unexplained deterioration of glycemic control. Several standardized screening tools for cognitive impairment have been used in

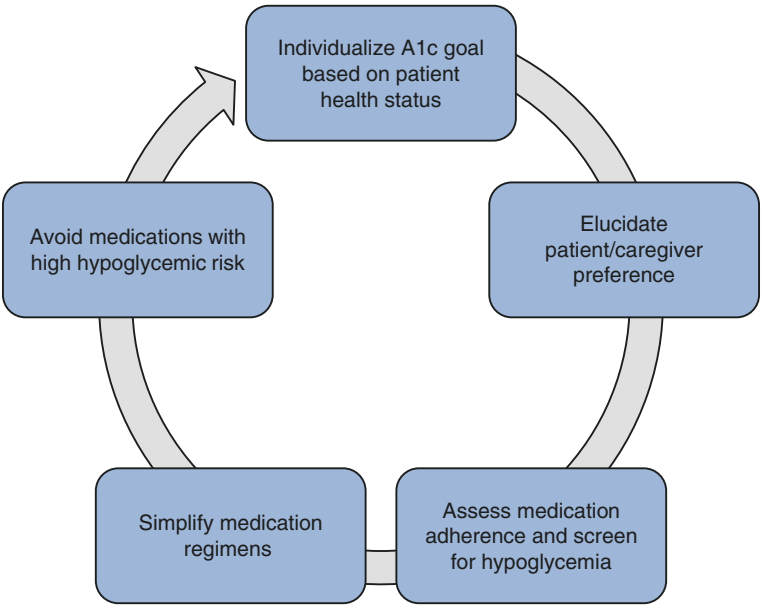

Fig. 6.4 Steps in developing diabetes management plans in patients with cognitive impairment

small studies in people with diabetes. The Montreal Cognitive Assessment (MoCA), clock-drawing test, or Mini-Cog are examples of short screening tools that may be used in this patient group [32, 35, 36]. Lastly, patients with known MCI should be closely monitored and screened for progression that may require changes in diabetes treatment strategies in the future.

Establishing Appropriate Treatment Goals

Several guidelines highlight the importance of individualizing glycemic goals based on co-existing medical conditions, cognitive status, and functional abilities in older adults with diabetes [31, 37–39]. For example, the guideline by the American Diabetes Association (ADA) delineates three major categories based on health status for adults over age 65: healthy, intermediate, and very complex/poor health. The healthy category includes individuals with few coexisting medical conditions and intact cognitive and functional status. The intermediate category includes individuals with multiple chronic illnesses or mild-moderate cognitive dysfunction, or 2+ IADL dependencies, while the very complex or poor health category includes individuals with end-stage chronic diseases, moderate-severe cognitive dysfunction, or 2+ ADL dependencies. The guideline recommends adjusting glycemic goals based on the category. The recommended glycemic goal for the healthy category is an A1c goal of <7.5% (pre-prandial glucose level of 90–130 and bedtime glucose

90–150 mg/dl). However, a more liberal hemoglobin A1c goal of <8% (pre-prandial glucose level of 90–150 and bedtime glucose 100–180 mg/dl) and <8.5% (pre-prandial glucose level of 100–180 and bedtime glucose 110–200 mg/dl) are recommended for the intermediate and poor health group, respectively. Though exact A1c goals differ by guidelines, the overarching principle remains the same. Less stringent goals in the multi-morbid population, including patients with cognitive dysfunction, is recommended.

Avoidance of Hypoglycemia

One of the most important aspects of establishing treatment goals in older adult with coexisting diabetes and cognitive dysfunction is to avoid hypoglycemia. Severe hypoglycemia has been shown to be associated with an increased risk of macrovascular events (HR 2.88), death from cardiovascular events (HR 2.68), and death from any cause (HR 2.69) [40]. Hypoglycemia in older adults results in worse outcomes compared to their younger counterparts. Fall and fall-related fracture are an additional catastrophic consequence of hypoglycemia in older adults with a major negative impact on quality of life [41]. Figure 6.5 shows poor outcomes of hypoglycemia in older adults with diabetes. As discussed above, hypoglycemia also contributes to the development of cognitive impairment, and hypoglycemia prevention may reduce the risk of cognitive impairment [42, 43].

The risk of hypoglycemia increases threefold in patients with cognitive impairment, although the risk is probably higher since it is likely underreported in this population [17]. These patients may not recognize these symptoms, may not remember having them, or forget to report them to their caregivers and/or providers. The risk further increases with age, malnutrition, longer duration of disease, recurrent hospitalizations, polypharmacy (especially use of insulin, sulfonylureas, beta-blockers, and ACE inhibitors), and renal or hepatic dysfunction [44–47]. Thus, instead of relying on patient report, clinicians should screen for hypoglycemia at every visit in adults with cognitive impairment.

Establishing Management Strategy: Simple Is Better

It is important to recognize when aging patients with diabetes start having difficulty performing self-care activities that they may have completed successfully for many years. In addition to screening for cognitive impairment, de-intensification or simplification of regimens to lower complexity should be considered [48]. Although insulin can be used safely in older adults, caution is needed when a complex insulin regimen is prescribed to individuals with cognitive dysfunction. Errors in medications, especially insulin dosing (extra doses or skipped doses), or skipped meals can result in fluctuating glucose levels, higher risk of

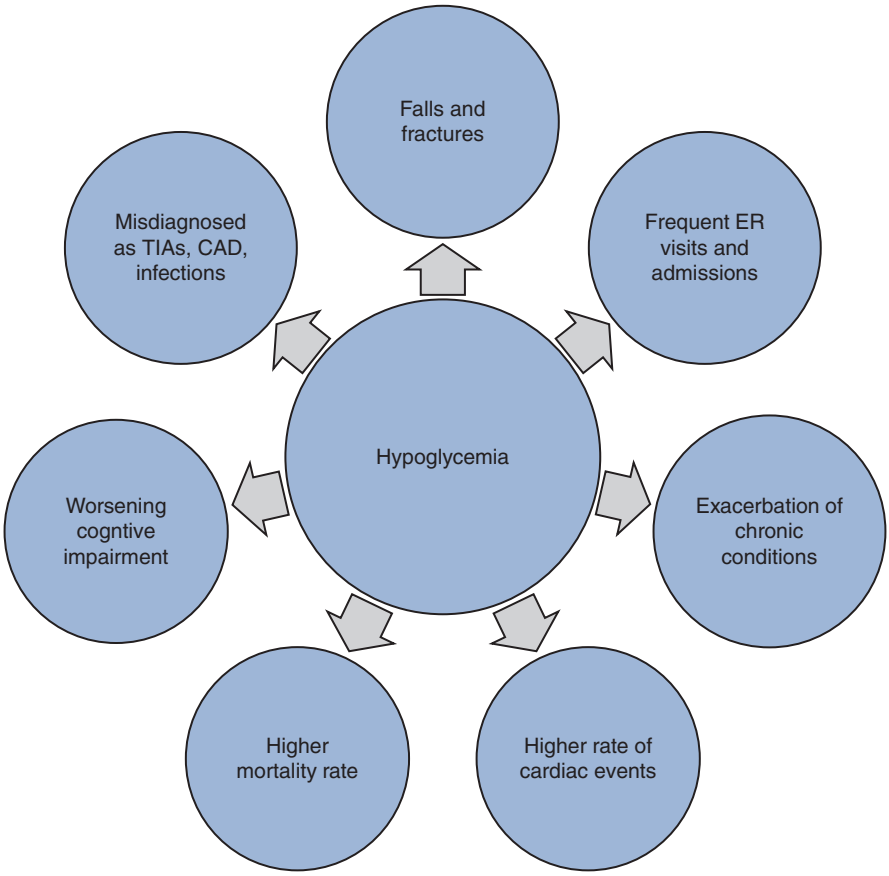

Fig. 6.5 Poor outcomes of hypoglycemia in older adults with diabetes

hypoglycemia, and anxiety associated with poor glycemic control. In a prospective study, simplification of the insulin regimen in older adults resulted in lower risk of hypoglycemia without compromising glycemic control [49]. The algorithm to simplify insulin regimen is now added to the 2019 Standard of Medical Care by the American Diabetes Association [48]. It is important to avoid sliding scale insulin in all older adults due to higher risk of resultant hypoglycemia with minimal improvement in hyperglycemia in all care settings [50]. Insulin sliding scales can cause rapid shifts in glucose levels and increase treatment burden for patients and their caregivers [51]. It is particularly dangerous in patients with cognitive dysfunction due to significant amount of "problem-solving" needed to use the scale. The same strategy should be applied to glucose monitoring if patients report difficulty adhering to frequent glucose checks. Reduced frequency of testing improves quality of life and independence. Simpler strategies to obtain glucose levels at different times to identify patterns and avoid multiple daily

Table 6.1 Diabetic medication classes with hypoglycemic risk

High risk	Low risk
Insulin (especially NPH)	Biguanide (metformin)
Sulfonylureas (especially long-acting agents)	Sodium-glucose cotransporter 2 (SLGT-2) inhibitors
Meglitinides	Glucagon-like Peptide-1 (GLP-1) receptor agonists
Pramlintide (when used alongside insulin)	Thiazolidinediones (TZD)
	Dipeptidyl peptidase 4 (DDP-4) inhibitors
	Acarbose

checks can be useful (e.g., check fasting glucose on some days, pre-lunch or pre-dinner on other days).

Medication Management

The general principle of managing diabetes in older adults with or without cognitive impairment is to choose agents with a low risk of hypoglycemia. Table 6.1 categorizes different classes of medications based on their risk of hypoglycemia. Newer classes of medications such as DPP-4 inhibitors, GLP-1 receptor agonist, and SGLT-2 inhibitors have a lower risk of hypoglycemia; however, cost remains an important barrier to use [52]. The recent Standard of Medical Care by the American Diabetes Association published a detailed algorithm for choosing medications based on patient and medication features [48, 52]. The algorithm emphasizes presence of certain co-morbidities (coronary artery disease, congestive heart failure, and chronic kidney disease), side-effects and contraindications, effect on weight, hypoglycemia risk, and cost of medications.

Metformin remains the drug of first choice for all adults, including older adults. Low cost and low risk of hypoglycemia makes it attractive for use in older adults with cognitive impairment. It is not recommended as an initial therapy in patients with an estimated glomerular filtration rate (eGFR) between 30 and 45 ml/min/1.73 m^2, and use of metformin is contraindicated entirely in patients with an eGFR between <30 ml/min/1.73 m^2 [52]. Sulfonylurea is generally not recommended in this population due to high risk of hypoglycemia. Both DPP-4 inhibitor and SGLT-2 inhibitors are once daily oral pills with low risk of hypoglycemia and are well suited for patients with cognitive impairment. GLP-1 receptor inhibitors are injectable agents; however, they have once weekly formulations, which may be attractive to caregivers who assist patients with medications. Cost and limited experience remains a barrier to their use. Insulin carries a high risk of hypoglycemia and should be used cautiously in the older adult with cognitive impairment. Basal insulins can be used in combination with non-insulin agents in patients with lower complexity and risk of hypoglycemia [49]. Use of short-acting insulin for meal coverage should be used judiciously as it increases regimen complexity and risk of hypoglycemia.

Patient and Caregiver Preferences

Caregivers should be involved in all treatment decisions for successful management of diabetes in older adults with any suspicion of cognitive impairment. It is important to engage caregivers to discuss what is feasible given the extent of their resources. These preferences should also be balanced when individualizing glycemic goals and treatment strategy. If caregivers or patients are unable to administer multiple medications, then simplifying the regimen will ease treatment burden and improve adherence. Frequent education should be provided to patients as well as caregivers about recognizing symptoms of hypoglycemia, and clinicians should ask about these symptoms at every clinic visit. Impaired cognition and functional status can limit adherence to lifestyle modifications. Therefore, a person-centered approach to design a diet and exercise regimen that the patient can successfully adhere to is imperative. Physical therapy and nutrition consultations may improve success rate.

Diabetes Management in Specific Living Situations

A patient's residence and resources play a critical role in diabetes management in all older adults. It is important for clinicians to know who is helping a patient with cognitive decline manage diet, glucose monitoring, routine follow-ups, and medications. For community-dwelling patients, it may be family members or a private aide. Nursing staff may be managing most, if not all, of these tasks if patients live in assisted living or long-term care. Thus, resources and assistance available in various living situations are different and impact how diabetes management strategies should be implemented. Table 6.2 describes important considerations and strategies to manage diabetes in cognitively impaired individuals based on living situations.

Management of Diabetes in Long-Term Care (LTC) Facilities

Prevalence of diabetes and cognitive dysfunction are higher in residents of LTC facilities and is especially challenging [51]. Progressive cognitive decline combined with multi-morbidity, progressive functional decline, irregular eating habits, recurrent infections, and transitions between facilities and providers can increase risk of hypoglycemia as well as poor glycemic control. Cognitive impairment and mood disorders further add to the risk if patients with behavioral disturbances intermittently decline care. These patients have been typically excluded from clinical trials, resulting in a lack of evidence-based guidance or a standardized approach to manage this population. The American Diabetes Association has published a position statement delineating principles in management of older adults with diabetes in the LTC facilities [51]. In general, treatment goals in this population should prioritize

Table 6.2 Diabetes care strategies based on living situations in residents with cognitive impairment

Living situation	Important considerations	Strategies for diabetes care
Independent, community	Patient may need caregiver support for diet and medication adherence Complex regimens can be dangerous if patient/caregiver has difficulty managing multiple medications and doses Acute illness can lead to further cognitive decline	Re-educate patient and caregivers on each follow-up visit Evaluate medication non-adherence, treatment burden, and caregiver fatigue Simplify complex regimens based on patient/caregiver preference
Assisted living facility	Likely more cognitively impaired and may need more assistance with ADLs/IADLs Facility may assist with administrating oral medications, but may not assist with glucose monitoring or insulin injections Inadequate diabetes education for staff Patient may not have control over the content of their meals	Engage assisted living facility or caregiver to manage medications if patient has difficulty with adherence Perform cognitive testing routinely to monitor progression of cognitive dysfunction Monitor for treatment failure during acute illness and taper insulin dose to avoid hypoglycemia
Short-term skilled nursing facility	Goal is to return to permanent living situation HbA1c may be unreliable due to recent acute illness Patient may not have control over content of their meals	Avoid nighttime glucose checks and insulin sliding scale to prevent hypoglycemia from overcorrection Consider tighter glycemic control to help with wound healing Ensure that new diabetes regimen is not difficult to manage by patient/caregiver upon discharge
Long-term care	Patient has a limited life expectancy with high burden of comorbidities May be fully dependent on all ADLs/IADLs and diabetes self-care High hypoglycemia vulnerability due to higher risk of adverse effects of medications, delirium, acute illness, and anorexia Frequent changes in health status impact glucose levels Medications fully managed by medical team Patient has no control over content of their meals Inadequate diabetes education for staff High staff turnover can increase risk of adverse events	Focus on quality of life and harm reduction Adjust frequency of glucose monitoring that balances risk of hypoglycemia and nursing staff workload Avoid nighttime glucose checks and insulin sliding scale to prevent hypoglycemia from overcorrection Cautious interpretation of HbA1c due to presence of multiple comorbidities that can falsely change HbA1c level Engage nursing staff to provide appropriate diabetes care Re-educate nursing staff frequently on hypoglycemia monitoring

reducing risk of hypoglycemia, which can have catastrophic consequences. The benefits of tight glycemic control in these patients are limited. Adequate nutrition is very important in this population. Institutionalized patients with cognitive impairment are prone to irregular dietary intake and nutritional deficiencies. Skipping meals can also become a major cause of hypoglycemia. A restrictive diabetic diet has been associated with unintentional weight loss, while a wide variety of food

Table 6.3 Strategies to reduce risks of hypoglycemia and promote quality of life in nursing home patients with cognitive impairment

Hypoglycemic event	Evaluate nutritional intake Consider increasing frequency of glucose checks for 24 hours after a hypoglycemic event Re-evaluate patient health status and adjust HbA1c goal if needed Taper regimen
Severe hyperglycemia	Ensure adequate hydration Prescribe prandial insulin for severe post-prandial hyperglycemia to the preceding meal. For example, if pre-lunch glucose is persistently elevated, administer prandial insulin at breakfast Administer prandial insulin (dose should be matched to carbohydrate intake) immediately *after* meals to avoid hypoglycemia Sliding scale use should be avoided, however may be used judiciously for a short duration during an acute illness Closely monitor for symptoms of diabetic ketoacidosis or hyperosmolar hyperglycemic state and request urgent evaluation if warranted
Medication management	Refusal of medications may occur, especially injectable medications – Reevaluate goals of care to assess if medication can be discontinued Consider long-acting forms of oral medications (use with caution in renal impairment), liquid formulations, or medications that can be crushed Avoid insulin in patients with erratic dietary habits and tendency to refuse diabetes-related care If insulin is needed, start with long-acting basal insulin. Administer basal insulin in the morning to target postprandial hyperglycemia. Morning administration also reduces risk of overnight hypoglycemia, which can occur with nighttime administration Avoid sulfonylureas, especially with concurrent use of insulin. Specifically, long-acting sulfonylureas carry higher risk of prolonged hypoglycemia
Glucose monitoring	Refusal of blood glucose monitoring may occur and need simpler regimen Recommend "block testing": Obtain glucose levels at different times to identify patterns to avoid multiple daily checks (e.g., check fasting glucose on some days, prelunch or predinner on other days) Avoid checking nighttime glucose (unless hypoglycemia is suspected), since postprandial hyperglycemia is common and correction with sliding scale insulin increases risk of hypoglycemia Increase frequency of monitoring during acute illness or if blood glucose levels are persistently too low or too high until levels normalize
Nutrition	Prescribe a regular diet without restrictions but avoid highly concentrated sweets Offer patient preferred foods if anorexia is a problem Obtain nutrition consultation if meal intake is persistently inadequate
Physical activity	Encourage activity that the patient can perform Encourage ADL independence
Nursing staff support	Develop an interdisciplinary team and provide frequent education to nursing staff regarding how different medications and insulin work Establish facility-wide hypoglycemia and hyperglycemia protocols to assist nursing staff

choices enables more consistent food intake. In general, a regular diet tailored to the patient's preferences while avoiding concentrated sweets is advocated for long-term care residents [53]. Table 6.3 shows some practical pointers for safe diabetes management in LTC patients with cognitive impairment. Overall, the care plan should aim for harm reduction and optimization of quality of life.

Case Vignette: Mrs. GD

Our 89-year-old woman with diabetes and cognitive impairment has wide fluctuations in glucose levels due to multiple medical comorbidities, functional impairment with dependency in several IADLs, irregular eating habits, and complex medical regimen. Hypoglycemia may be contributing to her high risk of falls. In addition, her daughter reports high level of caregiver distress. The following changes may help to improve this patient's diabetes management:

- Liberate glycemic goals up to A1c <8.5% based on ADA guidelines.
- Stop glyburide due to high hypoglycemia risk.
- Simplify insulin regimen. One approach would be to switch long-acting insulin to the morning. This change of time would lower the risk of hypoglycemia in the morning while improving glucose levels in the afternoon and evening. Non-insulin agents such as metformin (if eGFR >45 ml/min/1.73 m^2), DPP-4 inhibitors, SGLT-2 inhibitors, or GLP-1 receptor agonist (once a week) can be added while concurrently discontinuing meal-time insulin and sliding scale. Consider discontinuing all insulin if oral medications are able to control glucose levels to desired goals.
- Decrease frequency of glucose checks to once daily, checked at different times each day to obtain a pattern of glycemia.
- Educate the patient's daughter regarding possible executive dysfunction in this patient which can limit insight into self-care. This may avoid frustration when the patient eats undesirable snacks when alone in the house.
- Refer the patient and her daughter to social worker for counselling for caregiver stress and education.

Conclusion

The management of diabetes in patients with cognitive impairment must require a thoughtful approach since each patient and caregiver will face different challenges with disease management and lifestyle modifications. Table 6.4 provides some practical approaches for management for clinicians.

Table 6.4 Unique challenges of diabetes in older adults

Distinct feature	Practice points
Cognitive impairment interferes with diabetes self-care	Involve caregivers in discussions regarding feasibility of and barriers to treatment Seek social work consultation to assist with caregiver burden and resource allocation For patients with advanced cognitive impairment, focus on maximizing independence and quality of life
HbA1c is not always reliable in older adults	Use fingerstick glucose levels instead of HbA1c to assess diabetes control during times of acute illness or for patients with multiple comorbidities Measure fingerstick glucose levels daily at different times to determine pattern of glycemia and adjust diabetes regimen accordingly
Post-prandial hyperglycemia is more severe than in younger patients	Postprandial hyperglycemia contributes to HbA1c more than fasting blood glucose Postprandial hyperglycemia is associated with increased risk of Alzheimer's disease
Hypoglycemia unawareness is common, deadly, and frequently missed	Patients with cognitive impairment are at higher risk of hypoglycemia, and episodes are likely underreported Patients may still have hypoglycemia despite high HbA1c Liberalize glycemic targets and simplify insulin regimens to reduce hypoglycemia risk Avoid drugs that can precipitate hypoglycemia

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Chapter 7
COPD Management in Older Adults with Dementia

Ruby Shah

Main Points
- COPD is underdiagnosed in elderly patients with dementia.
- Both in treatment and diagnosis, there is much more dependence on caregiver report and importance of caregiver involvement.
- Symptom-focused pragmatic approach is the best.

Case Vignette
In your primary care practice, you see Ms. Avery, an 88-year-old woman with 50 pack year smoking history who quit 15 years ago. She has no known lung disease but does have coronary artery disease, mild cognitive impairment (MCI), which you diagnosed 3 years ago, and osteoarthritis affecting her knees and both hands. Her medications include aspirin and lisinopril. A beta blocker and statin were stopped last year due to side effects. Ms. Avery takes all her medications regularly and lives at home by herself. Her daughter lives across the street, comes to check on her daily, and assists with some instrumental activities of daily living (IADLs). During the visit, she appears well and you don't find any abnormalities on exam, but her daughter mentions that in the past 6 months they have noted increased coughing and a decrease in energy. Ms. Avery no longer wants to go grocery shopping and, when pressed, she admits

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she becomes tired and short of breath. You decide to prescribe her inhalers to see if her symptoms improve but struggle in trying to decide which ones to start and how aggressive to be in confirming a diagnosis given her trouble with dexterity, her MCI, and increasing difficulties with activities of daily living (ADLs).

As this clinical vignette highlights, there are specific nuances to the care of elderly patients with chronic obstructive pulmonary disease (COPD), especially those with underlying dementia. Here we review the current evidence and discuss potential approaches to COPD diagnosis and management in the elderly patient with dementia. Of note, we refer to dementia as a single entity in this chapter although, as discussed elsewhere, it is a more complex category with various causes.

Introduction

The current generation that is reaching its sixth and seventh decade is large and has a significant percentage of smokers and former smokers. World Health Organization (WHO) estimates place the global prevalence at 251 million in 2016. COPD is expected to be the third leading cause of death by 2030 [1, 2]. One particular study found that, globally, women now have a higher incidence of COPD than men (incidence rate of 182.62 vs. 134.03 per 10,000 person-years) with similar trends in the United States [3]. COPD is also a big driver of healthcare costs and expenditures. In 2010, the US government spent nearly $ 49.9 billion on COPD [3–5]. As the older adult population ages and the frequency of encounters in emergency rooms and primary care offices increases, it is important to equip practitioners with information regarding their care. In a busy primary care setting, it can be difficult to know what to prioritize when it comes to the care of an elderly patient with dementia. Arriving at a diagnosis of COPD can be challenging, and knowing how to effectively manage it can be even more dauting. Aging patients frequently have comorbidities that can complicate both the diagnosis and the management of COPD. Multiple studies have found that there is an increased prevalence of cognitive decline in those with COPD. Therefore, these two entities are often being treated together. In order to do so, pathophysiology is important, and arriving at a diagnosis requires a more pragmatic approach. Meanwhile, treatment should be focused on improving quality of life and must be adapted to concurrent comorbidities, especially dementia. Current trends also incorporate cost effectiveness principles, non-pharmacologic interventions, and a multidisciplinary approach.

Age-Related Respiratory Changes/Comorbidity

There are age-related changes in the respiratory system, which result in an expected decline in lung function. Lung tissue becomes more complaint, the chest wall becomes stiffer as a result of respiratory muscles becoming weaker with age, and

the ventilation to perfusion gradient is enhanced due to increased perfusion of lung bases as opposed to the apices [6]. In a lung with pre-existing damage from years of smoking or COPD, the damage seen from the aging process is even more pronounced [7]. The pathogenesis of COPD is a combination of loss of alveolar space and inflammation affecting the airways. Immunopathologic changes in advancing age can augment this process. The main effect is an increase in the residual volume [8]. As seen in the circulatory system, there is a blunted physiologic response to hypoxia and hypercapnia, with past exposures to smoke and environmental exposures accelerating this process [9]. As a result, the milder asymptomatic COPD may become symptomatic or unmasked as the patient ages. Conversely, age-related changes may lead to an overdiagnosis of COPD [10].

As mentioned above, COPD and cognitive deficits are often treated together. Some studies have found a modest increase in incidence of mild cognitive impairment (MCI) or dementia in patients with COPD, roughly 1.5–2-fold higher when compared to age matched cohorts without comorbid COPD [11, 12]. There is no clear evidence of the exact etiology of this association; however, it has been hypothesized that ongoing oxidative stress or hypoxemia can lead to cognitive dysfunction. In fact, there is some evidence that more severe hypoxia is associated with a higher degree of cognitive decline [13].

Diagnostic Considerations

The primary clinical manifestations of COPD are breathlessness and decreased exercise tolerance. Patients may also exhibit fatigue, cough, sputum production, and wheezing. The current Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines delineate a symptom/severity approach to initial diagnosis and assessing the progression of COPD [14]. However, diagnosis based on establishing airflow obstruction on pulmonary function tests (PFTs) is the current standard of care for COPD [15]. However, assessing symptom severity and obtaining PFTs can pose a challenge in patients with dementia.

Patients with dementia and COPD have been shown to exhibit frontal disinhibition and behavioral disturbances more frequently than those with dementia alone [16]. Of note, the Mini-Mental State Exam (MMSE) has low diagnostic accuracy in identifying cognitive impairment in co-morbid dementia and COPD [16]. COPD symptom questionnaires to be completed by caregivers do exist, but they are not specifically validated for clinical use [17]. These measures also have not been tested in patients with dementia. Overall, however, this becomes increasingly problematic in a patient that is unable to complete the tool. A greater reliance on caregiver report and keeping a high clinical suspicion can help in patients with the right risk factors, such as a significant smoking history. Establishing a baseline of cognitive function with validated tests such as the Montreal Cognitive Assessment (MoCA) and a detailed history of ADLs can help clarify feasible goals for diagnosis at the onset.

Multiple reviews [18] find that COPD remains underdiagnosed in elderly patients, and those with cognitive difficulties are less likely to receive PFT testing [19]. On the other hand, older adults are also more likely to be falsely classified as

having airflow obstruction using the classic cut-off for PFTs. Specifically, cohort studies have determined that a FEV1/FVC down to 65% may be normal in the elderly population [8]. Another study found that using the standard cut-off <70%, 35% of healthy, elderly non-smokers would be classified as having stage I COPD and nearly 50% of those over 80 years of age [10, 20]. Nonetheless, the classification using symptoms and PFTs as per the GOLD guidelines remain the preferred approach barring any specific patient limitations. However, clinicians should be mindful that PFTs may need to be interpreted differently in elderly patients. There is evidence that limited spirometry without lung volumes is sufficient to diagnose or assess the severity of obstruction in an elderly patient [21]. They are also very highly variable based on patient effort. If there is a poor understanding of instructions or deficits in attention, the coordination necessary to complete the test may not be possible. Here too, a more detailed history involving the caregivers and additional cognitive evaluation may help to make any diagnostic measures more successful.

Overall, balancing the limitations of the patient's comorbid dementia with the importance of more definitive diagnosis or delineation of severity of obstruction is recommended. For example, if the patient and caregiver/family are struggling with transportation due to dementia-related behavioral issues, it may not be particularly beneficial to try to obtain a PFT, which may not significantly alter management. Instead, it may be more beneficial to focus on symptom control alone using other measures. In a more functional elderly patient, assessment or reassessment of cognitive function with the MoCA (or a similar cognitive evaluation) followed by consideration of the feasibility of obtaining PFTs versus spirometry alone would be a reasonable approach. In older adults who cannot participate in full PFTs, using a validated questionnaire to catalog symptoms could provide a worthwhile addition toolbox of the primary care provider; see Fig. 7.1.

Treatment Considerations

As introduced already, there are challenges in the treatment of COPD caused by the difficulties of medical disease management in patients with cognitive impairment. As already discussed, assessing severity of the disease can pose a challenge as patients with dementia may minimize their symptoms or inaccurately describe their true symptomatology. A more pragmatic approach at this juncture is recommended. A six-minute walk test, spirometry rather than full PFTs with lung volumes, and extrapolating from caregiver reports are all additional methods that can be used to assess severity. Of note, the BODE index has not been validated in the elderly population but has been compared to other mortality predictors [22]. The current guidelines do not include other functional assessments, such as the six-minute walk test, but this may be a tool to consider earlier in an elderly patient with dementia as it is less dependent on patient report.

Medical management should focus on quality of life considerations and minimizing medication effects or adverse events. Management can be separated into pharmacologic and non-pharmacologic. Specific methods for patient education may need to vary due to cognitive understanding as well as relying more heavily on

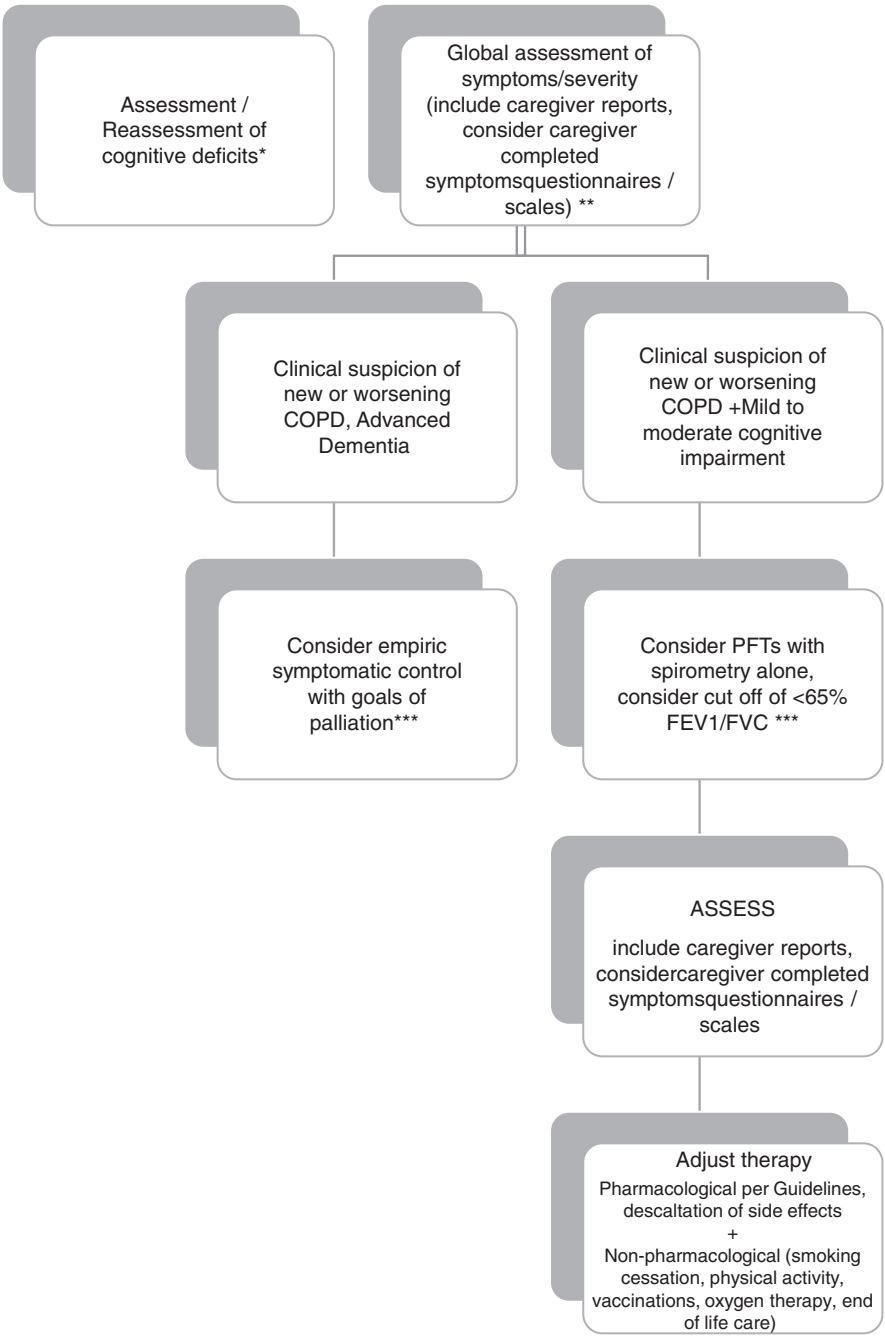

Fig. 7.1 This figure represents a modified approach to diagnosis and management based on the suggested GOLD guidelines but highlighting departures from the guidelines that can be considered. Specifically, strategies for assessing cognitive baseline, relying on caregiver information and using less validated but potentially more feasible assessments, and staying flexible. (∗MMSE, MOCA, or neuropsychic testing if available. ∗∗Discussed in more detail in the text. ∗∗∗This represents a departure from current guidelines that aren't always applicable to elderly patients with dementia)

caregivers and families. When the COPD or dementia is more progressed, it will be critical to involve the surrogate decision maker or involved family in decisions regarding the management of acute exacerbations and end-of-life decision-making.

Pharmacologic Treatment

The current GOLD guidelines are the mainstay of therapy for COPD. They are heavily focused on inhaler-based therapies that use short- and long-acting bronchodilators such as short-acting beta-2 agonists (SABAs), long-acting beta-2 agonists (LABAs), and both short-acting and long-acting anti-muscarinic agents, which also act as bronchodilators. SABAs for acute symptom relief, along with regular daily use of LABAs and/or LAMAs, are first line agents for general management. If patients fail therapy or have progression of disease, inhaled corticosteroids can be added. Long-term use of inhaled corticosteroid as monotherapy is not recommended. A large cohort study found no increased risk of adverse events, and specifically no respiratory events, related to the LAMAs despite previous observational studies finding a possible increased risk of acute respiratory events [23, 24]. Modern inhaler formulations are increasingly combining all the therapies into a single inhaled medication for their apparent convenience of use. Additionally, the quickly evolving landscape of new inhalers available make it difficult for providers to stay abreast of the recent types of inhalers and their formulations. However, multidrug inhaler-based therapies, especially those combining an inhaled corticosteroid, should be used with caution despite their apparent convenience. Inhaled corticosteroids have been demonstrated to increase risk of cataracts, diabetes, pneumonia, and osteoporotic fractures in elderly patients with COPD [25–28].

In addition to the concerns for possible side effects, compliance with inhaler-based therapies remain problematic. Current literature demonstrates a poor compliance with inhalers with 50% of patients abandoning therapy within the first year, even without underlying cognitive dysfunction [29, 30]. Factors such as overall cognitive function, dyspraxia, and executive functioning further impact compliance with inhaler therapy [31]. Specifically, cognitive and executive dysfunctions may exacerbate poor compliance due to inability to deliver proper education on the correct usage of inhalers, a part of care which has been shown to significantly improve compliance and efficacy.

Therefore, prior to deciding on a treatment plan, it may be helpful to perform baseline cognitive evaluation to help inform decisions on how to proceed with treatment. One review published in 2017 found that cognitive evaluation could predict inhaler non-compliance or incorrect use [31].

However, due to the highly variable nature of cognitive decline, practitioners are often not good at assessing the true function of our patients. Asking questions regarding function, including performance of activities of daily living (ADLs) and instrumental activities of daily living (IADLs), can be helpful. However, evaluation

with validated cognitive assessment tools such as the MoCA may provide a more accurate assessment of cognitive function. The MoCA is a validated, well-established tool to detect declines in cognition, including executive functioning (especially when compared to the MMSE or global physician assessment) [32]. Once evidence of significant or progressive cognitive decline is demonstrated by cognitive assessment, or by improper demonstration of inhaler use by the patient or caregiver, continued reliance on inhaler therapy may not be the best treatment approach [33] see Fig. 7.1.

When deciding on initial or altering therapy in an elderly COPD patient, another important consideration is patient dexterity. Impaired dexterity due to osteoarthritis or other rheumatologic conditions may limit the use of certain types of inhalers. For example, Jarvis et al. [29] found that nearly half of patients studied found the MDIs difficult to use and nearly half also reported no perceived benefit. In comparison, the dry powder inhalation devices were found to be even more difficult to use and resulted in less perceived benefit. There were more reported errors with DPIs than MDIs; having multiple prescribed inhalers was also associated with greater errors in inhaler technique. There is evidence to support the use of nebulized therapy in place of inhalers, albeit in small studies [34, 35].

There are no specific studies examining the use of theophylline in patients with dementia. In addition, as it is no longer recommended in treatment guidelines, it typically is outside the scope of the primary care setting [36].

Assessing Treatment Efficacy

Investing time to truly assess barriers to prescribed treatments during follow up visits can often be the most effective tool in understanding if alterations to the care plan are required to increase the likelihood of success. In addition, when patients have cognitive deficits, educating caregivers regarding concerning symptoms and triggers to avoid can make a big impact. Follow up visits should also focus on establishing goals which are feasible, keeping in mind the quality of life and difficulty of specific regimens. The number of exacerbations should be assessed at each visit as well as patient being considered to meet a more severe disease category if they have had (1) at least two exacerbations treated with oral corticosteroids, antibiotics, or both in the preceding year, (2) at least one severe exacerbation that required hospital admission in the previous year, or (3) one or more exacerbations per year for 2 consecutive years. If patients meet this criterion and/or have a poor response to therapy including difficulty with compliance, it can help to guide discussions about how to manage end-of-life care, hospitalizations, acute exacerbations, and overall goals of care. This is discussed in more detail below.

In addition to the challenges outlined above, patients with concurrent COPD and dementia have nearly three-fold risk of cardiovascular comorbidities [37]. This relationship is attributed to the same biochemical pathways and accelerated aging process [7, 38]. As a higher number of comorbid conditions is associated with increased

COPD exacerbations, evaluating and treating comorbidities is extremely important in the development of a comprehensive management plan [39].

In 2019, based on results from secondary analysis of randomized controlled trials, peripheral eosinophil counts were introduced into guidelines as a means to predict response to ICS [40–42]. However, this remains controversial and, as ICS as first or second line treatment in the elderly patient with dementia is not recommended, more practical application data may be needed before this lab value is used regularly by the primary care provider to inform COPD management.

Non-pharmacological Treatments

The nonpharmacological treatment of COPD patients discussed in guidelines and described in the literature includes smoking cessation (counseling plus pharmacotherapy), influenza and pneumococcal vaccination, and pulmonary rehabilitation. Included here is a brief discussion regarding oxygen therapy given the challenges it can pose in the elderly patient with dementia. There are few studies looking at behavioral interventions in patients with comorbid COPD and dementia touched upon in this section.

Pulmonary rehabilitation is an important non-pharmacologic treatment consideration in patients with significant COPD. Multiple studies in the literature describe that a high percentage of patients with COPD have difficulty performing ADLs; therefore, a focus on quality of life and improving patient functioning is important. Pulmonary rehabilitation has been shown to significantly improve the ability to perform ADLs as well as the sensation of dyspnea. It is recommended in guidelines as a tool to regain loss of function after exacerbations and hospitalizations [43]. Systematic reviews summarizing the benefits of pulmonary rehabilitation note that exercise training; self-management and behavioral change; and psychological support all help to significantly impact patients' physical activity, multiple comorbidities, and the symptoms of COPD. These positive outcomes are very dependent on picking an appropriate candidate for these interventions; studies have found that a factor related to poor success with pulmonary rehabilitation is cognitive deficits. Thus, one of the significant limitations of pulmonary rehabilitation is that cognitive decline affects compliance and success of any such program. The primary care provider is positioned to know the patient well and can be a good judge of the feasibility of including pulmonary rehabilitation in the care plan. As an example, if pulmonary rehabilitation is recommended or prescribed by a pulmonologist, this can be pursued without hesitation in patients with mild cognitive impairment, as there is no downside to this treatment. However, in patients with more significant cognitive deficits, the likelihood of successfully participating in pulmonary rehabilitation should be discussed with the patient, caregiver, and primary care provider to avoid a referral that leads to frustration without gain. Another limitation of pulmonary rehabilitation is access, both due to lack of availability in all practice settings and transportation challenges that patients with dementia may encounter as their condition progresses. In addition to pulmonary rehabilitation, it should be noted that

multiple studies describe multi-disciplinary targeted and tailored interventions involving a therapist as having sustained impact on functioning and symptoms [44]. Similar to pulmonary rehabilitation, these types of programs may not be accessible by most patients in the primary care setting and would present similar challenges in individuals with clinically significant cognitive deficits. In patients with limited access to pulmonary rehabilitation or multi-disciplinary interventions or those who have cognitive barriers to participation, attempts to include modest exercise in their nonpharmacologic therapy should be pursued, as this has been shown to improve both dyspnea and the ability to maintain functional status [45]. For primary care providers, it is possible to extrapolate from these findings and apply them to varying real-world practice settings. Of note, there is no consensus from published studies in terms of target of physical activity. The minimum to apply to all patients with COPD and dementia would be to set feasible goals of walking or similar moderate activity in a familiar setting with the help of family and care providers.

Smoking cessation is another nonpharmacologic intervention that has a significant impact on the symptoms and progression of COPD in older adults. It has been shown to improve health status, decrease symptoms, and reduce the occurrence of acute exacerbations [46, 47]. Despite this proven benefit, many patients with COPD continue to smoke, highlighting smoking cessation as an important intervention that primary care providers can provide. In the elderly patient with dementia, access to cigarettes may be dependent on other individuals (i.e. family, caregivers) providing the tobacco products. Although there are no studies addressing this topic, it is a common scenario encountered in primary care, and providers should consider, when it is appropriate, asking these individuals to stop providing the tobacco products. Even if limiting access to tobacco is not pursued, there is very little harm in continuing to counsel patients and families regarding tobacco cessation. This should include obtaining information on who obtains the tobacco products, assessing barriers to cessation including the goals and feelings of the patient and caregiver, and then negotiating an acceptable action plan. There are very few studies looking specifically at the safety and efficacy of nicotine replacement in patients with dementia. One review concluded that nicotine replacement therapy alone is more effective than non-nicotine replacement therapy and that patches minimize side effects [46]. However it should be noted that there are far fewer studies examining non-nicotine therapy in the elderly, so the conclusions may be skewed toward nicotine replacement therapy. Nicotine replacement has a cholinergic effect, which is enhanced in the elderly and has the potential for worsening agitation and behavioral changes in patients with chronic dementia [48]. Therefore nicotine replacement should be prescribed very cautiously, and treatment with noncholinergic medication options might be a better choice. If nicotine replacement therapy is determined to be the better option, very close monitoring has to take place. Patients with dementia may not recall daily total doses and may access tobacco products. Perhaps a caregiver will have to monitor intake more closely.

Vaccination in older adults with COPD is important as there is evidence from large cohort studies that exacerbations can be decreased with vaccination for seasonal flu. Additionally, bacterial infections to which patients with COPD are more susceptible are decreased by influenza vaccinations. Similar findings is seen with all formulations of the pneumococcal vaccinations as well. Therefore, primary care

providers can significantly improve care of older adults with COPD, including those with concurrent dementia, by recommending these simple, cost-effective interventions [49, 50].

Guidelines are clear that oxygen therapy improves survival in patients with severe COPD and hypoxia on routine ambulatory testing. Coverage is an issue in most regions and the accepted criteria is at least one of the following: (1) arterial blood gas with a PaO2 of less than 55 mmHg, (2) oxygen saturation at or below 88% at rest, (3) oxygen saturation at or below 88% while asleep for a specified time (in a patient with oxygen states 89% or greater at rest), (4) oxygen saturation at or below 88% during exercise (such as during a six-minute walk test). However, even in patients without dementia who meet criteria for oxygen, only one-half of patients use their prescribed oxygen therapy at home and one-fourth report using oxygen therapy outside their homes during activities [30]. Secondary to declines in cognition or dementia related behaviors, older adults with dementia may not be compliant with oxygen therapy or may become agitated by the oxygen delivery system. A trial of oxygen therapy with close follow up is critical in patients with dementia to assess feasibility, effects on symptoms, and modifications to oxygen therapy, which could lead to increased compliance.

In primary care based comprehensive treatment of comorbid COPD in older adults with dementia, there are behavioral interventions that can result in a significant impact. Addressing cachexia and weight loss has been shown to decrease the risk of exacerbations [51]. As feeding issues and weight loss are common as dementia progresses, means for optimizing nutrition should be considered early in the disease course in patients with concurrent COPD. Options to optimize nutrition include ensuring access to food and the ability to prepare meals; addressing dental issues; modifying diets on an individual basis including smaller, more frequent meals and finger foods; and prescribing dietary supplements. Additionally, there are targeted programs focused on patient education around self-monitoring as well as empowering patients to be more proactive in their care. These programs have been shown to lead to sustained benefits including fewer hospitalizations and ER visits [52]. Guidelines also recommend the addition of the use of such self-management strategies. Although these strategies have been studied in primary care, the real-world application of these has not extensively been examined. In patients with cognitive deficits, it will be critical for primary care providers to consider how to implement education and self-management strategies at a level consistent with patient cognition or to involve family/caregivers as the primary focus of this technique.

Other Considerations

Acute Exacerbations

Acute exacerbations are more deadly and costly in patients with dementia and COPD [5]. Effective and timely management of acute exacerbations in an outpatient setting can minimize the mortality and cost associated with hospitalization. Thus, it

is important to discuss how to handle exacerbations, even before they occur, on a case-by-case basis. Early recognition and self-management strategies can help prevent hospitalization [53]. There is evidence to suggest that availability of antibiotics and a short course of corticosteroids at home can help manage the early stages of an exacerbation at home along with a 10 day escalation of LAMA and ICS or nebulizer therapy [54]. Evidence suggests reduced short term mortality and less treatment failures of exacerbations with antibiotics, specifically when dyspnea is accompanied by increased sputum production and purulence [55]. However, the use of prophylactic antibiotics at home remains controversial with mixed results in the literature due to variability in regimens used. There are also certain caveats that one must consider. Current guidelines urge not using antibiotics in the absence of sputum purulence and using antibiotics that are supported by local resistance patterns and cover the usual Haemophilus influenzae, Streptococcus pneumoniae, and Moraxella catarrhalis, as these are the most common bacteria found in sputum cultures from bronchoscopy samples [56].

End-of-Life Care

Observational studies show that more than 75% of COPD patients experience significant dyspnea in the last stages of life. Additionally, 78% of hospitalized patients with COPD were unwilling or reluctant to receive mechanical ventilation. Earlier adoption of palliative measures has been shown to be more beneficial in this population [57]. Moreover, advanced planning and facilitating a discussion with patient's caregivers can change the progression of events significantly. However, from the patient perspective, physicians are rated poorly at discussing death and dying [58, 59]. A dual agenda approach is better received by patients, a "Hope for the best, plan for the worst" attitude. In addition, many patients and families hope to optimize resources to allow for death at home with a contingency plan for hospitalization [58]. The primary care provider is urged to schedule a separate appointment to discuss advance planning with a proxy decision maker also present. The discussion can be framed around a dual agenda described in the literature and have a goal of arriving at common goals (decreasing hospitalization, minimizing suffering). In the author's experience, this approach can be quite effective. In addition to the end-of-life issues presented above, consideration can be given to non-invasive ventilation at home as a palliative approach to further prevent hospitalizations [34, 60]. However, such a discussion is outside the scope of our current discussion.

Future Directions

There is room for improvement in the care of this challenging patient population that is commonly seen in the primary care setting. Two current trends seen both in practice and the literature are worth mentioning:

Moving forward, technology may play an important role in the care of older adults with COPD and dementia. The onset and ubiquity of mobile devices and the concurrent development of mobile-device applications which patients can and are using to record health data represent an opportunity for primary care. There have already been integrated electronic health records that interface with patients and allow access to primary care providers in the form of non-traditional encounters. Patient-facing risk assessment tools are also being developed and described [61]. All these tools can aid self-management. More specifically, in the elderly patient with dementia, this could allow for ease of more frequent communication and monitoring, which is not possible through more traditional encounters. How to most effectively implement technology in this complex population needs to be more broadly studied but represents a growing and promising area to improving healthcare delivery through increased ease of communication with the patient and/or caregiver. Studies also describe a shift toward interdisciplinary, in home care and wrap around services. In clinical practice, more insurance carriers and managed care programs are providing for the services of social workers, respiratory therapists, nurses, and others. How this will evolve and integrate into the primary care setting remains to be seen and outcomes yet to be rigorously studied.

Conclusion

A pragmatic diagnosis and management of COPD in the setting of dementia involves being flexible, patient centered, and ensuring early involvement of caregivers and families. Guidelines offer a roadmap but, in older adults with COPD and dementia, often must be modified based on the individual circumstances of the patient and their caregivers. Ultimately, as dementia progresses, a more palliative approach focusing on quality of life, symptom control, and comfort becomes necessary. The primary care physician can feel empowered to make these decisions and, in doing so, can optimize care for these patients and their families.

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Chapter 8
CKD in Older Adults with Dementia

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Main Points

- Chronic kidney disease (CKD) has highest prevalence in the age group over 60 years. CKD is classified into 5 stages based on estimated glomerular filtration rate (eGFR) and urine albumin excretion. The classification provides a guideline to healthcare providers on when to initiate interventions and when complications of CKD arise.
- Determination of kidney function is challenging in elderly patients due to lack of validation of glomerular filtration rate estimation formula in this group. This needs to be acknowledged when assessing kidney function in this age group.
- Several aspects of management include drug dosing based on renal function, fluid and electrolyte management, anemia, and bone mineral disorders. These have been reviewed in detail in this chapter.
- Finally, there are ethical considerations for deciding treatment plan for elderly patients with dementia needing renal replacement therapy. This often requires tailoring individual treatment for the patients.

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Case Vignette

A 70-year-old Caucasian male with history of type II Diabetes Mellitus, Hypertension, coronary artery disease, and dementia is referred to nephrology from his primary care office for further evaluation of elevated creatinine of 2.0. He is asymptomatic. In terms of his comorbidities, his diabetes is managed with insulin with the most recent Hba1c result of 6.5. His blood pressure is well controlled with lisinopril 40 mg daily, carvedilol 12.5 mg twice daily, and furosemide 40 mg daily. In addition, he takes aspirin 81 mg daily and atorvastatin 40 mg daily. He is followed by neurology for his vascular dementia. He is a non-smoker and does not drink alcohol. On exam, BP is 120/70, HR 64, and systemic examination is unremarkable. He is independent for his activities of daily living and resides with his family. Lab results are as follows: hemoglobin 12.5, Sodium 140, Potassium 5.2, Chloride 98, CO2 21, BUN 43, Creatinine 2.0.

Seeing the patient in clinic, the following concerns are recognized: (1). What stage of chronic kidney is this and what work up is needed? And (2). What would be recommended for further management of this patient?

In this chapter, we discuss chronic kidney disease and different aspects of its management, with a special focus on patients with dementia.

Chronic Kidney Disease (CKD) In Elderly Patients

Chronic kidney disease (CKD) is defined as abnormalities of kidney structure or function that persists for 3 or more months with implications for health [1, 2]. The prevalence of CKD is highest in those over 60 years age, reaching 21.1%, according to the United States Renal Data System (USRDS) report for 2018. These patients experience increased morbidity and mortality compared to those without CKD [3]. CKD is classified into 5 stages based on estimated glomerular filtration rate (eGFR) and urine albumin excretion. The classification provides a guideline to healthcare providers on when to initiate interventions and when complications of CKD arise. The most common risk factors for CKD include older age, hypertension, diabetes mellitus, cardiovascular disease, and obesity (BMI >30 kg/m^2). Kidney function needs to be monitored in patients with these risk factors.

Studies establishing association of age-related decline in eGFR are limited and are mostly cross-sectional. The Baltimore Longitudinal Study of Aging (BLSA) is one of the most important studies that highlights the longitudinal effect of changes in renal function with aging [4]. It is from this study that we know that even the individuals without any comorbid conditions, or an intrinsic renal disease, have a decline in creatinine clearance with aging of 0.75 ml/min/year. A similar decline has been noted in other studies as well. Furthermore, patients in the BLSA study who did not have CKD showed greater decline in kidney function amongst older

participants. The rate of decline in kidney function differs between the various stages of kidney function and is influenced by the presence of comorbidities.

Formulae for Estimation of Kidney Function in the Elderly

The Modification of Diet in Renal Disease (MDRD) equation is the most commonly used equation for determining the eGFR in elderly patients and uses creatinine in the calculation along with other variables including age, gender, and race [5]. Other novel methods such as the Cystatin C based equations and the 24 hour urine creatinine clearance can be used as well; although they present some challenges (i.e., collection of a 24 hour urine). Based on eGFR calculated from these formulas, CKD is divided into five stages to guide the management as well as establish prognosis for the kidney disease.

Clinical Assessment of the Elderly with Dementia and CKD

The mainstay of evaluation of patients with CKD is to assess the risk for further adverse events by determining progression of renal disease, cardiovascular events, complications of CKD, and mortality [6]. Special considerations are applicable in the elder population which could impact the course of disease. These factors include frailty, falls, functional impairment, and cognitive impairment as these affect decision-making regarding CKD management in these patients, especially when addressing the option of conservative management vs. renal replacement therapy. When treating elderly patients with CKD, it is important to assess for frailty as patients with CKD and ESRD have a higher risk of frailty and subsequent consequences including falls, disability, hospitalization, and death. Individuals 65 years of age and older who are on hemodialysis have a higher risk of falls as compared to age-matched controls without ESRD (38% versus 4%) [7]. The assessment of functional status is equally important when considering treatment options for advanced CKD. This includes evaluation of independence in performing activities of daily living and instrumental activities of daily living. Lastly, evaluation of cognitive impairment is very important in management of CKD patients with dementia. Yaffee and colleagues studied the Chronic Renal Insufficiency Cohort (CRIC) database and determined that an age of 55 years or greater with a low eGFR was associated with cognitive impairment [8]. These patients are also known to have higher rates of cardiovascular risk factors, metabolic derangements, anemia, and polypharmacy. The patients with higher level of cognitive dysfunction are also at risk for further decline after initiation on dialysis. Hence, cognitive assessment needs to be done carefully in chronic kidney disease patients, especially with known dementia, to inform decision regarding treatment.

Frailty and CKD

Frailty is a progressive condition recognized by a variety of criteria. Fried and colleagues provide a clinical scale comprised of self-reported exhaustion, unintentional weight loss, weakness (measured by grip strength), slow walking speed, and low physical activity [35]. Factors such as inadequate nutrition, physical inactivity, stress, and disease processes such as CKD predispose to frailty [35]. Recognition of frailty is important as it has been associated with worsening mobility, impaired activities of daily living, recurrent falls, increased hip and non-spine fractures, hospitalizations, and increased mortality. It has also been associated with development of dementia in older adults, particularly those with baseline higher cognitive functioning [36].

In the CKD population, the prevalence of frailty and disability is 15% and 12% respectively compared to the non-CKD elderly patient and is similarly high in patients with ESKD on hemodialysis [37].

Chronic inflammation, anemia, malnutrition resulting from the anorexia and nausea associated with uremia, hormonal changes, and depression in patients with CKD play a significant role in leading to the frail state. Management focuses on approaching all of these factors when caring for CKD patients. Exercise training, particularly Tai Chi, has been shown to slow the decline in physical functioning [38]. Increased inflammation and uremic symptoms in CKD patients contribute to malnutrition and sarcopenia. Use of ACE-I (angiotensin converting enzyme inhibitors) has been associated with better nutritional status, improved muscle strength, and decrease in inflammatory markers in CKD. Hormonal changes including low vitamin D and testosterone levels as well as hypo- and hyperthyroidism lead to increased sarcopenia [39]. Correction of these hormonal abnormalities can lead to improved muscle strength in these patients. Growth hormone treatments in elderly patients on hemodialysis was shown to improve quality of life [40]. Use of erythropoietin stimulating agents improves frailty symptoms related to anemia. One in 5 patients with CKD will suffer from major depression, making it a condition that is imperative to recognize and manage by way of counselling, cognitive behavioral therapy and/or pharmacotherapy [41].

In the following sections, we will describe important aspects of medical management in older adults with dementia and CKD as well as briefly discuss the decision for renal replacement therapy vs. conservative management in patients with dementia.

Electrolyte Management

The kidney is involved in numerous functions including endocrine, excretory, and metabolic functions. There is some age-related decline in renal function that contributes to CKD in the elderly in addition to the comorbidities. Typically, older

adults are able to maintain water and electrolyte balance under normal conditions, but this can be affected by illnesses, certain medications, and decline in cognitive ability [9]. This can be further potentiated by pre-existing CKD.

Sodium

Sodium is the main ion in the extracellular fluid, and the total sodium determines the extracellular volume [10]. There is a defect in urinary concentrating ability in the elderly with decrease in the ability to tolerate water deprivation as well as water boluses due to failure of normal renal responsiveness to ADH. Additionally, there is an intrinsic defect in thirst in the elderly leading to decreased fluid intake. These physiologic changes, along with polypharmacy, predispose older individuals to dysnatremias. Those with dementia are more predisposed to these abnormalities due to impacts of their cognitive impairment on these physiological changes. The most common electrolyte abnormality is hyponatremia and is often discovered incidentally on route blood test [9, 10]. It is important to assess and treat underlying factors. The recommended goal of treatment is to correct sodium levels up to 8–10 meq over 24 hours to prevent complications.

Potassium

Potassium, the main intracellular ion, is influenced by numerous hormones, eGFR, and intracellular translocation of potassium. According to Schlanger et al., there is a decrease in trans-tubular potassium gradient (an index reflecting the conservation of potassium in the cortical collecting ducts of the kidneys) in healthy elderly people compared to younger people which leads to a limitation in the ability of kidney to excrete a load of potassium [9]. Hence, these patients become particulary predisposed to high potassium levels (hyperkalaemia). In addition, certain prescription medications that are commonly used in older adults can interfere with urinary excretion of potassium including angiotensin converting enzyme inhibitors (ACE-I), angiotensin receptor blockers (ARBs), potassium sparing diuretics, and non-steroidal anti-inflammatory drugs (NSAIDs). These mediations should be used with caution and the potassium level closely monitored.

Acid-Base

Under normal conditions, most elderly patients are able to maintain acid-base balance [8]. However, under conditions of excess acid production due to acute kidney injury, sepsis, or medication that interfere with acid secretion, older adults are more

susceptible to developing acute metabolic acidosis. This is partially due to the fact that, as the kidney ages, it is less effective at excreting hydrogen ion load rapidly [10, 11]. In CKD, there is impairment of excretion of the daily acid load, mostly due to decreased excretion of ammonia from little functioning nephrons [12, 13]. Metabolic acidosis in these patients can further cause pathophysiological changes leading to worsening of bone disease, increased protein catabolism, reduced respiratory reserve, systemic inflammation and overall, a higher rate of mortality. Kidney Disease Improving Global outcomes (KDIGO) guidelines recommend starting oral bicarbonate supplementation unless contraindicated in CKD patients with serum bicarbonate levels <22 mmol/l to maintain serum bicarbonate within normal range [3]. The management remains the same in older patients with dementia.

Blood Pressure

KDIGO guidelines recommend blood pressure (BP) goals less than or equal to 140/90 mmHg if albuminuria is <30 mg/day, and BP less than or equal to 130/80 mmHg if albuminuria >30 mg/day [14]. However, these recommendations need to be used with caution in elderly patients, especially in those over 85 years of age, as a J-shaped relationship is observed with the lower BP. Hence, these patients may benefit from slightly higher BP compared to the younger individuals [15]. Furthermore, most of the key trials on which the guidelines are based did not include patients over 70 years of age. The benefit of lowering BP is uncertain for both progression of renal disease and mortality. Additionally, the majority of older adults have isolated systolic hypertension and, with frailty, they are predisposed to hypotension and falls with aggressive BP control. Due to exclusion of older patients from most of the trials, recommendations regarding choice of antihypertensive agent for these patients also remains difficult. While ACE inhibitors and angiotensin reductase inhibitors have been recommended for CKD patients with proteinuria, once initiated, patients need to be monitored for acute renal failure and electrolyte abnormalities. Hence, before prescribing these medications for elderly patients, one must consider whether there is proteinuria or not, if the CKD is progressive, and whether there are comorbidities that justify use of these agents.

Drug Dosing

Elderly patients are at an increased risk for adverse drug reactions, including overdose or non-adherence, due to polypharmacy [16]. In addition, they are more likely to have multiple prescribers providing care due to the high prevalence of multiple chronic health issues. According to Gray et al., new onset adverse drug reactions in the elderly are commonly mistaken as new onset disease or complications of aging and about 15–45% of elderly patients develop moderate to severe forms of memory

impairment from medication use [16]. Another major problem is medication reconciliation and failure to present complete list of current medications to various providers due to cognitive impairment, which can negatively impact patient health with significant risk for drug-drug or disease-drug interactions. In addition, most of these patients are at high risk for polypharmacy with more than 50% of these patients having five or more prescription drugs. This is even higher in elderly patients with kidney disease, especially those on dialysis, and places them at a higher risk of nonadherence and adverse drug reactions and drug interactions [17]. Most drugs and/or their metabolites are renally excreted and renal changes with CKD and aging put elderly patients at increased risk for accumulation for drug and/or active metabolites. There is close correlation between GFR and renal drug elimination, which can be useful in dosage adjustment determination. Drug dosage should be adjusted according to estimated creatinine clearance to avoid toxicity in elderly patients with CKD.

A good approach to dose adjustments in elderly patients includes obtaining and performing a complete medical history and physical exam; assessment of renal function/eGFR; determining loading and maintenance dose; and monitoring drug levels. The loading and maintenance doses may need to be lowered in elderly patients and the dosing interval may need to be increased to avoid overdosing.

Anemia

Anemia is a common consequence of chronic kidney disease. The risk of anemia increases as GFR declines, especially when GFR is <60 ml/min per 1.73 m^2. The prevalence of anemia has been reported to be >10% in the elderly population (>65 year old), which is much greater than the usual population [18]. According to the KDIGO guidelines, anemia is diagnosed in adults and children >15 years with CKD when hemoglobin level is <13.0 g/dl in males and <12.0 g/dl in females [19]. There are ethnic, racial, and other patient-centered factors that might play a role in the prevalence of anemia in the elderly. NHANES III data revealed African-Americans have a higher prevalence of anemia among individuals older than 65 year of age [18].

Causes of Anemia in the Elderly

Determining the cause of anemia can be difficult given the increased risk of lower hemoglobin (Hb) levels in the elderly population along with increased risk of comorbidities, including CKD, leading to anemia. Discovering the etiology of anemia is important as it can inform what, if any, treatment an older adult would desire based on their goals of care. Even in older adults with CKD, other causes of anemia should be investigated thoroughly before considering treatment with an erythropoietic stimulating agent (ESA).

Treatment

Treatment of anemia should be considered if it persists after treating any underlying nutritional deficiencies [18]. Iron and ESAs are the main treatments for anemia in CKD. The treatment of anemia in CKD patients can lead to improved quality of life, decreased requirements for blood transfusion, and improvement in left ventricular hypertrophy. According to KDIGO guidelines, the potential benefits of avoiding or minimizing blood transfusions, ESA therapy, and anemia-related symptoms should be weighed against the risk in individual patients when prescribing iron therapy [19]. In CKD patients with anemia, a 1 to 3 month trial of oral iron therapy or a trial of IV iron can be initiated to increase Hb concentration with transferrin saturation (TSAT) less than or equal to 30% and ferritin less than or equal to 500 μg/l. Factors including severity of iron deficiency, intavenous (iv) access, prior response to oral or iv iron therapy, iron status tests (TSAT and ferritin), patient compliance, and cost should be considered prior to treatment. For ESAs, guidelines recommend not to initiate ESA in CKD patients with Hb >10 g/dl based on two trials, the CHOIR and TREAT trials, which demonstrated an increased risk of cardiovascular events at hemoglobin levels greater than 13 g/dl [20, 21].

Monitoring

According to KDIGO guidelines, in patients with CKD without anemia, Hb should be measured when clinically indicated and (1) at least annually in patients with CKD 3, (2) at least twice per year in patients with CKD 4–5 not on dialysis, and (3) at least every 3 months in patients on dialysis [16]. In CKD patients with anemia not being treated with an ESA, Hb should be measured when clinically indicated and (1) at least every 3 months in patients with CKD 3–5 not on hemodialysis or (2) at least monthly in patients with CKD 5 on hemodialysis. Monitor iron status (TSAT and ferritin) at least every 3 months during ESA therapy to help inform decisions regarding whether to start or continue iron therapy. Monitor iron status more frequently when initiating or increasing ESA dose, when there is blood loss, or to assess response after course of IV iron.

Chronic Kidney Disease and Bone Mineral Metabolic Abnormalities

What Is CKD- Mineral Bone Disorder (CKD- MBD)?

CKD-mineral and bone disorder (CKD-MBD), also known as renal or uremic osteodystrophy, includes the mineral, bone, and extra-skeletal calcific abnormalities that arise as a complication of CKD [22]. These result from dysregulation of the

calcium, phosphorous, vitamin D, and parathyroid hormone metabolism. As a result of these dysregulations, CKD patients experience increased bone resorption, decreased bone formation, upregulation of the parathyroid hormone receptors in osteoblasts, increased osteoclastic activity, and reduced activity of the osteoblasts. Patients with CKD-MBD and osteoporosis have a high risk of fractures and cardiovascular disease. Patients on dialysis have a four-times increased risk of having hip fractures and those who incur a hip fracture have almost twice the risk of mortality as compared to those without a fracture [23].

Risk Factors for Fractures in Patients with CKD

Elderly patients with CKD are at high risk of fractures due to renal osteodystrophy, frailty, myopathy, and polyneuropathy. In a study of patients with ESRD, older age, female gender, Caucasian ethnicity, lower BMI, prior kidney transplant, and peripheral vascular disease were independent predictors of hip fracture [24]. Medications including, but not limited to, aromatase inhibitors, gonadotropin-releasing hormone agonists, thyroid replacement therapy, antiepileptics, antidepressants, antipsychotics, lithium, gastric acid lowering agents, thiazolidinediones, loop diuretics, heparin and warfarin, vitamin A, and cyclosporine have been associated with increased risk of osteoporosis.

Monitoring/Assessment

Assessment of CKD related bone and mineral disorders in an elderly patient with CKD is complex. The initial evaluation should include serum biomarkers and non-invasive imaging.

Serum Biomarkers

KDIGO recommends that serum phosphorus, calcium, alkaline phosphatase, 25-hydroxy vitamin D, and intact PTH be serially measured in patients with CKD 3–5. Calcium and phosphorus levels can be monitored every 6 to 12 months in CKD stage 3, and PTH levels are obtained to determine the baseline, and further monitoring for PTH is done if the baseline levels are elevated or CKD progression is noted. Closer monitoring of serum calcium and phosphorus every 3 to 6 months and PTH every 6 to 12 months is suggested in CKD stage 4. In CKD stage 5, serum calcium and phosphate should be checked every 1 to 3 months and PTH every 3 to 4 months. Alkaline phosphatase activity should be checked annually in patients with CKD 4–5 and more frequently in the presence of elevated PTH [25].

Noninvasive Imaging

Imaging tools to assess bone health include DEXA scans (Dual Energy XRay Absorptiometry), quantitative computed tomography (qCT), and heel ultrasound. A DEXA scan is most commonly used to assess bone mass. According to the WHO definition, a T-score of -2.5 is defined as osteoporosis. KDIGO guidelines recommend using DEXA scans to measure BMD in patients with fractures and in those with known risk factors for osteoporosis [25]. A quantitative CT can help distinguish outer dense cortical bone from inner spongy trabecular bone. However, CT is more expensive than DEXA scan and results in greater exposure to radiation. Hence, its role needs to be better established.

Bone Biopsy

Bone biopsy remains the gold standard in diagnosing renal osteodystrophy. However, it is invasive, limited in availability, and expensive. Given the benefit of antiresorptive therapies in patients with CKD stage 3 to stage 4, and lack of evidence that these drugs induce adynamic bone diseases, the 2017 KDIGO guidelines no longer recommend that bone biopsy be performed prior to initiating these medications [25].

Management

Lifestyle changes including smoking cessation, decreasing alcohol consumption, and moderate weight bearing exercises have shown benefit in reducing fracture risk [26]. Management of CKD-MBD includes targeting normalization of phosphorous levels, maintaining as close to possible a normal calcium level, and addressing vitamin D insufficiency/deficiency. Low vitamin D levels can be associated with increased cardiovascular mortality in patients on peritoneal dialysis and a higher risk of myocardial infarction in men [27]. A 25 (OH) vitamin D level more than 30 ng/ml should be targeted in CKD stage 3 and 4 per KDOQI, while monitoring for hypercalcemia. Daily calcium intake of 1200 mg/day and vitamin D intake of 800 to 1000 IU/day is recommended by the national osteoporosis foundation for patients aged 50 years and older.

Dietary phosphate restriction is not always easy, as efforts to limit phosphorus may affect the intake of other essential nutrients, particularly proteins. Consultation with a dietician regarding nutrition in patients with CKD should be considered. Dietary restriction cannot completely control phosphorous and, hence, phosphorus binders are necessary in patients with hyperphosphatemia. Calcium based phosphate binders, although cheap and effective, have been associated with increased vascular calcification [28]. Other binders include formulations of sevelamer (also

available in powder form) and iron-based binders. The calcimimetic agent, cinacalcet, has been studied in dialysis patients with secondary hyperparathyroidism to improve bone density and reduce risk of fractures [29].

Antiresorptive agents include bisphosphonates and denosumab. Bisphosphonates inhibit osteoclastic activity and their use has been traditionally limited to patients with eGFR >30 ml/min due to concerns of accumulation in impaired renal function and risk of over suppressing bone remodeling. In small studies, alendronate, risedronate, clodronate and ibandronate have been shown to be safe in CKD [30–33]. However, bone biopsy is recommended before using bisphosphonates.

Densoumab is a monoclonal antibody against the NF-κB ligand receptor, and it inhibits osteoclast proliferation and development. A post hoc analysis of Denosumab use in postmenopausal women with osteoporosis, excluding those with hyperparathyroidism, showed that it is safe and effective among subjects with stage 1 to 4 CKD.

Another pharmacologic drug that is available are selective estrogen receptors. They are safe to use in women with osteoporosis and mild to moderate CKD [34]. Although, there are side effects of deep venous thrombosis, pulmonary embolism, and risk of stroke in post-menopausal women with coronary heart disease that need to be considered. Additionally, long-term safety and efficacy of these agents in CKD needs to be further explored.

Fluid Management in CKD

Nocturia increases in older adults as a result of several mechanisms. The diurnal variation in urine production in adulthood is a result of increased antidiuretic hormone (ADH) release during sleep and several other factors. In advanced age, especially in elderly males, the nocturnal secretion of ADH is impaired, which may explain the increased diuresis at night [42]. Age also affects the concentrating ability of the kidney with an impaired response to ADH causing an acquired partial nephrogenic diabetes insipidus. An intact thirst mechanism will nullify this effect, but elderly individuals with impaired access to water may not be able to adequately reduce urine formation and will be at increased risk of dehydration. Alterations in neurohormonal systems, such as the renin-angiotensin-aldosterone (decreased with age) and atrial natriuretic hormone (increased with age), lead to natriuresis and contribute to the nocturnal polyuria [43]. Detrusor instability increases with age, consequently resulting in urinary urgency, frequency, and incontinence. In patients with Alzheimer's compared to individuals of the same age with normal cognition, plasma concentration of ADH is found to be lower likely because of reduced release of ADH from the hypothalamus into the bloodstream. This and the aforementioned factors lead to a high prevalence of urinary incontinence and possible dehydration.

Nocturnal polyuria can be managed with the aid of several pharmacologic options. Desmopressin (DDAVP), an ADH analogue, can be used. Adverse effects

include water retention and development of hyponatremia, particularly with the intranasal formulation. Thus, only the oral formulation should be used for the treatment of nocturnal polyuria syndrome. Anticholinergic agents such as oxybutynin and tolterodine can also be used as they act as antispasmodics and decrease detrusor instability.

Ethical Considerations in Initiating RRT in Patients with Dementia

In a study looking at more than 300,000 patients aged 66 years and older, the incidence of dementia was estimated to be 4.6% in women and 3.7% of men 1 year after initiation of hemodialysis. The lifetime risk was estimated to be 25% for women and 21% for men. The risk of dementia diagnosis post hemodialysis initiation increased if the patients were older, female, had a history of stroke, institutionalized, immobile, or required assistance with activities of daily living. Mortality was nearly twofold higher in patients diagnosed with dementia compared to patients of similar age [44]. In patients treated with dialysis, the cognitive dysfunction worsens with longer duration of dialysis [45]. In addition, several studies evaluating outcomes in elderly patients initiated on dialysis found loss of the survival benefit of dialysis in patients aged 80 years or older [46]. No survival benefit was demonstrated in patients aged 75 years or older when their comorbidities included cardiovascular disease [47]. In the DOPPS (Dialysis Outcomes and Practice Patterns Study), the median survival was 7.9 years if age was less than 45 years, 4.5 years if 45–74 years, 2.5 years if greater than 75 years of age [48]. Based on the above evidence and similar findings in other studies, conservative therapy seems a reasonable alternative to pursuing dialysis in the elderly patient with comorbidities.

Quality of life must be considered independently of the survival benefit. As such, dialysis in patients with comorbidities is associated with recurrent hospitalizations and increased risk of death in the hospital. In contrast, patients undergoing conservative care have fewer hospitalizations, are more likely to receive hospice care, and are more likely to pass away at home compared to those being treated with dialysis [49].

For patients with a high frailty index, poor functional status, and severe medical comorbidities, advanced care planning and palliative care involvement must be sought early on in the course of renal disease.

Conclusion

Dementia and CKD overlap in their risk factors, co-prevalence, and impact on the quality of life and frailty in older adults. Optimizing medical management of CKD in patients with dementia should include management of anemia, iron deficiency, electrolyte and acid-base abnormalities, mineral and bone disorders, and blood

pressure. Providers should keep the symptoms of ESRD (anorexia, nausea, vomiting, fatigue, pruritis and psychological symptoms such as depression) in mind, especially as verbal communication and expression may be affected in the patient with dementia. Renal replacement therapy, including dialysis and renal transplantation, theoretically increase the biologic life span, but quality of life should be an important consideration. Renal replacement therapy comes with its own risks, including intensive care and hospitalizations. Goals of care should be aligned with the patient and their family, and an open, honest discussion is key to ensuring the most suitable outcome for the patient while upholding the ethical principles of appropriate and compassionate care of the elderly with dementia and CKD.

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Chapter 9
Management of Musculoskeletal Pain in Older Adults with Dementia

Francisco Loaiciga and Regina Mackey

Main Points

- Pain in older adults is a multidimensional experience that requires a multidimensional assessment.
- Because pain characteristics in the setting of dementia can change rapidly, regular and frequent assessments are necessary.
- Always encourage physical activity as tolerated.
- Reassure the patient and family that pain can be relieved for the most part.
- Adequate pain management requires tailoring the regimen to the type and intensity of pain, a careful stepwise approach as well as slow medication uptitration are required.
- Beware of opioids and NSAIDs (non-steroidal anti-inflammatory drugs) in patients who are experiencing delirium or somatization.
- Be aware of the pitfalls of polypharmacy.

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Introduction

An estimated 50% of people that are diagnosed with dementia also experience pain. The difficulty, including inability in some individuals, to communicate pain in moderate to severe dementia represents a challenge for its adequate recognition, assessment, and treatment.

Untreated pain in dementia patients has been related to a myriad of neuropsychiatric disorders including restlessness and agitation, violent behavior, persistent affective disorder, sleep disorder, and depression among others; appropriate pain management has been demonstrated to ameliorate and, in some cases, treat such comorbid conditions.

Effective pain management involves an interdisciplinary approach using multimodal techniques with the goals of increasing quality of life, relieving suffering, and treating the cause whenever possible.

In this chapter, the authors review the most practical aspects of musculoskeletal pain in patients with dementia.

Case Scenario

Mr. X is a 90-year-old male, with a past medical history that includes Alzheimer's dementia, hypertension, hyperlipidemia, hypothyroidism, and diabetes mellitus type 2. The patient's dementia was diagnosed 10 years ago, at that time he was showing decreased ability to perform complex tasks (e.g., planning dinner for guests or handling finances); for the past 2 years, it has affected his ability to speak (one to five words a day). The patient presents to the clinic in company of his spouse who reports that for the past 2 months the patient seems "less interested in interacting with the family" and that he spends the majority of the day sitting on his sofa holding his right arm; his wife has noted episodes or moaning at night, especially when transferring from the sofa to the bed, insomnia, and has stopped feeding himself for the same period of time. The patient's spouse related no concerns for recent falls or trauma and reports that the patient is adherent to his medication regimen. Further workup including complete blood count, complete metabolic profile, thyroid stimulating hormone (TSH) levels, serum vitamin B12, serum folic acid, and hemoglobin A1c elicited no abnormal results. The patient's spouse also agreed to repeat head CT and right upper extremity imaging, but they did not elicit acute intracranial changes or signs of trauma/fracture. The physical examination showed a male with advanced dementia, with vital signs within the normal range for age, and with decreased passive and active range of motion with stiffness in the right shoulder; the patient's cognitive status made it impossible to the examiner to elicit cooperation with voluntary range of motion and other diagnostic maneuvers. During the physical exam, the patient associated a noisy labored breathing, occasional moaning, facial grimacing,

and also, he was pushing the examiner away from his right upper extremity, but the examiner was able to distract him by voice and touch during these episodes to decrease the distress.

Further chart review and verbal confirmation from the spouse denoted that the patient suffered from frozen shoulder in his sixties, which required arthroscopic capsular release due to refractory symptoms; a discussion with the patient's surrogate help develop a plan that includes conservative measures of treatment and symptom management geared toward quality of life, based on the patient's performance status and prognosis.

Pathophysiology of Pain Perception in Dementia

The pathophysiology of pain might not be the same in patients with dementia as it is in patients without cognition dysfunction. Although studies showing these differences are few, they suggest that specific neuropathological changes may affect pain experience and perception, and they are also different in the four more common types of dementia [1, 2]. Based on some studies, dementia subtypes with more white matter damage (i.e., vascular dementia) will experience more pain [2]. This contrasts with dementias where the main damage is to gray matter, like Alzheimer's and frontotemporal dementias, when it seems that higher pain tolerance is experienced [3–5].

Neurodegenerative changes affecting patients with dementia will also affect pain processing areas at different levels, and various types of dementia will show specific changes in the pain pathway [5]. In simple terms, the subcortical and cortical brain areas related to pain are the medial and lateral pain systems. The medial system consists of the amygdala, medial thalamus, hippocampus, anterior cortex cinguli, and prefrontal cortex. The lateral pain system consists of primary somato-sensory areas and the lateral thalamic nuclei. The sensory-discriminative aspects (localization, intensity, and quality of pain) are mediated by the lateral pain system. Overlap of the two systems might occur in the insula. Both systems, lateral and medial, are involved in different aspects of the pain sensation. The medial system is responsible for the motivational-affective and cognitive-evaluative aspects, the autonomic, neuroendocrine response, and also memory of pain. The sensory-discriminative aspect of pain is regulated by the lateral pain system. There is still a third pathway mediating other critical aspects of pain, the limbic pain system, which mediates behavioral aspects of pain – for example, agitated behavior as a reaction to pain [6].

There are very few new studies about pain changes with neuropathological changes in dementia. Alzheimer's disease (AD) is one of the more often studied dementias. In patients with Alzheimer's disease, the great impact is in the medial pain system, which would imply that the motivational-affective and cognitive aspect would be more affected. This would translate to patients with AD having fewer affective components of pain than individuals with other etiologies of dementia. In

one study, the pain threshold among subjects with AD did not change but the pain tolerance (pain affect) was significantly higher compared with control [7]. The autonomic response to pain can be attenuated with mild pain stimulus but seems to be normal in severe pain. Therefore, when evaluating for pain, it may be helpful to measure the autonomic signs in patients with AD [4].

In other types of dementia, such as vascular dementia (VD), the damage can be quite heterogeneous with lesions scattered throughout the white matter, potentially leading to disruption of connection between distinct areas of the brain. As brain infarcts can occur at any location, they can result in changes in all five dimensions of pain and in any of the pain systems. For example, if the damage causes disruption of the connection between the cortex and sub cortex, an increase in the experience of the pain can be observed. This phenomenon is called differentiation. The type of pain caused by differentiation is also called "central pain" or "central neuropathic pain" [6]. This type of pain can happen after a stroke, called "central post-stroke pain," and may happen even 6 months after the event when patients began experiencing headaches. The pattern seen in vascular dementia is almost opposite of that observed in AD patients, with decreased affective pain experience and an increased suffering.

In patients with frontotemporal dementia (FTD), it is possible to observe a decrease of motivational-affective aspect of the pain due to the atrophy in the prefrontal cortex, a characteristic feature of this type of dementia. In one study, patients with FTD reported less pain than patients with AD following the same experimental pain stimulus. It is important to highlight, however, that most patients with dementia have mixed pathology with a combination of etiologies. This results in challenges in evaluating for and tracking differences in pain behavior among individuals with cognitive impairment.

In conclusion, although there is convincing evidence from research regarding the impact of dementia neuropathology on pain processing and perception, it is valid to speculate that atrophy of gray matter appears to cause an increase in pain tolerance while white matter lesions result in a decrease in tolerance. At this time, the consequences of the imbalance in excitatory and inhibitory processes in central nociception remain far from clear. However, what is understood regarding changes in pain processing should be considered when developing pain management approaches for use in dementia.

Recognition/Assessment of Pain in People Living with Dementia

A comprehensive pain assessment should include a thorough pain history (e.g., onset of pain, palliation, quality, radiation, severity, and timing) and pertinent physical exam. Depending on the severity of dementia, pain evaluation may include self-report (mild-moderate dementia) or a combination of an observational pain scale and information provided by family member(s), caregiver, or clinical personnel

familiar with the patient (advanced dementia) [8, 9]. If the patient suffers from an acute source of pain, the assessment should be directed toward the specific pathology responsible for the stimulus. In contrast, in patients dealing a chronic cause of pain, the assessment should be directed at finding the pathological, physical, and psychosocial aspects of the pain as well as its consequences.

Depending on the degree of dementia (mild, moderate, or severe), the presence of pain can be recognized as a "new" unpleasant experience, which can be expressed as noticeable disturbance in behavior and mood. The association between behavioral and psychosocial symptoms of dementia (BPSD) and pain is complex. We have not been able to create a standardized method that helps us differentiate between pain and BPSD secondary to other causes. The behavioral (e.g., repetitive questioning or aberrant motor behavior such as hitting) and psychological (e.g., delusions, anxiety, appetite changes, sleep changes, depression, or apathy) aspects of BPSD are sometimes the most prominent and, commonly, the only expression of pain, as well as being misinterpreted as part of the ongoing dementia [10, 11].

Non-verbal signs of pain in the adult with severe cognitive impairment include audible sounds such as moans, groans, sighs; facial cues like narrow eyes, furrowed brows, jaw drop, tightened teeth, and pursed lips; bracing the painful area by holding side rails, bedding sheets, table, or the affected area of the body; and restlessness which can be evidenced by constant hand motions, inability to stay still, or rocking [12] In an effort to increase reliability and validity of these behavioral signs of pain, investigators have created observational scales such as PAINAD (pain assessment in advanced dementia) and PACSLAC (pain assessment check list for seniors with limited ability to communicate) [13].

Even among individuals with cognitive impairment, the gold standard of pain assessment is self-report. There are a number of tools that can provide an objective approach to pain assessment and are as follows:

1. Numeric rating scales (NRS): Depending on the scale, NRS can range from 0 (no pain) to 5, 10 or 20 (higher numbers indicating more severe pain). Studies have shown that vertical representations of such tools are easier to use for patient experiencing difficulties with abstract thinking. The advantage of NRS includes the ability to score pain as well as measure response to treatment over time.
2. Verbal descriptor scales (VDS): Some examples are the VDS (Verbal Descriptor Scale), PPI (Present Pain Inventory), and the PT (Pain Thermometer). The VDS and the PPI use words or phrases to represent the level of pain (e.g., "none, mild, discomforting, distressing, horrible, and excruciating"). Verbal descriptor scales require the capacity to communicate verbally. In a recent study from Herr K. et al., 73% of older adults with mild to moderate cognitive impairment were able to complete the VDS. The PPI is as valid as the previously mentioned scales in similar populations, but completion rates are slightly lower. The PT denotes a thermometer with different intensities of pain, making it easier for patients with moderate to severe cognitive impairment to use. However, to optimize reliability among patients with cognitive impairment, it requires a health professional with experience applying the tool [14, 15].

3. Pictorial pain scales: Pictorial pain scales, including the Wong-Baker Faces pain scale, are based on a series of facial expressions that represent the severity of pain. This tool is more sensitive in adults with dyslexia and low literacy or limited education levels [16].

The following can be used as a guideline to assess pain in dementia patients:

(a) Patient or caregiver reports the presence of pain, or there is a behavioral change suggesting underlying pain.
(b) Assess the patient's capacity to express/report pain: can the patient verbally communicate?
(c) If the patient is able to communicate: use simple pain assessment questionnaires such as FACES scale®, examine with provocative testing (e.g., walking or prompting movement of the affected limb), if indicated.$_{20}$.
(d) If the patient is not able to communicate, consider assessing with an observational pain scale such as PAINAD, or PACSLAC, or examine with provocative testing such as walking [17].
(e) Provide education to caregivers and medical team in regard to findings and possible approach.
(f) Once other causes of pain have been ruled out (e.g., visceral pain, cancer pain, neuropathic pain, spiritual pain, and emotional pain), and a diagnosis of musculoskeletal pain has been established, proceed to provide a trial of pain medication, a regular follow-up, and a pain management plan.
(g) Treat main cause of pain, if possible, by establishing a differential diagnosis and an appropriate workup.
(h) Treatment plan: may be pharmacological, non-pharmacological, or both. If the pain is scored/perceived as mild, a non-pharmacological approach is recommended (e.g., trial of physical therapy, occupational therapy, acupuncture, animal therapy, aromatherapy, cognitive behavioral therapy, music therapy, physiotherapy, or TENS [transcutaneous nerve stimulation] if indicated). If the pain is scored/perceived as moderate to severe, consider a trial of anti-inflammatories such as acetaminophen, ibuprofen + proton pump inhibitor, or opioids (Table 9.1) [17].
(i) When it comes to medication management in the elder "start slow, go slow", titrate response to treatment and not dose.
(j) Pain managed with a no-pharmacological approach can be reassessed every 3–6 months.
(k) Pain managed with opioids requires individualization depending on the type of pain and close monitoring with frequent follow-up visits with the medical provider; if this is necessary to uptitrate treatment, please follow the recommendations from the WHO (World Health Organization) analgesic stepladder [18].
(l) Referral to a pain specialist: unusual cause of pain, primary care provider not comfortable with acute/chronic pain management, uncontrolled pain, despite above interventions.

Table 9.1 Acetaminophen and NSAIDs [96–101]

	Usual dosage	Formulation	Metabolism, excretion
√Acetaminophen	650 mg q 4–6 h (q 8 h if CCr less than 10 mg/ml)	T:80325,500,650, C:160,325,500 S:elixir120/5 ml,160/5 ml, 167/5 ml,325/5 ml	Hepatotoxic above 4 g/d, at high doses above 2 g may increase INR if taking warfarin, reduce dosage by 50–75% if liver or kidney disease or if alcohol intake (L,K)
Extended release	1300 mg q 8 h	S:160/5 ml,500/15 ml Sp:120,325,600 ER:650	
ASA	650 mg q 4 h	T:81,325,500,650 Sp:60,120,200,300,600	Kidney metabolism (K)
	Extended release: 1300 mg q 8 h or 1600–3200 q 12 h	650,800	
	Enteric-coated 1000 mg q 6 h	T:81,162,325,500,690,	
Ibuprofen	1200-3200 mg/day divided q 8 or 6 h	T:100,200,300,400,600,800 Ch:50,100 S:100/5 ml	GI ulceration, bleeding, platelet inhibition
Ketoprofen	50-75 mg q8h	T:12.5	L
		C:50,75	
	SR 200 mg	SR:200	
Ketorolac	10 mg q-6 h,15 mg IM or IV q6h	T:10 injection	Duration: use up to 5 days
Meloxicam	7.5-15 mg	T:7.5,15 S: 7.5/5 ml	Has some COX 2 selectivity, fewer GI AEs (L)
Naproxen	220-500 mg q 12 h	T:220,375,500,750	L
		S:125/5 ml	
	DR:375–500 q 12 h	DR:T:375–599	
	ER:750–100/d	ER:T:250,375,500	
Celecoxib	100–200 mg q12h	C: 50,100,200,400	Increased risk of MI, less Gi ulceration, no platelets inhibition, may increase INR when taken with warfarin, contraindicated if allergies to sulfonamides, may induce renal impairment, avoid if moderate to severe hepatic insufficiency Liver metabolism (L)

√ preferred for treating elderly
CCr creatinine clearance, *T* tablet, *C* capsule, *S* solution, *Sp* suppository, *ER* extended release, *L* liver, *R* renal, *AEs* adverse effects

Despite advances in understanding pain mechanisms, improvements of medication delivery methods, and increasing physician education, large numbers of patients are still suffering with pain, especially populations like older adults with cognition dysfunction. People with dementia often have chronic pain, although they do not always identify pain as a problem. The increased potential for drug-drug interaction and changes in pharmacokinetics in this population also present a challenge.

Even with these obstacles, pain in older adults with dementia can be successfully treated. In the light of the potential changes to the pain mechanisms related to dementia, and recommendation for pain assessment, we now move to discuss some of the most common pain syndromes and suggestions for assessment and treatment.

Common Musculoskeletal Disorders Affecting the Differential Diagnosis and Treatment of the Elderly

Shoulder Pain

Shoulder pain is a frequent concern in older adults. Second only to the knee, the shoulder is the most common appendicular joint for which individuals in the general population report pain [19]. The direct relationship between shoulder pain and dementia has not been well studied. As such, the diagnostic approach should be individualized based on the degree of cognitive impairment of the patient and also on the ability of the patient to cooperate with the examination.

The following are common causes of shoulder pain in the elderly:

(a) Rotator cuff tendinitis or impingement:

In rotator cuff tendinitis or impingement, the most common complaint is pain reaching upward, such as when putting on a shirt. Sleeping on the affected side may exacerbate pain. Active and passive ranges of motion are intact, but active range of motion reproduces the pain in situations such as clasping hands behind the cervical area or attempting to scratch the lower back. Abduction of the affected upper extremity will cause pain between 60 and 120 degrees (arc test). Imaging, such as X-rays, may show degenerative changes including osteophytes. MRI will help visualize the tendons of the rotator cuff and should only be obtained if a surgical intervention is being considered.

Treatment: Conservative measures are recommended as first line of treatment. These can include icing of the affected area up to three times a day for 20 minutes, a trial of acetaminophen, and physical therapy focused on increased range of motion. Intra-articular corticosteroids may also be beneficial. Nonsteroidal anti-inflammatory drugs should generally be avoided given the increased risk of gastrointestinal bleeding and renal dysfunction in

older adults. Persistent or increasing pain despite conservative measures may prompt the consideration of surgery if more aggressive intervention would be in keeping with the patient's goals of care [20] (Table 9.1).

(b) Rotator cuff tear:

Patients with a rotator cuff tear typically experience pain referred to the lateral deltoid area. Additional symptoms include weakness and inability to lift weight overhead. Physical exam finding includes the "drop test." For this exam, the patient stands and passively abducts the affected extremity to 90 degrees; with the arm at shoulder level, the patient is asked to keep the arm in that position as the clinician lets go. If the arm sinks once the clinician is no longer providing support, a rotator cuff tear is likely. Plain X-rays may be significant for displacement of the humeral head. MRI not only increases diagnostic accuracy but also may show the degree of muscle atrophy and fatty infiltration which may be helpful in predicting the response to treatment [20].

Treatment: Acute rotator cuff tears should be addressed surgically within 6 weeks of trauma if this is in keeping with the patient's goals of care. Chronic rotator cuff tears may benefit from surgery, but conservative measures such as cold compresses, acetaminophen, and a trial of physical therapy should also be considered. Corticosteroid injections may provide short-term relief (4 weeks) compared to other therapies [20].

(c) Osteoarthritis:

Shoulder osteoarthritis typically presents with posterior shoulder pain that radiates to the muscles of the upper ipsilateral affected arm. Patients typically suffer impaired passive and active ranges of motion as well as a sensation of crepitation when lifting objects. Strength is preserved but may be limited by pain. Typical findings on X-rays include joint space narrowing, osteophytes, and sclerosis. Treatment includes icing, acetaminophen, and intra-articular corticosteroids (which can also be diagnostic if the patient reports immediate improvement of pain after the infiltration). If aligned with the patient's goals of care, total shoulder arthroplasty and debridement can be effective when conservative measures fail [20].

(d) Frozen shoulder:

Patients suffering from frozen shoulder experience difficulty and stiffness with all motion. Active and passive motions are affected. Patients are unable to perform tasks such as touching their back or their ipsilateral scapular area. X-rays are indicated but results are often normal. Conservative measures such as a trial of acetaminophen, as well as physical therapy, can be effective in achieving pain control but full resolution may take up to 18 months. Intra-articular steroid injections may decrease the pain intensity and help the patient participate in physical therapy sessions. Joint manipulation under anesthesia or arthroscopic capsular release may be indicated in refractory cases [20]; certain medical conditions such as diabetes mellitus, heart disease, thyroid disease, or Parkinson's disease have been related to an increased risk of frozen shoulder.

Back Pain

The prevalence of back pain in the geriatric population is estimated to be more than 70% [21, 22]. The burden of back pain in patients with dementia is unknown. Back pain in older adults can be classified as acute pain (e.g., acute lumbar strain, acute disk herniation, and vertebral compression fracture), positional pain (e.g., lumbar spinal stenosis), or persistent pain (e.g., tumor, infection). Assessment and appropriate treatment of back pain are often complicated in institutionalized elders as a substantial proportion of the patients dealing with dementia are unable to accurately report their pain symptoms.

The prevalence of low back pain among older adults with dementia is not well studied and an individualized evaluation and treatment plan is required.

(a) Acute lumbar strain (lumbar pain syndrome):

Acute lumbar strain is defined as back pain that has been present for up to 6 weeks. The pain may be described as burning aching, stabbing, sharp, or dull and can range from vague to well defined. Pain intensity typically fluctuates and can range from mild to severe. The pain may radiate into one or both buttocks as well as the hip or thigh areas. An acute lumbar strain may be precipitated to heavy lifting or exercise [23]. Diagnostic testing is usually not necessary unless the pain has been present for greater than 2 weeks and has not shown signs of improvement, in which case imaging is indicated. X-rays can be helpful in evaluating other potential etiologies of pain including fractures, infections, and malignancy. MRI can provide a more accurate assessment of the spinal cord, surrounding bony areas, and degenerative changes or tumors.

Treatment: Patients with an acute lumbar strain should be counseled to continue their activities as tolerated to promote blood flow to the affected area. This can be helpful in accelerating the healing process leading to decreased inflammation and reduced muscle tension. If bed rest is trialed, it should be for a brief period of time (1–3 days). Vigorous or uncontrolled activities such as weight lifting are inadvisable while pain is severe. Heat and ice application can temporarily reduce the pain and may facilitate stretching, but they do not speed recovery. Acetaminophen is known to provide effective reduction of acute low back pain (Table 9.1). Physical therapy modalities such as ultrasound, electrical stimulation, traction, mobilization, and chiropractic manipulation can provide temporary relief but are not proven to improve long-term recovery. Acute low back pain usually resolves spontaneously and, in most cases, as long as activity can be maintained, formal therapy may not be required [24–27].

(b) Acute disk herniation:

Acute disk herniation can occur along the spinae. Lesions at the L4-L5 level are associated with unilateral sciatic pain as well as possible weakness when raising the ipsilateral first toe and sometimes the ankle and pain and numbness in the anterior aspect of the foot. Lesions as the level of L5-S1 may cause pain and, if severe, may result in perianal sensory deficit, anal sphincter paralysis, and sexual dysfunction. Pain is acute and varies with changes in position. Even though acute disk herniation has been broadly studied, the elderly group (≥65 years of age) has not been well studied.

Treatment: For acute disk herniation in older adults, consider symptomatic relief (please see acute lumbar strain treatment). The value of epidural injections is limited. Consider surgery if neurological symptoms persist and invasive intervention would be aligned with the patient's goals of care.

(c) Osteoarthritis and chronic disk degeneration:

Osteoarthritis and chronic disk degeneration symptoms tend to be limited to the lumbar spine or cervical area, depending on the location of the degenerated intervertebral disk. Common symptoms include pain that ranges from nagging to severe and disabling in the lumbar area, buttocks, and thigh, which tends to be worse when sitting, bending, lifting, or twisting and improves when walking and moving; periods of severe pain that come and go, lasting from a few days to a few months; and numbness and tingling in bilateral extremities. Pain in the cervical area may radiate to bilateral arms and hands.

Treatment: Eliminate the specific activities that provoke pain. Patients should be educated on abdominal muscle strengthening, back posture, and lifting precautions. A trial of acetaminophen is recommended at first and, if pain persists, corticosteroid injections may be helpful (Table 9.1). Consider acupuncture for refractory pain.

(d) Lumbar spinal stenosis:

Lumbar spinal stenosis is characterized by pain, numbness, or weakness in the legs, calves, or buttocks. Patients may associate pain in the calf area with ambulation and report the need for frequent short rests when walking any significant distance (neurogenic claudication). Pain may improve with bending forward, sitting, or lying down.

Treatment: The initial approach should be non-surgical with the use of non-opioid analgesics (acetaminophen, see Table 9.1). Most pain can be treated with non-prescription analgesics but, if pain is moderate to severe, a short course of low-dose opioids may be required. Older adults with cognitive impairment should be monitored closely on these medications as they can result in increased confusion, gait instability, constipation, and other side effects. Epidural injections may be prescribed to reduce swelling. Physical therapy and/or prescribed exercises may help stabilize the spine, build strength, and increase flexibility. A minimum of 4-6 weeks of therapy is recommended.

Patients may be considered for surgery if back and leg pain limits normal activity and affects quality of life, or if non-surgical interventions fail to provide relief. If there is evidence of progressive neurological deficit (limb numbness, leg weakness, or foot drop) or loss of bowel/bladder function, emergent surgical consultation should be pursued.

(e) Vertebral compression fracture:

Vertebral compression fractures are characterized by sudden onset of back pain. Generally, the pain intensity increases with standing or walking and decreases in the supine position. Patients may experience limited spinal mobility or the presence of deformity or disability. Imaging (i.e., CT scan or MRI) can be helpful in determining instability or fracture acuity.

Treatment: Traditionally, the primary interventions for vertebral compression fractures include bed rest, analgesic medications (acetaminophen or NSAIDS, see Table 9.1), brac-

ing, or invasive spinal surgery. Vertebral compression fracture pain that is allowed to heal naturally can last as long as 3 months; however, the pain decreases significantly in a matter of days to weeks. A short trial of intranasal calcitonin may provide symptomatic improvement in the acute phase. Narcotic pain medications should be limited to severe cases of pain not responding to other interventions and should be used for short periods of time. If the pain is refractory to non-surgical interventions, the patient may benefit from vertebroplasty or kyphoplasty. The risk of having similar fractures in the future may be reduced with bisphosphonates to help stabilize or restore bone loss.

(f) Tumors/aneurisms:

In this situation, the onset of pain is typically gradual with steady expansion. The pain is not positional. Pain at night when lying down is typical and should be considered a "red flag" symptom. Imaging techniques such as MRI or CT scan may help identify the etiology of the pain. Cancer-related pain responds better to opioid medications, while pain associated with aneurism may be treated with surgical intervention.

Hip Pain

Dementia and hip pain are two common pathologies in the elderly population; the natural progression of all subtypes of dementia represents a progressive decrease in performance status and hence less activity in addition to increased risk of cachexia or sarcopenia, osteoporosis, falls, depression, and vitamin D deficiency. Studies have shown that 86% of hip fractures occur in patients of age 65 and older, and individuals who suffer from cognitive impairment or dementia experience a higher risk of complications such as hip fracture compared to cognitively intact patients [28–30].

(a) Trochanteric bursitis: Trochanteric bursitis typically presents as chronic, persistent pain in the lateral affected hip or ipsilateral buttock which is exacerbated by lying or sitting on the affected side. The pain can be reproduced with transitioning to a standing position, prolonged standing, sitting with the affected leg crossed, or while climbing stairs. Half of patients report pain that radiates from the lateral aspect of the thigh to the knee and, at times, the pain may extend below the knee.

Treatment: Most cases of trochanteric bursitis are self-limiting and respond to conservative measures such as acetaminophen (Table 9.1), cold compresses, weight loss, physical therapy, and behavior modifications aimed at improving flexibility and muscle strengthening. These modifications, as well as decreasing precipitating movements, may speed recovery. When response to conservative measures fails, corticosteroid injections have shown response rates between 60% and 66%.(31)

(b) Osteoarthritis of the hip: The most common symptom of osteoarthritis of the hip is pain around the affected joint. The pain is characterized by its insidious increase of intensity over time; sometimes, sudden onset is also possible. The patient may develop stiffness and pain that are worse in the morning or after

resting or sitting for prolonged periods of time. With the progression of the disease, symptoms may be more frequent and affect the patient even at rest or at night. The patient may also report pain in the inguinal or thigh area that radiates to buttocks or knee; pain that increases with activity; joint stiffness that prevents the patient from flexing the hip or walking; and a grinding sensation. On exam, the clinician may appreciate crepitus during range of motion of the hip.

Treatment: Nonsurgical treatments are preferred for initial treatment of hip osteoarthritis. These include lifestyle modifications that avoid increasing strain on the affected hip, minimizing activities that aggravate the condition (e.g., climbing stairs), low-impact physical activity (e.g., cycling and swimming), and weight loss to reduce the stress on the hip joint. Physical therapy may recommend exercises that strengthen the muscles around the affected hip. In more advanced cases, the use of assistive devices including a cane or rollator can improve independence and mobility. A short trial of acetaminophen or topical non-steroidal anti-inflammatories is recommended to alleviate discomfort while the patient implements the above interventions (Table 9.1). A trial of oral steroids can be considered if the pain is disabling or the patient is not a good surgical candidate.

(c) Surgical treatment is indicated if the pain causes disability or it is intractable despite conservative measures. Possible surgical procedures include osteotomy, hip resurfacing, or total hip replacement.

(d) Hip fracture: Patients with hip fracture will experience pain to palpation in the groin area as well as the external aspect of the proximal thigh. The patient will express significant discomfort with rotation or flexion of the affected hip. On exam, the patient will hold the injured extremity in a still position with external rotation of the ipsilateral foot and knee.

Treatment: The immediate treatment for hip fracture is open reduction and internal fixation, total hip replacement, or hemiarthroplasty. A study by Hershkovitz et al demonstrated that patients with hip fractures had a 2-year mortality rate of 26.4% in patients with dementia versus 6.5% in those without dementia. This study also showed increased mortality after surgery with increasing age [31]. If the patient is not a good candidate for surgical intervention, aggressive pain management is recommended in the acute phase with opioid medications to ensure quality of life.

(e) There is scarce data regarding the non-surgical approach of hip fractures in medically unfit patients. The 2010 National hip fracture (NHFD) report associates that 3% of patients that sustain a hip fracture receive non-surgical management. (32) The major predictor of response in both surgical or non-surgical interventions is the patient's performance status previous to the fracture. Some authors have recommended the palliative care approach (end of life pathway), in patients with poor performance status or "poor health" in whom surgery would offer no benefit, but the authors did not define "poor health."

(f) In conclusion, a clear discussion between the medical team and the patient or his surrogate involving the risk versus the benefit of the surgical versus the non-surgical approach of hip fractures is advised; such discussion should be guided by the patient's previous activity level, his/her current general health state, and goals of care.

Knee Pain

(a) Knee osteoarthritis:

Knee osteoarthritis may present as a painful and inflamed knee joint that is worse in the morning or after sitting or resting. Strenuous activity may result in increased intensity of pain. On history, patients may report "locking" or "sticking" sensation during movement as well as the sensation of crepitus. The physical exam should attempt to rule out other causes of knee pain including malalignment varus (bow-legged)/valgus (knocked kneed), anserine bursitis (tenderness over the medial tibia), and iliotibial band syndrome (lateral tenderness to the knee at the insertion of the fibular head),

Treatment: Interventions are geared toward palliation of symptoms and decrease disability.

Nonsurgical Treatment
Lifestyle modifications that can be helpful for treating knee osteoarthritis include minimizing activities that aggravate the condition, losing weight to reduce knee stress, and participating in low-impact activities like swimming. Patient should avoid high-impact exercises. Physical therapy can be helpful in providing an exercise routine focused on increasing flexibility and range of motion, as well as muscle strengthening. If pharmacologic therapy is required, the first choice is acetaminophen (Table 9.1). Nonsteroidal anti-inflammatory medications should be used sparingly, if at all, given the increased risk of gastrointestinal bleeding and renal dysfunction in older adults. Intra-articular corticosteroid injections are often preferable in the geriatric population, given the reduced risk of systemic side effects.

Surgical Treatment
Surgical treatment should be considered if the pain causes disability or conservative management fails to provide pain relief. Interventions include arthroscopy, cartilage grafting, synovectomy, osteotomy, or total knee replacement.

Hand and Wrist Pain

(a) DeQuervain tendinopathy:

Patients often associate a sensation of dull or sharp pain and swelling either at the base of the thumb or affected wrist.

Treatment: First-line treatments in older adults include acetaminophen and a thumb spica splint to immobilize the wrist and thumb. If this does not result in resolution of symptoms, glucocorticoid injections or surgery should be considered.

(b) Carpal tunnel syndrome: Carpal tunnel is characterized by numbness, burning, tingling, or pain in the thumb, index, middle, and ring fingers. Paresthesia may radiate up the forearm toward the ipsilateral shoulder. Weakness of the affected hand may make it difficult to perform fine movements such as buttoning clothes.

Patient may associate dropping objects with weakness, numbness, or loss of proprioception. Since the differential diagnosis is broad, including trauma, diabetes mellitus, rheumatoid arthritis, thyroid disease, and amyloidosis, more advanced testing may be required to confirm the diagnosis. Tests may include nerve conduction studies, electromyogram (EMG), ultrasound, and laboratory testing for thyroid disease or screening for diabetes mellitus.

Physical exam: Positive Tinel's sign (tapping along the median nerve causes numbness or tingling) or Phalen's sign (acute flexion of wrists for 60 seconds should cause pain).

Treatment: Non-surgical treatment may include bracing or splinting, nonsteroidal anti-inflammatory drugs (Table 9.1), physical therapy, nerve gliding exercises, or steroid injections. Surgical interventions aim at releasing the median nerve via open surgical procedure or endoscopic procedure.

Common Foot Disorders

Foot pain is a common accompaniment of aging and can affect at least one in four older people. However, diagnosis and management of foot pain are missed commonly in the geriatric population, resulting in many older people with long-lasting foot pain and consequent disability. Foot anatomy is complex and so it is foot pain. Can be due to several factors, local or systemic (i.e. dermatological, vascular, neurological and musculoskeletal conditions that may manifest in the foot). The most frequently reported foot problems in elderly are keratotic lesions (corns and calluses), followed by nail disorders (particularly fungal nail infection), structural deformities such as hallux valgus ('bunions'), and lesser toe deformities (hammertoes and claw toes) [32]. The systemic conditions most usually associated with foot symptoms in elder people include osteoarthritis [33], rheumatoid arthritis [34], gout [35], and diabetes [36]. Know that local and systemic factors often coexist. Finding the cause of foot pain in older people might be difficult and requires a detailed systems examination in clinical practice.

Patient with dementia may be able to provide detailed history about the pain. Sometimes, the history provided by family or caregiver may be a point to start. When the patient is able to cooperate with the exam, active and passive ranges of motion, as well the biomechanical assessment, should be obtained. Next step would be evaluation of footwear, which should be a must part of any assessment of foot pain. Imaging evaluation should be included, especially when patient is not able to provide history or cooperate with physical exam.

All patients with dementia should have routine foot care, keeping foot hygiene, treatment of toenails and keratotic lesions. Clinical reports show that regular podiatry treatment can maintain or improve foot health in older people [37], and end of podiatry services may result in a subsequent deterioration of foot health and mobility in this age-group [38].

Although these problems are considered common, they are often ignored. Nail disorders, due to the difficulty of keeping toenail hygiene, such as onychomycosis

(fungal nail infection) and oncycryptosis (ingrown toenails), can be extremely painful and disabling [39]. In some nursing homes, where podiatry services are limited or unavailable, nursing staff may be required to perform this role [40].

Painful plantar calluses commonly are managed with scalpel debridement by a podiatrist, although the effectiveness of this approach is uncertain. A recent trial has shown that scalpel debridement of plantar calluses is more effective in improving the mechanical properties of the skin than the application of topical keratolytic agents [41]. This data might be mostly important when treating elderly with diabetes, as regular scalpel debridement of plantar calluses has been shown to be effective in the prevention of neuropathic ulceration [42].

Some treatment of corns might require scalpel debridement; however, a recent randomized trial suggests that corn plasters containing 40% of salicylic acid may be more effective [43]. In this trial, the use of corn plasters was associated with a higher proportion of resolved corns, a prolonged time to corn recurrence, less pain, and reduced corn size over the first 6 months in comparison with scalpel treatment. Nonetheless, in older people with poor skin integrity or peripheral neuropathy, as several cases of foot ulceration associated with corn plasters have been reported in people with diabetes [44].

Footwear evaluation is one of the most fundamental components of effective management of foot pain in older people with dementia. Almost half of the elderly people wear shoes that are too short or too narrow [45] due to fashion influences [46, 47], not measuring foot dimensions when purchasing shoes [48], and the limited availability of footwear that caters for the altered shape of the older foot [49]. Wearing shoes that are narrower than the foot may be associated with corns on the toes, hallux valgus deformity, and foot pain, whereas wearing shoes shorter than the foot is associated with lesser toe deformity [50]. Also, shoes that are too tight in the forefoot or too loose in the heel may lead to reduced walking speed and gait instability [51].

Because there is an association between suboptimal footwear and foot pain, a simple and important thing to do would be changing footwear. A recent randomized trial has shown that the use of appropriate footwear is effective in reducing foot pain in older people [52].

Plantar Fasciitis

Plantar fasciitis is a very common condition treated by the orthopedist and is the most common cause of heel pain in the age group of 40–60 years [53]. It is in general unilateral but can also be bilateral. Although it is believed to be an inflammation, histologic changes show myxoid degeneration with necrosis of the collagen and hyperplasia of angioblast. Thus, the correct term to describe this condition would be plantar fasciitis [54].

Risk factors for development of plantar fasciitis include the following: obesity, prolonged standing/walking (e.g., military personnel), pes planus, excessive running, pes cavus, leg discrepancy, etc.

The diagnosis is based on history and physical exam. In later stages of dementia, the majority of the individuals are not able to give valid history, due to loss of communication or inability to understand questions related to pain. When self-report is not available, the caregiver, who knows the patient well and is used to his/her behavior, might be able to provide history peace. One should always make an effort to obtain the self-report anyway. Heel pain may be present with the first step in the morning or after prolonged rest. The palpation of the medial plantar calcaneo region is painful, so it is the passive ankle/first tow dorsiflexion [53–55]**.** Imaging can be used when history and a physical exam are difficult to obtain or when other causes need to be ruled out. Ultrasonography may show [53, 56] findings of increased plantar fascia thickness, and abnormal tissue signals the diagnosis of plantar fasciitis.

Treatment is conservative and includes: rest, activity modification, ice massage, oral analgesics, and stretching techniques can be tried for several weeks. If pain persists, then other therapy modalities such as foot orthotics, night splinting, and corticosteroid injections should be considered. Ninety percent of patients will improve with these conservative techniques. If a patient's symptoms persist 6 months or longer, further invasive procedures are sometimes required [55, 57].

Osteoarthritis

Osteoarthritis (OA) is the most common form of synovial joints disease and a frequent cause of chronic pain in older people. It is a hypertrophic form of arthritis where an overgrowth of the bone around the affected joint is seen. As opposed to the atrophic form, it occurs in young people and is characterized by inflammation and bone erosion (e.g., rheumatoid arthritis). Pathology shows a focal area of articular cartilage loss with overgrowth of subchondral and marginal bone, and clinically it is a pain related to joint use and joint stiffness. Hypertrophic arthritis subsequently became known as *osteoarthritis* (because of the prominent involvement of bone) or *degenerative arthritis* because of its relationship to age and the development of a belief that it was a consequence of wear and tear and tissue degeneration [58].

Osteoarthritis (OA) of the knee is one of the leading causes of disability among noninstitutionalized elderly adults [59]. Severe knee OA may have several consequences, including loss of mobility with limited daily activities, and affect individuals and society economically. The World Health Organization (WHO) Global Burden of Disease Study, conducted in 21 epidemiological regions worldwide, reported a 26.6% increase in the burden of knee OA from 1990 to 2010 [60]. Diagnosis of OA can be made in two ways. First, it may be considered following the American College of Rheumatology Classification Criteria for knee OA include knee pain and age over 40 years with morning stiffness lasting less than 30 minutes and crepitus on motion21. For patient with severe dementia, with difficulty communication, the second approach may be necessary, using imaging. Typical changes of OA on a plain radiograph include joint space narrowing (generally assumed to reflect articular cartilage loss) and osteophyte, sclerosis, and cyst formation. There is very little overlapping between the plain radiograph and the joint damage. About

10% of individuals with knee pain have completely normal radiographs, whereas up to 40% of subjects with severe radiographic changes apparently are pain free. Several other imaging modalities can be used for the evaluation for OA, but currently none is used as a routine in clinical practice. MRI has a great potential in evaluating all components involved in the OA. Currently, there are no guidelines showing very good evidence with disease-modifying treatment. Nonsteroidal anti-inflammatory therapy (Table 9.1), exercise, and control of body weight remain the primary treatment options; there is no effective treatment for severe knee and hip OA, and total joint replacement is typically the final and only effective solution for relieving pain and disability.

Osteoarthritis (OA) and dementia are prevalent causes of disability in geriatric patients. To date, information on the temporal correlation between these progressive diseases and the risk of dementia in patients with OA is limited. There is a growing body of evidence investigating the risk of dementia in patients with OA. Patients with OA exhibit a high co-prevalence of other chronic diseases. Around 90% of patient with OA have at least one additional chronic disease, of which cardiovascular diseases are the most common. Weight-bearing activities such as walking can exacerbate the pain and reduce the activity level of patients with OA [61], leading to lack of physical activity which may result in poor fitness and a higher risk of cardiovascular disease [62, 63].

Studies have reported the preventive effects of physical activity and exercise on dementia [64–66]. They suggest that improving physical activity after joint replacement is crucial in preventing dementia, particularly in geriatric patients with OA. Pain relief and restoration of ambulation can help patients to achieve higher levels of physical activity. Furthermore, obesity is a key risk factor for OA, as indicated by the high prevalence of hip and knee OA in overweight patients [67]. Researches have suggested that physical activity reduces cardiovascular risk by controlling blood pressure and exerting positive effects on brain structures. Conversely, discontinuing daily activities because of OA can expose patients with OA to a higher risk of dementia [68–70].

Rheumatoid Arthritis

Rheumatoid arthritis (RA) is the most common inflammatory arthritis among adults with a prevalence of approximately 1% [71, 72]. The incidence of dementia in patient with RA is higher than that in the general population [73, 74]. It is a chronic autoimmune disease, causing inflammation and joint pain, leading to joint destruction and deformity [75].

RA can also cause inflammation in other parts of the body, including the heart, lungs, and blood vessels [76]. Dementia also shows changes in biomarkers indicative of inflammatory damage [77]. There are supporting evidence that common inflammatory biomarkers are found in both diseases (e.g., interleukin-6 [78, 79], interleukin-12 [80, 81], C-reactive protein [82], pentraxin 3 [83], endothelin-1 [84], and receptors for advanced glycation end products [85]). Elevated levels of

cytokines such as tumor necrosis factor-α and interleukin-10 are implicated in the pathogenesis of the RA and in the progression of dementia [86].

Treatment: Classical disease-modifying antirheumatic drugs (cDMARDs) are effective in controlling disease activity, reducing joint erosions, and improving quality of life [87]. Current guidelines recommend a combination of cDMARDs (including methotrexate [MTX] and at least one other cDMARD, plus short-term glucocorticoids) as first-line treatment, ideally within 3 months of symptom onset for people with recently diagnosed active RA [88]. First-line therapy in early RA is cDMARD as per guideline recommendation, with progression to a biologic therapy for patients with inadequate response, but a large proportion of patients do not need biologic therapy in the first 2 years of disease [89, 90].

Evidence about importance of both local and systemic inflammations in dementia are growing, such as cerebral inflammation occurring secondarily to beta-amyloid plaques, increased levels of serum inflammatory molecules and cytokines being present in Alzheimer's disease patients, and systemic inflammation being associated with cerebral microvasculature disease in vascular dementia. Several observational studies had suggested that non-steroidal anti-inflammatory drugs (NSAIDs) may reduce the risk of dementia, but sub-sequent interventional studies have been disappointing. Recently some observational studies have suggested a protective effect from conventional, synthetic disease-modifying anti-rheumatic drugs (csDMARDS) and tumor necrosis factor inhibiting (TNFi) biological therapies. Ongoing interventional trials are currently looking at whether therapies designed to treat inflammatory and autoimmune diseases have the potential to be used in the treatment of dementia [91].

Polymyalgia Rheumatica

Polymyalgia rheumatica (PR) may not be immediately obvious in patients with dementia, especially in patients with advanced dementia with difficulty to understand the pain questions and/or communicate about it. Polymyalgia rheumatica is one of the most common inflammatory rheumatologic conditions in older adults, [92] with a lifetime risk of 2.4% for women and 1.7% for men [93]. To date, evidence regarding the risk of vascular disease in patients with polymyalgia rheumatica is unclear. There are several biological mechanisms shared between polymyalgia rheumatica and vascular disease. These include the inflammatory burden of the disease, [94, 95] pain, and stiffness to the muscles.

The most common initial complaint is shoulder and neck pain, bilateral and symmetric. Eventually, an involvement of the pelvic and shoulder girdles and the corresponding proximal muscle groups. Distal limb muscles involvement is not common. Stiffness is usually the predominant feature, most severe after rest, and may prevent the patient from getting out of bed in the morning. The diffuse muscular pain increases with movement and nocturnal pain is common. Muscle strength evaluation is difficult due to pain, but it is usually decreased. Some systemic features may help with diagnosis: low-grade fever, fatigue, weight loss, and an elevated

erythrocyte sedimentation rate (ESR). The lack of specificty of symptoms, make PMR a diagnosis of exclusion. There is an extensive differential diagnosis in older patients with muscle pain, stiffness, and an elevated ESR. No specific diagnostic tests exist, and diagnosis depends on having a high index of suspicion supported by history, examination, and raised inflammatory markers.

Treatment: Unless there are any contraindications, patients should be started on 15 mg prednisolone per day, which brings rapid relief of symptoms within days. Higher doses are rarely required. If there is no rapid response, reconsider the diagnosis. Prednisolone should be titrated down slowly, guided by symptoms and not by the ESR. The dose can often be reduced fairly rapidly to 10 mg per day and then reduced by 1 mg daily every 4–6 weeks. After that, the dose should be reduced slowly, aiming to have the patient off steroids around 2 years, although some patients may require small doses of steroids for longer periods.

Some patients, when weaned off steroid therapy, may require a small dose of anti-inflammatory drugs to reduce the muscle pain. Relapses are common and should be diagnosed on clinical grounds (Table 9.1).

Case Scenario (Continued)

This patient has no history of trauma, with a negative serologic workup suggesting no delirium, imaging and limited physical examination are concerning for a pathology related to the glenohumeral joint such as rotator cuff (RC) impingement, RC tendinopathy, RC tear, frozen shoulder, glenohumeral instability, or labral tear. The patient's past medical history, and co-morbidities (diabetes mellitus and hypothyroidism), may support the diagnosis of recurrent frozen shoulder.

In this case, the patient's performance status is poor, marked by the natural progression of dementia, which is denoted by the patient's decreased verbal communication skills. An end of life, goals of care discussion is required or requires an update, if already done in the past, as this patient's risk factors will increase further morbidity and mortality if a surgical intervention is performed anytime.

The most important approach to this case is immediate symptom management as uncontrolled pain (calculated PAINAD score of 8/10) increases the risk of delirium, depression, anxiety, and faster worsening of baseline dementia symptoms. Since the primary care provider for this patient already had a goals of care/end of life discussion with the patient's surrogate, medical management is granted immediately. We would start the patient on a trial of acetaminophen 325 mg by mouth every 8 hours as needed for pain along with a trial of physical therapy with follow-up in 2–3 weeks; if the patient reports a return to previous baseline (e.g., improved ability to move his right extremity and increased interaction with family), and a downtrend in the documented PAINAD score, we can consider a continuation of acetaminophen as needed for pain management with close monitoring of liver function. If this approach does not provide any benefit, a trial of intraarticular steroid injections is indicated.

Conclusion

Pain assessment and treatment may present numerous challenges in older adults, especially those with cognitive dysfunction. In addition, elders are typically more sensitive to analgesic effects of opioids with high risk of peak effect and longer duration of action secondary to the decreased elimination [96–98]. However, this does not mean that pain should not be effectively treated in this population.

When initiating an analgesic regimen, providers should avoid or exercise extreme caution with nonsteroidal anti-inflammatory drugs given the increased risk of gastric and renal toxicity in older adults [98]. Providers should also anticipate side effects and counsel patients/caregivers whenever a new analgesic is initiated. Constipation associated with opioid use is of particular concern in older adults with dementia and a bowel regimen should be initiated at the time the pain medication is prescribed. To minimize the number of medications older adults are taking, to reduce the risk of side effects, and to improve analgesic effects, providers should combine pharmacologic therapy with non-pharmacological treatments whenever possible.

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Chapter 10
Management of Sleep Issues in Older Adults with Dementia

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Main Points

- Sleep disorders, such as obstructive sleep apnea and insomnia, are common in elderly patients with dementia.
- Appropriate evaluation and treatment may be of significant benefit in cognitive function.
- Other sleep disorders, such as rapid eye movement (REM) sleep behavior disorder, restless legs syndrome, and circadian rhythm disorders, can impact elderly patients with dementia and require an understanding by the treating care provider to ensure proper recognition and treatment.

Case Vignette

A 65-year-old female presents to the clinic with sleep-related complaints. She reports difficulty falling asleep. It takes her about 1–2 hours to fall asleep at night. Her sleep is disturbed by frequent nocturnal awakenings and nocturia. There is no one who has witnessed her sleep and is able to report findings such as snoring. She does not have any daytime sleepiness. She reports some memory loss. She lives in an assisted living facility with limited activities during the day. She spends her evenings watching TV. She reports consuming three to four cups of coffee per day. Other medical problems include hypertension (HTN) and hypothyroidism. Her exam reveals a thin, elderly woman with a

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BMI of 31. Her ENT exam reveals Mallampati class II airway without significant anatomical abnormalities. The rest of her physical exam is unremarkable. What would be the next step in evaluation?

As the patient's insomnia is likely due to her lack of significant activity during daytime, lack of sunlight exposure during daytime, and significant caffeine intake, recommendations to address these concerns may improve some aspect of her complaints. However, her report of frequent nocturnal awakenings warrants further evaluation with polysomnography which, in this case, showed obstructive sleep apnea (apnea hypopnea index of 18 with SpO_2 nadir 82%) with significant treatment benefit with use of continuous positive airway pressure (CPAP) 8 cm H_2O. The patient began the use of CPAP during sleep and her family helped her implement a more involved daytime activity schedule with activities outdoors as tolerated. Additionally, caffeinated products were reduced to a cup of coffee in the morning and another in the early afternoon. With these interventions, the patient reported an improved ability to achieve and maintain sleep at night in addition to improved memory.

Introduction

Sleep disorders are common in elderly patients with dementia. Appropriate evaluation and management can improve cognitive function and be associated with significant improvement in quality of life, as well as positively impact caregiver satisfaction. Sleep-related conditions that are common in elderly patients with dementia, including obstructive sleep apnea, insomnia, restless legs syndrome, REM behavior disorder and others, will be discussed in this chapter.

Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) is a common disorder that is underdiagnosed and contributes a great deal to the morbidity and mortality of older adults. Consisting of repeated upper airway closure during sleep yielding arousal from sleep and intermittent hypoxemia, OSA is recognized as a major risk factor for a number of important chronic medical conditions and can contribute to reduced quality of life.

OSA is reported in terms of the apnea hypopnea index (AHI) which is the number of apneas (complete cessation of airflow) + hypopneas (decrement in airflow) per hour of sleep as measured in a sleep study performed at home or in a sleep center.

Centers for Medicare and Medicaid Services (CMS) defines OSA as apnea hypopnea index (AHI) >15 or AHI >5 in the presence of hypertension, stroke, ischemic heart disease, mood disorder, or symptoms of daytime sleepiness.

Symptoms suggestive of sleep disorders, such as sleepiness and inability to maintain sleep in the presence of comorbid conditions such as hypertension and cognitive dysfunction, are common in the elderly patient and warrant further evaluation.

Epidemiology

Estimates of the prevalence of OSA vary based on the populations studied and on the definition of OSA that is used. Prevalence of OSA is higher in males when young. In middle-aged adults, prevalence is estimated to be 24% for men and 9% for women [1]. However, after the age of 50 years, prevalence in males versus females begins to assume a ratio of 1:1. This is believed to be due to the protective effect of estrogen in younger females. Prevalence of OSA is also noted to increase with age, up to approximately 70 years, with a prevalence rate of 30–40% at this age. In a study of adults >62 years of age, nearly one-third had AHI >15 without commonly known risk factors of snoring, neck circumference, and increased BMI [2].

Prevalence of OSA in patients with dementia appears to be higher than in the general population. Published reports suggest a prevalence as high as 40–70% compared to 5–19% seen in cognitively non-impaired people [3]. In a study of institutionalized patients with dementia, 70–80% had an AHI of >5 events per hour. OSA is a common sleep disturbance in patients with vascular dementia [4]. OSA may also be more common in Alzheimer's disease (AD), with prevalence as high as 40%, although the reasons for this increase in prevalence are unclear [5]. APOE4 lipoprotein allele, which is linked to higher risk of AD, may be associated with a higher risk of OSA according to some studies [6].

Pathophysiology

Upper airway collapse during sleep is the basic abnormality that leads to OSA. The increased prevalence of OSA in older adults without worsening obesity suggests that loss of tissue elasticity associated with aging may contribute to increased airway collapse. In post-menopausal women, reduced levels of sex hormones are partially implicated as a factor contributing to airway collapsibility, as the prevalence of OSA in post-menopausal females approaches that of similarly aged males.

OSA contributes both to sleep fragmentation and to hypoxemia, and both have been implicated as possible mechanisms leading to impaired cognition. Hypoxemia appears to have a stronger correlation with intellectual function and executive function, whereas, sleep fragmentation is associated with alterations in vigilance, alertness, and memory [7, 8]. Prospective studies done in men and women with normal cognition have suggested that the risk of dementia in patients with OSA was linked more to hypoxemia than to sleep fragmentation. Loss of regional volume and white

matter integrity in the hippocampus, cingulate cortex, and some cerebellar regions can also be seen in patients with OSA [9].

Sleep fragmentation, as seen in OSA, is associated with greater cerebral beta-amyloid deposition. The glymphatic system which is believed to play a role in the removal of toxic substances in the brain, especially during sleep, has decreased functioning with aging and in the presence of sleep deprivation [9]. Thus, while the exact mechanisms of OSA's contribution to dementia are still to be elucidated, there certainly appears to be a contribution of untreated OSA to the development of dementia.

Clinical Manifestations and Complications

Common clinical presentations of obstructive sleep apnea include symptoms of unrefreshing sleep, choking or gasping during sleep, and witnessed apneas during sleep. Symptoms of feeling unrefreshed, daytime sleepiness, and nocturia are more common than reports of witnessed apnea in older adults [10]. Among elderly patients, cognitive dysfunction and cardiac disease are also more frequently reported. Daytime napping can be indicative of sleep deprivation or fragmented night time sleep which may be contributed to by OSA. During assessment of patients with dementia, collateral history from caregivers should be obtained since patients may not be able to accurately report history. Clinicians should also have awareness of the higher risk of OSA in patients with vascular dementia who might present with a different clinical presentation. Patients with cerebrovascular disease who have OSA are likely to be less obese and less sleepy compared to other patients with OSA [11]. Questionnaires such as the Berlin Questionnaire and the Epworth Sleepiness Scale can be useful tools to assess risk for OSA [12, 13]. The Berlin Questionnaire has higher sensitivity whereas the Epworth Sleepiness Scale has higher specificity in identifying OSA.

Nocturia Commonly associated with urethral obstruction or bladder spasm, nocturia may also suggest the presence of OSA. As arousal from sleep is common in OSA, there is increased recognition of a full bladder necessitating urination. Symptoms of nocturia should prompt consideration of OSA as an underlying cause. Patients with OSA and nocturia who are treated with CPAP report significant reduction in symptoms of nocturia [14].

Impaired cognition Prevalence of impaired cognition increases with aging. Patients with OSA are known to experience symptoms of sleepiness and impairment of executive function, working memory, alertness, and attention. Cognitive impairment associated with OSA can be independent of age [15].

OSA can lead to wide spectrum of cognitive impairment ranging from mild impairment to severe impairment and delirium [11]. In adults who are at least 40 years of age with a diagnosis of OSA, the risk of developing dementia within 5 years of diagnosis was 1.7 times higher than in matched subjects without OSA [14].

Among patients with Alzheimer's disease, prevalence of OSA is noted to be higher suggesting that untreated OSA may contribute to the development of

dementia. Treatment of these patients with CPAP may improve cognition. In a study of patients with Alzheimer's disease, a brief trial of CPAP therapy was associated with improvement in cognitive function [16]. Most studies on intervention for OSA are notable for short follow-up periods, and data on long-term response are currently lacking. However, there are reports of significant improvement of cognitive impairment with diagnosis and adequate treatment of OSA [17]. In a small study of Alzheimer's patients, short-term CPAP therapy for OSA was associated with improvement in mood, sleepiness, as well as neuropsychological test performance. In another study, sustained improvements were noted with use for more than 1 year [18]. In a study of AD patients with severe OSA, use of CPAP therapy was associated with slower cognitive decline [19]. In patients with vascular dementia, CPAP therapy has been shown to significantly improve cardiovascular outcomes [11]. More work is necessary to conclusively link OSA and cognitive decline; however, there is certainly cause to suspect an association.

Development of dementia is well known to be associated with cardiovascular disease; thus, disease processes like OSA that contribute to cardiovascular disease can be linked to dementia.

Hypertension In older adults, OSA is known to be an independent risk factor for hypertension (HTN). CPAP therapy has the most effect on patients with significant HTN and who are adherent with the use of CPAP.

Atrial fibrillation Well known to be associated with OSA, atrial fibrillation is commonly encountered in the elderly population and, when present, should prompt an evaluation for the possibility of OSA. Results of the Sleep Heart Health Study suggest that patients with severe OSA had a significantly increased risk of complex cardiac arrhythmias compared to those without OSA [20]. In addition, Nishihata et al. demonstrated that untreated OSA was associated with higher risk of cardiovascular death and hospitalization [21].

Stroke In a study of patients over the age of 60 years, Yaggi et al. were able to demonstrate that, while prevalence of stroke increases with age, OSA is an independent risk factor for stroke. However, in this study, treatment with CPAP did not appear to affect the risk of stroke or death [22].

Overall, cardiovascular disease–related mortality has been associated with untreated OSA. Results from a Spanish study suggest that there is a twofold increase in the risk of death among elderly patients with severe OSA. Treatment with CPAP significantly reduced the risk of cardiovascular mortality [23].

Diagnosis

In the presence of risk factors, patients with clinical findings suggestive of OSA should undergo testing with polysomnography, either in-lab study or home sleep study. Home sleep studies can be performed to diagnose OSA in patients with a high

pre-test probability of OSA, but patients with dementia can have difficulty using the recording devices without adequate supervision. In patients who are likely to have difficulty utilizing ambulatory testing devices at home, diagnosis of obstructive sleep apnea is recommended via an in-lab polysomnogram. When attempting therapy with positive airway pressure (PAP), monitoring the patient's response – again with in-lab polysomnogram – is of benefit to document tolerability of and response to therapy.

Treatment

Continuous positive airway pressure (CPAP) therapy is the mainstay of treatment of OSA in elderly patients. It is a positive pressure device connected to a face mask by a flexible hose. The airway pressure, delivered by the device via face mask, acts as a splint to keep the upper airway open throughout the respiratory cycle. Most studies have demonstrated improvement in daytime somnolence and quality of life with CPAP therapy.

Patients with OSA who were compliant with CPAP therapy show greater improvement in attention, executive function, psychomotor speed, and recall compared to patients with OSA who are unable to effectively use CPAP therapy. Additionally, among patients with OSA who were able to use CPAP for more than 6 hours per night, normalization of memory was observed [24]. Elderly patients may require lower CPAP pressures compared to younger adults. They are observed to tolerate CPAP well with similar rates of adherence compared to younger adults [25, 26]. Factors affecting CPAP adherence in older adults include cognitive impairment, medical and mood disturbances, nocturia, lack of a supportive partner, and impaired manual dexterity. Presence of dementia is not known to negatively affect CPAP adherence, though there are limited studies available addressing this topic.

While the presence of dementia is not known to adversely affect CPAP adherence, it is recommended that caregivers are involved in encouraging adherence with frequent reminders. With CPAP therapy, the sleep quality of caregivers is also likely to improve due to the patient's reduced nocturnal awakenings. By reducing caregiver distress, institutionalization of patients with dementia could potentially be prevented.

Alternate therapies for OSA include mandibular advancement devices and upper airway surgery. Mandibular advancement devices are oral appliances that are worn during sleep and improve airway patency by moving the mandible anteriorly. They have been proven effective in treatment of snoring and mild to moderate OSA. Results of a small study suggest that age >55 years may be associated with reduced efficacy of oral appliances for OSA treatment. These devices have not been studied in patients with dementia but can be considered as an alternative therapy to CPAP provided the patient keeps the device inserted properly in the mouth throughout sleep. Positional therapy, where side-sleeping aids are used to facilitate sleep in the lateral sleep position, may be considered, especially if there is a significant improvement in OSA severity when sleeping in the lateral sleep position [11].

Upper airway surgeries such as septoplasty, uvulopalatopharyngoplasty, tongue base reduction, and tonsillectomy are surgical options that may be of benefit in select patients; however, they may be associated with increased morbidity in older adults. Proper evaluation by a surgical specialist with training in sleep-related airway surgery is encouraged when seeking surgical options for OSA therapy. In contrast, bariatric surgery is reasonably effective in reducing the severity of obstructive sleep apnea in the elderly [14].

Insomnia

Introduction

Insomnia is a chronic condition that includes symptoms of dissatisfaction with quality or quantity of sleep and an association with daytime impairment. Symptoms should be present for at least three nights a week for more than 3 months prior to evaluation. Published prevalence of insomnia ranges widely depending on the exact definition used. A recent Canadian study yielded a prevalence of 23.8% (patients aged 6–79 years) [27]. In a study done in the United States, prevalence of insomnia symptoms among adults older than 20 was reported to be around 5% [28].

Prevalence of insomnia increases with age and is higher among women compared with men. Prevalence of insomnia in patients with dementia is much higher, estimated to be around 49%. While insomnia can be common in individuals with all causes of dementia, patients with Parkinson's disease, Lewy body dementia, and vascular dementia are noted to have a higher frequency compared to patients with Alzheimer's dementia (AD) [29]. In patients with Parkinson's disease, insomnia is more common in women and patients with longer duration of disease [30].

As insomnia frequently coexists in patients with dementia, insomnia may also play a causative role in the development of dementia. In a prospective study of patients with primary insomnia, it was found that primary insomnia was a potential risk factor for the development of dementia in the future. This risk was higher in younger patients in the age group 20–39 years compared to older adults [31].

Pathophysiology

Multiple factors are implicated in the development of late-life insomnia. Some of these factors include age-related changes in homeostatic and circadian sleep-wake regulation, psychiatric and medical comorbidity, use of medications and other substances that interfere with sleep and wake, and primary sleep disorders.

Normal sleep regulation is based on a complex interaction between the homeostatic pressure for sleep and the output of the circadian pacemaker that governs wake and sleep propensity. Aging is associated with changes to both homeostatic and circadian mechanisms. Advanced age has been associated with a marked

reduction in slow wave sleep and an increase in lighter sleep. This reduction in slow wave sleep, or 'deep sleep,' indicates weaker homeostatic sleep pressure in elderly persons. A reduction in the homeostatic drive for sleep and reduced strength of the circadian signal for sleep in the early morning hours have been implicated as underlying factors in the development of reduced sleep consolidation, advanced sleep phase, and early-morning awakenings in the elderly.

Consequences

While insomnia is certainly associated with patient complaints of poor-quality sleep, the presence of insomnia may also be associated with increased morbidity and mortality in older adults.

Untreated insomnia is known to be associated with increased incidence of depression. In a large study of older men, objective evidence of fragmented sleep with reduced sleep time, reduced sleep efficiency, and higher wake after sleep onset (WASO) was associated with worse physical performance compared to well-sleeping adults of the same age [32]. Insomnia, as defined by reduced sleep at night and poor sleep efficiency, was found to be an independent risk factor for falls in elderly women [33, 34].

Results of a meta-analysis of insomnia patients suggest that symptoms of insomnia and short sleep duration were associated with an increased risk for hypertension. Studies in post-menopausal women have demonstrated increased incidence of cardiovascular disease in the presence of insomnia [35].

In the presence of symptoms of insomnia, the risk of mild cognitive impairment or Alzheimer's disease (AD) is increased two to three times above that of older adults without insomnia [36]. In a meta-analysis of 27 studies of sleep and AD, it was found that individuals with sleep problems including short- or long-sleep duration, poor sleep quality, circadian rhythm abnormality, insomnia, and OSA had 1.68 times higher risk of cognitive decline and AD compared to individuals without any sleep problems [37]. In this analysis, OSA emerged as a strong risk factor, whereas insomnia and circadian rhythm abnormality were associated with an intermediate risk for cognitive decline and AD [37]. Insomnia also increases the risk of mortality as noted in a study of older adults. Those with initial sleep latencies longer than 30 minutes or sleep efficiency lower than 80% had close to twice the risk for mortality [38].

Diagnosis/Evaluation

Most of the evaluation of insomnia includes a detailed sleep history, symptoms, sleep-wake schedules, presence of comorbid conditions, current medication use, and assessment for other sleep disorders like obstructive sleep apnea. Questionnaires

may be a useful tool to identify patients without overt symptoms of insomnia. The Pittsburgh sleep quality index is a widely used questionnaire which has been validated to assess the quality of sleep [39]. The Italian version of this questionnaire has been validated in patients with dementia.

Sleep disordered breathing can contribute to insomnia complaints. In a study of patients with primary insomnia, it was noted that 43% of patients had OSA upon PSG testing [40]. Co-occurrence of insomnia and OSA may be particularly high among the elderly with frequent reports of sleep maintenance insomnia during initial presentation. It has been reported that women frequently have complaints of insomnia in addition to daytime sleepiness in the presence of OSA [41]. Actigraphy is a type of testing, usually available at tertiary referral sleep centers, that records rest and activity periods and can be an additional resource which is considered a reliable and useful tool for the assessment of circadian rhythms and sleep-wake patterns and monitoring of treatment response.

Management

Medical and psychiatric comorbid diseases are believed to be both a risk factor and a consequence of insomnia. Management should be directed not only at comorbid illness but also on insomnia itself.

Both non-pharmacologic and pharmacologic interventions are widely used for patients with dementia and insomnia. There are very few clinical trials to guide therapy in patients with dementia.

Non-pharmacologic Therapy

Many non-pharmacological treatments are employed in the management of insomnia among patients with dementia. Bright light therapy is especially important due to the frequent lack of natural light exposure in older adults with dementia, especially those in assisted living or nursing homes without daytime access to brightly lit areas. Data regarding bright light therapy in dementia are mixed but trend toward a positive effect. Morning bright light therapy using a light box of 2500–10,000 lux for 1–2 hours is the most commonly used method in clinical studies [42]. Increase in total sleep time, improved sleep efficiency, and a decrease in nighttime awakenings are reported following intervention with bright light therapy [42].

Interventions such as limiting caffeine and alcohol intake, reducing intake of fluids close to bedtime, maintaining dark and quiet bedroom environments, and avoiding naps during daytime are helpful in improving sleep in patients with dementia. In a pilot intervention study of nursing home residents with dementia, a significant improvement in sleep quality was noted after eliminating caffeine in the afternoon and evening [43]. Another study of nursing home residents evaluated

multidimensional therapy including reduction of daytime in-bed time, implementation of 30 minutes or more of daily sunlight exposure, increased physical activity, structured bedtime routine, and efforts to decrease nighttime noise and light [33]. These efforts led to decreased daytime sleepiness and increased participation in social and physical activities [44].

Behavioral treatments such as stimulus control, sleep restriction, progressive muscle relaxation, and biofeedback, which are all parts of multicomponent cognitive behavioral therapy for insomnia (CBT-I), have been shown to be effective for treatment of insomnia in older adults [45]. CBT-I involves the identification of maladaptive beliefs and attitudes regarding the distinction between normal and abnormal sleep. These beliefs are redefined to induce positive changes in sleep-related cognition and associated behavioral and emotional outcomes. CBT-I has been found to be as effective as pharmacologic therapy for insomnia, with beneficial effects lasting long term after completion of therapy [46]. While experience with CBT-I in patients with dementia has not been reported significantly, it is reasonable to assume similar efficacy if the patient is able to cooperate with the recommendations.

Pharmacologic Therapy

Sedative hypnotic medications are commonly used in patients with dementia for treatment of insomnia, but they are associated with side effects such as daytime somnolence and cognitive dysfunction and may not alleviate symptoms in the long term. The available literature does not point conclusively to any particularly effective medications and mostly looks at avoidance of adverse consequences more than treatment of insomnia.

Benzodiazepines can lead to multiple adverse effects including addiction, gait instability, worsening cognition, rebound insomnia, and drug interactions. The nonbenzodiazepine hypnotics (also called the "Z- drugs"), including zolpidem, eszopiclone, and zaleplon, and other medications such as suvorexant are also utilized but have not been studied in dementia. Trazodone at low doses (25–50 mg qHS) is commonly used in patients with dementia, with reported low incidence of adverse effects [47].

In a randomized controlled trial targeting depression, mirtazepine was reported to be tolerated well in older adults with dementia and concurrent depression, possibly through improved sleep quality [48]. In clinical trials of older adults with insomnia, ramelteon (a melatonin receptor agonist) was noted to be associated with significant improvement [49].

Risperidone has also been noted to be associated with improved sleep in patients with AD [50];however, use of atypical antipsychotics in dementia is generally discouraged because the FDA has added a black box warning for typical and atypical antipsychotic use in patients with dementia due to increased risk of death [51].

Melatonin use may improve sleep efficiency, total sleep time, and cognitive performance while resulting in minimal adverse effects. Melatonin at doses of 2–5 mg,

taken near bedtime, is the usual dosing that has been studied [52]. In individuals who do not respond to maximal behavioral interventions, low-dose melatonin can be attempted with close monitoring for adverse effects.

It should be noted that polypharmacy is common in elderly adults. A clinical assessment should include consideration of reduction or cessation of medications which could contribute to insomnia including acetylcholinesterase inhibitors, monoamine oxidase inhibitors, serotonin specific reuptake inhibitors, serotonergic-noradrenergic reuptake inhibitors, bronchodilators, beta-blockers, decongestants, CNS stimulants, etc.

The American Geriatrics Society (AGS) Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults are widely used by clinicians and updated regularly [53]. Originally published in 1991, the "Beers List" can help identify medications that may be inappropriate in the elderly. The criteria can be used by clinicians involved in the care of elderly adults with dementia who present with symptoms of insomnia.

Rapid Eye Movement Sleep Behavior Disorder

Rapid eye movement (REM) sleep behavior disorder (RBD) is the loss of normally occurring skeletal muscle atonia during REM sleep, resulting in dream-enacting motor activity during sleep. While the prevalence of RBD only impacts approximately 1.06% of middle to older aged adults, the prevalence is higher in patients with dementia (~22%) [43, 44]. It is most common in patients with alpha synuclein pathology including Lewy body dementia, Parkinson's disease, and multiple system atrophy.

The pathophysiology of RBD is not fully understood. In normal REM sleep, the absence of motor activity occurs via active inhibition of spinal motoneurons plus reduced drive within locomotor generators. While phasic oculomotor and locomotor activity, such as rapid eye movements and brief low amplitude muscle twitches occur as normal phenomena in REM sleep, more elaborate motor activity is normally suppressed [54]. The underlying pathology in RBD is suspected to be due to loss of normal inhibitory mechanisms in REM sleep yielding excessive motor activity [54].

Characterized by arousal from sleep associated with complex motor behavior or vocalization, RBD can lead to injury to the patient or the bed partner. The excessive motor activity seen in RBD includes kicking or punching in association with dreaming. Patients can experience vivid dreams, usually violent or associated with significant physical activity, and consistent with the observed behavior.

Acutely, RBD can be caused by alcohol withdrawal or medications including tricyclic antidepressants, monoamine oxidase inhibitors and serotonin specific reuptake inhibitors (SSRIs). Importantly, when RBD is not caused by medication or other sleep disorders like obstructive sleep apnea, the subsequent risk of developing neurodegenerative disease is quite high at 20% 5 years after diagnosis [55, 56]. Neurodegenerative disease onset can occur as late as 10–15 years after the onset of RBD.

The International Classification of Sleep Disorders (ICSD-3) states the following diagnostic criteria for REM sleep behavior disorder (RBD): (1) repeated episodes of sleep-related vocalization and/or complex motor behaviors, (2) these behaviors are documented by polysomnography to occur during REM sleep or, based on clinical history of dream enactment, are presumed to occur during REM sleep, (3) polysomnographic recording demonstrates REM sleep without atonia (RWA), and (4) the disturbance is not better explained by another sleep disorder, mental disorder, medication, or substance abuse. Video polysomnography is essential for the definitive diagnosis of RBD, but the procedure is complex and not always tolerated by patients with dementia. Specific questionnaires are useful for clinical purposes. The Mayo Sleep Questionnaire, bed partner/informant version, has been validated for use in patients with cognitive decline [57].

The goal of therapy for RBD is to reduce the frequency and intensity of abnormal vocal and motor behaviors during sleep and prevent injury to the patient and the bed partner. Simple measures such as moving sharp and injurious objects, including firearms, out of harm's way are encouraged. Placing a mattress or cushions on the floor adjacent to the bed, or sleeping on ground level is frequently recommended to minimize fall injuries. Medical therapy is frequently utilized with clonazepam and melatonin being the two most frequently used medications. In patients with cognitive impairment, clonazepam should be used cautiously as it can result in increased confusion and daytime fatigue [58]. Melatonin, in doses ranging from 6 to 15 mg, can be used by itself or in conjunction with clonazepam. Unfortunately, treatment of RBD symptoms has not been shown to slow the progression of neurodegenerative disease.

Restless Legs Syndrome

Restless legs syndrome (RLS) is a condition characterized by the presence of an urge to move the legs which may or may not be accompanied by uncomfortable sensations. According to the International Classification of Sleep Disorders, there are four essential clinical features [59]:

1. The presence of an urge to move the legs, usually accompanied by or thought to be caused by uncomfortable and unpleasant sensations in the legs.
2. These symptoms must begin or worsen during periods of rest or inactivity such as lying down or sitting.
3. The symptoms be partially or totally relieved by movement, such as walking or stretching.
4. These symptoms occur exclusively or predominantly in the evening or night rather than during the day.

The prevalence of RLS is up to 8% in older adults and may be higher in patients with cognitive impairment and other neurologic disorders [60]. For example, the prevalence of RLS is up to four times higher in patients with Parkinson's disease

(PD). This may be partially due to augmentation of RLS symptoms by PD medications [61]. Early-onset RLS is defined as onset before the age of 45 years and is more often associated with a family history of RLS. RLS occurring after the age of 45 years has a stronger association with the serum iron status (usually measured by ferritin levels <50 micrograms/L). Iron deficiency with low ferritin levels can be common in the elderly. Other comorbid conditions which are common in older adults and predispose to RLS include chronic renal failure, hypothyroidism, hyperthyroidism, folic acid deficiency, chronic liver disease, and rheumatoid arthritis.

Ninety percent of patients with RLS report difficulty in initiating and maintaining sleep [62]. Studies on cognitive performance in RLS patients report inconsistent findings. In patients with dementia, RLS can be associated with nocturnal agitation behaviors [63]. RLS also needs to be considered as a possible etiology in patients with dementia and wandering [11, 62].

Treatment for RLS begins with non-pharmacologic interventions including optimizing sleep hygiene, doing moderate exercise during the day, and limiting the use of caffeine, alcohol, and smoking. Persistent symptoms will likely require treatment with non-ergot-derived dopaminergic agents such as ropinirole and pramipexole, alpha-2-delta ligand drugs such as gabapentin and pregabalin, or opioids. Clinicians prescribing dopaminergic agents should be aware of the augmentation effect of some of these medications in addition to other side effects of sleepiness, hypotension, hallucinations, etc. The alpha-2-delta ligand drugs have a reasonable safety profile, but sedation can be encountered even with low doses, especially in the elderly. Opioids are typically avoided, especially in patients with dementia, but may be necessary in particularly difficult-to-treat patients. Iron supplementation has been utilized, especially in patients with low iron stores, with improvement in RLS symptoms.

Circadian Rhythm Disorders

The endogenous circadian rhythm plays a critical role in maintaining sleep. Older adults are known to have more fragmented endogenous circadian rhythms. External "zeitgebers" (or time keepers) such as light exposure, physical exercise, regularly scheduled mealtimes, and daytime activities help entrain the sleep-wake rhythm in a 24-hour period.

Elderly patients who are less mobile and perhaps living in a long-term care environment may have less of these zeitgebers which leads to disrupted circadian rhythms and associated sleep-wake patterns. Disrupted circadian rhythms can impact sleep, mood, and memory, which in turn can lead to increased risk of cognitive impairment [64]. Circadian rhythm abnormalities have been associated with an increased risk of cognitive impairment, and irregular sleep-wake rhythms are of particular concern in AD [37]. Patients may lack a well-defined sleep period with sleep periods of only 2–3 hours at a time. In AD, the suprachiasmatic nucleus and pineal gland can both be affected by pathologic damage with neuronal loss and

neurofibrillary tangle formation [65]. Both structures are well known to contribute to the establishment of a normally functioning circadian rhythm.

To address abnormal circadian rhythms in older adults with dementia, treatment consists primarily of daytime exposure to bright light, usually sunlight, and increased physical activity during daytime. Moderate to vigorous daytime physical activity is needed for a normal circadian rest-activity rhythm. In a study of older adults with and without dementia, the amount of moderate to vigorous daily activity necessary for establishment of a good circadian motor activity pattern was almost an hour per day [66]. Interventions to decrease daytime in-bed time, 30 minutes or more of daily sunlight exposure, increased physical activity, structured bedtime routine, and efforts to decrease nighttime noise and light have shown benefits in improved daytime participation in activities and decreased nighttime arousal from sleep in patients with dementia [32, 53].

Dementia Medications

Clinicians involved in the care of dementia patients should be aware of the potential side effects of memory medications on sleep. Seemingly contradictory findings are noted in the case of donepezil. In a small study conducted on patients with Lewy body dementia, it was shown that donepezil reduced sleep disturbances and night time wakefulness. However, in two clinical trials, donepezil was associated with higher rates of reported insomnia [67].

Conclusion

Sleep disorders are common in elderly patients with dementia. Obstructive sleep apnea and insomnia are the most recognized concerns, but other sleep disorders and medication-related adverse consequences can contribute to many of the sleep-related complaints in elderly patients with dementia. Appropriate recognition and treatment, without adverse consequences, is likely to be of significant benefit in improving patient outcomes.

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Chapter 11
Visual Issues in Older Adults with Dementia

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Main Points

- Vision loss in elderly can be from various ocular degenerative conditions. These can be compounded by dementia and depression that could be worsened by vision and hearing losses.
- Recognizing and treating these comorbidities in a timely manner can help improve overall quality of life in the geriatric population.

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Case Vignette
A 70-year-old male living at a nursing facility is reported to increasingly have social withdrawal and stops participating in his otherwise favorite evening board games with his friends in the facility. He starts spending more time alone in his room, is more withdrawn, and declines to socialize. The attending nurse calls his son to inform him that his dad possibly has "worsening dementia or depression" and could benefit from a neuropsychiatric evaluation. His son visits him at the facility and notices that his father has difficulty finding his glasses and cane. The decision is made to send the patient for an ophthalmology consult. At the ophthalmologist's office, the patient is diagnosed with bilateral mature cataract with poor visual acuity. The depression screening question ("Do you feel sad or depressed often?") was negative and the dementia screen (Mini-Cog) was normal. He undergoes bilateral sequential cataract extraction successfully with good postoperative visual recovery. Three months after surgery, his attending nurse at the facility reports that the patient has returned to baseline functioning and is again enjoying his evening board games with friends and socializes as he used to before his visual acuity deteriorated.

Introduction

There is an aging demographic shift in the United States and across the globe with a steady rise in the number of older adults and improved ability to manage chronic illness. With this aging of the population, there is an increase in incidence and prevalence of age-related health issues including visual impairment. Visual impairment is unequally distributed among the population with the highest prevalence in older adults [1].

The etiology of visual complaints in the elderly is varied and includes refractive error (including presbyopia), cataract, age-related macular degeneration, and primary open angle glaucoma. These disorders can usually easily be detected by trained eye care professionals including ophthalmologists and optometrists. In the community, allied health care and nursing providers with adequate training can also learn to screen for these common ocular issues (e.g., cataracts and refractive error).

Neuropsychological disorders like depression, dementia, and posterior cortical atrophy also can occur in the elderly and can present as visual loss. These central nervous system disorders can be more challenging to identify and may occur with or without other ocular disease. In these CNS conditions, it is usually the higher order visuospatial relations that are affected and this translates to more functional deficits in visual processing, reading, and complex visual task performance. These conditions should be suspected in elderly patients with unexplained visual symptoms who have an otherwise normal eye exam. A high suspicion for an underlying higher order visual processing deficit should also be considered when the patient

cannot adequately explain or express the visual disturbance or the patient may have no "chief complaint" but may be brought for medical care by a spouse or caregiver secondary to deterioration in daily functioning. In the absence of structural ocular changes to explain visual changes, visual fields tests should be done which could reveal a homonymous hemianopia or two juxtaposed homonymous hemianopias (cortical visual loss) [2, 3]. A clock draw test is an easy screening test, with reasonable sensitivity and specificity, to detect neurocognitive deficit–related visual processing difficulties. In the clock draw test, the patient is asked to draw a clock, fill in all of the numbers, and mark a particular clock hour (e.g. "11:10") on the picture [4].

In a pooled data analysis from individuals of age 40 years and older, it was determined that approximately 8 million individuals had uncorrected refractive errors accounting for visual impairment and another 3 million patients had visual impairment secondary to other causes. This stresses on the importance of including basic visual testing as a part of routine annual health screening to reduce visual disorder–related loss of productivity, quality of life, and overall burden of related medical expenses [5].

Alzheimer's Disease (AD), Dementia, Depression, and Vision

Visual impairment is common in the elderly and often coexists with dementia. When this occurs, it can result in a significant impairment of daily functioning. In addition, visual impairment is an independent risk factor for development of depression in older adults and can alter social relationships and mood levels [6]. Depression and vision loss together can cause significant distress to an elderly patient and could sometimes manifest as disruptive behavior, which in turn prompts family members to restrict the activities of their elderly family member due to safety concerns [7].

The possible association of vision with dementia and cognitive decline has been investigated. Among subjects with baseline normal cognitive function who were enrolled as participants in an aging, demographics, and memory study, those who had at least one visit with an ophthalmologist had a 64% lower risk of dementia compared to individuals who did not have any ophthalmological care [8]. In addition, it was determined that the risk of developing of Alzheimer's disease (AD) was approximately five times greater for subjects with poor baseline vision and no eye exam. If this association is presumed to be causal, the number needed to treat to prevent one case of dementia is four individuals [8]. The close association of AD patients having a higher incidence of poor baseline vision suggests that possible treatment of underlying visual disorders could significantly alter the development and progression of neurocognitive diseases in older adults. In a cross-sectional study of two representative US populations (the National Health and Nutrition Examination Survey (NHANES), 1999–2002, and the National Health and Aging Trends Study (NHATS), 2011–2015), visual impairment was associated with a two-fold higher odds of developing dementia or cognitive dysfunction in individuals of

age 65 years or older [9]. This stresses the importance of screening for visual acuity and timely intervention in older adults to limit disability secondary to cognitive dysfunction.

AD can present with a variety of visual issues wherein it can affect visual acuity, color vision, and contrast sensitivity. Additionally, it can disrupt the tracking and refixation movement of the eyes such as the initiation and maintenance of saccades (hypometric saccades) and smooth pursuit; visuospatial deficits with difficulty identifying and naming objects; and difficulty reading with inability to understand written words.

Gillette et al. recommend screening for vision, in addition to neurocognitive testing, as part of memory evaluation in older individuals. If measures that slow cognitive decline can be applied in time, for example a delay in onset of AD by 5 years, it is predicted that it would reduce prevalence of the disease by 50% over a period of 50 years [10].

A large proportion of the elderly population with visual impairment and dementia reside in nursing homes or other institutionalized care settings. Studies have shown that up to 66% of older adults in nursing facilities do not have a record of having an eye exam, despite having insurance coverage [11]. In addition, the majority of long-term care facility caregivers lack sufficient training to identify visual impairment in residents. The facilities provide eye care services only on "requested" basis, and a large portion of patients go undetected as they are unable to verbalize their visual concerns secondary to coexisting cognitive dysfunction or communication disorders [12]. In a review of articles on eye care services for elderly, Thibault et al. found that providing some basic eye care at long-term care facilities (i.e., refraction, treatment of active ocular diseases, environmental adaptations, and visual rehabilitation) improved overall quality of life and limited erroneous labeling of unrecognized visual deficits as dementia [13, 14].

Cataracts and Visual Loss

Cataracts are a frequently encountered cause for visual deterioration in older individuals. The incidence of cataracts increases every decade after the age of 40 years, with 50% of white people being affected by 75 years of age and an additional 20% being impacted by the time they are 80 years old. Women have a higher incidence rate (61%) compared to men (39%) [25]. The burden of visual loss secondary to cataracts is rising steadily with the incidence increasing from 20.48 million in 2000 to 24.41 million in 2010. It has been predicted that the incidence is likely to double with over 50 million people being affected by 2050 [25].

An improvement in daily living activity score is noted after cataract surgery among older adults over 80 years of age, with the score noted to be slightly lower after the age of 90 [26]. Most elderly patients have a good outcome postsurgery, even after accounting for the slightly higher risk of adverse events. Lundstrom, in a Swedish-based study, reported that 77.8% of patients over the age of 85 years reported improvement in perceived difficulties of daily living determined by a five benefit level questionnaire system [27]. Patients in this age group also reported

decreased home help requirements postsurgery, although the benefit was slightly lower in >85 years old group as compared to <85 group which could be attributed to coexistence of other comorbidities which limited the benefit of visual outcomes [27]. Chandrasekaran et al. reported that patients had significant improvement in mental health domains post-cataract surgery, without significant change in physical health domains [28].

Chronological age alone should not be a contraindication for surgery as even patients over the age of 90 years have shown significant improvement in visual acuity in the absence of other ocular comorbidities [29, 30]. In addition, Fagerstrom described an improvement in depression in patients following visual improvement after successful cataract surgery, where 79% of individuals had restoration of acuity to enable reading postsurgery [31]. This outcome was also supported by McGwin who reported significant reduction in depressive symptoms in patients who underwent cataract surgery ($P = 0.01$), whereas the no-surgery group reported worsening depressive symptoms. However, no change in cognitive status was recorded at baseline and on follow-up in the two groups. In addition, there was no difference in the rate of falls in either group in relation to surgery and the authors concluded that there is no association of cataract surgery with incidence of falls (risk ratio (RR) = 0.96, 95% confidence interval (CI) = 0.64–1.42) [32, 33]. Foss et al. however reported reduction in falls after the first eye surgery (rate ratio 0.66, 95% confidence interval 0.45–0.96, $P = 0.03$); however, the statistical significance was lost following second eye surgery (rate ratio 0.68, 95% CI 0.39, 1.19, $P = 0.18$) [34].

Screening for cataract surgery should be combined with a support system for referral and scheduling of surgery, in the absence of which the purpose of the system is lost [35]. Screening for cataracts could be a part of annual health check or provided in long-term care facilities. In these facilities, nursing could receive basic training from an ophthalmologist to identify cataracts or an eye care professional could come to the facility on a regular basis. Early identification and timely intervention result in better visual outcomes as opposed to a wait period of over 6 months for surgery, which has been associated with a worse visual decline and reduced quality of life [36].

Surgery for cataracts has evolved enormously over the past few decades and in now a relatively common, safe, outpatient, surgical procedure. Typically an uncomplicated surgery on one eye lasts only minutes, involves a microincision, has minimal blood loss, and requires only topical anesthesia. Usually there are no significant physical restrictions after the surgery other than avoiding heavy work. Older adults with physical disabilities may however require some supervision and assistance with appropriate use of postsurgical topical treatment.

Refractive Errors and Vision Loss

Uncorrected refractive error is a common problem that affects people of all ages. In the elderly population, uncorrected refractive error can significantly impact quality of life as well as result in increased incidence of falls, depression, and cognitive issues, all of which may be life threatening in the older population [44]. In a study

by Nael et al., 40% of participants had uncorrected refractive errors [44]. Furthermore, the study found that there was a higher prevalence of uncorrected refractive errors in patients who were being examined at home and could not afford the fees associated with ophthalmologist visits [44]. It is important to address these factors in older adults given the impact of vision on daily functioning and quality of life.

The Singapore Malay Eye Study examined the relationship between refractive error and cognition and concluded that when compared to the emmetropia participants, those with myopia were twice as likely to have cognitive dysfunction [42]. Furthermore, they found that correcting the refractive error did not improve the association between myopia and cognitive decline [42]. The reason for this is unclear. However, it has been hypothesized that there is a common pathophysiologic mechanism through which β-amyloid, a protein involved in AD, accumulates in the lens inside the eye [42]. This accumulation causes the lens to thicken and induce a myopic shift in refractive error. In another study, they concluded that those who had impaired near vision were more likely to have a decline in cognition [43]. Reyes-Ortiz et al. determined that those with poor near vision decreased 0.62 points on the Mini Mental State Examination blind version (MMSE-blind) over the 2-year study with an additional decrease of 0.13 points more per year than participants who had good near vision. Although the results from the studies had different conclusions, it is evident that cognitive decline is influenced by refractive error.

Presbyopia is an age-related change in which the eyes progressively lose their ability to focus on near objects secondary to loss of lens flexibility. Brown assessed visual acuity and functionality, measured by Snellen acuity and a visual function questionnaire, respectively [45]. He found that participants who had a visual acuity of 20/20 in the better eye scored a 91.5 on the vision questionnaire, while those who were hand motion to light perception in the better eye had a total score of 15.4 [45]. These findings were further supported in a study by Owsley et al. who looked at the association between uncorrected refractive error and vision-targeted quality of life and depression in nursing home residents. They split participants into two groups: (1) those who were corrected immediately about a week into enrollment and (2) those who were corrected 2 months after baseline [46]. They concluded that those who were corrected immediately for their refractive error scored higher in the Nursing Home Vision Targeted Health Related Quality of Life Questionnaire and experienced less depression in comparison to their counterparts who underwent delayed correction [46]. This not only supports the importance of correcting refractive error but also demonstrates the impact of timely treatment.

In addition, correcting refractive error is important because visual impairment has been found to be correlated with an increased risk of cognitive decline. Currently, there are two theories that hypothesize how vision can affect cognition. The first theory, known as the sensory loss consequence theory, explains that poor vision can cause a decline in cognition secondary to decreased activity levels [47]. Those that have poor vision are less likely to engage in activities which are important for brain stimulation and preventing a decline in cognition [47]. The second hypothesis explains that common pathways, such as inflammation or degeneration of the

central nervous system, affect visual acuity as well as cognition [47]. In the Salisbury Eye Evaluation Study, Zheng et examined the relationship between visual acuity measured with the ETDRS chart and cognition assessed by the Mini-Mental State Examination (MMSE) over an 8 year period [47]. They found that participants who had a visual acuity decline of one line on the ETDRS chart also had a decline in MMSE score of 0.83 points [47]. In addition, they determined that visual acuity had a larger effect on cognition than vice versa [47]. This conclusion demonstrates the importance of correcting vision in order to decrease the risk of cognitive decline. The findings from this study can be supported by previous studies such as the Australian Longitudinal Study of Aging and the Berlin Aging study which found a moderate association between poor vision and cognitive functions including memory, speed, and verbal ability [48, 49]. Overall, it is important to correct refractive error to reduce the risk of cognitive decline. First line of treatment includes full-time wear of corrected contact lenses or glasses. Corrected glasses are usually the preferred choice because contact lenses require good dexterity which may be difficult in the elderly population. The type of corrective glasses has also been found to be an important factor to consider when prescribing lenses for patients [50]. According to Lord et al., subjects who wore multifocal glasses were two times more likely to fall in comparison to non-multifocal glasses wearers [50]. This can be explained by the fact that multifocal glasses impair depth perception and edge-contrast sensitivity which is important to distinguish objects in the environment [50]. Therefore, it can be concluded that it may be more beneficial to prescribe non-multifocal glasses to older adults who are at risk of falling.

Glaucoma

Glaucoma is a degenerative optic neuropathy characterized by optic nerve cupping and visual field defects as a result of loss of retinal ganglion cells and their axons [37]. It is the second most common cause of blindness in the United States and the most common cause in African Americans. Glaucoma can occur with increased or normal intraocular pressure (IOP). It is classified depending on the appearance of the iridocorneal angle (i.e., open or closed) or the cause of glaucoma (i.e., primary or secondary). Primary open angle glaucoma (POAG) is the most common type [38].

Both glaucoma and dementia are neurodegenerative diseases that have been pathophysiologically linked and have features of neuronal loss that lead to cognitive and visual impairments, respectively [39]. Both diseases are more prevalent with increasing age and there is some evidence that the diseases share a final common pathological response leading to degenerative changes of ganglion cells [39].

In a longitudinal retrospective cohort study that was performed from January 1, 1994, to December 31, 2007, regarding the risk of developing dementia in patients with open angle glaucoma (OAG), there was no increased risk of AD or other dementias compared to patients without open angle glaucoma [40]. Another study performed histologic evaluation of the optic nerves of 10 patients with AD

compared with optic nerves from age-matched controls. Eight out of the ten AD optic nerves showed degenerative changes of retinal ganglion cells and their axons in the nerve fiber layer, while no degeneration was found in any of the controls [38]. This finding supports the hypothesis that both glaucoma and dementia are linked pathophysiologically as both are neurodegenerative diseases.

Although there is no difference in the diagnostic workup between younger and older patients with glaucoma, there are some additional challenges when treating patients with concurrent dementia and glaucoma. There are many factors that contribute to the risk of poor compliance with glaucoma therapy and these are more commonly encountered in elderly patients [41]. Some of the elderly patients do not have adequate transportation to the eye care provider's office or to the pharmacy. In addition, elderly patients have difficulty administering eye drops because of memory impairment or physical restrictions. Treatment options should take into consideration individual patients and disease-related risk factors.

Treatment Options

The treatment modalities for glaucoma are similar in young and elderly patients, with the primary treatment typically being pharmacologic. Common medications used are prostaglandins analogues, beta-blockers, alpha-adrenergic agents, carbonic anhydrase inhibitors, parasympathomimetics, epinephrine, hyperosmolar agents, and combination glaucoma drugs.

If the patients fail maximum medical and non-surgical options such as laser treatment, surgical options can be considered after a thorough exploration of the potential benefits and risks with the patient and/or surrogate decision-maker. When considering surgical intervention in older adults, it is important to assess the overall health status including cardiovascular, respiratory, and renal issues; cognitive function; and the availability of a caregiver to provide postoperative support.

Age-Related Macular Degeneration (ARMD)

Age-related macular degeneration (ARMD) is a degenerative disease of the central retina that results in the deterioration of central vision. This can significantly impact activities of daily living, instrumental activities of daily living (i.e., driving), and the ability to recognize faces. The incidence of ARMD steadily increases as individuals age, with 1 in 10 Caucasians over the age of 80 years having the disease. The number of affected US population is expected to increase to 2.95 million by 2020 [20]. Significantly worse scores on cognitive tests correlate to more advanced macular degeneration. However, it cannot be ascertained whether the visual deterioration precedes the cognitive decline temporally versus preexisting cognitive dysfunction due to the cross-sectional design of the study. Keenan et al. discussed the hypothesis of degenerative conditions like AD and ARMD sharing similar environmental risk

factors and histopathologic disease; however, no association of increased risk of AD or dementia in patients with an existing macular degenerative disease was found [21].

The Age-Related Eye Disease Study (AREDS) research group evaluated the association of ARMD with cognitive dysfunction in 2946 patients [22]. Accurate assessment of vision in elderly with cognitive dysfunction could be challenging [22]. Suitable adjustments were made on visually demanding cognitive tests in patients with vision worse than 20/200. They concluded that patients with a vision worse than 20/40 performed poorly on the cognitive function tests and scored low (odds ratio 2.88, 95% confidence interval 1.75–4.76) compared to patients with vision better than 20/40 [22]. Studies have shown that use of beta carotene, vitamins C and E, and zinc is associated with a substantially reduced risk of progression of ARMD in elderly persons [23]. However, Clemons et al. found that the use of antioxidants and zinc supplementation did not have any effect on cognitive function.

There are two forms of ARMD: (1) the wet type (choroidal neovascular membrane formation) where treatment includes laser therapy or specific intravitreal injections and (2) the dry type (drusen, geographic atrophy of the retinal pigment epithelium) which does not have a definitive treatment. The AREDS 2 is a multivitamin supplement that has shown to reduce progression of dry ARMD to a more advanced stage [24]. Early diagnosis is key to management of both types of ARMD as they slowly progress and can be very disabling given their impact on central visual acuity [24].

Posterior Cortical Atrophy (PCA)

Posterior cortical atrophy is a type of dementia that is characterized by specific involvement of occipito-parietal regions and is independent of a specific underlying etiology. It is more commonly associated with AD with atypical areas of involvement as compared to traditional AD which impacts the amygdala, hippocampus, and frontal lobe. The mean age of onset of PCA is in sixth decade and is suspected in older adults experiencing visual disturbances that do not correlate to visual acuity. For example, patients may report being able to see the letters on the eye chart but cannot identify the letters when asked to read them. Patients may have acalculia, alexia, and anomia. In addition, simultanagnosia (82%) may be present. Simultanagnosia can be detected by asking patients to identify parts of a complex visual scene. Affected patients can identify the individual parts of a picture but are less able to interpret the entire scene. Various visual field defects may also be present in PCA including homonymous hemianopsia or cortical visual loss (47.5%).

Pathology on postmortem specimens have revealed presence of AD-like neurofibrillary tangles, but with an unusual distribution in Brodmann area 17, 18 as opposed to the more commonly involved hippocampus in AD [15]. FDG-PET scan is very useful but an expensive tool in the diagnosis of unexplained visual disturbance in elderly who have a normal eye exam. The scan is based on the principle of uptake of glucose depending on metabolic activity of the brain. In PCA, FDG-PET might show decreased uptake of glucose (seen as cold spots on the scan) in

posterior cortex in occipito-parietal areas [16, 17]. Alternatively, functional MRI could be used and has shown to correlate to reduced posterior cortical functioning [18, 19].

Low-Vision Devices and Improvement

Vision loss associated with a decrease in cognition can severely impair the activities of daily living (ADL) in the elderly. Eye care professionals should consider different treatment options that can help improve vision. According to Whiteside et al., factors to consider in order to improve vision include increasing contrast and lighting [51]. Pathology commonly associated with increasing age, including cataracts, glaucoma, and macular degeneration, degrades contrast sensitivity. It is important to increase contrast sensitivity to counteract those changes and improve vision. In addition, increasing lighting will help improve vision and functionality. Similarly to contrast, the amount of light that is transmitted through the eye can be decreased due to media opacities and retinal degeneration. In order to improve the amount of light that enters the eye, strategies such as an extra light source can be added, light sources can be angled, and a higher wattage light bulb can be used [51]. When further help is necessary, optical and non-optical low-vision devices can be used to improve functionality. Optical low-vision devices such as magnifiers help enlarge the image size of objects through handheld or stand devices. With the advent of technology, electronic magnifiers have been able to increase the size of objects as well as increase contrast sensitivity. Another device, called a telescope, has a smaller field of view in comparison to magnifiers but will help the user see both distance and close-up objects. Non-optical low-vision devices, such as talking aids, are able to provide information to patients through hearing. Those devices have been able to improve the patients' quality of life by helping them perform their daily activities. Shaaban et al. found that 56% of the participants had five lines or more of distance visual acuity improvement with low-vision devices and 76% were moderately to highly satisfied with their aids [52]. This improvement in quality of life is beneficial because it has been shown to be correlated with cognition. It is important that patients who can benefit from low-vision devices receive them early on to decrease their risk of cognitive decline.

Vision Rehabilitation

With age, vision can be degraded due to multiple causes including changes in refractive error, macular degeneration, and cataracts. Low vision is defined as a congenital or acquired impairment of visual acuity and/or visual field defect and /or other functional disability that makes it difficult to process learning, social interactions, and activities of daily living [53]. When vision can no longer be improved with correction or surgeries, low-vision rehabilitation can significantly improve a patient's quality of

life. Vision rehabilitation is the process in which patients are taught how to maximize their ability to perform activities through the use of optical, non-optical, and electronic aids [54]. Not only are they given visual aids, but patients are also taught different eye techniques that they can utilize including eccentric viewing, tracking, and scanning. Although vision cannot be restored, patients can improve their quality of life through these different aids. In a study by Whitson et al. [55], the impact that low-vision rehabilitation had on individuals with macular disease and mild cognitive deficits was evaluated. After 6 weeks of twice weekly vision rehabilitation, participants had an improved scores on the National Eye Institute Visual Function Questionnaire, (https://nei.nih.gov/sites/default/files/nei-pdfs/vfq_sa.pdf) timed performance measures, satisfaction with independence, and logical memory [55]. Furthermore, all participants reported they were able to achieve at least one goal, with more than 70% being able to achieve three goals [55]. This study demonstrates the impact vision rehabilitation can have on the quality of life of those with vision impairment. These findings were further supported by a study where 92% of participants who engaged in low-vision rehabilitation felt that the service met their needs and 77% believed their visual aid was useful [56]. It is important to refer patients to vision rehabilitation when necessary because it has been found that vision impairment is associated with an increased risk of cognitive decline. With improved functioning, patients may be able to perform activities of daily living that increases their brain stimulation. This brain stimulation in turn will decrease their risk of cognitive decline.

Summary

Visual impairment in the elderly can be due to a variety of causes and can result in impaired functioning and quality of life. It is important to evaluate and treat any ocular or neurologic etiologies as well as identify comorbidities. Visual loss can be the presenting or only sign of CNS disease, such as dementia and depression. Timely intervention and targeted treatment of the most common visual conditions can improve vision and daily functioning. If older adults meet the criteria for low-vision services, visual rehabilitation should be pursued.

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Chapter 12
Skin Conditions in Older Adults with Dementia

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Main Points

Most chronic wounds develop in the elderly population. Providers need to be especially vigilant in the prevention of these wounds in geriatric patients.

- Patients with dementia can be especially difficult to treat because of their inability to understand and adhere to plans of care. These plans might include non-weight bearing, use of offloading devices, or compression systems. Lack of understanding might lead to falls, agitation, or worsening of the wounds due to inability to comply with the treatment recommendations.
- Providers must work with patients, families, and caregivers to design a treatment regimen that can take into account the unique challenges of each patient with dementia so that wound healing can be achieved.

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Introduction

According to the CDC, by 2030, the population over the age of 65 years will reach approximately 71 million people [1]. As a result, this subgroup will make up approximately 20% of the US population (2010 US Census). Of the 5.8 million Americans currently affected by Alzheimer's dementia, 81% are of age 75 or older [2]. Given this demographic shift, skin conditions will become a prevalent concern facing all primary care clinicians. The management of patients with dementia and chronic skin conditions can be especially challenging. Clinical care of various skin conditions requires coordinated effort from the healthcare provider, the patient, and the family, depending on the spectrum of the patient's cognitive impairment.

Case Vignette
Mrs. K is an 89-year-old female with a history of Alzheimer's type dementia, diabetes mellitus, hypertension, and chronic venous insufficiency. She lives in the community with her daughter, and presents to clinic for a follow-up visit. The patient's daughter still works; therefore, Mrs. K spends 6–8 hours home alone during the day. Her MMSE is 18. She has become increasingly less mobile. On physical exam, you note that she has open wounds on her lower extremities consistent with venous stasis ulcers. She also has an area of superficial breakdown on her sacrum consistent with a stage 2 pressure injury. Mrs. K is incontinent of bowel and bladder, and is having more difficulty ambulating to the bathroom. She wears incontinence garments. The patient has been prescribed compression garments, but is unable to get them on.

Normal Changes of the Aging Skin

The skin is the largest organ in the human body. As the older adult ages, the skin becomes more fragile and more vulnerable to trauma [3]. Due to cellular and physiologic changes in the aging skin, there is a higher propensity for development of a chronic, non-healing wound. This may lead to increased pain, higher risk of infection, and increased risk for hospitalizations [4–6].

There are two processes affecting the aging skin. The first process is known as "normal aging" or *intrinsic effect*, which is the irreversible degeneration of skin tissue [7]. Within the intrinsic path of aging, the epidermis begins to flatten. This makes the skin more susceptible to trauma, decreases its water content (becoming drier), and increases the risk for infection. The second process of aging, or the *extrinsic effect*, is caused by photoaging, pollution, and exposure to smoke [10]. Photoaging is a result of ultraviolet exposure, causing the skin to appear leathery, with more wrinkles and less elasticity [3]. Lifetime exposure of skin to ultraviolet light weakens the connective tissues within the dermis. In addision, the aging blood vessels become thinner, increasing their fragility and becoming more susceptible to bleeding. We often see the older adults with "maroon, purple" hemorrhages on skin-exposed sites, such as the arm, hands, and even on lower extremities. This irregular-shaped purpura is known as *senile purpura* [3].

Skin Cancers

Skin cancers are categorized as cutaneous melanoma or non-melanoma skin cancers (NMSC) [8]. Typically, patients that are 65 years and older are found to have more NMSC lesions, which make up approximately 80% of all skin cancer cases. The most common form is basal cell carcinoma (70%) [9]. The primary clinician should incorporate a comprehensive assessment with the family and/or caregiver by performing a geriatric assessment that addresses all limiting factors. The treatment of skin malignancies may require surgical interventions, radiation therapy, and/or systemic chemotherapy. The primary care provider will need to determine a patient's cognitive ability to understand the interventions needed to treat this disease process, as well as determine if the patient has the nutritional and functional ability to undergo management.

As part of the routine care of a geriatric patient, the primary care provider needs to visualize the patient's skin. This may be a scan of the exposed areas on a routine visit and a full yearly skin assessment for visualization of non-exposed areas. In addition, as part of the routine assessment, the provider should include the skin as part of the review of systems at each visit. If the patient has dementia, the caregiver should be asked about any areas of skin concerns.

Pressure Injuries (Table 12.1)

The risk factors for pressure injuries include age (greater than 70 years), hypertension, vasculopathic conditions such as cerebral vascular disease and peripheral vascular disease, diabetes mellitus, smoking history, malignancy, malnutrition and low body mass index, incontinence (fecal and/or urinary), immobility, and previous history of pressure injuries [11–14]. Because these risk factors are more prevalent in the aged population, the primary care physician should be extra vigilant during the

Table 12.1 NPIAP pressure injury stages

Stage	Description
Stage 1	Non-blanchable erythema of intact skin
Stage 2	Partial-thickness skin loss with exposed dermis
Stage 3	Full-thickness skin loss
Stage 4	Full-thickness skin and tissue loss
Unstageable	Obscured full-thickness skin and tissue loss
Deep tissue pressure injury	Persistent non-blanchable deep red, maroon or purple discoloration
Medical device–related pressure injury	Results from the use of medical device, generally conforms to the pattern or shape of the device
Mucosal membrane pressure injury	Found on mucous membranes with a history of medical device in use at the location of the injury

physical examination of the elderly demented patient. Every clinic visit with the elderly demented patient should include a thorough skin exam with an emphasis on examining high-risk pressure points. The most common sites for pressure injuries include the sacrum, buttocks, heels, elbows, and back of the head [15]. The NPIAP classification for pressure injury was revised and is as follows [16]:

Stage 1: Non-blanchable Erythema of Intact Skin (Fig. 12.1)

The skin is intact with a localized area of non-blanchable erythema, which may appear differently in darkly pigmented skin. Presence of blanchable erythema or changes in sensation, temperature, or firmness may precede visual changes. Color changes do not include purple or maroon discoloration; these may indicate deep tissue pressure injury.

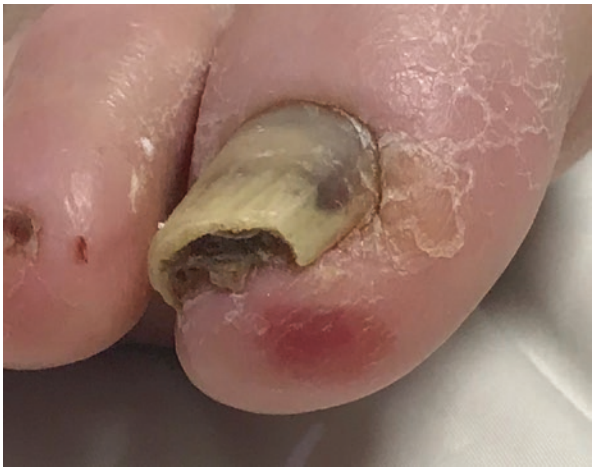

Fig. 12.1 Pressure injury stage 1. (Reprinted with permission from Dr. Garcia)

Fig. 12.2 Pressure injury stage 2. (Reprinted with permission from Dr. Garcia)

Stage 2: Partial-Thickness Skin Loss with Exposed Dermis (Fig. 12.2)

The wound bed is viable, pink or red, moist, and may also present as an intact or ruptured serum-filled blister. Adipose (fat) is not visible and deeper tissues are not visible. Granulation tissue, slough, and eschar are not present. These injuries commonly result from adverse microclimate and shear in the skin over the pelvis and shear in the heel. This stage should not be used to describe moisture-associated skin damage (MASD) including incontinence-associated dermatitis (IAD), intertriginous dermatitis (ITD), medical adhesive–related skin injury (MARSI), or traumatic wounds (skin tears, burns, abrasions).

Stage 3: Full-Thickness Skin Loss (Fig. 12.3)

The adipose (fat) tissue is visible in the ulcer and granulation tissue and epibole (rolled wound edges) are often present. Slough and/or eschar may be visible. The depth of tissue damage varies by anatomical location; areas of significant adiposity can develop deep wounds. Undermining and tunneling may occur. Fascia, muscle, tendon, ligament, cartilage and/or bone are not exposed. If slough or eschar obscures the extent of tissue loss, this is an unstageable pressure injury.

Stage 4: Full-Thickness Skin and Tissue Loss (Fig. 12.4)

Full-thickness skin and tissue loss with exposed or directly palpable fascia, muscle, tendon, ligament, cartilage or bone in the ulcer. Slough and/or eschar may be visible. Epibole (rolled edges), undermining, and/or tunneling often occur. Depth varies

Fig. 12.3 Pressure injury stage 3. (Reprinted with permission from Dr. Garcia)

Fig. 12.4 Pressure injury stage 4. (Reprinted with permission from Dr. Garcia)

Fig. 12.5 Unstageable pressure injury. (Reprinted with permission from Dr. Garcia)

by anatomical location. If slough or eschar obscures the extent of tissue loss, this is an unstageable pressure injury.

Unstageable: Obscured Full-Thickness Skin and Tissue Loss (Fig. 12.5)

Full-thickness skin and tissue loss is defined as a stage in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar. If slough or eschar is removed, a stage 3 or stage 4 pressure injury will be revealed. Stable eschar (i.e., dry, adherent, intact without erythema or fluctuance) on the heel or ischemic limb should not be softened or removed.

Fig. 12.6 Deep tissue injury. (Reprinted with permission from Dr. Garcia)

Deep Tissue Pressure Injury: Persistent, Non-blanchable Deep Red, Maroon or Purple Discoloration (Fig. 12.6)

Intact or non-intact skin with localized area of persistent non-blanchable deep red, maroon, purple discoloration or epidermal separation revealing a dark wound bed or blood-filled blister. Pain and temperature change often precede skin color changes. Discoloration may appear differently in darkly pigmented skin. This injury results from intense and/or prolonged pressure and shear forces at the bone-muscle interface. The wound may evolve rapidly to reveal the actual extent of tissue injury or may resolve without tissue loss. If necrotic tissue, subcutaneous tissue, granulation tissue, fascia, muscle, or other underlying structures are visible, this indicates a full-thickness pressure injury (unstageable, stage 3, or stage 4). Do not use deep tissue pressure injury (DTPI) to describe vascular, traumatic, neuropathic, or dermatologic conditions.

Medical Device–Related Pressure Injury (Fig. 12.7)

Medical device–related pressure injuries result from the use of devices designed and applied for diagnostic or therapeutic purposes. The resultant pressure injury generally conforms to the pattern or shape of the device. The injury should be staged using the staging system.

Mucosal Membrane Pressure Injury (Fig. 12.8)

Mucosal membrane pressure injury is found on mucous membranes with a history of a medical device in use at the location of the injury. Due to the anatomy of the tissue, these ulcers cannot be staged [16].

Fig. 12.7 Medical device related. (Reprinted with permission from Dr. Garcia)

Fig. 12.8 Mucosal pressure injury. (https://www.bing.com/images/search?q=Mucosal+Membrane+Pressure+Injury+Related+to+NG+Tube&FORM=IRTRRL. Accessed 1/27/2020)

It is important to understand that the staging definitions provided by the NPIAP are only to be used with pressure injuries. If a clinician suspects a different etiology, the wound should not be staged, but should be described fully in the medical record. The standard of care for treatment of a pressure injury is offloading the area of

pressure, appropriate moist wound healing, nutrition, and keeping the area clean and dry. This can be a challenge in a patient with incontinence, functional limitations, or dementia. Providers need to have a thorough understanding of the social situation surrounding the individual, including access to food, support system, ability to toilet and adequate hygiene, and what type of offloading equipment would be appropriate. The primary care provider can refer the patient to a wound care team for evaluation and management of the comprehensive care of the patient.

In the home environment, a patient with a pressure injury who is unable to position themselves will need a turning and rotating schedule, a specialty support mattress, use of barrier creams to prevent incontinence-associated dermatitis, and adequate nutrition. This skin bundle system can be best summarized as being on "POINT":

- *P*revention/*P*rotection
- *O*ffloading
- *I*ncontinence Care
- *N*utrition
- *T*issue Management

Prevention/Protection

Barrier creams help protect the skin from moisture and from contaminants that can irritate the skin and cause breakdown. They include ointments containing zinc oxide, petrolatum, lanolin, and dimethicone. In patients who have bowel or bladder incontinence, barrier creams should be used after each incontinent episode.

Caregivers will need to be monitoring the patient's skin daily. When a pressure injury occurs, the caregivers' focus will be on monitoring of that site and relieving pressure, but that may cause additional pressure to other vulnerable areas as there will be less turning surfaces. The hips, sacrum, and heels should be inspected during routine activities of daily living, including toileting and bathing.

Offloading

The primary care clinician should assess and minimize all offending contributors that can put a patient at risk for developing pressure injuries [17]. Relieving areas of pressure by turning and repositioning is the cornerstone of offloading. For example, the primary clinician can advise the family/caregiver of a bed-bound elderly patient with dementia to "float the heels" by placing a pillow or a thick rolled blanket underneath the calves, eliminating the pressure of the bed against the heel. The clinician can order specialty offloading shoes, boots, and heel protectors.

In patients with dementia, offloading may be a challenge. Demented patients will not understand the clinical necessity of offloading and may prefer to lay on one turning surface, thereby leading to high pressure areas. Techniques such as use of

pillows, foam wedges, or manipulation of the environment to accommodate patient preferences (e.g., turning the bed so the patient may see the television) may be of help with compliance.

In patients who are wheelchair-/bed-bound, there are several devices that can help relieve pressure and may prevent current pressure injuries from worsening. While static devices such as air or fluid-filled mattresses do not require electrical power, they do not provide the same level of pressure redistribution as dynamic devices that shift and redistribute pressure, such as the pneumatic ripple beds or alternating air pressure mattresses. For older adults who spend long periods of time in their wheelchair, it is important to redistribute pressure from the coccyx, sacrum, ischial tuberosities, and buttocks. This can be achieved with the use of pressure-reducing cushions and shifting of weight every hour while the patient is up in the wheelchair. Appropriate assessment of the patient's functional and clinical status needs to be done by a physical therapist to determine proper fit and correct choice of offloading cushion to meet the patient's needs. Some considerations that need to be addressed include patient's mobility, how much time they spend in the wheelchair, their body habitus, and incontinence status [18, 19].

In the home environment, the primary care clinician needs to ascertain whether the family can provide the appropriate turning schedule of at least every 2 hours. Limitations may be patient's body habitus, presence of contractures, or the family's inability to perform the task because of other obligations or their own needs, for instance sleep at night. In this situation, the primary clinician should offer solutions including hiring a private sitter/caregiver or placing the patient in a long-term care facility.

Incontinence

Urinary and/or fecal incontinence is a challenging issue for a patient with dementia. Poor hygiene can predispose the patient to incontinence-associated dermatitis (IAD). Management of IAD is based on two principles: avoiding contact between stool or urine and the skin, and providing a thorough skin-protecting regimen. Challenges related to incontinence include poor cooperation in bathing/hygiene, or timely attention to the skin after an incontinent episode. Patients with dementia may not be able to verbalize that an episode of incontinence has occurred; therefore, caregivers need to be vigilant and timely in their care of these individuals. To protect the skin from incontinence episodes, caregivers should create and implement a skin regimen that consists of three main elements: (1) cleansing the skin using a pH-balanced soap or shower gel, (2) applying an emollient-rich or humectant-based moisturizers or oils, and (3) applying petrolatum- or zinc-oxide-based skin protectant [20]. The skin ideally should be cleansed daily and whenever the patient experiences a major incontinence episode [20].

Nutrition

The nutritional status of a patient should be assessed to determine if nutritional supplementation is needed. The clinician should be cognizant about the patient's ability to feed themselves: whether independently or with assistance. They should be aware of any barriers to proper nutrition: financial constraints, restricted access to food, lack of a well-balanced diet, presence of poor dentition, or the need for a specific food consistency due to dysphagia. In a 2013 systematic review and a 2015 guideline by the American College of Physicians, there was moderate-quality evidence supporting protein supplementation to treat pressure injuries. The effect of vitamin C consumption on the rate of wound healing revealed no change. Contrary to popular belief, there is insufficient evidence to support the use of zinc supplementation and its improved rate of wound healing [17].

Tissue Management

The cornerstone of treatment in wounds with necrotic tissues is debridement. In patients with advanced dementia, sharp debridement may be challenging. This may be due to a lack of understanding of the risks and benefits of the procedure, due to the fact that debridement may be too painful for the patient, or because the individual may reside in a care setting that is not suitable for a sharp debridement. Use of less-invasive debridement methods could be utilized, such as autolytic debridement and enzymatic debridement. Autolytic debridement involves the use of a moist wound dressing or occlusive dressing that allows for the body's own collagenase to break down necrotic tissues. Enzymatic debridement chemically breaks down the necrotic tissue. Both of these methods are non-painful; however, they act slowly when compared to sharp debridement. Use of wet-to-dry dressings is no longer considered evidence-based standard of care in the wound care community. This modality of wound debridement is labor intensive, painful and can contribute to delayed wound healing by cooling down the wound bed at each dressing change.

If a provider does not feel comfortable with debridement of a wound, appropriate referral to a wound care professional is warranted.

Burns (Fig. 12.9)

A concern for patients with dementia is their deficit in executive function and decision-making. This may lead to high-risk behavior which can put the individual at risk for burns. In a population-based cohort study in New South Wales that studied the incidence of burns in patients with dementia over a 10-year period, approximately 79% patients in the study had burns that occurred at home. These were attributed to burns and scalds-related injuries from hot foods and beverages, cooking oils (the most

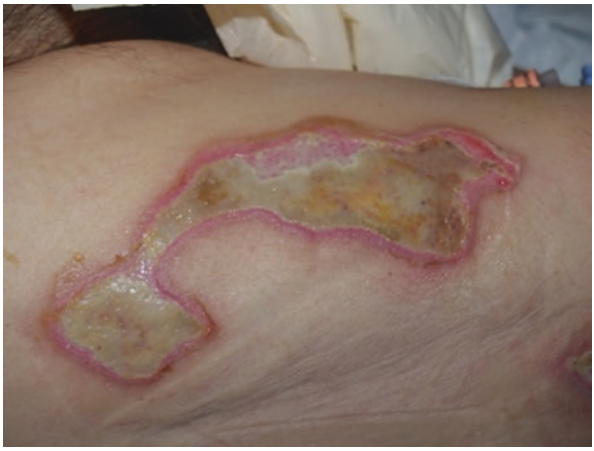

Fig. 12.9 Burn. (Reprinted with permission from Dr. Garcia)

Fig. 12.10 Pruritus. (Reprinted with permission from Dr. Garcia)

common cause in this study), and the use of hot tap water (faucet, baths, showers). Less than one-fourth of patients examined had burns as a result of fire or flames [21].

Management of first- or second-degree burns in the demented patient should focus on pain control, minimizing frequency of dressing changes, and the use of soothing topical dressings, such as Vaseline-impregnated gauze, hydrogel sheets/gels, or a silver-based cream or dressing to minimize the risk of infection. Any third-degree burn, or a burn involving the face or hands, should be referred to a burn center.

Pruritus (Fig. 12.10)

The most common skin condition in the elderly patient is itching or pruritus, which can impact quality of life. When creating a treatment plan, the clinician must investigate the root cause.

Patients with pruritus tend to scratch the affected areas causing widespread excoriations and crusted lesions. To the primary clinician, these wounds may mimic vesiculobullous diseases, such as shingles, bullous pemphigus, and pemphigoid vulgaris. As opposed to other medical conditions, lesions secondary to pruritus are usually located on areas within the patient's reach.

The most common cause of pruritus in the elder patient is xerosis, or dry skin. It is characterized as itching, burning, stinging, and dryness of the skin. Patients will present with a chief complaint of extreme dryness unrelieved with using lotion, which worsens during certain seasonal changes (winter vs. summer). Treatment of xerosis is focused on restoring the stratum corneum's level of hydration. The use of emollient-rich moisturizers such as humectants (glycerin, urea, hydroxyl acids/lactic acid) and occlusive and emollients (petrolatum, mineral oil, and lanolin) can improve the severity of pruritus to near resolution. A humidifier can also be utilized in a room where the patient primarily resides to restore hydration to the skin. Clinicians should recommend limiting showers to less than 10 minutes a day, and, if patient prefers taking bath, it is best recommended to take a warm vs. a hot bath.

Another cause for pruritus is atopic dermatitis and contact dermatitis. The clinician should consider any potential topical irritants or allergens, such as using a new detergent, moisturizers, or bathing products. Resolution of the pruritus occurs with the discontinuation of the products [3].

Skin Tears (Fig. 12.11)

Skin tears are most commonly seen in the older patient and with a higher prevalence in institutionalized adults [22, 23]. Most common locations are found on hands or arms [3]. Contributing factors that lead to skin tears are trauma from wheelchair injuries (25%), direct trauma from nearby objects (e.g., furniture, tub chairs, bed rails) (25%), from transferring (18%), and from falls (12.4%) [22]. The primary clinician should become familiar with the Payne-Martin skin tear classification system as it is important to distinguish a skin tear from a pressure injury found along bony prominence [25].

Fig. 12.11 Skin tear. (Reprinted with permission from Dr. Garcia)

Venous Leg Ulcers (Fig. 12.12)

Venous leg ulcers are defined as loss of skin on the lower extremity or foot due to fragile skin integrity, which can take more than 6 weeks to heal [24]. It accounts for 80% of all leg ulcers [26]. Venous leg ulcers have been estimated to afflict between 0.2% and 1% of the total population and between 1% and 3% of the elderly population in the United States and Europe [27]. Due to increased venous pressure, the veins within the lower extremities begin to distend and engorge with fluid.

The most important element in the treatment of venous leg ulcers is compression therapy. In addition, decrease salt intake and elevation of lower extremities should be included in the treatment regimen. In patients with dementia, these treatment modalities may be more difficult. Compression adherence may be limited due to patient's agitation, discomfort, and lack of understanding of the treatment. Sodium intake may pose as a challenge in a patient who has no control in their diet or in patients with anorexia, in which a low sodium diet may not be palatable. In patients who are taking atypical antipsychotics for the use of behavioral disturbance for dementia, limiting salt intake may further increase the risk of developing hyponatremia. It is important to discuss with the patient and their family/caregiver that leg

Fig. 12.12 Venous leg ulcer. (Reprinted with permission from Dr. Garcia)

elevation may be of benefit in decreasing leg swelling. Although leg elevation is part of the management of venous hypertension, the plan of care must weigh risks and benefits of treatment. Elevating a patient's leg in the bed or a chair may increase the risk of pressure injuries by limiting mobility or increasing pressure on pressure points.

Diabetic Foot Ulcers (Fig. 12.13)

There are currently 14.3 million Americans who are 65 years and older that are living with diabetes, which is approximately 26.8% of the elderly population (ADA) [28]. The prevalence of diabetic foot ulcers (or DFUs) among this population can be anywhere from 4% to 10% [29]. A multidisciplinary approach should be used in the treatment of DFUs. Clinicians involved may include the primary physician to manage diabetes, the infectious disease physician to best recommend antibiotic use, the wound care nurse or physician to manage the wounds, and if the ulcer penetrates deep and affects the bones, an orthopedic surgeon or podiatrist. Additional team members would include an orthotist for proper offloading footwear or devices, a social worker for community resources, and a dietician for maximizing nutritional status and diabetic education. A major concern is the risk of amputation which is likely higher in a demented individual who may not understand the importance of offloading. Preventive measures include keeping glucose under control, daily foot and nail inspection, cleaning the skin daily, preventing the feet from staying in a moist environment, never allowing the patient to walk (if mobile) without protective shoes both indoors and outdoors, and receiving yearly foot examinations.

The gold standard of diabetic foot ulcers is offloading. Some options for offloading include total contact cast, removable walking shoes or knee-walkers, and offloading boots. The clinician must always weigh risks versus benefits. Use of

Fig. 12.13 Diabetic foot ulcer. (Reprinted with permission from Dr. Garcia)

offloading devices may increase risk of falls, more so in a patient with dementia and gait imbalance. Restricting ambulation in a patient with dementia may not be feasible due to lack of understanding of the detrimental effects of pressure on a plantar foot wound.

Goals of Care

Setting goals of care is important in a patient with dementia. A discussion of expectations with families/caregivers sets the foundation for the plan of care. Providers must weigh the risks and benefits of treatment modalities in the setting of the patient's underlying medical conditions and life expectancy. If aggressive measures are consistent with patient's goals of care, clinicians should provide surgical or wound care referral for further management. The primary clinician must discuss with the patient and family/caregivers the goals of maintaining quality of life and dignity at the end of life [3]. The plan of care should emphasize that the wound may not be healable. The use of certain dressings or treatment modalities may impact the patient's quality of life. They should discuss pain management and address odor control. A discussion should also focus on skin changes at life's end (*SCALE*) if the patient is considered terminal or has a life threatening disease process that makes skin breakdown unavoidable [30]. This acronym is not a risk assessment tool, but rather raises awareness of potential skin breakdown that may occur at the end of life. The primary clinician should create a comprehensive plan with the families and/or caregivers to discuss expected skin changes, expectations, and palliation [30].

Case Vignette
Mrs. K has venous leg ulcers and a sacral pressure injury that need to be managed. She has moderate dementia and her daughter works. Some treatment recommendations would include the following:

- Evaluation of circulation to make sure she is a candidate for compression. If adequate, compression therapy needs to be initiated. Remember, patient was unable to use a standard compression garment.
- Referral to wound care center for management of venous leg ulcer and pressure injury.
- Referral to adult day care or hiring of a caregiver to supervise patient during the day and assist with incontinence care or mobility.
- Ordering an appropriate offloading cushion for her to chair/wheelchair
- Achieving good diabetic control.
- Obtaining a nutrition consult to maximize nutrition and assist with diabetic management.
- Obtaining a physical therapy consult to improve functional status.
- Moisture barrier cream for skin protection

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Chapter 13
Oral Health in Older Adults with Dementia

Maryam Tabrizi, Victoria A. Mañón, and Clark Whitmire

Main Points

- Poor oral health is highly prevalent in patients with cognitive impairment (dementia).
- The consideration of all health conditions, behavioral management, and medication use in patients with dementia are critical aspects of dental treatment and clinical outcomes.
- Oral health management in patients with dementia requires a collaborative approach, utilizing dentists as oral health physicians.

Epidemiology and Demographics

Since 1946, the baby boomer generation has impacted the growth and development of the United States, demanding adaption of the society's economy and healthcare systems. The aging of our nation has extensive implications for virtually every aspect of American society and the nation's health landscape, including medicine

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and dentistry. The first wave of baby boomers turned age 65 in 2011 [1]. It is estimated that every day for the next 20 years, approximately 10,000 Americans will celebrate their 65th birthdays [2]. In 2030, the last baby boomer will turn 65, and one in five Americans will be 65 years of age or older [3]. This generation is more racially and ethnically diverse than any other. In 2010, 80% of adults 65 and older were non-Hispanic white; by 2060 this percentage will decrease to 55%. Foreign-born adults over the age of 65 will compose nearly 26% of the population in the United States [4]. Differing cultural norms, language barriers, and health beliefs will have a profound effect on our nation's public health. Oral health is no exception. The complexity of the issue increases when one considers management of these factors in addition to a complex medical history.

As the population continues to age, the number of chronic diseases each person has and the associated polypharmacy increases. It is estimated that the 74% of people on Medicare in the United States between the ages of 65–69 have multiple chronic diseases, increasing to 88% after the age of 85. Of these individuals, 65% had two or more chronic conditions, 43% had three or more, and 24% had four or more. As the patients advanced in age, so did the average number of chronic conditions. Patients between the ages of 65 and 69 had on average 1.88 chronic conditions which increased to 2.71 chronic conditions after the age of 85 (average number of medical conditions in the study population of age 65 years or older was 2.34) [5].

As the patient acquires more chronic conditions, the existing diseases predispose the patient to acquiring new disorders. There are links between various systemic diseases and cognitive disorders, including diabetes and Alzheimer's disease. The impairment of glucose metabolism seen in diabetes impacts neurocognition [6]. As the patient becomes more cognitively impaired, without assistance, the patient may become unable to manage his or her diabetes, leading to cyclic decline of the patient. Additionally, patients with a history of mental disorder are predisposed to developing additional ones. For example, early onset anxiety, depression, and impulse-control disorders (as early as 11 years old) are risk factors for developing Alzheimer's disease later in life [7].

While cardiovascular disease (most notably hypertension) is the most common chronic condition in the United States, the most common cause of dementia in the Western world is Alzheimer's disease (AD) [8]. It is estimated that 5.8 million people in the United States have AD, and of those, approximately 96% are above the age of 65. As people age, particularly between the ages of 60 and 85, the probability of developing AD increases by a factor of 15 [9]. By 2050, it is projected that nearly10 million Americans over the age of 65 will have AD. Currently, one person in the United States will develop AD every 67 seconds. By 2050, one person will develop AD every 33 seconds [10, 11]. The clinical manifestations of AD include progressive cognitive decline beginning initially with the impairment of short-term memory formation that eventually leads to dependence of others for basic daily functions and premature death. The pathophysiology of AD is characterized by diffuse formation of amyloid plaques and neurofibrillary tangles with reactive microgliosis that leads to neural

degeneration and loss of synapses [9]. The progressive decline in cognitive function is accompanied with progressive inability to complete adequate self-care, including dental hygiene, that can lead to rampant dental caries and/or periodontitis. As the population continues to age, dental practitioners will encounter more patients with AD in their practices. It is imperative that the practitioner is equipped with the knowledge and skills to manage the patient.

This chapter will review a clinical case in detail, focusing on all health aspects of a patient with dementia. Four primary considerations when providing dental care to geriatric individuals with dementia are the general oral health and dentition status of the patient, his or her socioeconomic status, the patient's medical and cognitive vulnerability, and interprofessional education/collaboration with other health professionals. We will discuss how to evaluate the general status of oral health in patients with dementia, review the connection between cognitive function and oral health, and describe the differences between oral health in the aging patient with and without dementia. We will conclude with a discussion on acceptable oral health care maintenance practices for elderly patients with dementia.

Case Report

An 87-year-old female presents for oral evaluation and dental treatment. The adult daughter and responsible legal party (RLP) requested that a dentist examine and provide dental treatment to her mother, a 14-month resident of a memory care facility. The attending facility physician had suggested that the cause of her mother's anorexia, recent onset of insomnia, and lower right facial swelling were dental related and required dental evaluation and treatment.

Medical History

Due to the patient's advanced stage of cognitive decline, the patient's medical history was obtained from the RLP and review of her medical record. The medical history is significant for Alzheimer's disease (dementia with behavioral disturbance), major depressive disorder, recurrent atrial fibrillation, essential hypertension, hyperlipidemia (HLD), atherosclerotic heart disease without angina, chronic obstructive pulmonary disease (COPD), age-related osteoporosis, hypomagnesemia, malignant neoplasm of non-specific breast, muscle weakness, metabolic encephalopathy, recurrent urinary tract infections (UTI), history of sepsis, pain in an unspecified joint, limitations of activities due to disability, history of a fall, and other non-specific symptoms and signs involving cognitive functions.

Medications (See Table 13.1 for More Clinical and Pharmacological Information)

Acetaminophen tablets 325 mg – 2 tablets every 6 hours
Alendronate sodium 70 mg – for osteoporosis (over 5 years)
Amlodipine besylate tablets 2.5 mg prn for hypertension
Anastrozole tablet 1 mg – 1 tablet daily for malignant neoplasm
Aspirin EC – 81 mg – 1 tablet daily
Atorvastatin calcium tablets 80 mg – 1 tablet daily for hyperlipidemia
Calcium carbonate 600 mg tablet – 1 tablet daily for indigestion
Multivitamins/minerals supplement tablets – 1 tablet per day
Xopenex HFA 45 mcg/actuation aerosol inhaler – 2 puffs inhaled every 4 hours prn for COPD
Memantine 10 mg tablet – 1 tablet per day for dementia/Alzheimer's disease
Metoprolol tartrate 25 mg tablet – 1 tablet twice a day for hypertension and rate control
Citalopram hydrobromide 10 mg tablet – 1 tablet per day for depression

Table 13.1 List of patient medications with relevant clinical and pharmacological features

Medication	Treatment/use	Dental consideration
Acetaminophen 325 mg/6 h	Mild to moderate pain, antipyretic	Mechanism of action poorly understood but appears to selectively inhibit cyclooxygenase activity in the brain Risk of hepatotoxicity in elderly with prolonged use (patient had renal failure) Consider concomitant use of a proton pump inhibitor to prevent gastrointestinal bleeding [12]
Alendronate sodium 70 mg/day	Osteoporosis	Bisphosphonate medication associated with an increased risk of MRONJ associated with oral diseases and oral surgery with prolonged use (AAOMS position paper) [13] Risk of fracture/delay healing
Amlodipine besylate 2.5 mg/need	Hypertension	L-type calcium channel blocker Important to monitor vitals during surgery and ensure patient took the medication appropriately prior to the procedure Avoid epinephrine with elevated blood pressure Gingival hyperplasia-increase bleeding [14]
Anastrozole tablet 1 mg/day	Malignant neoplasm of the breast	Nonsteroidal aromatase inhibitor (NSAI) Associated with higher incidence of ischemic cardiac events in women with preexisting ischemic heart disease. Monitor vitals Lowers estrogen levels [15]

Table 13.1 (continued)

Medication	Treatment/use	Dental consideration
Aspirin tablet 81 mg/day NSAID reduces effectiveness of beta-blockers	Mild to moderate pain, antipyretic, cardiovascular prophylaxis	Irreversible inhibition of COX-1 and enzymatic modification of COX-2 Prolongs bleeding (antiplatelet) Reduces effectiveness of beta-blockers [16]
Atorvastatin calcium 80 mg/day	Hyperlipidemia	HMG-CoA reductase inhibitor (LDL lowering agent) Increases risk of rhabdomyolysis, diabetes mellitus Decreases mortality associated with CVD [17]
Calcium carbonate 600 mg/day	Indigestion, peptic ulcer disease	Also known as Tums Side effects include xerostomia, bloating, nausea, vomiting, belching, alkalosis, constipation, hypercalcemia, and renal failure (milk alkali syndrome) [18]
Xopenex HFA 45 mcg/actuation aerosol inhaler, 2 puffs every 4 hours PRN	COPD	Short-acting beta-2 agonist Ensure patient has inhaler present at the time of surgery in case of pulmonary event Side effects include dizziness, headache, nausea, seizures, anxiety, irregular heartbeat, and xerostomia [19]
Memantine, tablet 10 mg, 1 tablet by mouth	Alzheimer's disease	Acts at glutamatergic NMDA, serotonin (5-HT3), nicotinic acetylcholine, dopamine, and sigma receptors Can cause confusion, dizziness, headache, GI, syncope, coma, xerostomia [20]
Metoprolol tartrate tablet 25 mg, 1 tablet every 12 hours PRN for heart rate greater than 100 beats per minute	Hypertension	Beta-blocker Important to monitor vitals during surgery and ensure patient took the medication appropriately prior to the procedure May cause irregular heartbeat (up to 28% heart failure) and xerostomia Prudently avoid dental anesthetic with epinephrine [21]
Citalopram hydrobromide tablet 10 mg one time a day	Antidepressant	Selective serotonin reuptake inhibitor (SSRI) May cause xerostomia, insomnia, suicidal ideation, serotonin syndrome, prolong QT interval, and glaucoma Metabolized by liver enzymes (CYP3A4, CYP2C19) [22]

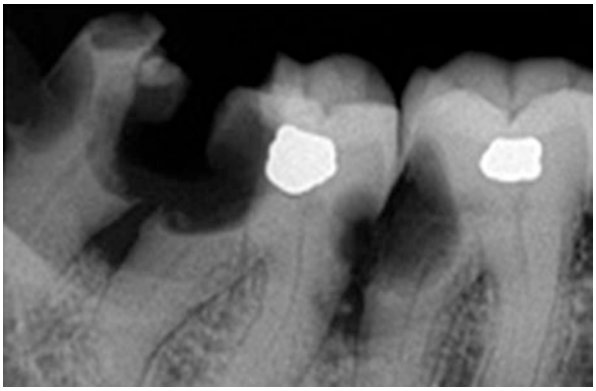

Fig. 13.1 Dental radiograph of the described patient's lower right quadrant, including teeth #29, #30, and #31, exhibiting extensive interproximal caries. The etiology of the dental caries is multifactorial and includes the use of xerostomia-inducing medications, cognitive and physical decline, and poor hygiene associated with the use of dental prostheses. Radiographs such as this are not uncommonly found among elderly patients with dementia

Clinical Evaluation

After a course of antibiotics of 1-week duration prescribed by the attending physician, a dental examination was performed. There was lower right facial swelling and tenderness, decreased from the original presentation, per report. Oral inspection revealed gross dental caries in teeth #29, #30, and #31(second premolar, first and second molar on lower right) and was confirmed radiographically (see Fig. 13.1). Due to the extensive nature of the dental decay, extraction of the offending teeth was the recommended optimal treatment.

Risks and Challenges

Due to the extent of tooth decay, there is an increased risk of tooth fragmentation during the extractions. Therefore, all three molars require surgical extractions. Generally, for complex procedures such as these, patients come to the dental office, which is furnished with specialized equipment, instruments, and dental assistants trained in surgery. However, most long-term care facilities are not equipped with the instrumentation and staff necessary for such procedures. Lack of proper setting, equipment, and logistics of moving the patient makes the predicament more challenging, as the patient's family prefers that the dental procedure is completed at the patient's bedside. Additionally, the patient's medical history increases the risks associated with use of oral sedations and dental anesthesia. She is also taking alendronate, reporting a history of use over 5 years, increasing the risk of developing medication-related osteonecrosis of the jaw (MRONJ). The presence of a dental

infection and lack of patient cooperation may result in longer procedure time, difficulty to achieve profound anesthesia, and may require additional local anesthetic. Transferring patient to the hospital or dental office for treatment was not an option.

The information presented in this case report is translatable to millions of other elderly Americans with dementia and very poor oral health conditions

Oral Health Status of the Elderly with Dementia

The clinical case presented is a single representative example of many dental patients with AD; as the population continues to age, the number of elderly adults with dementia will also continue to increase. By 2030, it is projected that over 22 million (30%) of the 74 million of older Americans will need specialized geriatric care [23]. The onset and progression of dementia in the elderly exposes them to higher risks of rampant dental caries and advanced periodontal disease due to medication-induced xerostomia, age-related reduction in salivary gland secretion, physical and cognitive impairment that impairs routine oral hygiene, and poor hygiene associated with dental prostheses, such as complete and partial dentures.

Association Between Oral Health and Dementia

As previously stated, the number of comorbidities in the elderly is accompanied by polypharmacy, which predisposes the patients to medication-related xerostomia. Over 400 medications induce hyposalivation, the main cause of medication-related xerostomia (i.e., dry mouth) [24]. These medications include diuretics, beta-blockers, anti-depressants, anti-histamines, anti-convulsants, and anti-psychotics. Saliva is protective against dental caries and the associated bacteria due to the presence of bicarbonate and secretory immunoglobulin A (IgA) [25]. During mastication, the production of saliva assists with the increase of oral pH, combating the acid production of oral bacteria with exposure to carbohydrates. Saliva also functions to lavage the teeth and gingiva of remaining food particles. Without saliva, the food remains attached to the teeth and the acids produced by the bacteria linger in the oral cavity, catalyzing the formation of dental caries [26]. The effects of medication-related xerostomia can be ameliorated with consistent and thorough oral hygiene practices with regular visits to a dentist.

Cognitive impairment associated with AD diminishes the patient's functional capability to exercise daily personal hygiene activities, including toothbrushing and flossing [27]. Patients with AD commonly take several medications (for dementia and other comorbidities) that induce xerostomia to deter the onset and/or progression of dementia. As the cognitive and physical decline progresses, the individual's ability to execute personal hygiene activities decreases, leaving them dependent on caretakers. Without the necessary hygienic care, the medication- and age-related

declines exacerbate the rate of dental caries and periodontal disease. Without this additional assistance, geriatric patients are susceptible to decline in their oral health. Patients unable to afford assistance are particularly vulnerable. As seen in the case presentation, many geriatric patients present with multiple acute and chronic health conditions, each requiring unique management and medications.

Consequently, the general oral health status of the elderly with dementia is very poor with multiple underlying factors. Specialized geriatric treatment of individual older adults is becoming more challenging, particularly with the increasing incidence of AD; dentistry is no exception.

Evaluation

Dental care for patients with dementia is challenging because they are often are unable to care for their oral health. As the number of patients with comorbidities increases, including the progressive physical and cognitive decline observed in AD patients, today's dentists are evolving to become an "oral health physician." The baby boomer generation has changed the landscape of healthcare across health disciplines including dentistry, requiring the average practitioner to have an intimate understanding of comprehensive healthcare. Dentists are required to manage patients of any age with any number of comorbidities, including physical and mental health disorders.

Dental Function and Aging Mouth

The primary functions of human dentition include chewing (mastication) and esthetics. The masticatory system initiates the chemical and mechanical processing of food, including the secretion of salivary amylase and lipase, and physical breakdown of macromolecules of food. Mastication requires skeletal and muscular components, including the mandible and maxilla, muscles of mastication, and temporomandibular joint (TMJ) for the physical degradation of the bolus. Although the relationship between cognitive functions and masticatory functions has not yet been established, patients with dementia demonstrate a decrease in masticatory functions, partially due to loss of dentition and decline in the function of muscles. As individuals age, the rate of edentulism increases. Thirty percent of those aged 75–84 years and 47% of individuals aged 85 years and older exhibit complete edentulism (loss of all teeth). Edentulism is significantly more prevalent among elderly with cognitive declined [28]. Edentulism impacts the patients' ability to intake nutrition; impairment of masticatory functions leads to the deterioration of swallowing due to reduction tongue pressure against the hard palate [29]. This is a serious problem, leading to dysphagia in patients with Alzheimer's disease. Studies indicate that aspiration of gastrointestinal and pulmonary fluids due to

complications of dysphagia associated with dementia increases the rate of mortality due to pneumonia [30].

Connection Between Cognitive Function and Oral Heath

Oral health is the most neglected aspect of health in persons with dementia, yet no systematic reviews have been published on examination of the severity of the issue. Until recently, there have been no guidelines established for geriatric oral health. Regardless of the severity of dementia, living arrangements or dentition status, individuals with dementia had a significantly poorer oral health and more missing teeth than those without dementia [31].

Oral diseases accumulate over time, and individuals age at different rates. Clinician should evaluate the patient's overall health status considering age, medical, and dental status. The clinician should assess the masticatory system for normal aging versus oral disease. The presence of disease(s) will prompt treatment. Treatment of the elderly patient may illicit fear from the practitioner, including concern for sudden patient deterioration and the increased risk of medical emergencies. Although there is a level of uncertainty for all healthcare providers while treating the elderly with polypharmacy, this should not hinder the well-versed practitioner from accepting these patients in his or her practice [32].

When treating oral diseases in the elderly population with dementia, providers must consider cognitive status, behavioral management, medication interactions, and side effects. It is largely recognized that oral health has a significant effect on overall health. Without evaluation of the oral cavity, comprehensive care of the older adult is incomplete. Evaluation of masticatory functions and maintenance of dentition are crucial at any stage of dementia to ensure proper function and nutrient intake [33]. In addition, while there are still unanswered questions on the relationship between cognition and mastication, there is a consistency in physiologic fitness between mastication and cognition. By increasing systemic and cerebral circulation, it is clear that mastication activates several areas in the brain. The region that specifically reacts to mastication includes the dorsolateral and ventral prefrontal cortex and parietal cortex. Studies show stronger response in frontal area with higher age. Prefrontal cortex which is involved in cognitive function shows higher activity in older adults [34–36].

Dental Treatment for Patients with Dementia

As the population continues to age, oral health care providers will be treating a greater number of older adults. A large cohort of the elderly will be frail, medically and cognitively vulnerable, have limited financial resources, and multiple disabilities. Many older adults present with extensive oral diseases and are homebound or

in long-term care facilities. Dental care for the elderly with dementia requires knowledgeable oral health professionals who are well versed in mental health conditions, disabilities, and normal age-related changes and disease [37]. Dental treatment planning for the elderly with dementia is focused primarily on providing care that it is evidence based and patient centered. Patients with dementia usually suffer from depression and anxiety [38]. These factors must be considered, especially when determining the patient's tolerance for dental treatment. Cultural sensitivity and competency will also impact the clinical outcomes of dental treatment [39].

Medications for older adults with dementia can consist of different classes of drugs, including opioids, antipsychotics, NSAIDs, beta-blockers, and Ca^{+} channel blockers. Concurrently, the aging process includes physiologic changes in cellular homeostatic mechanisms (i.e., body temperature regulation and blood and extracellular fluid volumes), which may involve decreased organ mass and functions. Changes involving decline or loss of bodily systemic function may include the central nervous system, the cardiovascular, the gastrointestinal, the respiratory, the renal, and the immune systems [40]. The term *pharmacodynamics* is used to describe the effects of drugs on the body and evaluate age-induced physiological changes. Knowledge of pharmacodynamics is particularly important when evaluating medications that affect the cardiovascular and the central nervous system as the aging process may affect the profile of some medications. Changes at receptor sites and/or the change in the number of receptors over time can lead to alteration of drug efficacy [41]. Anticoagulants are a class of drug that requires special attention, especially during invasive dental treatments such as dental extractions. While stopping the anticoagulant drugs for dental surgeries is an option, it is not always recommended for patients taking warfarin. Consultation to with the patient's prescribing physician should be completed to better understand the patient's risks for adverse outcomes, inform their physician they are having a dental procedure completed, and to formulate a patient management plan. A PT/INR should be obtained the morning prior to the procedure and evaluated according to the patient's overall health conditions since patients INR therapeutic range and plasma concentration often vary [42]. In addition, stopping anticoagulation in patients with elevated risks of thrombosis or cardiac events (ASA II or higher) may be contraindicated as the risk of an adverse event outweighs the benefits. For these patients, treatment modifications may include avoiding multiple extractions at one time, keeping the appointments short, and proper closure of the surgical site. Coordination with the patient's prescribing physician (hematology or primary care) prior to the surgery is recommended to provide optimal care for the patient.

As the clinician evaluates the patient's medications, it is important to consider how the drugs being prescribed will affect the patient and how they will interact with their existing medications. Despite this attention to detail, medication-related problems for the elderly may be still caused by overuse or misuse of the drugs. Age-related physiologic changes further complicate the issue. *Pharmacokinetics* is the term used to describe the behavior of a drug once administered. There are four components of pharmacokinetics: distribution, metabolism, elimination, and absorption. The first three components are affected by age; unless a malabsorptive syndrome is present, absorption remains the same. Aging has an impact on a wide range of functions in the human body. Age-related changes of the tissues and organs

at the cellular and molecular levels affect how drugs are distributed, and how they are eliminated from the body [43]. Declines in hepatic and renal function can impair the elimination of medications from the body, while changes in adipocytes and albumin levels alter the drugs distribution. Prescribing medications for patients with dementia and other comorbidities requires calculated attention and a fair amount of knowledge about the drug's characteristics and potential drug interactions to prevent undesired effects. Naturally, this knowledge also applies to all dental treatments.

Pain Management of the Geriatric Patient

Pain in the elderly is generally multifactorial, particularly in those with dementia, sensory impairment, and disability [44]. Assessment of pain must include both biologic age and chronological age as aging is progressive and individualized, particularly in elderly with dementia when prescribing this group of drugs.

The pharmacokinetic changes associated with aging, as described above, means that older adults will require lower doses of analgesic medication. Acetaminophen (Tylenol) is the drug of choice for most elderly patients for the management of mild to moderate pain due to its safety profile, efficacy, and low abuse potential. Despite its safety, when used incorrectly, acetaminophen overdose may lead to acute liver failure. A single overdose or therapeutic ingestion may cause hepatotoxicity. The maximum recommended dose for frail patients or those over the age of 80 years is <2 g over 24 hours [45].

Nonsteroidal anti-inflammatory drugs (NSAIDs) NSAIDs are routinely used by the geriatric population due to frequency of chronic pains for a variety of health conditions, including arthritis and dental pain. They have both anti-inflammatory and analgesic properties [46]. NSAIDs are associated with a number of adverse effects, most commonly their effect on the gastrointestinal tract. This class of drugs inhibits the protective effects of prostaglandins and can cause gastric erosion, leading to the formation of peptic ulcers and gastric bleeding. In the elderly, these effects tend to be more severe due to age-induced physiologic changes. NSAIDs may also reduce renal blood flow, affecting elimination of other drugs. They may decrease the effects of anti-hypertensive drugs, including diuretics, betablockers, and ACE inhibitor. Patients susceptible to ulcer formation require alternative options for dental pain, such as the cyclo-oxygenase (COX)-2 inhibitor celecoxib. A 200 mg dose twice a day may be recommended for pain management with less risk of gastric ulceration and bleeding. In combination with NSAIDs, COX-2 inhibitors may produce adverse reactions of the gastrointestinal tract, the platelets, and the kidneys [47, 48].

Opioid Analgesics

Opioid analgesics are used in dentistry for the treatment of moderate to severe pain. Due to their high abuse potential and risk for decrease in respiratory drive, opioid analgesics are safer and are used for breakthrough pain on a short-term basis.

Prudent prescribing practices should be considered in light of the current opioid crisis in the United States.

Opioid medications are primarily metabolized in the liver by the cytochrome P450 enzymes. The metabolism and excretion of opioids are impaired in patients with liver disease and in the elderly, increasing the drugs' half-life and the depth of therapeutic effects. These pharmacokinetic and pharmacodynamic changes are associated with natural aging and any additional comorbidities of the liver [41]. Increased serum levels of opioid analgesics due to poor metabolism and excretion may lead to unwanted side effects, including constipation, dizziness, nausea, vomiting, physical dependence, respiratory depression, and death [49]. Many adverse reactions to meperidine have been attributed primarily to the accumulation of its major metabolite, normeperidine. Thus, meperidine should be avoided in the elderly [50]. Alternatively, codeine is a weaker analgesic than other opioids and is commonly used in dentistry; it is converted to morphine by the liver enzyme CYP2D6. Combinations of opioid drugs with other analgesics (NSAIDs) are commonly used and are found to achieve great levels of analgesic effects than independent use of each medication. Opioids routinely used in dentistry include codeine (Tylenol #3), oxycodone (OxyContin), hydrocodone (Norco), and tramadol (Ultram). When prescribing opioid medications, it is important to remember to use adjusted doses, to monitor systemic side effects, and to avoid long-term use of the medication.

Dental Local Anesthesia

Anesthesia in the dental office is considered safe for all ages if properly administered. Yet, elderly patients presenting with other underlying health conditions such as decreased renal and liver functions will require a much lower dose of anesthetic. Because opioids are central nervous system depressants and dental anesthetics are systematic depressants, the interaction of two drugs may be life threatening for vulnerable patients [51]. Generally, it is sensible to minimize the use of epinephrine simply because of the expected effect of aging on the heart. Additionally, monitoring blood pressure and vital signs is advised when administering local anesthetic with epinephrine in elderly. Following are a few clinical recommendations: (a) do not use anesthetics if unnecessary, (b) use long-acting agents with caution, c) vasoconstrictors are generally safe, (d) administer the anesthetic slowly, remembering to aspirate prior to injection, (e) limit dosage to two to three dental anesthetic carpules (1.8 cc) per visit, especially for medically compromised patients (ASA II or higher), and (f) warn caregivers about lip/tongue-chewing while still numbed (especially in dementia patients).

Maintenance

The best dental treatment for elderly patients with dementia is prevention by keeping up with dental maintenance. Oral health maintenance includes oral hygiene, preventive measures for new dental caries, and arresting existing caries by

application of fluoride/SDF (silver diamine fluoride) [52]. Oral health maintenance is required even for edentulous patients with dementia because often they have problems with swallowing food and dryness of oral cavity. They are at high risk for fungal infections and sores.

Interprofessional Education and Collaboration

Sharing Care

Patients with dementia (as shown in our case review) with poor oral health and pain often express unsettled, restless, sometimes aggressive behaviors. Behavior management is a crucial first step for administrating local dental anesthesia and delivering treatment. Providing dental treatment may not be possible without a minimal dose of oral sedatives. Modification of treatment is based on the patients' clinical availability and how they may present at the appointments. Many patients with dementia take variety of psychotropic medications; thus, sedative drug choice, dose of the drug, and the time of administration for dental treatment are critical, especially for institutionalized and homebound patient. Oral health and general health are interwoven; it is a shared effort of a healthcare team to prevent medication reactions [53].

Summary

The generation of baby boomers has changed the landscape of healthcare in the United States forever. Patients have longer life expectancies, which is accompanied by multiple chronic health conditions. The majority of the elderly are keeping their teeth throughout life, many of which have a history of extensive dental restorations that require adequate, routine maintenance. This care is not available for most patients due to socioeconomic status and/or cognitive decline. The risks associated with complex medical histories may also deter practitioners from treating elderly patients. Through education and awareness, a new, age-friendly platform of healthcare guidelines is necessary so that the overall health, including oral health, of the elderly improves, increasing their quality of life.

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Chapter 14
Health Maintenance and Preventive Care in Older Adutls with Dementia

Ursula K. Braun

Main Points

- Preventive testing in older adults should be individualized for each patient, considering their priorities, functional status, prognosis, and the benefits and burdens of testing.
- Preventive immunization, especially for influenza and pneumococcal vaccines, should be a priority in older adults except in cases of strict contraindications.
- Healthy lifestyle counseling should be continued throughout advanced age. It includes discussion of physical activity, sexual dysfunction and sexually transmitted diseases, alcohol misuse, and smoking cessation.

Case Vignette: The Longs

The Longs are a married ambulatory couple who visits you for Mrs. Longs "Welcome to Medicare" visit. Mrs. Long is 65 years old, obese with a BMI of 30, and has osteoarthritis. She wants to know for how long she will need Pap smears. She also wants her husband to get checked out, too. He is 72 years old and hasn't visited a doctor for the last 10 years. He is overweight (BMI 28), and smokes, but is trying to cut down. You diagnose him with hypertension,

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hyperlipidemia, and diabetes mellitus. What screening tests and general health advice should you give this couple?

Using the Schonberg Index (eprognosis) you feel that both have a robust life expectancy of ≥10 years. You recommend a colonoscopy to Mrs. Long which is normal, and you perform one last PAP smear for her (this is her third in a 3 subsequent years, all were normal). She also will continue with mammograms. Mr. Long does not want a colonoscopy after seeing Mrs. Long's colonoscopy preparation and has a FIT test instead. Because it comes back positive, he can be convinced to undergo a colonoscopy after all. It shows a 6 mm adenoma that gets snared off. PSA testing is not recommended and he expresses no interest in such testing. Since he is a smoker with >30 pack years, you recommend a chest CT to screen for lung cancer – it is normal and he finally manages to quit smoking. You give both the flu vaccine and recommend pneumonia vaccination. Mrs. Long has had PPSV23 already 2 years ago, so she receives PCV13 now. Mr. Long has not had any prior pneumonia vaccination and you administer PCV13 now and plan to give PPSV23 6–12 months later. Because of cuts suffered during gardening, both of them already had a tetanus booster recently. You offer both the shingles vaccine; after Mr. Long sees how sick Mrs. Long felt after receiving Shingrix, he decides to take Zostavax instead despite it being less effective. You also offer Mr. Long abdominal ultrasound screening for an aortic abdominal aneurysm (negative) and Mrs. Long a DEXA scan (showing osteopenia). Hepatitis C screening is negative for both. You counsel both on physical activity, especially weight-bearing exercise, encourage Mr. Long's smoking cessation, and inquire about sexual dysfunction, advising Mrs. Long on lubricating gels to help with vaginal dryness. They both deny any alcohol use and depression screening is negative. You recommend a daily Calcium intake of 1200 mg/day for both which preferably should come from healthy food intake, not from pills, and recommend 800 units of Vitamin D intake/day.

Introduction

Older adults should receive preventive health measures from which they are likely to benefit rather than being harmed, and such measures should be adjusted according to their health status and remaining life expectancy. In general, clinical conditions can be categorized as

- Robust: ≥5 years life expectancy
- Frail: <5 years life expectancy
- End of life: <2 years life expectancy

Patients with moderate dementia may have a life expectancy between 2 and 10 years. There are many tools available to help clinicians estimate remaining life

expectancy and guide screening decisions, both for community-dwelling older adults (the Schonberg Index for adults age 65 or above (5- and 9- year mortality) [1] and other popular calculators [2, 3]) as well as for nursing home residents with dementia (the Mitchell Mortality Risk index) [4]. There are also many disease-specific calculators, e.g., the model for end-stage liver disease (MELD) score for patients with advanced liver disease [5], the body mass index, airflow obstruction, dyspnea, and exercise capacity (BODE) index for patients with chronic obstructive pulmonary disease (COPD) [6], the Seattle heart failure model [7] or the mortality risk score for heart failure [8] for patients with heart failure, and many various calculators for different types of cancer mortality, e.g., for colon, rectum, pancreatic, or lung carcinoma [9–12], and the Palliative Performance Scale for patients with advanced diseases [13].

Counseling should encourage preventive care that helps older patients maintain functional independence and increases quality of life. Patients who have a limited life expectancy should have frank discussions about the limitations, risks, and burdens of continued cancer screening in light of shifting health priorities. This should be done gently, and be framed in terms of a positive recommendation, like "this test would not help you live longer," rather than stating "you may not live long enough to benefit from this test," based on a study on older patients' preferences regarding communication about stopping screening in respect to estimated limited life expectancy [14, 15]. Tables 14.1, 14.2, 14.3, 14.4, and 14.5 discuss the respective cancer screening tests, which may or may no longer be indicated in elderly patients, and appropriate counseling needs to weigh risks and potential harms against expected benefits. All recommendations are based on the guidelines by the United States Preventive Services Task Force (USPSTF) [16]. These recommendations are ranked by strength of evidence:

- A grade of A means there is high certainty that the net benefit is substantial.
- A grade of B means either there is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.
- A grade of C means that there is at least moderate certainty that the net benefit is small and that the service should be offered selectively to individual patients based on professional judgment and patient preferences.
- A grade of D means that the use of the service should be discouraged as there is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.
- Last, a grade of I means that current evidence is insufficient to assess the balance of benefits and harms of the service. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.

Cancer Screening Tests

The following cancer screening tests are indicated for both genders:

Table 14.1 Screening for colorectal carcinoma

While there is increasing prevalence of colon carcinoma with age, there are also increasing harms of colonoscopy with age
The USPSTF recommends against routine screening in adults ≥75 years of age (grade **C**) and against ever screening ≥85 years olds because risks outweigh benefits
Annual FOBT or sigmoidoscopy every 5 years starting age 50 or colonoscopy at age 50 and every 10 years up to age 75 is recommended for those at average risk and with a life expectancy of >10 years (grade *A* recommendation)
The American Cancer Society changed their screening recommendations in 2018 to begin screening at age of 45
Medicare covers annual FOBT, sigmoidoscopy every 4 years (every 2 years for those at high risk), or colonoscopy every 10 years

USPSTF United States Preventive Services Task Force, *FOBT* Fecal Occult Blood testing

Table 14.2 Screening for lung cancer (grade B recommendation)

The USPSTF (2013) recommends *annual* screening for lung carcinoma with low-dose high-resolution CT for adults aged 55–80 who have a ≥30 pack-year history of smoking and currently smoke or have quit within the past 15 years
Screening should be stopped once a person has not smoked for 15 years or develops a life-limiting condition or the ability or willingness to undergo curative lung surgery

Table 14.3 Screening for cervical cancer

Papanicolao smear every 3 years if a woman is sexually active and has a cervix, the USPSTF recommends screening for women age 21–65 years (grade A)
Alternatively, women aged 30–65 could receive screening with a combination of Pap and human papillomavirus testing every 5 years (grade A recommendation, 8/2018)
Screening should stop at age 65 for women with 3 consecutive normal Pap smears who are not a high risk for cervical cancer (grade D)
Medicare covers Pap smear and pelvic exams every 2 years

Table 14.4 Screening for breast cancer

The USPSTF recommends a screening mammography every 2 years, with or without clinical breast exam, for all women aged 50–74 (grade B, 1/2016).
It is unknown whether screening mammography results in a survival benefit for women ≥75 years (grade I).
Physicians should discuss the pros and cons of mammography every 2 years with robust patients who have more than 5-year life expectancy.
Perform periodic clinical breast exam No trial has evaluated clinical breast exam without mammography
No evidence that breast self-examination reduces morbidity/mortality
Medicare covers annual mammography

Table 14.5 Screening for prostate cancer

The USPSTF (2012) recommended *against* screening for prostate cancer in 2012. In 2018, it revised recommendations stating that screening should be an individualized decision for men aged 55–69 (grade C recommendation), and that no screening should be done for men aged ≥70 (grade D recommendation)
The American Cancer Society and the American Urological Association recommend discussing potential benefits and possible harms of screening with men ≥50 who have >10 year life expectancy

Guiac-based fecal occult blood testing (gFOBT) or fecal immunochemical testing (FIT) uses antibodies to detect blood in the stool. FIT-DNA testing (aka stool DNA-test) combines the FIT with a test that detects altered DNA in the stool. Benefit of FIT over guiac testing is that compliance is higher because only one bowel movement needs to be collected.

The following screening tests are indicated for women:

The following screening test is not recommended for men:

Preventive Immunizations Beneficial for Older Adults

Seasonal Influenza Vaccination

All adults ≥65 years old should receive an annual influenza vaccine, unless they have contraindications (e.g., severe allergic reaction) [17]. An egg allergy is not a contraindication for receiving a flu shot [18]. Adults ≥65 years may receive the standard or high-dose inactivated intramuscular influenza vaccine; the intranasally administered live-attenuated influenza vaccine has not been approved for adults ≥50 years old. A high-dose trivalent flu shot (Fluzone High-dose), not to be confused with a standard dose quadrivalent flu shot (Fluzone Quadrivalent), is approved for people 65 years and older. Although the high-dose influenza vaccine may result in increased immunogenicity, there are no data demonstrating greater protection against influenza illness. There is also a trivalent flu shot made with adjuvant (Fluad) that is approved for people 65 years and older. Greater efforts need to be made to increase vaccination rates among older adults, especially those of racial and ethnic minorities. The Centers for Disease Control update immunization guidelines regularly [19].

Pneumococcal Vaccination

All adults ≥65 years old should receive at least one pneumococcal vaccination in their lifetime [20]. If a person was vaccinated before age 65, the vaccine should be repeated after 5 years. There are two types of pneumococcal pneumonia vaccines (PPV):

- The *pneumococcal polysaccharide vaccine* (PPSV23 or Pneumovax 23®) is a 23-valent polysaccharide vaccine that CDC recommends for use in all adults ≥65 years old. It has been available since 1983.
- The *pneumococcal conjugate vaccine* (PCV13 or Prevnar 13®) provides protection against the 13 serotypes responsible for most severe illness. It contains a purified capsular polysaccharide from 13 types of pneumococcus conjugated to nontoxic diphtheria toxin (CRM197). This vaccine has been available since 2010.

If PCV 13 has been given first, then PPSV23 can be given 6–12 months later. If PPSV23 has been given first, PCV13 should be given no earlier than 12 months afterwards [21].

Yearly influenza vaccination is also very important because the flu increases patients' chances of getting pneumococcal disease.

Tetanus-Diphtheria Vaccination

A tetanus-diphtheria booster (Td) is recommended every 10 years, for individuals who have received one dose of Tdap (tetanus, diphtheria, acellular pertussis) vaccine [22].

Herpes Zoster Vaccination

Herpes zoster vaccination is recommended for those ≥60 years old, unless immunocompromised. 50% of persons who live to age 85 will develop zoster in their lifetime. It is a painful rash that occurs along one or more dermatomes caused by reactivation of latent varicella zoster virus infection from a prior chickenpox infection. Anyone who has had a prior infection with varicella zoster virus (chickenpox) is at risk of shingles. There are currently two vaccines available and both also reduce the risk for the feared post-herpetic neuralgia pain:

- The *recombinant zoster vaccine* (RZV, Shingrix®, 2018) is preferred. It is an adjuvanted, non-live vaccine that should be given intramuscularly at age 50 or above in two doses given 2–6 months apart.
- Alternatively, one dose of *zoster vaccine live* (ZVL, Zostavax®, 2006), a live attenuated vaccine can be given subcutaneously at ≥60 years.

Compared to placebo, Zostavax significantly reduced the risk of developing zoster by 70% in those 50–59 years, and by 51% in those ≥60. However, in those ≥80 years, Zostavax was only 18% effective while Shingrix was 89.1% effective in preventing shingles in this older, at-risk age group. Shingrix was also more effective in the younger age group, preventing shingles 90–97% in the ≥50 year olds, compared to placebo [23]. There are no head-to-head trials. 78% of patients receiving Shingrix have pain at the injection site, compared to 40% of patients

receiving Zostavax. The rare adults who have not had chickenpox or who have no documented evidence of immunity should receive two doses of varicella vaccine.

Medicare Part B covers flu and PPV vaccines and may cover Td. Medicare Part D covers other vaccinations (with co-payments).

Other Recommended Screening Tests for Older Adults

Blood pressure and *weight* should be checked at every visit, and *height* should be checked annually. The USPSTF found good evidence that screening for and treatment of high blood pressure in adults substantially reduces the incidence of cardiovascular events (grade A recommendation) [24, 25]. All patients with a blood pressure higher than 135/80 mm Hg should have *blood glucose* screening for diabetes. Additionally, the USPSTF recommends screening for abnormal blood glucose as part of cardiovascular risk assessment in adults aged 40–70 years who are overweight or obese (Grade B recommendation) [26]. Clinicians should offer or refer patients with abnormal blood glucose to intensive behavioral counseling interventions to promote a healthful diet and physical activity [27]. Such counseling may be useful even for individuals without any known risk factors, especially if they are motivated to make behavioral changes (Grade C recommendation) [27].

Weight Loss to Prevent Obesity-Related Morbidity and Mortality in Adults: Behavioral Interventions (Grade B Recommendation)

The USPSTF recommends that clinicians offer or refer adults with a body mass index (BMI) of 30 or higher (calculated as weight in kilograms divided by height in meters squared) to intensive, multicomponent behavioral interventions [28].

Statin Use for the Primary Prevention of Cardiovascular Disease in Adults: Preventive Medication

The USPSTF recommends that adults aged 40–75 without a history of cardiovascular disease (CVD) (i.e., symptomatic coronary artery disease or ischemic stroke) use a low- to moderate-dose statin for the prevention of CVD events and mortality when all of the following criteria are met: (1) they have 1 or more CVD risk factors (i.e., dyslipidemia, diabetes, hypertension, or smoking); and (2) they have a calculated 10-year risk of a cardiovascular event of 10% or greater. Identification of dyslipidemia and calculation of 10-year CVD event risk requires universal lipid screening in adults aged 40–75 (Grade B recommendation) [29].

Although statin use may be beneficial for the primary prevention of CVD events in some adults with a 10-year CVD event risk of less than 10%, the likelihood of benefit is smaller, because of a lower probability of disease and uncertainty in individual risk prediction. Clinicians may choose to offer a low- to moderate-dose statin to certain adults aged 40–75 without a history of CVD when they have 1 or more CVD risk factors; and they have a calculated 10-year risk of a cardiovascular event of 7.5–10% (Grade C recommendation) [29]. There is currently insufficient evidence to assess the balance of benefits and harms of initiating statin use for the primary prevention of CVD events and mortality in adults 76 years and older without a history of heart attack or stroke [29]. Risk calculators often overestimate risk in real-world populations, and the 10-year risk for individuals >75 years old, even for those with optimal risk factor profile, always exceeds 7.5% using the ACC/AHA calculator [30]. Risks of statin therapy, like statin myopathy or drug-drug interactions, underscore the need to discuss patients' goals and values in deciding about whether or when to start statin therapy for primary prevention [31].

Screening for Osteoporosis with DXA Scan in Women >65, or Women <65 at Increased Risk for Osteoporosis (Grade B Recommendation)

The USPSTF found convincing evidence that bone measurement tests are accurate for predicting osteoporotic fractures in women and men [32]. The most commonly used test is central dual-energy x-ray absorptiometry (DXA) of the hip and lumbar spine. Although several bone measurement tests similarly predict risk of fracture, DXA provides measurement of bone mineral density (BMD), and most treatment guidelines use central DXA to define osteoporosis and the threshold at which to start drug therapies to prevent osteoporotic fractures. The USPSTF found adequate evidence that clinical risk assessment tools, e.g., the Simple Calculated Osteoporosis Risk Estimation (SCORE; Merck) [33], the Osteoporosis Self-Assessment Tool (OST) [34], or the licensed FFRAX tool [35], are moderately accurate in identifying risk of osteoporosis and osteoporotic fractures [32, 36]. The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for osteoporosis to prevent osteoporotic fractures in men [32].

Abdominal Aortic Aneurysm (AAA)

An abdominal ultrasound to screen for an abdominal aortic aneurysm is recommended one time only for men aged 65–75 who have ever smoked (Grade B recommendation) as they have the highest prevalence, occurring in about 7% of this population; there is insufficient evidence regarding screening women aged 65–75

with history of smoking or family history [37, 38]. Men who have never smoked have an approximate risk of 2% for having an AAA; screening such men carries a Grade C recommendation [37, 38].

Screening for Depression (Grade B Recommendation)

The USPSTF recommends screening for depression in the general adult population [39]. Screening should be implemented with adequate systems in place to ensure accurate diagnosis, effective treatment, and appropriate follow-up. Commonly used depression screening instruments include the Patient Health Questionnaire (PHQ) in various forms [40, 41] or the Geriatric Depression Scale in older adults [42]. All positive screening results should lead to additional assessment that considers severity of depression and comorbid psychological problems (e.g., anxiety, panic attacks, or substance abuse), alternate diagnoses, and medical conditions.

Hepatitis C Screening

The USPSTF recommends screening for hepatitis C virus (HCV) infection in persons at high risk for infection. The USPSTF also recommends offering one-time screening for HCV infection to adults born between 1945 and 1965 (Grade B recommendation) [43].

Healthy Lifestyle Counseling

Healthy lifestyle counseling should include counseling about physical activity, sexual dysfunction and sexually transmitted diseases, alcohol misuse, and smoking cessation.

Physical Activity

Physical activity can promote a sense of well-being and prevent future falls and cardiovascular events. Suggested exercises should help with flexibility (e.g., stretching), endurance (e.g., walking, cycling), strength (e.g., weight training), and balance (e.g., Tai Chi, dancing). Such exercises can improve gait and balance and decrease risk and fear of falling. Even chair-bound individuals can still benefit from exercises to increase quadriceps or upper extremity strength (which are both needed for transferring), e.g., by following along TV or YouTube programs like “Sit and be fit.”

Table 14.6 CAGE questionnaire

Have you ever felt you should *cut down* on your drinking?
Have people *annoyed* you by criticizing your drinking?
Have you ever felt bad or *guilty* about your drinking?
Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (*eye-opener*)?

Sexual Dysfunction and Sexually Transmitted Diseases

Clinicians should counsel older adults annually about sexual dysfunction and sexually transmitted infections. Both men and women infrequently discuss sexual problems with clinicians. Among men, erectile dysfunction is the most prevalent problem (37%) [44]; among women, the most prevalent sexual problems are decreased libido (43%), difficulty with vaginal lubrication (39%), and inability to climax (34%) [45]. Although the prevalence of sexual activity declines with age (73% among adults 57–64 years old vs. 26% among adults 75–85 years old) and is significantly less common among women than men, many older adults are sexually active, and about half report at least one bothersome sexual problem. The rate of sexually transmitted infections (STIs) and HIV is also rising in older adults [46].

Alcohol Misuse

Clinicians should ask annually and when indicated/symptomatic about alcohol misuse using a standardized self- or clinician-administered screening test like the Alcohol Use Disorders Identification Test (AUDIT) [47] or the Short Brief Michigan Alcoholism Screening Test-Geriatric Version (MAST-G) [48] that are effective in identifying problem drinking in older adults. While the CAGE questionnaire (see Table 14.6) is better known, it does not detect the full spectrum of unhealthy alcohol use. Brief behavioral counseling interventions to reduce unhealthy alcohol use should be offered if indicated (grade B recommendation) [49].

Smoking Cessation

Smokers' readiness to quit or cut down should be assessed and encouraged at every visit. Medication therapy or nicotine replacement therapy as well as behavioral interventions can be offered for support. Clinicians should emphasize that smoking cessation at any age can lead to reduced rate of progression of COPD and reduced rates of many cancers and cardiovascular disease. Even patients who already have developed lung cancer and are undergoing surgery, radiation, or chemotherapy will still have a benefit from quitting smoking [50–52].

Chemoprophylaxis

Aspirin for Primary Prevention of Cardiovascular Disease and Colorectal Cancer

Aspirin lowers the risk for cardiovascular disease and colorectal cancer, both of which account for significant numbers of deaths in the United States. The USPSTF recommends initiating low-dose aspirin for primary prevention of CVD and CRC in adults 50–59 years old who have a 10% or greater 10-year CVD risk, are not at increased risk of bleeding, have a remaining life expectancy of at least 10 years, and are willing to take low-dose aspirin for at least 10 years (grade B recommendation). Recent trials showed that the use of low-dose aspirin for primary prevention in older adults ≥70 years (≥65 years for Hispanics or African Americans) did not result in a significantly lower risk of cardiovascular disease than placebo but resulted in a significantly higher risk of major hemorrhage events [53].

Calcium

The USPS Task Force found insufficient evidence to recommend for or against calcium supplementation to prevent fractures in most community-dwelling adults at higher doses and recommends against them at lower doses [54]. However, the American Geriatrics Society suggests that clinicians recommend at least 1000 IU/d of vitamin D supplementation as well as calcium supplementation of 500–1200 mg/d for community-dwelling seniors ≥65 years old to reduce risk of fractures and falls [55].

Vitamin D

The USPSTF recommends against vitamin D supplementation to prevent falls in community-dwelling adults 65 years or older (grade D recommendation). These recommendations apply to community-dwelling adults *not* known to have osteoporosis or vitamin D deficiency. For such individuals, 1000 units/d are generally recommended. Patients with Vitamin D deficiency may need higher-dose Vitamin D supplementation,

Multivitamins

The USPSTF recommends against the use of β-carotene or vitamin E supplements for the prevention of cardiovascular disease or cancer (grade D recommendation). There is insufficient evidence to assess the balance of benefits and harms of the use of other single- or paired-nutrient supplements or multivitamins for the prevention of cardiovascular disease or cancer.

Screening for Geriatric Health Issues/Geriatric Syndromes

Despite the fact that the USPSTF found insufficient evidence to recommend screening of all older adults for hearing loss, primary open-angle glaucoma, impaired visual acuity, thyroid dysfunction, elder abuse/abuse of vulnerable adults, illicit drug use, and cognitive impairment, clinicians caring for older adults will perform such screening periodically since the harms are negligible compared to the potential benefits gained.

The elements of a comprehensive geriatric assessment (CGA) include assessment of medications, with particular attention to polypharmacy and efforts at deprescribing, functional status, gait and balance, nutritional status, hearing, vision, affect, cognitive status, and social support. Assessing a patient's ability to perform activities of daily living (ADLs) includes inquiring about dressing, feeding, toileting, grooming, ambulation (including balance/risk of falls), and bathing; assessing a patient's ability to perform instrumental activities of daily living (IADLs) includes inquiring about shopping, food preparation, using the telephone, housekeeping, laundry, mode of transportation, responsibility for own medications, and ability to handle finances.

The USPSTF recommends exercise interventions to prevent falls in community-dwelling adults 65 years or older who are at increased risk for falls (grade B recommendation). Additionally, USPSTF also recommends to *selectively* offer multifactorial interventions for fall prevention to community-dwelling adults ≥age 65 who are at increased fall risk (based on the circumstances of prior falls, presence of comorbid medical conditions, and the patient's values and preferences), a grade C recommendation.

Interventions such as a home safety evaluation to reduce risk for falls, pocket talkers or hearing aids to improve hearing, treating visual impairments to improve or restore vision, or teaching Kegel exercises to improve urinary incontinence can greatly and quickly improve quality of life. Restoring function can "put more life in the years, rather than just more years in a life."

Medicare started covering an Annual Wellness Visit since 2011 (for seniors who had Part B coverage for >12 months), in addition to an Initial Preventive Physical Examination, or "Welcome to Medicare" preventive visit, that has to be completed within the first 12 months of enrollment [56]. These visits include a detailed assessment for geriatric health issues, and they now also support end-of-life care planning, either by providing written or verbal information to the patient about the option of preparing an advance directive in case a health condition causes them to be unable to make health care decisions. At the very least, a potential surrogate decision maker should be identified whom the patient would trust to make health care decisions if incapacitated.

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Correction to: Oral Health in Older Adults with Dementia

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The book was inadvertently published with an incorrect title of Chapter 13 in Table of contents and Chapter 13. The title is now corrected as "Oral Health in Older Adults with Dementia" in the book.

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