Geriatric Ophthalmology

A Competency-based Approach

Hilary A. Beaver
Andrew G. Lee
Editors

Second Edition

Springer

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Foreword

The Second Edition of *Geriatric Ophthalmology: A Competency-Based Approach* is a terrific and timely book especially for trainees in ophthalmology and related eye professions. And it will serve as a handy reference for those who are fully trained yet would like to update their skills in providing high-quality care to seniors. The Second Edition provides new information and up-to-date references to the continuously emerging science related to caring for the older eye patient. This pithy well-written book has been created by leaders in the emerging field of geriatric ophthalmology. It provides insightful and practical guidance for the common age-related eye conditions and the common comorbidities such as falls, dementia, and depression that profoundly impact the evaluation, treatment, and outcome of older eye patients. Indeed, the excellent eye professional will understand the unique issues their older patients manifest. Older patients dominate health care and more so in ophthalmology than most specialties. Yet American medicine has been slow to integrate geriatric concepts and principles into specialty medicine. For this reason, practical reference books are vital.

What is so different about the older patient? Many issues, but perhaps summarized by three characteristics: (1) the presence of a unique variety of comorbidities in each patient; (2) profound but variable loss of physiological function, especially in those over 80 or so; and (3) heterogeneity created by these variabilities. Together these phenomena result in a marked increased vulnerability in the older patient. This vulnerability makes the senior more prone to missed diagnoses and complications from surgical and medical interventions. Thus the excellent eye professional must carefully consider all comorbidities, some of which may not be obvious or listed on a problem list (such as early dementia or depression). These considerations are imperative in discussing the benefits and burdens of any evaluation or treatment in an older patient. The Institute of Medicine points out this need for all clinicians who deal with adults to become knowledgeable in geriatric principles appropriate to their practice [1].

This book is a reflection, in part, of a two-decade effort of the American Geriatrics Society with ongoing support of the John A. Hartford Foundation, and in the past the Atlantic Philanthropies, to introduce geriatrics into specialty medicine. As the late, visionary geriatrics leader, David H. Solomon, MD, in his prescient Foreword to the First Edition stated: “The goal is to help all ophthalmologists to improve the quality of care they provide to the millions of patients suffering from age-associated

eye conditions." This effort, called the Geriatrics for Specialists Initiative (GSI), has resulted, among other accomplishments, in innovations in specialty-specific graduate medical education and the creation of new knowledge through sponsoring the career development of specialists committed to the geriatric aspects of their specialty. This research and career development effort is now promulgated by an entry-level award of the NIA/NIH called Grants for Early Medical and Surgical and Specialists Transitioning to Aging Research (GEMSSTAR). The editors of this book, Hilary A. Beaver and Drs. Andrew G. Lee, have long been leaders in the GSI.

The book follows a common template based on recommendations of the Accreditation Council for Graduate Medical Education (ACGME) to focus on competencies. Chapters start with a typical clinical scenario followed by practical information on medical knowledge, clinical care, management, inter-professional communication skills, professionalism, and system-based practice and conclude with a review of the patient vignette now with an informed geriatric approach. Each chapter is inclusive and easily reviewed.

This is likely to be a book that teachers will want in the hands of their trainees, and it serves as a thoughtful and practical template for curricula.

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1. Institute of Medicine. Retooling for an aging America: building the health care workforce. Washington, DC: The National Academies Press; 2008.

Preface

We rewrote and extended this text to serve those clinicians, scientists, students, and allied health professionals who focus on the needs of older adults. This book was born from three paradigm shifts in eye care for geriatric patients. First, eye care providers are moving away from the traditional "disease-diagnose-treat" model of ophthalmic care to a holistic model based on "disease prevention, contextual diagnosis, functional assessment, treatment and rehabilitation." Second, there is an increasing recognition that geriatric patients are not just "older adults," similar to the recognition that children are not just "little adults"; there are recognized differences in the anatomy, physiology, pathophysiology, pharmacology, clinical presentations, and responses to disease and treatments in both of these groups. Third is the move from a "medical knowledge"-based model of care to a competency-based model.

We have structured the chapters around the six Accreditation Council for Graduate Medical Education (ACGME) core competencies in medical education. These are Patient Care, Medical Knowledge, Professionalism, Interpersonal and Communication Skills, Practice-Based Learning and Improvement, and Systems-Based Practice. These are further described in the text and create a framework for how to approach patient care in the complicated situation of an at-risk elderly patient with multiple comorbidities.

We have chosen a case-driven format to highlight the concept of competencies in medicine instead of the traditional medical knowledge-based paradigm. We hope to align with the emerging consensus for more comprehensive understanding and proficiency by eye doctors in the ACGME competencies. Each chapter begins and ends with an illustrative case that exemplifies the points of care encompassed by the competencies. We have based the chapters on the main diseases in ophthalmology, cataract, glaucoma, diabetic retinopathy, and age-related macular degeneration, all diseases of aging, and the effect of vision loss on the geriatric patient in their quality of life (QOL). This book focuses on the most common eye conditions causing treatable and untreatable vision loss, the consequences of poor vision (falls, fractures, depression, worsening dementia), and comorbidities such as hearing loss and elder abuse that compound subnormal vision. We want this text to be useful to medical students, residents, fellows, clinicians, and allied health personnel in their care of older patients with geriatric ophthalmology problems. We hope that this little book encourages you to think about geriatric patients with the competencies in mind and

with the unique issues of our elderly population. Our goal is not to make eye doctors into geriatricians but to increase awareness and expertise by eye doctors in geriatric topics. After all we all will (hopefully) end up joining this demographic someday.

For the purposes of this text, we will rely upon the ACGME definitions of the six competencies. The reader might wish to view this glossary in the beginning as the definitions for these competencies are not always intuitive or self-explanatory. The website http://www.acgme.org (https://www.acgme.org/Portals/0/MilestonesGuidebook.pdf) further describes the use of the competencies [1], and https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/240-Ophthalmology_2019.pdf?ver=2018-08-21-132343-853 [2] has the definitions of these competencies – patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. We have based the chapter structure of this book on the competencies.

Houston, TX, USA Hilary A. Beaver
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Acknowledgments

This book is dedicated to our families including our parents Nancy P. Beaver, William T. Beaver, MD, Rosalind G. Lee, MD, and Alberto C. Lee MD; our siblings Diane P. Poirier, Roderick W. Beaver, MD, Richard B. Lee, and Amy B. Lee, MD; and our daughters, Rachael E. Lee and Virginia A. Lee. Hilary A. Beaver wishes to recognize her coauthor, coeditor, and spouse Andrew G. Lee for his constant encouragement and ongoing support and for starting the nidus of her enthusiasm for championing the care of the elderly. We both wish to recognize our mentors in geriatrics the late, great David Solomon MD, as well as ongoing leaders in the field George Drach, MD, and John Burton, MD. We thank the American Geriatrics Society and their dedicated staff for years of support and encouragement.

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Scope of the Problem and Demographic Shift in Population: Visual Disease Incidence and Prevalence in the Elderly Population

Jennifer Doyle and Gwen K. Sterns

The increasing number of elderly persons in the United States presents a rising challenge to our medical system and especially to our ophthalmologists. We see this due to a combination of lower fertility rates, aging of the post-World War II baby boomers, and increasing life expectancies. The older population is considered to be those 65 and older. In the United States, life expectancy at age 65 has increased from 11.9 years in 1902 to 19.1 years in 2009 [1]. In 2014, there were 46.2 million people aged 65 or older, representing 14.5% of the US population or about one in every seven Americans. This percentage is predicted to increase to 21.7% of the population by 2040 [2]. According to a 2010 Census Bureau report, the age group 85 and older is projected to double from 4.7 million in 2003 to 9.6 million in 2030, and by 2050 it is expected to increase to 20.9 million [1]. This age group of 85 and older is the fastest-growing segment of the US population. Similar aging of populations can be seen internationally.

The dramatic demographic shift in the United States toward an older population has impacted the specialty of ophthalmology disproportionately, as many common eye disorders occur with increasing frequency and severity with older age. As our population ages, we are seeing an increase in age-related eye diseases (AREDs). Most of these disease processes lack early warning signs and occur gradually over the years. They can often be detected and treated if a routine comprehensive eye exam is performed. The four most common age-related eye diseases are age-related macular degeneration (AMD), cataracts, diabetic retinopathy, and primary open-angle glaucoma [3]. Early recognition and treatment can help prevent vision loss in many of these patients and thus help to prevent and reduce disability from vision loss (Fig. 1).

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Case Vignette

A 70-year-old African-American man with a history of diabetes mellitus and chronic open-angle glaucoma can no longer safely drive his car. Over the past few months, he damaged his car backing into his garage and hitting the garage door. He is unable to read the road signs and is complaining about driving at night and in cloudy conditions. His last appointment with an ophthalmologist was 2 years ago. He missed several follow-up appointments and stopped his drops because he did not feel that they were improving his vision. He thought because his glasses were 2 years old; he needed an updated pair so he agreed to see his wife's ophthalmologist.

He was told he had advanced optic nerve head cupping from his untreated glaucoma and that this could not be reversed or corrected with glasses. He was also found to have cataracts as well as background diabetic retinopathy. Some of his visual loss could have been preventable had he continued his eye care and followed recommended treatment guidelines.

Fig. 1 As the elderly population ages, the number of extreme elderly, or those over the age of 85, will continue to advance. Family participation in coordination of care may be particularly important to aid these patients in accessing care

Practice-Based Learning and Improvement

The leading causes of age-related vision loss in the United States are age-related macular degeneration (AMD), cataracts, glaucoma, and diabetic retinopathy. The National Eye Institute looked at each condition in 2010. Based on statistics at that time, they made an estimation of Americans aged 65 and over that would have the same diseases in 2050. For AMD, the estimated number of Americans was 2.1 million in 2010 and 5.4 million predicted in 2050. For glaucoma, there were 2.7 million Americans in 2010 and an estimated 6.3 million by 2050. Diabetic retinopathy totaled 7.7 million in 2010 with numbers predicted to be up to 14.6 million in 2050. Between 2010 and 2050, the number of people with cataracts would potentially double from 24.4 million to 50 million [4].

There are prevention strategies that will help to avoid this expected increase in visual impairment and blindness in our elderly population. According to the CDC, patients with diabetes should have a dilated exam at least once a year. The CDC also recommends that people at higher risk for glaucoma should have a dilated exam every 2 years. Those at risk for glaucoma include all African-Americans aged 40 years or older, everyone older than age 60, and people with a family history of glaucoma [5]. Blood pressure control, glycemic control, and smoking cessation are other ways to lead to a reduction in vision loss [6].

This gentleman was at a high risk for loss of vision due to age and diagnosis of both diabetes and glaucoma. If his primary care provider had requested the patient to have proof of yearly eye examination, it may have helped detect the disease earlier. Alternatively, if the ophthalmologist had informed the primary care physician of the patient's missed appointments, it may have prompted earlier intervention. As doctors, we have to communicate with each other and work together to inform and educate patients about the importance of eye exams. It is also the responsibility of the patient to keep scheduled appointments and comply with recommendations made by physicians. In a high-risk population, such as those with dementia, the caregiver should make an additional effort to reschedule missed examinations and set up a reminder call system for those noncompliant patients.

Patient Care

The Eye Diseases Prevalence Research Group reported that approximately 1 in 28 Americans over age 40 years is diagnosed with low vision or blindness [6]. "Low vision" encompasses a variety of visual impairment problems. Low vision refers to uncorrectable vision loss that affects people's ability to participate in activities of daily living and/or things that they enjoy. It is more than just an acuity test or loss in field of vision, which separates it from "legal blindness" which does have a standardized definition to include acuity and field testing.

The patient in the clinical vignette has numerous problems affecting his vision. He has lost vision due to his chronic open-angle glaucoma, diabetes, and cataracts. Each one needs to be addressed. Treatment options for glaucoma include topical

medications, laser, or surgery. In patients with arthritis who have trouble putting drops in or patients with dementia who forget drops, sometimes laser or surgery is the best treatment option. In some instances addressing one issue can help another. For instance, by removing this patient's cataract, it could possibly lower the intraocular pressure and allow for a more clear view of the retina for diabetic monitoring. However, addressing one issue can also exacerbate another. For example, if the patient has clinically significant macular edema, cataract removal can worsen inflammation and edema. Comorbidities must therefore be taken into consideration when planning treatment. The ophthalmologist may need to work with other eye specialists such as retina or glaucoma subspecialist to help in planning and implementation of care. It is also important to work with the primary care doctor and keep them informed in order to help ensure the best treatment plan for the patient. Patients appreciate open communication between their doctors.

Presenting patients with treatment options and including them in the decision-making process are important in gaining their confidence. Explaining the disease process and reviewing different treatment options help the patient to better understand their condition, to participate in the decision-making process, and to take responsibility of compliance with their care. In our clinic case, our patient needs to understand the severity of his condition while being allowed to take control of his condition.

Medical Knowledge

The ophthalmologist requested access to past medical records from the former ophthalmologist and internist. They initiated glaucoma treatment after consultation with the internist to make sure there was no contraindication to the glaucoma medications. A long discussion was held with the patient to explain that the glaucoma drops were to prevent further vision loss and would not to restore any vision loss from glaucoma. This was done to encourage future medication compliance.

Refraction improved the patient's vision so he would now be able to read the road signs and be legal to drive in his state. It was explained to the patient that the glasses might only be a temporary improvement as his cataract will likely progress as a part of the aging process to a point requiring surgery. It was further explained that in addition to aging, uncontrolled diabetes could cause cataract changes in addition to diabetic retinopathy. This encouraged the patient to work more closely with his internist to institute tighter glycemic control and more frequent monitoring.

Interpersonal and Communication Skills

The patient was instructed in the use and instillation and the importance of his eye drops. A technician demonstrated eye drop instillation and then asked the patient to perform instillation to ensure competence. He was instructed to keep a record of the actual times he took his medicine. Time sheets for documenting this information were reviewed, and the patient and his wife were made joint participants in his care.

The importance of this participation was conveyed to the patient as well as the importance of the record keeping. On his return visit to the ophthalmologist, staff reviewed his medication sheets with him and confirmed with the pharmacy the patient had been complying with medication refills. All of the patient's questions were answered.

Professionalism

The physician took the time to address the patient's concerns and explain his comorbidities and the relationship between his compliance and vision loss. The patient was educated, not lectured. The physician made sure the patient understood the importance of taking his medications as well as the side effects of the medications. The physician let the patient know that they understood the difficulties the patient faced and challenges he had ahead of him and tried to be sensitive to the patient's needs. This communication leads to a more compliant patient.

Systems-Based Practice

There is a significant economic burden attached to vision loss in adults. The economic burden in the United States is estimated to cost annually approximately $51.4 billion [7]. These costs include direct medical costs such as outpatient services, inpatient services, prescription drugs, vitamins, and other medications used by people with AMD, cataract, diabetic retinopathy, glaucoma, or refractive error. Also included are nursing home care for those with a visual impairment and government programs for the visually impaired (i.e., Department of Education's Independent Living Services for Older Individuals Who Are Blind as well as many other programs). Many other variables were factored in, such as informal care costs, quality-of-life adjustments, and lost productivity for people who are visually impaired or blind, including lower wages compared to those in the same age group who have normal vision [6].

The ophthalmologist established communication with the primary care doctor. The patient knew he had a team working for him and did not want to let them down. Any changes in medications from the ophthalmologist and changes in the retinopathy were shared with the patient's primary care medical doctor. Working as a team and communicating with each doctor involved in the patient's care provided a support system for the patient.

Case Resolution

The patient was treated for his glaucoma with topical medications. His glaucomatous visual field loss could not be restored, but no further visual field loss occurred. Glasses were used until his cataracts had advanced to a point

requiring surgery. The removal of the cataracts helped to improve his vision, lower eye pressure, and enable better visualization of his retina for evaluation and treatment of his diabetic retinopathy. His ability to function significantly improved, and he was again able to safely drive and read the newspaper. He gained an understanding of the importance of his glaucoma drops, of the relationship of his diabetes to his ocular disease, and that his vision loss was not just due to age. He became an active participant in his own care and was able to regain some independence.

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Refractive Error in the Geriatric Population

Hilary A. Beaver

Case Vignette

An 88-year-old African-American male is sent by his primary care physician for retinal evaluation for diabetic retinopathy. He has had worsening diabetes control requiring insulin therapy. He moved to the area after the death of his wife, who had been his primary caregiver, and is currently living with his daughter. He has not seen an eye care professional in the last 12 years. His past medical history is significant for diabetes and hypertension, both diagnosed at the time of a stroke 5 years previously and both currently controlled. A diabetic nurse is working with the patient on diabetic nutrition and insulin administration but has doubts if the patient can see well enough to accurately draw up his own insulin. The daughter travels frequently for work and has additional concerns that the patient cannot ambulate unassisted in her dark basement apartment. She is pursuing nursing home placement to gain assistance with her father's medication and his general care. He has been active with his hobbies of wood working and cabinet work but has been less and less able to pursue these activities. He is quite distressed by the loss of these activities.

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On evaluation the patient sees 20/100 OD and 20/80 OS at distance and reads J7 in each eye at near. The technician performs a manifest refraction starting with the patient's current glasses prescription but gets little improvement. The external, pupil evaluation, motility, confrontation fields, and tonometry exams are normal. The slit lamp exam shows mild nuclear and cortical cataracts, and the fundus exam shows mild, nonproliferative diabetic retinopathy OU. The optic nerves are pink bilaterally, and the cup to disc ratio is 0.3 OU.

Patient Care

Visual disturbance is a significant cause of impairment in the very elderly, those aged 85 and older, ranking third in prevalence after arthritis and heart disease [1]. Recent studies show 3.6 million individuals, or 18% of people over the age of 70, to be visually impaired. The absolute numbers of the visually impaired elderly will grow with the aging of the US and world populations. Although there is an increase in ocular pathology with age, including diabetes, cataracts, macular degeneration, and glaucoma, the leading diagnosis for isolated vision loss in this population is refractive error (91.5%) [2] (Fig. 1). Visual acuity screening by primary care practitioners therefore remains a recommended geriatric screening tool for general eye health and visual function. Acuity testing uncovers undiagnosed refractive error, cataract, and macular degeneration and is currently felt to be used appropriately in the primary care evaluation of geriatric patients [3].

Loss of visual acuity in the elderly can affect both quality of life (QOL) and participation in activities of daily living (ADL). Visually impaired elderly are twice as likely to have trouble with walking, transferring to a bed or chair, preparing meals, managing medication, and leaving the house. Visual difficulties with ADL create social isolation, depression, and anxiety. The visually impaired elderly have more comorbidities with falls, hip fracture, hypertension, heart disease, and stroke. Combined vision and hearing loss affects an additional 8.6% or 1.7 million elderly, exacerbating further both functional difficulties and social isolation [2]. Although decreased vision from uncorrected refractive error can be as disabling as vision loss from non-correctable causes, it is easily remedied with spectacles. Patients who have additional comorbid eye disease may also benefit in maximizing their daily activities by correcting any coexistent refractive error, both for distance and for near tasks.

Bilateral loss of vision has an even greater effect on the QOL and on life expectancy than does unilateral vision loss. Patients with bilateral loss of vision are less mobile, less likely to participate in either activities of daily living or any visually demanding task, and have worse self-rated health. A self-imposed isolation ensues as patients withdraw from social and religious activities. These bilaterally visually

Fig. 1 Progressive lenses allow viewing at distance, intermediate, and near, but the bifocal may increase the risk of falls in the at risk elderly

impaired individuals depend more on family and community assistance and are more likely to be in an institution. They suffer greater rates of recurrent falls, fractures, depression, emotional distress, and death than patients with monocular vision impairment. Vu found that unilateral visual impairment was related to falling, poor general health scores, emotional difficulty, social limitation, difficulties with visual ADL, and dependency but noted that bilateral impairment increased the likelihood of dependency, nursing home placement, and emotional difficulties. Bilateral visual loss amplified difficulties with visual tasks 6- to 41-fold [4].

Medical Knowledge

The aging process affects multiple parameters of visual acuity. The vision of the elderly may drop significantly with mesopic conditions or with glare (Table 1). Both contrast sensitivity and color vision are known to decrease with age, particularly the discrimination within both dark shades and pastel colors. Difficulty adapting to changing light levels presents a hazard when navigating even familiar environments. The useful field of view (UFOV) is the area of field in which one can recognize and react to visual stimuli. The UFOV declines in the elderly, as does the reaction time to items within the UFOV [5]. The UFOV is helpful in predicting functional impairment with driving and has been shown to correlate with the previous 5-year history of MVA in glaucoma patients [6].

Table 1 Age-related median acuity in variable light conditions: 900 patients

Age	High-contrast acuity	Low-contrast high-luminance acuity	Low-contrast low-luminance acuity	Low-contrast, glare conditions acuity
Youth	20/20	Little change	Little change	20/30–20/40
82	20/30	20/55	20/120	20/160

Data derived from Watson et al. [5]

Refractive error is a significant cause of vision loss throughout the world. The World Health Organization (WHO) 2004 world estimates show 153 million people over the age of 5 to be visually impaired from uncorrected refractive error, including 8 million blind due to the lack of corrective eyewear. Ninety-five million of these individuals are over the age of 50, including 6.9 million of those legally blind from refractive error, sometimes as a result of surgical aphakia or inadequate pseudophakic correction. The WHO defines visual impairment from uncorrected or inadequately corrected refractive error as "visual acuity of less than 6/18 in the better eye that could be improved to equal to or better than 6/18 by refraction or pinhole." Uncorrected refractive error by this definition is therefore the current, predominant world cause of visual impairment (49%) and is the second most common cause of world blindness (18.2%) [7].

There are different rates of refractive error reported in different ethnic populations. Tan et al. studied a multiethnic Asian population aged 55–85 participating in the Singapore Longitudinal Aging Study (SLAS). They found higher rates of myopia (30.1%), particularly among Chinese (30.8%), compared with Indians (22.6%) and Malays (18.2%) and age matched European-derived studies (15.5–26.2%). There found an association of myopia with male gender and higher education (5.4 times the risk, $P < 0.001$). They note an association of astigmatism with diabetes and short stature. They noted differences in their myopia risk with similarly aged Chinese in the Shihpai Eye Study (12.8% (65–69 years), 19.4% (70–74 years), 26.5% (75–79 years)), the Beijing Eye Study (22.9%), the Mongolian eye study (21% (60–69 years) and 26.5% (70 and older)), and contrast as well to reports from India and Bangladesh that are greater than 40% [8].

Presbyopia is not currently included in the WHO evaluation but affects many elderly individuals. Sherwin et al. studied a population in the rural Rift Valley, Kenya, and found 85.4% of the patients over age 50 to have functional presbyopia, with only 5.4% having access to glasses, predominantly due to cost. The functional impact of uncorrected presbyopia on this population included difficulty reading, sewing, recognizing small objects, and harvesting grains, and illustrates the importance of near correction both for literate and for illiterate communities [9].

Access to affordable health care is considered a particular problem in developing countries; the 2010 goal by the WHO for sub-Saharan Africa is to have one refractionist per 100,000 people [9]. The elderly in first world nations have better access to health-care providers but continue to suffer correctable vision loss as well. Correctable refractive errors affect almost one-third of individuals aged 40 or older in the United States, Western Europe, and Australia [10]. The Beaver Dam Eye Study found hyperopia in 49% and myopia in 26.2% of patients 43–84 years of age, with a statistically significant hyperopic shift with age [11]. This is supported by the work from Bengtsson, who studied an elderly Swedish population and found a hyperopic shift in the population between 55 and 70 years [12].

Similarly, Khalaj examined 446 Iranian subjects aged 50 years and older with a mean age of 62 +/− 9.3 years. They found 96.4% had refractive error, of which hyperopia (45.9%) was the most frequent, followed by myopia (33.6%) and astigmatism (16.8%) [13].

Many individuals in developed world nations also have uncorrected or suboptimally corrected refractive error. The National Health and Nutrition Examination Survey 1999–2002 showed that 59.5% of visual impairment in the US population aged 60 or older was due to uncorrected refractive error [14]. The Baltimore Eye Study of 5300 east Baltimore patients found 54% to have significant uncorrected refractive error, improving their vision by at least one line, while 7.5% improved by at least three lines [15]. The Melbourne VIP study, a population-based study of 2530 Melbourne adults aged 40 and older, found correctable vision loss in 84 of 159 participants with bilateral vision loss (53%) and 165 of 302 participants with unilateral vision loss (55%) [4]. The problem exists even in elderly patients who live full time in a controlled care environment. A 1994 study found 34% of elderly residents in residential care homes in the United Kingdom to have significant yet uncorrected refractive errors [16]. Stoll et al. showed in 1963 that 60% of chronic geriatric mental hospital inpatients in Michigan had significant, unrecognized refractive error [17].

Refractive error affects daily function, ADL, and QOL indicators. Vision loss from uncorrected refractive error affects QOL indicators of the National Eye Institute Visual Function Questionnaire (NEI-VFQ-25) to levels similar to cataract. Self-reported function in the NEI-VFQ-25 scale scores are significantly decreased in general vision, near vision, distance vision, driving, ocular pain, role difficulties, dependency, social functioning, and mental health [18]. The Salisbury Eye Evaluation (SEE) project looked at binocular presenting visual acuity and function in activities of daily living (ADL). They found presenting acuity to be less than 20/40 in 4% at age 65, advancing to 16% at age 80. Functional difficulties with ADL were more common in women, and in blacks, and were doubled if there was impairment in presenting binocular visual acuity to less than 20/40 [19].

Correcting the unrecognized refractive error has been shown to significantly improve patient's self-reported QOL indices. Owsley et al. found that correction of even a modest amount of myopia and hyperopia can improve self-reported skills of general vision, reading, psychological distress, activities, hobbies, and social interaction and can significantly decrease depressive symptoms [20]. Coleman et al. showed a similar improvement in NEI-VFQ composite scores in self-perception of general vision, distance vision, near vision, and mental health [21].

Interpersonal and Communication Skills

The effect of age-related changes in acuity and visual field may be minimized with the appropriate spectacle prescription, even in patients with ocular comorbidities. The specific visual goals of the patient and family should be addressed while recommending these optical options. For example, the patient with trouble ambulating may do better in single-vision distance glasses without a bifocal, allowing them a clear view of the floor and any obstacles. They should also be offered separate reading glasses for near work or the option of a bifocal for distance and near viewing while

seated. In contrast, the patient who has no trouble ambulating but has difficulty with needlework or model building might improve their craftsmanship with a pair of single-vision near glasses with stronger magnification then worn in their standard bifocal. The elderly patient active in cabinetmaking should be given a prescription for safety glasses to protect their eyes while filing, grinding, and hammering.

Professionalism

Treating eye diseases in the geriatric patient requires a subtle shift in the delivery of medical care. What may be an inconvenient visual limitation to a younger patient may prevent an older patient from living independently. Low-vision rehabilitation services early in the course of disease may prevent permanent loss of function, depression, and exacerbation of pre-existing dementia, issues expanded elsewhere in this text. The correction of refractive error in the elderly may require a more prolonged process, with both streak retinoscopy and refraction, but the potential benefit to the individual is significant. Recall that there is no formula that differentiates physical age from chronologic age. Elderly patients should be evaluated and treated based on their visual function and their QOL.

Systems-Based Practice

The economic burden of vision loss and correctable vision loss in the United States is staggering and is expected to rise. Thirty-eight million adults over age 40 have vision-related illness in the United States, with an anticipated 50 million affected by the year 2020 [22]. Estimates of the cost to the US economy vary from $35 to $51 billion annually and include direct medical costs, related costs such as dependency needs, institutionalization, lost QOL indices, increased risks of comorbid disease and mortality, and an estimated $8 billion in lost productivity [22, 23]. The direct medical cost of refracting and providing glasses for the estimated 9.2 million patients 65 and older in 2004 was estimated to be $1842.14 million [23]. The social and economic benefit of rehabilitating these elderly is likewise significant and will rise with the aging population. Visual impairment increases the risk of frequent falls by a factor of 6 and the risk of institutionalization by a factor of 4; blindness increases institutionalization by a factor of 10 compared to sighted individuals [22]. Sixteen percent of visually impaired and 40% of legally blind seniors aged 65 and older live in nursing facilities compared with only 4.3% of their peers [23]. The population living in these facilities will continue to grow, as the cohort of extreme elderly (aged 85 and older) will be seven times larger in 50 years than in 1980 [16].

Tielsch et al. studied nursing home residents for visual acuity and causes of vision loss. They found that the rate of blindness significantly increased with age, starting at age 40–59, doubling to as much as 28.6% of residents age 90 years and older. The prevalence of poor vision (20/200 blindness, 20/40 to 20/200 visual impairment) was 35.8% using US Social Security definitions for disability. A significant percentage of the subnormal vision was due to refractive error. The rate of

blindness in this study was improved by 20% with adequate refraction, and visual impairment was likewise improved by 37%. It was suggested that poor vision contributed to the cognitive decline and decline in ability to care for themselves that may have led to the need for nursing home placement. The potential to deinstitutionalize this segment of the nursing home population by simple refraction could have a large effect on both local and national systems of care [24].

The societal and system of care benefits of addressing uncorrected refractive error are gaining international recognition as well. Treating subnormal vision from uncorrected refractive errors (URE) is now one of five global initiatives of the World Health Organization (WHO) plan to eliminate blindness. Ferraz studied 7654 subjects in the state of Sao Paulo, Brazil, and found 13.8% had uncorrected refractive error. When corrected, 60.7% of participants originally found to have moderate visual impairment improved to normal vision. Similarly, 15.7% of those classified as severe visual impairment improved to the moderate category, and 18.9% of those considered blind were improved to low vision. They found the greatest benefit in the elderly, ages 60 and older ($p < 0.001$). Overall, they found 24% of patients over age 50 had URE, showing a greater benefit for optimal optical correction for this age group [25].

Case Resolution

The clarity of the fundus examination and the view of the cataracts do not appear to match the patient's manifest refraction. The clinician performs dry retinoscopy and a subsequent refraction that yield an acuity of 20/30 OU. There is a large difference between the patient's current glasses and current refraction. Upon further questioning, the patient states that his own prescription glasses were lost several years ago. His current glasses belonged to his wife, and he uses them as a simple magnifier.

The patient is placed in trial frames for distance and near in the office and is able to comfortably read the print in an office magazine. He navigates in the office setting without difficulty, finding and returning from the bathroom without assistance. He is given a prescription both for a bifocal and for a separate pair of distance glasses for walking. The diabetic nurse subsequently teaches him to draw up his own insulin and to administer his own medication. He initiates a move to a south-facing, ground-floor apartment above his daughter and is successful in living independently. He has returned to wood working and wears his safety glasses.

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Cataracts and Cataract Surgery

Hilary A. Beaver

Case Vignette

An 80-year-old woman is bought in by her son for continuing care of mild nonproliferative diabetic retinopathy, cataracts, and geographic atrophy. She is a well-established patient and is familiar with the physician and the office staff. The ophthalmic technician notes that the patient required more assistance than usual to navigate to the exam chair. The son remarks that his mother had recently moved to an assisted living center. He feels that she is less involved with visually oriented tasks and is more socially withdrawn despite what he considers expanded social and occupational opportunities at the living center. The patient initially denies any problems, but after some discussion admits she has had increasing difficulty watching television and ambulating, particularly on uneven surfaces. She denies being sad or depressed as a cause of her social isolation but states her activities are impacted because her vision seems worse. The patient is apologetic about "complaining" and wary because her own mother had a poor outcome from cataract surgery years previously.

On evaluation, her objective visual acuity is stable at 20/250 and 20/100. Her responses are more hesitant than in her past visits. Her exam reveals progression from 2+ to 3+ nuclear cataracts with stable, moderate geographic atrophy OU and mild nonproliferative diabetic retinopathy OU.

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Patient Care

The patient care domain for cataract surgery includes the election of and timing of surgery, the eye selected for surgery, and the option to pursue cataract extraction in the second eye. The clinician needs effective communication with both the patient and the family to gather the information needed to make the decision for surgical intervention. Good communication defines the patient's needs and wishes as well as their current level of visual function. It is important to evaluate patients based on their functional ability and their desire for improvement, not on their chronologic age. Ageism, the tendency to limit access to care due to chronologic age, may come from the practitioner, the family or caregivers, or the patient themselves. Some elderly attribute their social isolation and declining involvement in activities of daily living (ADL) to age and not to disability or depression and thus may not seek needed medical assistance.

Nestam investigated the outcomes of cataract surgery on three age groups of patients, those under 84 years, 85 to 89 years, and 90 years and older. Patients were questioned on ability to read, watch TV, orient, and perform activities of daily life (ADL), as well as patient satisfaction and visual acuity. The most elderly had the worst vision and were the most dissatisfied preoperatively and had a larger improvement postoperatively though were also still statistically worse and more dissatisfied postoperatively than their younger counterparts. This was felt due to their age-related comorbid conditions. The majority of patients improved vision with surgery and improved in their reading, watching TV, orientation, ADL, and acuity. Age was also not felt to be a limiting factor for recommending surgery as 2/3 of patients 84–89 and 43% of patients aged 90 and over survived to follow-up 4 years postoperatively [1].

In a separate study, Mutoh reviewed cataract surgery in patients over age 90 and compared them to those under age 90. They found systemic disease (81% vs. 57.8%, $p < 0.05$) and senile dementia (14.3% vs. 0%, $p < 0.05$) to be significantly higher in the older age group. 47.6% of the older age group had intraoperative systemic changes (hypertension, restlessness, electrocardiogram abnormalities) compared to 2.2% in the under 90 age group ($p < 0.001$), though surgery was completed in all cases. There was worse preoperative vision in the older group but equal postoperative vision in both groups. There was a significant decrease in endothelial density in the over 90 age group ($p < 0.5$) but not the younger group. The severity of symptoms prompted the decision on two restless patients over 90 to defer surgery on their fellow eyes, as it was felt they could not be surgically controlled and were at significant risk for surgery in their second eye [2].

The current recommendations for the timing of cataract surgery are based on patient's self-reported difficulty with daily activities. Vision loss from cataracts has historically been measured with high-contrast Snellen acuity. Other factors such as contrast sensitivity, depth perception, binocularity, glare, and mesopic acuity have been shown to affect ADL and are currently accepted criteria in the decision to perform cataract extraction [3, 4]. In fact, contrast sensitivity has been proven more sensitive than Snellen acuity in detecting functional visual problems. Multiple

studies show an effect of contrast sensitivity on activities ranging from postural stability to flight simulation [5]. Contrast sensitivity is influenced by many age-related eye disorders. These conditions include not only cataract, glaucoma, and macular degeneration but also spherical aberration induced by age-related lenticular curvature changes [5].

McGwin et al. studied patients aged 55 and older who elected to proceed with cataract surgery and compared them to those who elected observation. Patients completed preoperative and 1-year follow-up questionnaire of the Activities of Daily Vision Scale (ADVS), distance acuity, contrast sensitivity, and disability glare. The follow-up results in the ADVS subscales of the surgery group showed statistically significant improvement when compared with the no-surgery group correcting for initial differences between groups. The surgery group improved 15–21 points, whereas the no-surgery group remained unchanged at 1 year on the ADVS. The primary deficit reported by patients as a reason for surgery was driving [6].

The current recommendations for cataract surgery are therefore not limited by a specific visual acuity. A patient should perceive problems in their visual function or daily activities that are consistent with their cataract. They should be able to physically tolerate the procedure and should want to improve their vision by surgical means. If the patient meets these recommendations, they are a reasonable surgical candidate, independent of their chronologic age or Snellen acuity [3, 4] (Fig. 1).

It is important to document patient's problems with ADL. There are several patient questionnaires designed to determine functional visual disability. The more extensive National Eye Institute Vision Function Questionnaire was abbreviated to

Fig. 1 New technology allows more accurate calculation of intraocular lens power, decreasing the patient's postoperative spectacle dependence. (Optical biometry, in this case the IOLMaster)

a 25-item questionnaire (VFQ-25) that has been extensively studied for cataract and other ocular conditions and is summarized in Table 1. The VFQ-25 is translated into nine other languages, including Japanese, Turkish, and Italian, and also exists as the VFQ-25 plus appendix (VFQ-39) [7, 8]. This questionnaire is a public document, developed by RAND, funded by the NEI, and available without charge to researchers provided the source is cited [8]. The VFQ-25 measures not just visual function on the ADL but also the social and emotional impact that the vision has on the patient's global health. Loss of visual function on the NEI-VFQ has been proven to correlate with dense nuclear sclerotic cataract and also the need for cataract surgery [7]. Interestingly, the scores do not progress statistically with the progression of the density of cataract, suggesting that even milder forms of cataract can significantly interfere with visual functional [9]. The VFQ-25 and scoring instructions are available in English, Spanish, and Greek at http://www.rand.org/health/surveys_tools/vfq/. A separate 19-question survey, the Activities of Daily Living Scale (ADVS), measures difficulty with specific visual tasks and was designed to evaluate cataract surgical candidates [10].

Although cataract surgery is an elective procedure, there are situations in which the physician can preferentially promote surgery over observation. The patient

Table 1 Summary of 25 areas covered by the VFQ-25 [7, 8]

General ratings
Overall health
Eyesight
Concern about eyesight
Experience of periocular discomfort
Troubles caused because of vision
Difficulty with ordinary print
Difficulty with hobbies and near activities
Difficulty finding objects on a crowded shelf
Difficulty reading signs
Difficulty navigating uneven terrain
Difficulty seeing peripheral obstacles
Difficulty reading nonverbal cues in others
Difficulty selecting clothing
Difficulty engaging in social situations
Difficulty going to entertainment events
Effect on frequency and ease of driving
Effect on driving at night, or in weather, traffic, or unknown environments
Difficulty reaching goals because of vision
Difficulty with duration of work or activities
Difficulty with periocular pain or discomfort limiting activities
Influence on likelihood to stay at home
Influence on frequent frustration
Effect on loss of control over activities
Reliance on what others tell patient
Reliance on others for help
Concern will embarrass self or others

should be informed that in some cases there are increased risks inherent to observation. For example, a patient with an unusually narrow anterior chamber angle but with retention of moderately good vision may progress to phacomorphic glaucoma even after peripheral iridotomy. The more narrow the anterior chamber becomes, the more technically challenging the procedure and the higher the likelihood of corneal decompensation. The angle and anterior chamber may continue to narrow with progressive lens growth, and it may become necessary to encourage cataract extraction despite good vision and lack of functional complaints. A similar situation is seen with pseudoexfoliation cataracts. Although the majority of patients with pseudoexfoliation have uncomplicated surgery, there is potential for increased surgical difficulty with increasing lens density and worsening zonular integrity. Although lens extraction remains an elective procedure while the patient is functionally asymptomatic, in symptomatic cases with an undecided patient, the practitioner can discuss the potential for increased future surgical risk with continued observation.

The preoperative surgical discussion includes documentation of the patient's preferred DNR status and their designated Medical Power of Attorney. Both the patient care and the professionalism domains for cataract surgery in the elderly allow the clinician to share their past professional experience and their clinical judgment on the patient's particular situation. Keeping abreast of the scientific literature allows the clinician to better educate the patient and the family on their care options. By recognizing and respecting the limitations of their own surgical experience and abilities, the clinician will provide better medical and surgical care in a more efficient and competent manner.

Preventative care and maintenance of health are important patient care parameters. Involving the patient's family practitioner and anesthesiology preoperatively addresses the unique needs of compromised elderly patients. The family and the residential care facility nursing staff are also part of the perioperative team and can address issues in postoperative compliance with medical treatment and follow-up. These preemptive efforts will coordinate the patient's perioperative medical regimen and recovery and allow a seamless transition of care. Finally, the clinician can consider referring elderly patients with limited vision potential for a postoperative low-vision rehabilitation evaluation in order to maximize the final visual function for the patient's desired activities of daily living. All of these components work in concert to meet the overall goal of patient-centered care.

Medical Knowledge

The literature describing the effects of cataract on ADL in the elderly is compelling. These studies show that the loss of visual function from cataracts negatively affects quality of life measures similar to chronic systemic disease [11]. Early cataracts decrease performance-based visual function, and self-assessed visual function becomes more compromised with age [12]. Increasing age and poor visual function are independently associated with the loss of independence, including the avoidance

of night driving and nursing home placement. Elderly patients with poor vision are more likely to have falls and fractures, suffer from a fear of falling, and need walking aids [13]. Decreased visual function has been shown to decrease visual confidence, socialization, and quality of life indicators [14].

Cataract surgery, however, has been associated with improved mood, anxiety, perceived health, cognition, and neuropsychiatric symptoms. Jeffries et al. studied cognition, mood, and visual hallucinations and confirmed other studies that show mood does not change significantly postoperatively. There was a statistically significant improvement in cognition in patients with preoperative normal and mildly decreased cognition, supporting the cognitive resource theory of freeing neural resources from dealing with visual impairment and allowing these resources to attend to other cognitive tasks. This was not felt to be directly due to acuity, as most of the improvement was found in nonvisual cognitive tasks. There was no improvement, however, in patients with more moderate cognitive impairment. Visual hallucinations resolved in two patients, with some progression in other patients, felt due to delirium and dementia; these changes were not statistically significant [15].

It is important to discuss the benefits of cataract extraction in older patients with visual disabilities. Surgical intervention for cataracts is known to increase visual function and independence. First-eye surgery in patients with bilateral cataracts has been shown to improve visual function (reading, IADL) and to decrease vision-related disability. Patients who improve their reading vision postoperatively also show improvement in their depression scores [16]. With the significant effect of cataract on visual function and the general good results of cataract surgery, cataract extraction has become the most common procedure performed worldwide among the elderly [17–19].

Although the outcomes of cataract surgery are overall favorable, results may vary by technique. Surgical success rates range in clinical studies from 50 to 95% [19, 20], with up to 89% of patients benefiting from improved quality of life [21]. A recent meta-analysis of randomized control trials found a spectacle-corrected visual acuity of 6/9 or better in 91% of individuals undergoing phacoemulsification and in 86% undergoing extracapsular cataract surgery (ECCE). Extracapsular surgery is increasing in developing nations due to a decrease in intracapsular surgery and an increase of manual sutureless small-incision extracapsular cataract surgery (SICS) [22]. One recent prospective, randomized trial showed that phacoemulsification and SICS provide equal immediate and long-term surgical outcomes, though SICS was significantly faster, less expensive, and less dependent on technology [23].

Interpersonal and Communication Skills

The doctor and elderly patient relationship optimally includes the patient's family. The technical office staff are an invaluable resource for useful observations on the patient's visual functional status and general well-being. Because the contribution of cataract to vision loss is incremental and progressive, patients have difficulty differentiating the gradual limitations in ADL due to cataract from those due to other

aspects of aging. As a result, elderly patients may downplay the contribution of cataract and may be slow to pursue an elective surgical correction of their vision. The family may be more objective and are often better able to observe a change in visual function and ADL. These observations include a decrease in the ability to drive, to navigate uneven terrain, to travel to social functions, and to engage in favored activities such as reading, working puzzles, and watching television. The family thus may be the first to report a decline in visual function and is a helpful addition to the patient visit. When present, they can review the physician's recommendations with the patient.

The eye practitioner is uniquely able to evaluate the ocular contribution to an elderly patient's functional decline. The functional effect of vision loss is intertwined with a potential senescent decline in stamina, attention level, mental function, and general interest. There may be a coexistent decrease in cognitive activities due to depression or dementia. The ophthalmic surgeon can consider alternative causes for a loss of visual interest, particularly if the level of vision measured on exam would not prohibit involvement in previously enjoyed visual pursuits. The alternative causes of a decline in activities can be pursued in coordination with the primary practitioner and in some cases with formal neuropsychologic testing. One simple office test for dementia is to have the patient perform a clock drawing or to verbally interpret a complex visual scene [24]. The effect of and diagnosis of cognitive decline is further discussed in the section of this book on depression and dementia.

There is some evidence that cataract surgery can improve cognitive function in some patients and may slow progression of cognitive decline in others. Tamura prospectively studied the effect of cataract surgery on cognition. They found that 60 percent of patients with cognitive impairment increased their Revised Hasegawa Dementia Scale (HDS-R) score by at least 4 points, and this effect persisted with vision-dependent items factored out of testing. Although those with moderate cognitive impairment did not show improvement, they also did not show worsening, suggesting a stabilization of their cognitive impairment. The control group had no improvement, which confirmed that the cognitive improvement after surgery was not due to a learning effect on the postsurgery presentation of the HDS-R [25].

The ophthalmologist's final decision for surgery must weigh the often conflicting reports of visual disability from the patient, from the family, and from other caregivers, as well as from changes in the patient's eye examination.

Professionalism

Cultural, gender, and age-related differences affect the patient's perception of and use of the medical system, including their access to and pursuit of elective ocular procedures. One generational difference is seen in those elderly patients who grew up during World War II and the Great Depression. This elder generation of patients may be reticent about complaining about postoperative pain or accepting pain managment [26]. They may likewise view pursuing a functional ocular limitation as "needless

complaining." These patients have different expectations than the more medically and technically savvy Baby Boomer generation. The elderly may also base their own outcome expectations upon their parent's surgical experiences from years ago and may require additional chair time to dispel these fears. Although finding the additional time for an extended discussion with the reticent or confused elderly is difficult with today's rapid clinic patient turnover, professionalism requires placement of the patient's needs for education before the doctor's needs for efficiency.

Practice-Based Learning and Improvement

The adept clinician will practice self-reflection and constantly improve their own practice by critically reviewing and assimilating relevant material from the medical literature. This includes being aware of the specific population that they serve and applying to that population an understanding of the effect that cataracts have on the elderly locally, nationally, and internationally. It is likewise important to recognize the risk factors for and interventions against the development of cataract and the risks and benefits of cataract surgery in patients with comorbid eye disease.

Cataracts continue to be a leading cause of vision loss from the first world to the third world. A recent review of cataract epidemiology by Abraham shows that cataracts cause 47.8% of the world's 37 million blind, with 82% of cataract blindness occurring in those 50 years and older [20, 22]. Although 90% of those blind from cataracts live in developing nations, cataracts continue to be the leading cause of low vision both in US nursing home patients (37% of white and 54% of African-American subjects) and in other developed countries (78% of low vision in the Netherlands) [20]. The incidence of cataract is rising globally as the population ages. The world estimation of 20 million blind in 2007 is expected to rise to 40 million blind in 2020 [18, 20, 22]. There is therefore great interest in preventing cataracts, as delaying the onset of cataract formation by 10 years could decrease the need for surgery by 50% [20].

There are a number of cataract risk factors that can be modified. Smoking is associated with nuclear sclerosis [NSC] and posterior subcapsular [PSC] cataracts, diabetes with cortical opacities [CO] and PSC, UV light exposure with CO and PSC, and myopia possibly with all types of cataract. Oral corticosteroids are linked to PSC cataracts and to a lesser degree are inhaled steroids [22].

Vision loss from cataracts is also related to gender and age. Women are more likely than men to lose vision from cataracts when age matched, though worldwide surgery is often provided preferentially to men [22]. The incidence of vision loss from cataract is known to increase with advancing age. Postmenopausal hormone changes, genetics, and serum markers of inflammation are all under investigation for their role in cataract formation. Finally, there is conflicting data on the role of antioxidants and cataract formation. Studies of nutritionally deprived populations are currently ongoing [20].

Comorbid eye disease can significantly impact the risks and the benefits of cataract surgery. The clinician can use advances in technology to facilitate access to the medical literature about ongoing studies and techniques to maximize the outcome

in at-risk eyes. This new knowledge will optimally be used to educate not only themselves but also their patients and their ophthalmic colleagues. The physician should draw on their past experience of treating patients with similar comorbid diseases, intertwining this with the literature evaluating cataract surgery in patients with multiple ocular diagnoses. They should use this information to continuously update their surgical and medical practice and council their patients with comorbid disease.

Gray et al. found comorbid eye disease in 39% of British cataract patients, including glaucoma in 14%, age-related macular degeneration in 13%, and diabetic retinopathy in 4% [18]. Naeim et al. showed that cataract extraction was beneficial and cost-effective in 75% of patients who preoperatively were felt to have less than 30% chance of benefiting from surgery. The benefit and cost-effectiveness of cataract surgery in these patients were measured comparable to influenza and pneumococcal vaccination in patients over 65 years of age, lovastatin for cholesterol reduction, and radiation after breast-conserving surgery [19]. A study by Ma et al. evaluated cataract surgery in 60 eyes of 51 patients with advanced age-related macular degeneration (AMD) to see if cataract surgery is still beneficial to vision-related quality of life in these patients. They found a statistically significant improvement in postoperative corrected vision. Vision improved in 56.67%, and the quality of life (QOL) questionnaire improved significantly in 72% of patients. QOL subsets that showed the most improvement were general vision and lighting, mobility (100% of subsets of mobility showed improvement), psychological adjustment, reading, fine work, and activities of daily living. The most improvement in QOL was found in patients with the worst preoperative vision. It was felt that these findings indicated enough of an improvement that these patients with AMD would be able to live independently and care for themselves [27].

The outcomes of these studies overall support the performance of elective cataract surgery in patients with visual limitations, despite the presence of other eye conditions that may limit their expected improvement.

Systems-Based Practice

The national financial costs of cataract surgery in the elderly population are high; the benefits both to the individual and to society are likewise significant. Cataract extraction is the most common surgical procedure performed on patients 85 and older [23]. In the 1990s, 60% of Medicare expenditures was spent on cataract surgery and related care, costing $3.4 billion annually [20, 28]. The economic benefits of cataract surgery outweigh the financial costs of surgery, however. The savings occur in quality of life improvement for the individual as well as in the release of family care duties for relatives of the visually impaired [18, 22]. The demand for cataract surgery thus continues to rise both in the United States and abroad [17, 18, 20].

There is interest in the United States and abroad to determine the cost-effectiveness of second-eye surgery. One-third of all cataracts removed in the United Kingdom and 30–45% of cataract surgeries performed in the United States are second-eye surgeries. Recent recommendations support improved patient outcomes

with rapid, successive surgeries [18, 28]. Second-eye visual impairment causes poor binocular acuity, stereoacuity, and even abnormal motion perception; one cataractous eye can induce binocular inhibition of the visual input from a pseudophakic, rehabilitated first eye. Second-eye surgery dramatically improves both self-assessed visual function and stereoacuity [28], decreases self-assessed visual impairment, and improves not only mobility but also routine daily and leisure activities [17] in levels comparable to first-eye surgery [18]. Current research therefore supports second-eye surgery assuming that the same difficulties with visual function and quality of life indices are met as with first-eye surgery [18, 28].

Finally, there is interest in the effect of cataract surgery on both the mental health function and the physical well-being of elderly patients. Gray et al. reviewed several studies that looked at the effect of cataract surgery in dementia and depression. They found an improvement in the patient's perception of their health and a decrease in anxiety and depression simply from scheduling the patient for cataract surgery. There are improvements in MMSE scores postoperatively in both first- and second-eye surgeries in patients who did not have significantly depressed initial MMSE. Additional studies have showed an improvement in cognition, though others showed no improvement in depressive symptoms [18]. Owsley compared nursing home cataract patients who elected to undergo surgery with those who declined surgery on scales of depression and health-related quality of life. The surgery group had a statistically significant improvement in vision ($p < 0.001$), and the Nursing Home Vision-targeted Health-Related Quality of Life showed an age-corrected improvement in subscales of vision ($p = 0.005$), reading ($p = 0.001$), psychological distress ($p = 0.015$), and social interaction ($p = 0.33$). The VF-14 improved as well ($p = 0.004$), though there was no statistical change in the Medical Outcomes Study Short-Form 36, Geriatric Depression Scale, or Cataract Symptom Score. This showed that acuity, quality of life, and psychosocial factors improved but supported other studies that do not show an improvement in depression [29].

Cataract surgery can likewise affect the physical well-being of the patient. Studies have demonstrated that 25% of patients over 65 years old fall yearly and that visual impairment (by decreased acuity, contrast sensitivity, visual field, PSCC, and nonmiotic glaucoma medication) contributes to falling [14]. First- and second-eye cataract surgeries in elderly patients with cataract-related visual loss have been shown to significantly decrease the postoperative risk of falls. Risk factors that amplified the risk of falling preoperatively were older age, use of more than four medications, and a past fall, though these risk factors were nullified after cataract surgery [14]. Foss et al. hypothesized that earlier second-eye surgery (1 month) would decrease the fall rates compared with the then standard surgical timing of the second eye (1 year). Although this study did not reach enrollment due to changes in second-eye timing policy, there were statistically significant improvements in visual function (acuity, contrast sensitivity, stereopsis), in patient confidence regarding falling, and in existing visual disability [30]. It is unfortunate that despite all the benefits of cataract surgery in the elderly, the access to medical care, insurance status, and ability to speak English still all affect the rate of appropriate cataract surgery in the United States [20].

Case Resolution

The family involvement in this clinical case proves to be very beneficial to the patient. The son accompanies his mother on this visit and provides an accurate and objective assessment of his mother's declining visual function. He reminds his mother of her past interests, leading into a lengthy discussion with the clinician on the option of cataract surgery. The clinician shares their past observations of the outcomes of other patients with similar comorbid ocular conditions, the recommendations of the medical literature, and the anticipated limitations of best corrected vision due to the patient's degree of macular degeneration. She is reassured in the potential visual benefits despite her expected limitation of vision. The clinician reviews the many advances in surgical technique since the patient's mother's procedure, relieving her fears about the surgery and the postoperative care period. The patient defines her goals to be improved contrast sensitivity, ambulation, and brightness. She chooses to try her best eye first, claiming that "the other one isn't worth anything," and becomes very enthusiastic about proceeding rapidly to surgery. The ophthalmologist contacts her primary care physician, arranging for them to maximize her diabetic and hypertensive control preoperatively, and additionally sends preoperative information to the skilled care facility where she lives.

The patient undergoes uncomplicated cataract extraction with lens implantation. She subsequently proclaims that her vision is "100 percent improved" at 20/80, including both improved brightness and increased clarity of vision. Her son interjects that she has spent more time watching television and has become involved with a local coffee group. She elects to proceed with her second eye, feeling it is now relatively "dim and yellow vision" when compared with her pseudophakic eye. The physician discusses the benefits of second-eye surgery and the anticipated improvement in her daily function over unilateral cataract surgery. They arrange for her to see a low-vision consultant postoperatively, as she hopes to acquire a closed circuit low-vision device for use at the living facility.

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Glaucoma in the Elderly

Joanna H. Queen and Hilary A. Beaver

Case Vignette

An 85-year-old Caucasian man presents for evaluation after an increased intraocular pressure was detected at a community screening for glaucoma. He has a past medical history of severe degenerative arthritis in his hands and suffers from stable angina. Though a widower, he lives independently near his family; he has declined previous suggestions to move in with them or to the local retirement center. On examination, the patient has 20/20 visual acuity OU, an increased intraocular pressure (IOP) of 28 mmHg OU, and glaucomatous cupping of 0.9 OU. Both a confrontation visual field and formal perimetry show a superior arcuate glaucomatous defect OU. At that point, his eye doctor begins a one-eyed trial in the right eye (OD) of timolol GFS 0.5% each morning.

On follow-up evaluation, the patient reports perfect compliance. He reports intermittent blurred vision after placing the new medication. He mentions also a baseline intermittent dizziness due to low blood pressures. On

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further questioning, he thinks this may be increased with the new therapy. Although he last placed the timolol at 7:00 AM, his intraocular pressures on examination are unchanged and still elevated as during his initial appointment and are equal OU. After questioning, he confirms lid closure and punctual occlusion for 5 min after each drop.

His daughter is present for the current exam and reports that she has witnessed the patient both remembering to take his medication and instilling the drops. When asked to apply an additional drop in the office, the patient elevates his eyes, positions and squeezes the bottle, closes his eyes, and correctly applies correct punctual occlusion. The patient and his daughter are unaware that the process failed to squeeze a drop out of the bottle and into the eye.

Patient Care

The patient care competency includes the use of preventative care for populations as well as individuals. Treatment and prevention start with diagnosis. We know that the incidence and prevalence of glaucoma increase with advancing age, but because it is often asymptomatic until advanced, the disease can have devastating visual and functional consequences by the time of diagnosis. Glaucoma-related vision loss negatively affects the quality of life and activities of daily living in the elderly, an ever-increasing population in the United States. The elderly are currently increasing at more than twice the rate of the general population; the population over 85 years of age is projected to be 7 times larger in 2050 than it was in 1980. Glaucoma currently affects 2.2% of Americans over age 40 and 7.7% of individuals over age 80. The total number of patients with glaucoma is thus projected to increase by 50% by 2020 [1, 2].

The likelihood of developing glaucoma is affected by race as well as age. Glaucoma is the primary cause of blindness for African-Americans and is three to four times more common than in non-Hispanic whites. This risk is higher still in black patients originating outside of the United States. Other races are increasingly being recognized at increased risk for glaucoma as well. Glaucoma is found in up to 22% of Latinos over age 80 and causes 28.6% of all blindness in the Latin American population. The repercussion to the US population is significant: in the 2010 Census, 50.5 million individuals (16.3% of the population) identified themselves as Latino or Hispanic [2–5].

There is a role for screening at risk populations for eye disease (Fig. 1). Ten percent of the elderly have undiagnosed visual disorders and could benefit from screening. Up to a quarter of patients, over 80 with vision loss are unaware of their disease, including 7% who are blind from their disease [1, 2]. Compounding this problem, elderly patients with decreased vision may overestimate the quality of their vision, decreasing the likelihood that they will seek ophthalmic evaluation and care [6].

Fig. 1 Application of ophthalmic drops to facilitate examination

Institutionalized Americans are at a higher risk, with current estimates showing 26% of nursing home residents to have visual impairments [7]. Although half of glaucoma patients in America are undiagnosed, that number increases as high as 75% in Latin Americans for both open-angle glaucoma and for ocular hypertension [5]. There is potential benefit in screening the general elderly population for common diseases such as glaucoma in order to prevent vision loss and the comorbid conditions that accompany the loss of sight. There is increasing attention to performing this vision screening at sites where the elderly frequent, such as senior living facilities, activity centers, and outpatient clinics. These screenings may be performed by traveling nurses. Tonometry is currently one of the recommended means of glaucoma screening. Tonometry can be accomplished with light and inexpensive equipment performed by minimally trained non-ophthalmic personnel but is still underutilized as a glaucoma screening tool [1]. The benefit of public health screening has been studied and has support in the literature [1, 6], but the effect on the rates of vision-related functional impairment and effect on quality of life has been debated. The US Preventive Services Task Force (USPSTF) literature review (2005) found insufficient evidence to recommend for or against screening adults for glaucoma. The USPSTF found "good evidence that screening can detect increased intraocular pressure (IOP) and early primary open-angle glaucoma (POAG) in adults," and "early treatment of adults with increased IOP detected by screening reduces the number of persons who develop small, visual field defects." They agreed that "early treatment of those with early, asymptomatic POAG decreases the

number of those whose visual field defects progress" but felt that the overall evidence was not sufficient to determine the "extent to which screening – leading to the earlier detection and treatment of people with IOP or POAG – would reduce impairment in vision-related function or quality of life" [8]. This has led to debate, encouraging screening specifically by eye care professionals. In response to the USPSTF paper, the American Academy of Ophthalmology (AAO) produced a response emphasizing the new evidence for screening and the importance of the role of eye care professionals in screening. The summary of the letter is below:

1. *There is, in fact, a clear chain of evidence that connects glaucoma screening by eye care professionals with meaningful preservation of visual function and quality of life, through the reduction of worsening of glaucoma.*
2. *Community glaucoma screening will result in detection of patients with meaningful loss, since most will already have significant visual field loss in excess of − 4 dB.*
3. *Visual field loss at the − 4 dB level has a demonstrable and clinically significant impact on patient visual functioning and vision-related quality of life.*
4. *There is documented cost-effectiveness from the societal perspective in treating this level of visual field loss.*
5. *Glaucoma screening, defined as including an eye examination that detects all other conditions that threaten sight in the elderly and thus will result in significant benefit for older Americans in key indicators as important as IADL's and ADL's* [9] (Fig. 2).

Fig. 2 Confrontation visual field testing

The question of the cost-effectiveness in treating glaucoma is a significant one. The direct economic cost of glaucoma to the United States is $2.86 billion annually for doctor, hospital, and drug treatment fees [2]. This estimate does not address the indirect costs of lost productivity, loss of quality of life, depression, institutionalization, and comorbid injury from falls and accidents. Although the geriatric population is already at risk of falling from comorbid medical conditions, glaucoma adds a significant risk for injury and falls. The loss of peripheral vision, particularly loss in the inferior visual fields, increases the likelihood that a patient will run into objects while walking and increases the need for home modification and environmental analysis training [7]. Haymes et al. found glaucoma patients to have a threefold increase in annual falls and a sixfold increase in motor vehicle accident (MVA) in the preceding 5 years compared to controls. Glaucoma patients who suffered an MVA were sevenfold more likely judged at fault [10]. The Salisbury Eye Evaluation study found visual field loss to be the primary visual indicator of an increased risk of falling [11]. Several studies have shown binocular visual field loss to be associated with a significantly increased risk of motor vehicle accident [11, 12]. Adequate glaucoma treatment, maximal vision correction and rehabilitation, and fall prevention could decrease both the personal and the social costs of glaucoma in our aging population.

Patient-centered care also applies to the individual and should be considered when performing diagnostic testing on the elderly glaucoma patient. Goldmann applanation and formal visual field testing, though gold-standard in glaucoma evaluations, have limited utility in patients unable to position comfortably at a slit lamp or visual field perimeter. In addition to physical limitations, even mild cognitive decline can affect visual field results [13]. Assessing the patient as a whole, including both their physical and cognitive limitations, results in a tailored work-up that is more comfortable to the patient and more revealing of true visual deficits and changes for the physician (Fig. 3).

Fig. 3 Formal Humphrey visual field testing

Medical Knowledge

Glaucoma is a significant visual disorder that affects the gamut from first-world to third-world nations. The World Health Organization projects 80 million people to be affected by glaucoma worldwide by 2020, and a recent Cochrane meta-analysis estimates those numbers will climb to over 110 million by 2040 [14]. The worldwide ratio between open-angle and angle-closure glaucoma is approximately 3:1. Of these patients, most bilateral glaucoma blindness in the world is due to angle closure. The overall incidence of glaucoma begins above age 40 and increases sharply with age [15]. The reach of glaucoma as a major cause of vision impairment extends to first-world nations and accounts for 10% of blindness in the United States. In the United States, one million elderly over the age of 65 have vision loss from glaucoma, and 75% of those legally blind from glaucoma are over the age of 65 [3].

The elderly at risk for glaucoma are also at increased risk of drug toxicity following treatment for glaucoma (Table 1). Although glaucoma medications are primarily applied as topical drops, those drops are adsorbed systemically through the conjunctiva and the nasal mucosa. Drugs administered via the mucosa directly enter the bloodstream without undergoing first pass elimination in the liver. The systemic effective dose of these medications is therefore larger than a similar oral dose. All medications have an increased potential for side effects in the elderly patient. The elderly have a lower muscle-to-fat ratio, less cardiac output, and less effective renal and liver clearance. Older patients have more comorbid medical conditions, including chronic obstructive pulmonary disease (COPD), diabetes, hypertension, cardiac arrhythmias, congestive heart failure, and arthritis that can be adversely affected by the use of topical

Table 1 Side effects of glaucoma medication [3, 16, 18]

Medication	Side-effect profile
Alpha adrenergic agonists	Topical allergy, dry mouth, exacerbation of cardiac disease, headache, sleep or gastrointestinal (GI) disturbance, hypertension, fatigue, interaction with MAO inhibitors, and tricyclic antidepressant agents
Beta-2 adrenergic agonists	Topical allergy, aphakic/pseudophakic macular edema
Beta 1 and 2 antagonists	Hypotension, bradycardia, bronchospasm (less in B-1 selective agents), fatigue/loss of exercise tolerance, exacerbation of underlying cardiac disease, masking of hypoglycemia or thyrotoxicosis, depression, impotence, syncope, headache
Carbonic anhydrase inhibitors	Topical: Local allergy, stinging, oral > topical with metallic taste, GI disturbance, idiopathic aplastic anemia, metabolic acidosis, hypokalemia, paresthesias, anorexia, fatigue, kidney stones, depression, weakness, metabolic acidosis
Osmotic diuretics	Exacerbation of underlying cardiac disease, subarachnoid hemorrhage, rapid diuresis
Parasympathetic cholinergic agents	Miosis causing difficulty with dark adaptation and mesopic conditions, cataract, myopic shift, headache, GI disturbance, diaphoresis, dyspnea, hypotension, arrhythmia, weakness, bronchospasm
Prostaglandin analogues	Topical allergy, iris and eyelid pigmentation, growth of lashes, conjunctival hyperemia, uveitis, macular edema, musculoskeletal pain

glaucoma medication [16]. Alpha agonists, in particular, have been found to cause increased morbidity in the elderly due to their ability to cross the blood-brain barrier and cause sundowning, somnolence, and confusion [16]. The elderly take more systemic drugs with which ophthalmic drugs can interact and have lower serum albumin and other plasma-binding sites, such that there is more competition for binding and more free drugs available. Therefore, elderly patients in particular should be instructed on punctual occlusion and lid closure to minimize systemic adsorption of their topical medication. Oral glaucoma medications pose even greater risk for drug-drug interactions and exacerbation of systemic comorbidities, in particular CNS depression/somnolence and exacerbation of chronic kidney disease. Elderly patients on oral carbonic anhydrase inhibitors could be monitored in partnership with their primary care provider with complete blood count (CBC) and kidney function labs [17].

Because elderly patients with glaucoma frequently have comorbid constitutional diseases such as arthritis, they should be instructed and observed performing the correct instillation of their topical medications. Elderly patients with arthritis in their hands, peripheral neuropathy, or generalized weakness can be asked to demonstrate self-administration of drops with a sample of artificial tears. Although these dropper bottles have different shapes and rigidities, this simple test can give a general confirmation whether the patient is able to self-administer drops.

If there is an observed difficulty with drop instillation, there are a number of options for assisting the patient to better deliver their medication. Difficulty with steady hand positioning can be remedied by purchasing an eye drop guide (a plastic brace that fits around the neck of the bottle and rests on the periorbital skin/orbital rim), many of which are commercially available and inexpensive [19]. Limited neck extension can make placing the eye drop in the inferior fornix difficult. This can be alleviated by having the patient instill their drops lying down (while in bed in the morning and evening is a convenient time for once or twice daily dosed drops) with the neck of the bottle resting on the bridge of the nose and the nozzle over the desired eye. Another benefit of this method is that the patient can close their eyes while administering drops; gravity brings the drop to the medial canthus, the most dependent area of the supine periorbita.

Even with good technique for drop instillation, there remains a large issue with daily compliance [20]. Keeping the bottle near something the patient does every day at the same time (e.g., toothbrush, television remote control) helps with compliance. If the patient takes multiple IOP-lowering drops, it is helpful to provide the patient with a printed grid. The drop name and cap color are written in large letters along one axis and the time to take the drop along the other axis (Table 2). The patient moves the dropper bottle across the grid as they take their drops, visualizing the doses taken and when to take them next. In patients taking more than one eye drop, it can be helpful to mention cap color in addition to medication name, as this is a common way patients identify drops [21].

Elderly patients are also at higher risk for complications after glaucoma surgery including suprachoroidal hemorrhage [23]. As such, a thorough discussion of risks and benefits of any surgical intervention is necessary. It is important to have this discussion with the patient as well as their family or support system given the increased

Table 2 Eye drop medication class by cap color [22]

Medication	Side-effect profile
Adrenergic agonist combinations	Light green
Adrenergic agonists	Purple
Anti-infectives	Tan
Anti-inflammatory, nonsteroidal	Gray
Anti-inflammatory, steroids	Pink
Anti-inflammatory, immunomodulators	Olive green
Beta-blocker combinations	Dark blue
Beta-blocker	Yellow
Beta-blocker (pediatric dose)	Light blue
Carbonic anhydrase inhibitors	Orange
Cytotoxic	Black
Miotics	Dark green
Mydriatics and cycloplegics	Red
Prostaglandin analogues	Teal

assistance that is required after glaucoma surgery. Transportation to frequent postoperative clinic appointments, increased drop usage, and blurred vision perioperatively can have profound quality-of-life consequences, particularly if the surgical eye is the patient's better or only eye. It is to the patient's and physician's benefit to plan for these changes ahead of the surgical date to allow for adequate patient assistance.

Interpersonal and Communication Skills

Good communication skills are essential when interacting with the elderly but in particular the older patient with glaucoma. This includes awareness of and recognition of the unique social, economic, physical, and mental needs of elderly patients with glaucoma. For example, a frank discussion of financial resources available for medication might be needed in an elderly patient on a fixed income. The financial hardship created by an expensive branded medication might be sufficient grounds to select a less expensive or generic alternative. The clinician should consider asking the older patient specifically if they prefer generic medication over brand name therapy. In addition, elderly patients are often already dosing systemic medications throughout the day and may prefer a topical drug with multiple dosing to paying additional money for a slow-release, single-use medication. Although patients may talk freely about this aspect of care when the subject is raised by the practitioner, they may be unwilling to broach the subject themselves.

Family members may be able to provide additional valuable information that impacts compliance. They may accompany an elderly patient to their appointments and can be consulted as to the patient's compliance with medication, side effects from medication, and coexistent medical conditions. Some family communication may be nonverbal, and it may be quite helpful to keep them visible while taking a history from the patient. A family member grimacing and shaking their head may be a more helpful indicator of compliance than the patient's verbal pronouncement and can at least raise the question for discussion with the patient about their ability to independently dose their own medication.

The clinician should strive to put the patient at ease. Allowing the patient to share sometimes difficult personal information can have vast implications on compliance and care. A patient who is unable to recall their care plan or to comply with their medication may be unwilling to state this due to the implications on self-reliance, self-sufficiency, and the need for institutional care. It may be difficult to discover a difficulty with medication, as patients with dementia may retain their interpersonal and communication skills far into their disease. A clinician viewed as hurried or uninterested will also not gain the patient's confidence. The patient and their family read nonverbal cues as well as the clinician. Sitting during the interview instead of standing, maintaining good eye contact, and giving the patient ample time to answer a given question will improve communication with the patient. Asking a patient to list the medication they are taking and the dosing of that medicine may be much more informative than asking them to confirm medicines read from the chart. In this age of declining reimbursements leading to more rapid patient encounters, it is increasingly important to remember the communication competency when dealing with the elderly patient.

Professionalism

Aspects of physician professionalism can affect both the eye care and overall health care of the glaucoma patient. The healthcare provider should recognize and respect the elderly patient's need for independence and show compassion and empathy for the psychosocial aspects of the disease, including fears of blindness and dependency. Although it is important to confirm medical compliance, it is also important to respect patient's autonomy and independence. The clinician in this setting may have to spend more time with the elderly patient with glaucoma to address any social or non-ocular but age-related impediments to care. These adjustments allow the patient to retain dignity through self-reliance, independence, and autonomy but allow the option of adding additional assistance from visiting family members or from home health services.

The professionalism competency also includes ethics and the withholding of medical care. An example of such a choice is seen in the decision to either proceed with surgery or to continue with suboptimal medical management in a poorly controlled, elderly glaucoma patient. Although advanced age and comorbid medical conditions will impact patient care, the decision to treat aggressively or not should be made in discussion with the patient, and if they are not able to make the decision independently, then the discussion should include their family members or other caregivers. The withholding of medical or surgical care based on chronologic age alone is not appropriate and is a form of "ageism." A healthy, spry, independent living 90-year-old may in fact be a better candidate for aggressive treatment than a frail, incapacitated, institutionalized, or terminally ill 70-year-old patient. It is better to outline the benefits and risks of the medical and surgical options, including the effect of advanced age on surgical outcome, and allow the patient to decide on their course of treatment.

Table 3 Top questions to ask your elderly glaucoma patient

1. Do you have asthma, emphysema, or chronic bronchitis?
2. Do you have heart disease, rhythm problems, or heart failure?
3. Do you have hypertension or hypotension? Do you take a beta-blocker?
4. Can you walk up a flight of stairs without stopping for breath?
5. Are you diabetic? Do you get hypoglycemic?
6. Would it bother you if your eyes changed color?
7. Have you ever had inflammation in the eye (uveitis) or macular swelling?
8. Have you had complicated cataract surgery?
9. Are you on antidepressants of any kind?
10. Do you have any allergies to medicines, particularly eye drops? If so, what was the allergy?
11. Are you able to give yourself medication, specifically eye drops?

Practice-Based Learning and Improvement

There is overlap between the practice-based learning and improvement and with the medical knowledge competencies. The clinician should stay abreast of new medical practices and apply these best practices to their own patient care. This would include being facile with the new medicines available for glaucoma and the new surgical options for treating the disease. Most new medications have a limited number of recognized toxicities and contraindications outlined at the time of FDA approval. More of these toxicities become defined with case reports or FDA updates in the months to years after a drug is approved. The clinician should stay abreast of the literature and new drug information and apply this information to the different patient populations with whom they interact (Table 3). In our scenario, this would include recognition of the special pharmacokinetics in the elderly population. Although there may not be specific contraindications in glaucoma drug therapy simply by age, the clinician should be cognizant of the interaction of comorbid disease and medication toxicity frequently encountered in the elderly [24].

Systems-Based Practice

The system of care includes all facilities and individuals that a patient will encounter during the course of their therapy. In this case, the system of care includes the patient, the clinician, the family caregivers, and the skilled home healthcare providers that were refused by the patient. In addition, the local system of care includes the pharmacy where the patient obtains their medication, the primary care practitioner managing their hypertension, and the local hospital and emergency department. The macro system of care includes the pharmaceutical company and industries that make their medication, the insurance agent and company (in this case Medicare and the federal government), any cost-containment policies of these third-party payers, and the health policies of the county, state, and federal government. The clinician should be aware of how their own provision of care is influenced by the other components

of the system of care and how to employ those other components to the best advantage of the patient. The clinician should work within their system to provide the best quality care with the most optimal use of the limited resources of the system.

Case Resolution

In this case, observing the patient self-administer drops and improving his technique and compliance were the most important parts of the encounter. The clinician discussed with the patient and family the failure of proper drop application and the option of home healthcare assistance. The patient was adamant about his ability both to remember and to instill his own medications and declined attempts to arrange home health care. The clinician however brokered an agreement to allow the daughter to assist in her father's care. The daughter lives near to her father and has come to all of his appointments and thus gains her father's consent to witness the daily instillation of drops. The daughter works during the day and so cannot come in late morning, and the patient is "not a morning person," staying up at night and waking after 9:00 AM.

In this case, the clinician changed the medication to a single evening dosing of a prostaglandin analogue. Nighttime dosing of prostaglandins coordinates the schedules of the caregiver and the patient with the optimal dosing for the drug in question. The selection of a prostaglandin lessens the likelihood of postural hypotension in this chronically hypotensive patient, not only decreasing the risk of falls but also lessening the likelihood of inducing nocturnal hypotension and potential side effects such as anterior ischemic optic neuropathy. The solution format of the prostaglandin was preferable in this case as well. Gel-forming solutions can temporarily blur vision and contribute to a fall. Gels are also more difficult to squeeze from a bottle in patients with arthritis or weak finger strength.

Having reviewed the risks and benefits of the new medication and the alternatives to treatment, he is given a written prescription and a follow-up appointment for IOP evaluation in 6 weeks' time. The patient and daughter are instructed to see his primary care physician for evaluation of his dizziness and for a fall prevention assessment.

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Diabetic Retinopathy and Its Management

Charles C. Wykoff

Case Vignette

A 70-year-old man notes progressive problems with reading the newspaper and seeing signs while driving over the past year. His most recent examination with a comprehensive ophthalmologist was approximately 3 years ago when he was told he had some evidence of "diabetes" in his eyes. He also has a past medical history of diabetes for which he is taking an oral hypoglycemic agent and a history of hypertension for which he is taking two medications, but he cannot recall what the medications are and did not bring them to his examination. He is not aware what his hemoglobin A1C level is, but his reply to this question was that he might have "a little anemia."

On evaluation, his visual acuity was 20/50 in his right eye and 20/60 in his left eye with his glasses. A manifest refraction revealed no change to his current prescription and did not result in any better visual acuity measurement. The pupils reacted normally to light, and intraocular pressures were 19 and 18 mmHg in the right and left eyes, respectively. The slit-lamp examination showed no iris neovascularization in either eye although there was some nuclear and cortical opacity in the right eye and nuclear opacity in the left eye which did not appear to account for any decrease in visual acuity. Dilated

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ophthalmoscopic examination of the right eye showed more than 20 dot and blot hemorrhages in one field both nasal to the optic nerve and temporal to the macula. There were a few nerve fiber layer infarcts, also referred to as cotton-wool spots (CWS), but no evidence of neovascularization of the optic nerve head or elsewhere. The distance between the surface of the retina and the retinal pigment epithelium in the center of the macula appeared thickened, with microaneurysms and lipid within the central macula (Fig. 1a). Dilated ophthalmoscopic examination of the left eye also showed more than 20 dot and blot hemorrhages in one field temporal to the macula, but no evidence of neovascularization of the optic nerve head or elsewhere. As in the right eye, the center of the macula appeared thickened with microaneurysms and lipid within the central macula (Fig. 2a).

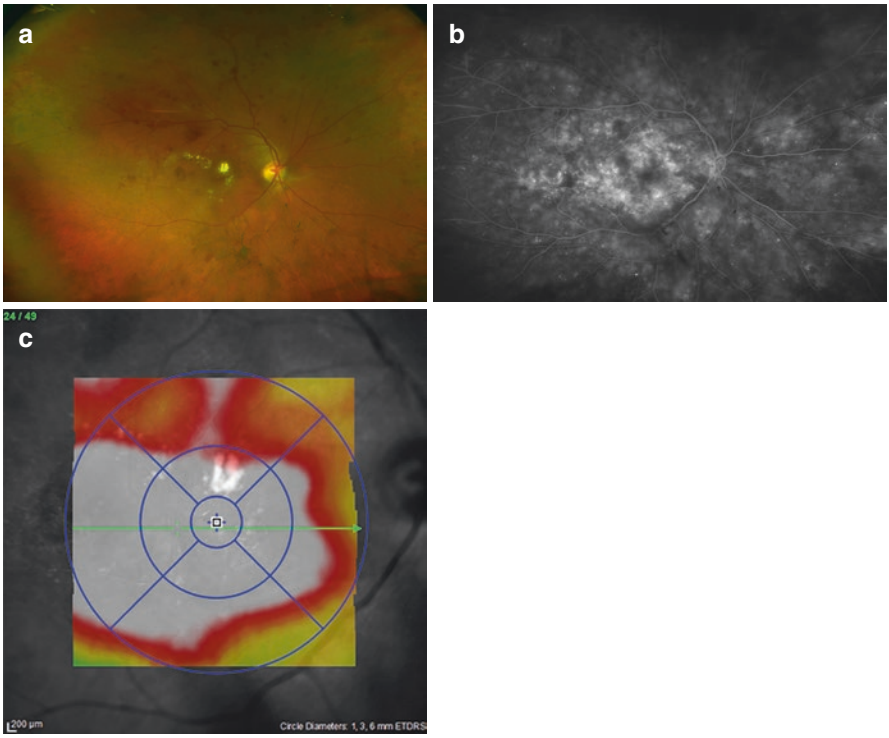

Fig. 1 Right eye with nonproliferative diabetic retinopathy and diabetic macular edema. (**a**) Fundus photograph showing intraretinal hemorrhages throughout the retina and prominent hard exudates within the macula. (**b**) Wide-field fluorescein angiogram showing multifocal nonperfusion and extensive leakage throughout the macula and mid-peripheral retina due to diffuse breakdown of the blood-retinal barrier. (**c**) Spectral domain optical coherence tomography topographical map showing severe retinal edema involving the entire macula. (**d**) Spectral domain optical coherence tomography line scan through the fovea showing severe macular edema with both subretinal and intraretinal fluid

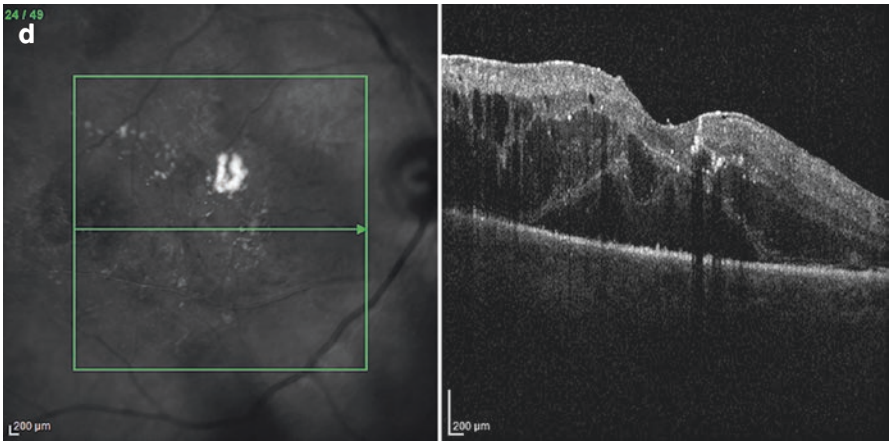

Fig. 1 (continued)

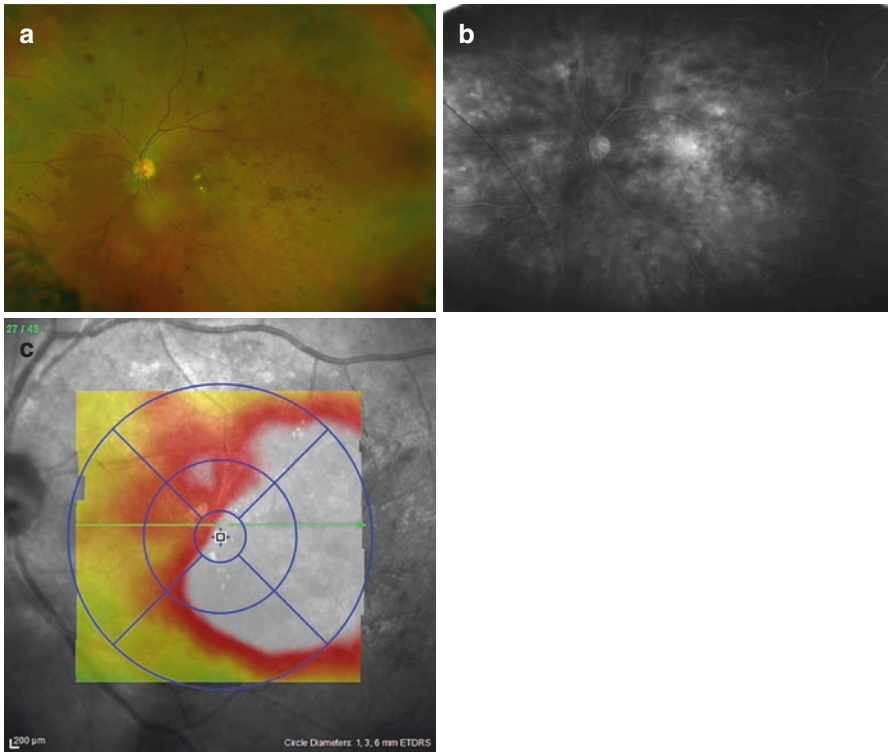

Fig. 2 Left eye with nonproliferative diabetic retinopathy and diabetic macular edema. (**a**) Fundus photograph showing intraretinal hemorrhages throughout the retina and multifocal hard exudates within the macula. (**b**) Wide-field fluorescein angiogram showing multifocal nonperfusion and extensive leakage throughout the macula and mid-peripheral retina due to diffuse breakdown of the blood-retinal barrier. (**c**) Spectral domain optical coherence tomography topographical map showing severe retinal edema involving the central and temporal macula. (**d**) Spectral domain optical coherence tomography line scan showing macular edema with a small locus of subretinal fluid and severe intraretinal fluid

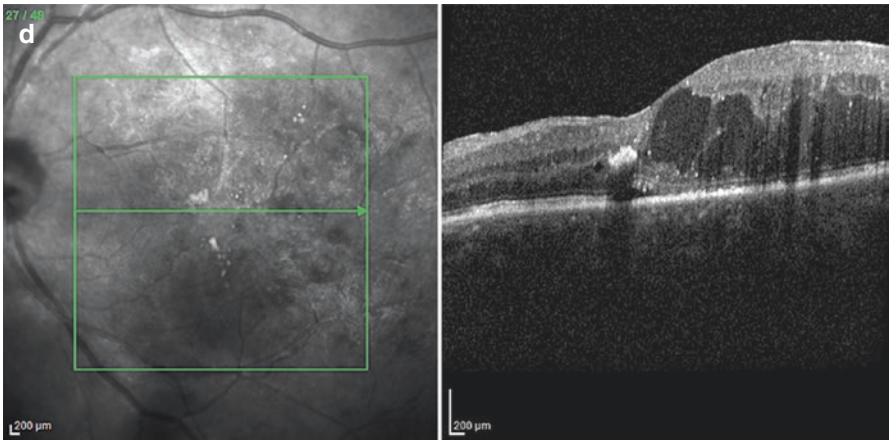

Fig. 2 (continued)

Systems-Based Practice

This vignette provides an example of many of the challenges of managing diabetic retinopathy (DR) in older people. DR is a common cause of vision loss in people over age 50 in the United States. Before getting to the management of the patient's retina problems from a medical knowledge competency standpoint, it is important for the comprehensive ophthalmologist to realize that he or she represents a part of an entire team of healthcare providers (including nurses, technicians, the primary care physician, the endocrinologist, podiatrist, social worker, the family) who must work together with a patient who has diabetes in the management of diabetic retinopathy. Coordination of care, patient and family teaching, and insuring glucose monitoring and control require a system-wide effort that includes of course the treating ophthalmologist.

Interpersonal and Communication Skills: Professionalism

Related to this important interaction, the treating ophthalmologist is encouraged to communicate with other providers of care for the patient's diabetes. Such communication might have reduced the chance for a gap in this patient's continued eye care. The patient had not had a dilated fundus examination from an ophthalmologist in over 3 years, even though the patient reports having had some level of DR identified at that last exam. Even if only mild, nonproliferative DR with no macular edema was noted, the patient should have had at least an annual examination to watch for progression of retinopathy for which treatment might be indicated to reduce the risk of vision loss. The recommended frequency of follow-up visits for patients with diabetes is dependent on their level of DR and well published [1]. There may be an

increased difficulty for some older people to get to even one physician, because of multiple medical problems. This problem can be compounded for the older person with diabetes, where frequent examinations with many specialists might be necessary, including, for example, a primary care provider, an endocrinologist, an ophthalmologist, a podiatrist, a cardiologist, and renal specialist.

Also of note in this patient is the potential confusion of the older patient with diabetes to be aware of which medications he or she is taking, since some of these may have an impact on the ophthalmic care, for example, on choice of ocular antihypertensive medications. Some patients should be encouraged to actually bring their medications to the examination for accurate recording or at least a carefully developed list.

Furthermore, this case highlights the difficulties with understanding the concept of hemoglobin A1C [2]. First, this patient apparently confused the term "hemoglobin A1C" with hemoglobin and the concept of anemia. Second, although the hemoglobin A1C is a convenient laboratory value to judge control of diabetes, which is critical to reducing the chance of both development of and progression of DR [3, 4], this patient may not understand the concept.

Also, this patient may not realize that the progressive vision loss is not from cataract or an incorrect spectacle correction. The physical examination indicates that his cataracts can be seen with a slit-lamp biomicroscope but are not judged to be the cause of his recent vision loss. Older patients often may believe that vision loss is an inevitable symptom of aging rather than ascribing a specific diagnosis, such as diabetes, as the cause of visual impairment. While vision loss may become more common with age, older patients should realize that aging, in and of itself, is not a cause of vision loss. Rather, specific diagnoses including DR may become more prevalent with older age and are potential reasons for vision loss. Older patients should not just accept vision loss as an inevitable sign of aging but should pursue with an ophthalmologist what the cause of vision loss is, especially since most incidents of vision loss in older people can be treated. This is especially true for all older patients with diabetes to understand, even at a time when diabetes has been diagnosed but there is no DR.

The patient also may not realize that features of DR such as macular edema can cause vision loss and may be present before any vision loss has occurred. The patient may also not understand that vision loss may be prevented in such cases if focal/grid photocoagulation is initiated when the center of the macula is thickened or when edema appears to be encroaching on the center of the macula [5].

Management of Diabetic Retinopathy in Older People: Medical Knowledge and Patient Care

DR is the fifth leading cause of blindness around the world and is rising in prevalence [6, 7]. According to the first World Health Organization Global Report on Diabetes in 2016, approximately 8.5% of adults have diabetes mellitus or 1 in 12 adults on the planet [8]. Largely mediated through progressive retinal vascular

damage and subsequent local ischemia, DR leads to visual loss primarily through diabetic macular edema (DME) and proliferative DR (PDR).

Therefore, the management of DR in any age group includes the management of two processes: (1) DME and (2) level of retinopathy.

Management of DME

Macular edema represents a thickening of the retina due to intercellular and occasionally subretinal accumulation of edema. Presumably, loss of pericytes and capillary nonperfusion due to elevated blood sugar levels can lead to increased retinal vascular permeability and concomitant development of vascular abnormalities including microaneurysms and retinal telangiectasis. These changes allow intercellular fluid to accumulate, most easily within the outer plexiform retina, then throughout the retina, and even into the subretinal space. The edema is recognized clinically as an increased distance of the surface of the retina from the retinal pigment epithelium or by documentation of this thickening on OCT imaging and/or fluorescein leakage by angiography (Figs. 1b–d and 2b–d).

The management of DME includes counseling to maintain blood glucose levels as near to normal levels as is possible in collaboration with the patient's primary care team. This should be balanced by the risks of treatment to achieve these levels and helps the patient recognize that managing their cardiovascular risk factors impacts the maintenance of vision. Communication with the patient's primary care provider, endocrinologist, or whoever is specifically managing the diabetes care is essential. Diabetes can involve many specialists, and the coordination of this care can be challenging for any patient. For the older patient, this coordination can be even more challenging as additional comorbidities unrelated to diabetes are often present. Attention to blood pressure and lipid control should be performed for any patient, but a patient with diabetes can be reminded by the ophthalmologist that maintaining care of blood pressure and lipids is associated with less DR and vision loss.

The initial workup for a patient suspected of having DME include any onset of metamorphopsia presumed from DME or central scotoma potentially from macular capillary nonperfusion. Ocular history regarding past laser treatments and past pharmacologic treatments including intravitreal injections and surgeries should be elicited, along with kidney disease (which can exacerbate edema) and use of drugs that might be associated with edema.

Practice-Based Learning

The ophthalmological examination, as described in the AAO's Preferred Practice Pattern for Diabetic Retinopathy, should include an evaluation of visual acuity along with stereoscopic biomicroscopic examination of the macula and, if macular edema is suspected, OCT (Fig. 3). Fundus photography and fluorescein angiography might also be obtained, and wide-field imaging using both of these modalities

Fig. 3 Optical coherence tomography (OCT) allows evaluation for macular edema for baseline examination and progress of the disease to guide treatment

may also be considered. OCT could provide objective quantification of the edema for comparison to future visits (Figs. 1 and 2). Wide-field fundus photography may be valuable to document baseline DR severity level, particularly as the location of DR lesions in a predominately peripheral pattern is a strong predictive examination finding correlating with more rapid progression of DR [9]. Fluorescein angiography, especially wide-field imaging, can inform the clinician on the burden of retinal nonperfusion and may identify subtle areas of neovascularization not evident during careful clinical examination. Furthermore, in select cases, angiography may facilitate placement of laser treatment (Fig. 4).

For decades, laser-based modalities were the cornerstone of management for both DME and PDR. Clinically, there are three types of DME: non-center-involving DME, center-involved DME with reduced central vision, and center-involved DME with preserved central vision. In the case of a preserved foveal contour with non-center-involving DME, the clinician may consider observation, macular laser treatment, or pharmacologic therapy. Macular laser for DME can reduce the risk of progressive visual loss by about 50% [10]. Specifically, the Early Treatment Diabetic Retinopathy Study (ETDRS) demonstrated that appropriately applied macular laser can reduce the risk of at least moderate vision loss from 30% without treatment to 15% with treatment when the center of the retina is edematous or threatened to become edematous. Most of the cases enrolled in the ETDRS had visual acuity better than a Snellen equivalent of 20/40. Despite its potential value, however, conventional laser treatment of the macula has limitations and possible untoward effects. For example, macular laser for DME has proven ineffective at substantially improving mean visual acuity [11, 12].

For patients with center-involved DME with reduced vision, in place of laser-based modalities, pharmacologic management is typically utilized, with the use of

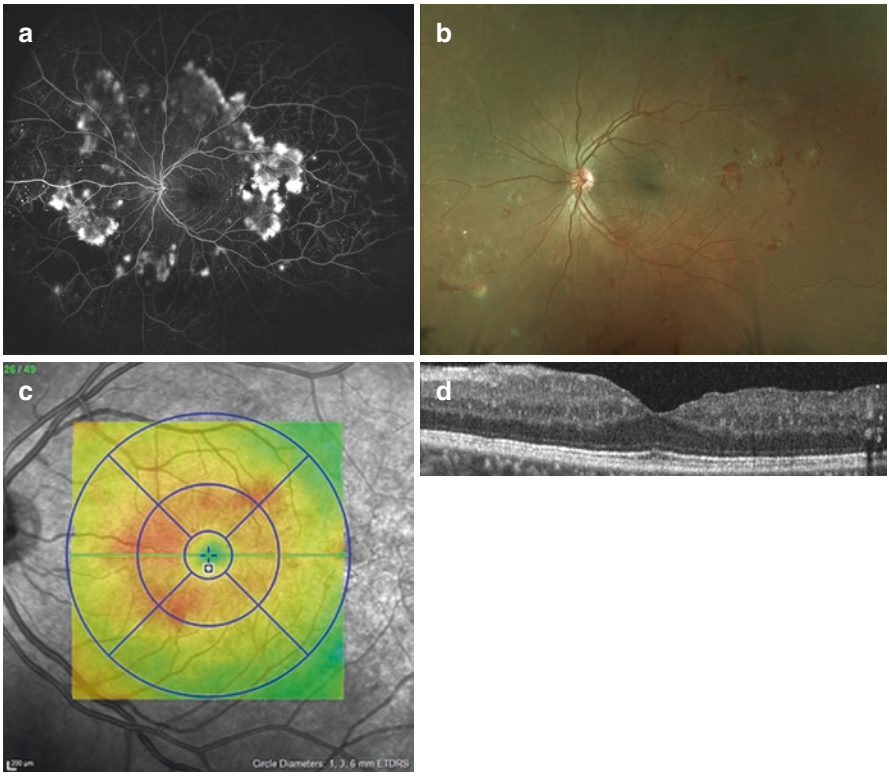

Fig. 4 Left eye with proliferative diabetic retinopathy. (**a**) Wide-field fluorescein angiogram showing extensive peripheral nonperfusion and extensive leakage due to neovascularization. (**b**) Corresponding fundus photograph showing intraretinal hemorrhages, cotton-wool spots, and preretinal neovascularization. (**c**) Spectral domain optical coherence tomography topographical map showing mild retinal edema across macula. (**d**) Spectral domain optical coherence tomography topographical line scan through fovea showing mild temporal macular edema with preservation of the foveal contour

two families of intravitreally administered medications: anti-vascular endothelial growth factor (VEGF)-specific agents and corticosteroids. Randomized, controlled trials have demonstrated that pharmacologic blockage of VEGF with the FDA-approved agents aflibercept (Eylea, Regeneron) and ranibizumab (Lucentis, Genentech), as well as FDA-off label bevacizumab (Avastin, Genentech), can be remarkably effective for the treatment of DME [12–14]. Similarly, the FDA-approved dexamethasone (Ozurdex, Allergan) and fluocinolone acetonide (Iluvien, Alimera) intravitreal corticosteroid implants have demonstrated efficacy in the treatment of DME [15, 16]. Phase III trial data using the anti-VEGF agents found that among eyes with baseline VA of 20/40 or worse, average VA increases by over 10 letters or 2 lines of vision through 1 and 2 years of regular, repeated dosing. Furthermore, longer-term follow-up analyses through 5 years of anti-VEGF dosing

suggest that a substantial proportion of patients may not require indefinite repeated intravitreal injections to manage their DME [17–19].

For patients with center-involved DME with preserved vision, the optimal treatment approach is still being defined by ongoing prospective trials. However, overall data indicates that earlier pharmacologic treatment with intravitreal anti-VEGF dosing leads to optimal outcomes compared to delayed treatment [20, 21]. Therefore, in many circumstances, such eyes are managed with pharmacologic intravitreal therapy.

Management of the Level of Diabetic Retinopathy

Regardless of whether DME is present, the ophthalmologist also must determine the level of DR. DR severity is quantified using features identified on examination, and eyes can be designated to a specific category on the Early Treatment Diabetic Retinopathy Study (ETDRS) DR severity scale (DRSS). There are 12 distinct steps within the DRSS: levels 20 and below represent no DR or questionable DR; levels 35 and 43 represent mild and moderate nonproliferative DR; levels 47 and 53 represent moderately severe and severe nonproliferative DR; and levels 60 through 85 represent PDR. If severe nonproliferative DR is noted (any of the following: (1) four or five fields of severe microaneurysms, (2) at least two fields of definite venous beading, or (3) at least one field of moderate IRMA), then careful follow-up is warranted because of a relatively high risk of progressing to proliferative diabetic retinopathy (PDR). Less than severe nonproliferative DR also requires careful follow-up from once a year, to twice a year, to three times a year, depending on the history, findings, and status of DME [22].

A patient's level of DR severity can be a powerful clinical tool. First, as DRSS step worsens, even among nonproliferative DR stages without DME, health-related quality of life progressively declines. Specifically, there appears to be a significant negative inflection point before the development of PDR in patients' quality of life; a DRSS level as early as moderate nonproliferative DR (levels 43) may represent a threshold beyond which progressive decline in quality of life measures is observed [23]. Another valuable insight from the DRSS is its predictive value both of future disease progression and visual loss as the prevalence of DME and the risk of progression to PDR both increase as DRSS step progresses. Progression to PDR within 1 year is anticipated in 52% of patients with severe nonproliferative DR (DRSS 53), increasing to 80% by 3 years [24]. Correlating with this, two-step or more worsening of DR severity is associated with an increased risk of vision loss.

If an eye has PDR, consideration must be given to ocular-specific intervention. Definitively, if an eye has high-risk PDR (defined as the presence of three out of four clinical findings: (1) new vessels, (2) new vessels on the optic disc (NVD), (3) severity of new vessels [either NVD greater than about a third of the area of the optic nerve or new vessels elsewhere, NVE, greater than about a half disc area], and (4) preretinal or vitreous hemorrhage), treatment is indicated. However, even eyes with PDR that is not yet classified as high risk are typically treated clinically. Traditionally, the treatment for PDR has been pan-retinal photocoagulation (PRP);

indeed, PRP remains a cornerstone of DR treatment as PRP can dramatically reduce the risk of severe visual loss [25]. Nevertheless, PRP can cause undesirable effects, potentially leading to peripheral visual field defects, night vision loss, and loss of contrast sensitivity [26]. Furthermore, PRP itself can be incompletely effective in some eyes, with supplemental PRP required in 45% of eyes and subsequent need for vitrectomy in at least 5% [26, 27]. Just as pharmacotherapy has largely replaced laser therapy for the management of DME, so has pharmacologic therapy proven valuable in the management of PDR [26]. In many cases, a combination of PRP and pharmacologic therapy may be indicated.

If vitreous hemorrhage occurs, either prior to or after PRP, vitrectomy might be indicated, especially if there is a clinically significant tractional retinal detachment from PDR (using ultrasonography if the hemorrhage precludes evaluation of the macula). Vitrectomy also might be indicated if vitreous hemorrhage does not clear promptly (Fig. 5).

Even in the absence of PDR, pharmacologic treatments are often utilized in the management of DR. Specifically, the phase 3 DME trials employing ranibizumab, aflibercept, and fluocinolone acetonide demonstrated impressive alteration of the anticipated natural history of progressive DR that worsens over time. First, anti-VEGF therapy and corticosteroids have been shown to significantly blunt the progression of nonproliferative DR to PDR [28, 29]. For example, PDR events were reduced at the 2-year primary endpoint in the RISE/RIDE phase 3 trials from approximately 34% with sham treatment to approximately 11% with monthly ranibizumab injections [28]. Second, in addition to slowing progression of DR, anti-VEGF therapy can actually improve DR severity in a substantial proportion of eyes, with approximately 1/3 of anti-VEGF treated eyes demonstrating such improvements through 2 years of regular, repeated intravitreal dosing [28, 30]. Third and possibly most fundamentally, VEGF blockade appears to have a significant impact on the underlying retinal vasculature itself, slowing progressive capillary loss. For

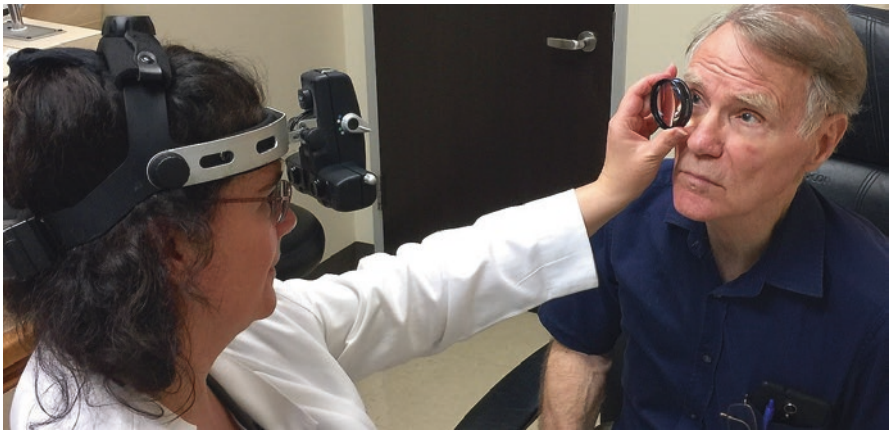

Fig. 5 Evaluation of the retina with indirect ophthalmoscopy

example in RISE/RIDE, analysis of fluorescein angiograms from eyes with no baseline retinal nonperfusion found that the development of retinal nonperfusion was significantly reduced at 2 years from approximately 30% with sham treatment to <10% with monthly ranibizumab dosing; similarly, sham-treated eyes demonstrated a faster rate of increasing nonperfusion compared to ranibizumab treated eyes [31].

Case Resolution

Our patient underwent wide-field fundus photographs of each eye, which documented moderate nonproliferative DR, warranting follow-up to monitor for the possibility of either eye approaching high-risk PDR for which treatment with either PRP or pharmacotherapy would be indicated. In addition, OCT was obtained to document the extent of central subfield thickening in each eye. There was confirmation of center-involved DME in each eye. The patient was asked if his family wanted to join him for a discussion of the management of his condition since much information needed to be relayed. Furthermore, it was offered to send this information to his primary care provider or provider of his diabetes care or both, with a copy to the patient to share with any of his other healthcare providers, since the management might be relevant to a large number of providers in a patient with diabetes.

He was told that intravitreal pharmacotherapy initiated with anti-VEGF injections has a high probability of improving his DME and optimizing his visual function. Treatment was initiated in both eyes, and the patient and family were counseled regarding the risks and benefit of the various intravitreal injection options.

Once the management of the DME was discussed, attention was given to the management of the level of retinopathy. Because of the volume of information, this discussion, which is not urgent, might be reserved for an upcoming follow-up in conjunction with subsequent visits for managing the diabetic macular edema in each eye. He should be aware of the need to monitor each eye for progression to PDR and consider treatment if PDR is noted to reduce the chance of severe vision loss. He should be counseled that such progression to PDR is much less likely to occur in the context of ongoing anti-VEGF or corticosteroid intravitreal therapy. He should be reminded that development of PDR usually first develops in the absence of visual symptoms, so that the patient should not wait for visual symptoms before returning for follow-up.

He should also be advised that optimal control of his cardiovascular risk factors is critically important. Finally, he should be aware that intensive management of DME and level of DR does not remove his need to continue his comprehensive eye care. The challenge in the care of the older patient with diabetic retinopathy is to add this management to his comprehensive eye care and his extensive comprehensive medical care as a result of his diabetes and the comorbidities associated with aging.

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Age-Related Macular Degeneration: Clinical Management

Charles C. Wykoff

Case Vignette

A 75-year-old woman reports progressive difficulty with reading and walking down steps over the past 12 months. She notices her symptoms especially in dim light and after transitioning from a well-lighted area to a darker area. She believed that her progressive visual difficulty was either because her glasses needed changing or her cataracts were worsening or she was just losing vision due to age. During her last comprehensive eye examination about 2 years ago, she was diagnosed with age-appropriate cataracts and also was told she had signs of dry macular degeneration. She was anxious with this latter diagnosis, but her doctor counseled her that there were steps she could take to minimize the risk of progression to advanced macular degeneration. Her doctor told her to stop smoking and to consider taking a dietary supplement. She bought a multivitamin over the counter that was marketed as good for "eye health."

On evaluation, her visual acuity was 20/25 in the right eye and 20/50 in the left eye with her glasses. A refraction revealed no change to her current prescription and did not result in any better visual acuity measurement. Her pupils reacted normally, and her intraocular pressures were 15 and 17 mmHg in the right and left eyes, respectively. Slit-lamp examination showed moderate nuclear sclerotic changes, which did not appear to account for any decrease in visual acuity. Dilated ophthalmoscopic examination of her right eye revealed numerous intermediate, soft drusen, with one large drusen

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having a diameter larger than 125 microns (greater in diameter than a retinal vein width where it crosses the optic nerve head) (Fig. 1a, b). Dilated ophthalmoscopic examination of the left eye revealed a similar pattern of drusen; in addition, there was geographic atrophy, as well as a thickening of the central retina with loss of the normal foveal contour and an area of subretinal hemorrhage at the temporal margin of the thickened retina (Fig. 2a–d).

Fig. 1 Right eye with intermediate dry age-related macular degeneration. (**a**) Fundus photograph showing large soft drusen throughout the macula with associated pigment clumping and changes of the retinal pigment epithelium (RPE). (**b**) Infrared fundus image with green arrow through the fovea marking the location of the adjacent spectral domain optical coherence tomography line scan showing multiple, discrete elevations of the RPE due to drusen without macular edema

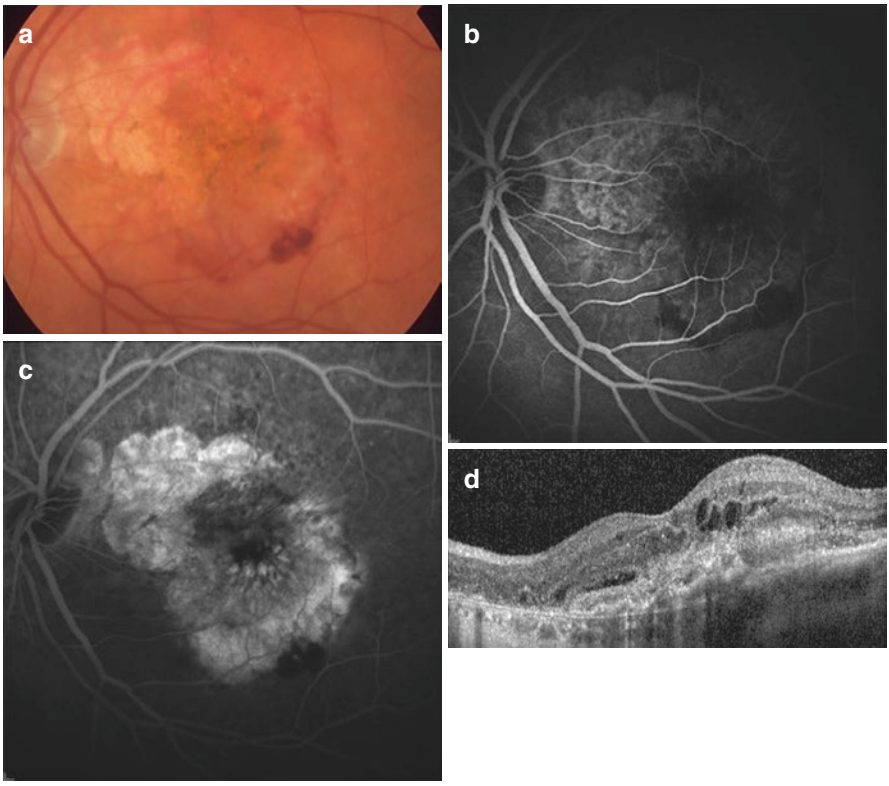

Fig. 2 Left eye with neovascular age-related macular degeneration (AMD). (**a**) Fundus photograph showing drusen, macular edema, retinal and retinal pigment epithelium (RPE) atrophy, and subretinal hemorrhage at the temporal edge of the neovascular lesion. (**b**) Early-phase fluorescein angiogram showing early window defect in the region of RPE atrophy superior/nasal within the macula and blockage related to subretinal hemorrhage. (**c**) Later phase fluorescein angiogram showing window defect in the region of RPE atrophy superior/nasal with extensive leakage from the choroidal neovascularization and persistent blockage secondary to subretinal hemorrhage. (**d**) Spectral domain optical coherence tomography line scan through fovea showing region of RPE atrophy as well as an irregular pigment epithelial detachment with associated subretinal and intraretinal fluid corresponding to the macular edema appreciated on examination and fundus photography

Patient Care

This vignette provides a typical example in older people of the challenges of managing untreated age-related macular degeneration (AMD). Macular degeneration is the most common cause of vision loss in people over age 50 in the United States and most developed countries around the world [1]. The patient's complaints, while vague, indicate difficulties with near (reading) and distance (going down stairs)

activities. Exacerbation of symptoms in dim light settings is commonly associated with AMD. The patient's recall of a diagnosis of both cataract and macular degeneration demonstrates both good communication between the patient and her comprehensive ophthalmologist and also the challenges of multiple diagnoses in older people. Since some degree of cataracts are ubiquitous, almost any patient over the age of 70 might recall such a diagnosis. A potential danger is that such patients subsequently may ascribe vision loss to the incorrect perception that the vision loss is from progression of cataract. In this case, the patient believed that recent vision loss "must" be, at least in part, from the cataract. We learn from the physical examination that her cataracts can be seen with a slit-lamp biomicroscope but are not visually significant and not the cause of her recent vision loss. Furthermore, the patient believes that vision loss is inevitably associated with aging rather than ascribing a specific diagnosis to her visual impairment. While vision loss may become more common with age, older patients should realize that aging, in and of itself, is not a cause of vision loss. Rather, specific diagnoses that become more prevalent with older age are reasons for vision loss. Older patients should not just accept vision loss as an inevitable sign of aging but should pursue with an ophthalmologist what the cause of vision loss is, especially since most incidents of vision loss in older people can be treated.

Interpersonal and Communication Skills

The case also demonstrates the anxiety that can come with a diagnosis of AMD. Until the early 2000s, most people who developed advanced AMD lost substantial vision, first in one eye and then often in the other eye within a few years, resulting in tremendous loss of visual function. Because there are approximately 200,000 new cases of neovascular AMD in the United States each year [2], it is common for many older patients to know someone or many people who have lost much of their independence and daily functioning from vision loss due to AMD. Thus, it is important for healthcare professionals who interact with older people to understand that the risk of vision loss from AMD can be reduced with the use of certain medications that are given by direct injection into the vitreous cavity of the eye during a procedure called an intravitreal injection. The class of pharmaceutical agents that is used to treat neovascular AMD blocks the biological activity of vascular endothelial growth factor-A (VEGF-A). The value of these medications in managing neovascular AMD has been demonstrated in multiple randomized clinical trials [3, 4]. It is critical that the value of these medications be relayed appropriately to the older population.

The patient was also taking a dietary supplement formulation that may not have been tested in randomized clinical trials to show efficacy. This situation is not uncommon and is important for anyone caring for older people to understand. While there may be multiple dietary supplements available that are marketed to benefit the eyes, only specific components have been validated in clinical trials. The Age-Related Eye Disease Study (AREDS) showed that a specific dietary supplement

formulation might reduce the risk of progression to the advanced stage of AMD (usually neovascular AMD) in people with the intermediate stage (usually any large drusen) [5]. However, because this formulation is not a prescription, and because sales of numerous dietary supplement formulations are available over the counter, often with ingredients added based on epidemiologic associations, older people often will take such formulations with little evidence to support their use. Typically, these epidemiologic associations have potential bias or confounding to lead to an erroneous assumption that taking a supplement based on these associations is proof of benefit. Instead, the older person should understand that the supplement is hypothesized, from epidemiologic studies, potentially to be beneficial but requires confirmation in subsequent, usually randomized, controlled trials before one should assume that there is strong evidence to support such an intervention. These challenges have been evident in studies evaluating older people's understanding of dietary supplements in AMD [6].

Medical Knowledge

Diagnosis and Management of AMD in Older People

Diagnosis of AMD

Diagnosis of both dry and neovascular AMD is made primarily by direct clinical examination of the patient. These forms often coexist, and patients can develop visual impairment from either form [7, 8]. The hallmarks of dry AMD are drusen and discrete retinal pigment epithelial (RPE) pigmentary changes. Drusen are cream to yellow, focal deposits visible under the neurosensory retina likely related to the buildup of retinal debris and localized chronic, low levels of inflammation and complement activation. RPE pigmentary changes typically manifest as focal areas of intraretinal or subretinal hyperpigmentation. In its advanced form, dry AMD can progress to geographic atrophy (GA) in which there is deterioration of the RPE and associated outer retinal structures including the photoreceptors and underlying choriocapillaris.

The principal clinical finding of the intermediate stage of dry AMD is drusen [5]. Approximately 8 million Americans have at least one large druse [2]. Thus, the intermediate stage of AMD is very common; of the 60 million people in the United States over the age of 55, at least 1 in 8 has the intermediate stage; over the age of 75, the number is approximately 1 in 4.

Neovascular AMD is defined by pathologic angiogenesis with abnormal blood vessel growth typically from the choroid under and/or into the neurosensory retina, thereby forming a choroidal neovascular membrane (CNVM), with potentially destructive vascular leakage and hemorrhaging. On examination, neovascular AMD is visualized as cystoid macular edema (CME) or exudation causing distortion, thickening, and elevation of the retina. Additionally, one may observe hemorrhage in or under the retina and/or fluid or fibrous tissue under the RPE causing a pigment epithelial detachment (PED).

Fig. 3 Optical coherence tomography (*OCT*) allows for a detailed evaluation of the layers of the retina

Numerous imaging modalities play central roles in neovascular AMD diagnosis and management. Fluorescein angiography (FA) and indocyanine green angiography (ICGA) can be used to visualize and characterize the causative pathologic vessels. Optical coherence tomography (OCT) was first employed clinically using time domain technology in the early 2000s, allowing cross-sectional observation of retinal architecture. Spectral domain technology subsequently supplanted time domain imaging, affording near-histology level detailed visualization of retinal anatomy. OCT is routinely employed to follow treatment response and guide ongoing therapy in the management of neovascular AMD (Fig. 3).

Management of AMD

While AMD is a progressive disease whose prevalence increases with age, affecting about 25% by 80 years of life, risk factors beyond age have been identified. Specifically, given its high prevalence and potentially devastating visual impact, much work has been dedicated to identification of modifiable risk factors that influence the development of advanced AMD. Non-modifiable risk factors include age, family history, genetic predisposition, female gender, and race (Caucasians are at greater risk than African Americans). In total, over 50% of one's risk of developing AMD is likely based on our genetic code. However, this genetic underpinning is complex; with other 30 recognized genetic loci, many involved in the complement cascade [9, 10].

Modifiable risk factors include smoking, specific supplement use, cardiovascular risk factors, and diet [11–13]. Smoking is strongly associated with the development of AMD, fulfilling causality criteria by demonstrating a temporal relationship, reversibility, and a dose-response effect in well-powered epidemiologic analyses [14]. Given that smoking is such a well-recognized risk factor for AMD [15] and given that smoking is a risk factor for so many other pathologies, clinicians may use identification of AMD as yet an additional reason for cigarette smokers to stop smoking.

The initial work-up for a patient suspected of having AMD should consist of a detailed history including any new onset metamorphopsia (visual defect in which objects appear wavy or distorted) or central scotoma, ocular history, and use of dietary supplements. The ophthalmological examination should include an evaluation of visual acuity along with stereoscopic biomicroscopic examination of the macula, OCT and possibly fundus autofluorescence, which is well suited for identification and longitudinal analysis of areas of GA, and angiography.

The intermediate stage of AMD is defined as the presence of one or more of the following three components: at least one large druse (about one retinal vein width as it crosses the optic nerve head or 125 μm in diameter), multiple medium size (64–125 μm) drusen, or GA sparing the center of the macula [5]. In a highly predictive and simplified severity score from AREDS [16], the presence of large drusen and pigment abnormalities in the retina (increased or decreased spots of pigmentation) are evaluated for each eye separately. The theoretical maximum severity score is 4 if both factors are present in both eyes. For clinical purposes, based on this scale, patients with 0, 1, 2, 3, or 4 risk factor(s) have a 0.5%, 3%, 12%, 25%, and 50% chance, respectively, of progression to advanced AMD (usually the neovascular form of AMD) within 5 years. About 30% of the progression could be to GA, which, if it progresses to involve the center of the macula, also can be associated with severe visual loss for which there is no effective treatment at this time, except to pursue low-vision aids to assist with visual tasks.

Ideally, interventions for the intermediate stage of AMD should aim to preserve central vision for as long as possible, so the patient can continue to read and perform activities of daily living. Therapeutic interventions should also have minimal adverse effects. The American Academy of Ophthalmology (AAO) recommends monitoring patients with no AMD or no intermediate stage of AMD to identify evidence of progression to the intermediate stage [17]. Ophthalmologists should provide a comprehensive medical eye evaluation every 1–2 years for patients 65 and older. Based on results from AREDS, the AAO does not recommend the use of AREDS supplements in clinical practice for patients with no AMD or without the intermediate stage of AMD as there is no proven clinical benefit in this population with currently available data.

For patients with the intermediate stage of AMD, ophthalmologists should educate them to monitor for onset of symptoms suspicious for CNV (new onset of metamorphopsia or new scotoma). Ophthalmologists should emphasize to patients that if they have drusen only, they likely will be able to preserve vision for a long time. Patients should be instructed that if they note visual decline or new visual symptoms, see an ophthalmologist promptly to evaluate for signs of disease progression. Large analyses of patients with neovascular AMD have indicated that earlier initiation of appropriate treatment optimizes long-term visual outcomes [18].

For subjects with the intermediate stage of AMD in one or both eyes, or the advanced stage of AMD in one eye in which the second eye is at risk of progressing to advanced AMD, the 5-year risk of progression to advanced AMD was 28% [5]. In comparison, for appropriate patients, consumption of specific supplements can significantly reduce progression to advanced AMD.

Two National Eye Institute-/National Institutes of Health (NEI/NIH)-sponsored AREDS studies have been conducted. Both were well-powered, prospective, randomized trials [5, 19]. AREDS enrolled 4757 patients and evaluated the ability of specific antioxidants (500 mg vitamin C and 400 IU vitamin E), minerals (80 mg zinc and 2 mg copper), and a carotenoid (15 mg beta-carotene) to reduce progression of AMD compared to placebo. At 5 years, consumption of this formulation reduced the risk of development of advanced AMD by 25% in patients with intermediate AMD or advanced AMD in one eye [5]. This protective effect persisted through 10 years of follow-up. As defined above, intermediate AMD was defined as extensive intermediate drusen in one or both eyes, one or more large drusen in at least one eye, or nonsubfoveal GA in one eye.

AREDS2 assessed the ability of two additional supplements to reduce the risk of developing advanced AMD beyond the beneficial effect of the AREDS formulation. In contrast to the AREDS trial, there was no placebo arm in AREDS2; all patients received at least the AREDS formulation with the potential addition of one or both of the following: (1) omega-3 long-chain polyunsaturated fatty acids, docosahexaenoic acid, DHA (350 mg), and eicosapentaenoic acid, EPA (650 mg), or (2) carotenoids, lutein (10 mg) and zeaxanthin (2 mg) [19]. From 2006 to 2008, 4203 patients between 50 and 85 years old were enrolled in AREDS2. All eyes were at high risk of progression to advanced AMD: 65% had bilateral large drusen and 35% had large drusen in the study eye and advanced AMD in the fellow eye. AREDS2 reported two clinically relevant findings. First, no significant reduction of risk was observed with the addition of DHA and EPA. Therefore, there is insufficient evidence to support the use of these omega-3 fatty acids for reducing the risk of progression to advanced AMD in high-risk patients at this time. Second, patients should not use beta-carotene supplements, due to its potential role in increasing lung cancer risk [20], and should replace this carotenoid with lutein and zeaxanthin. In secondary analyses, consumption of the carotenoids lutein+zeaxanthin provided 10% additional risk reduction against progression to advanced AMD beyond the benefits of the basic AREDS formulation. This effect appeared greatest (26%) in participants with the lowest dietary intake of lutein+zeaxanthin ($P = 0.01$). When the impact of the carotenoid beta-carotene was compared to the alternative carotenoids lutein+zeaxanthin, the latter provided 18% additional risk reduction over beta-carotene consumption ($P = 0.02$).

Based on these data, the AAO recommends that patients with the intermediate stage of AMD consider taking supplements that were included in the AREDS2 formulation. As mentioned earlier, healthcare providers should ensure that the patient actually is taking the dietary formulation described in AREDS2, including looking at the actual bottles, if necessary, to confirm the correct components have been obtained. The evidence base supporting use of other supplements in modifying the risk of AMD progression including herbs such as Ginkgo biloba is incomplete and does not inform clinical recommendations.

Patients with the intermediate stage of AMD must be carefully monitored to ensure understanding of progression of existing disease and in conjunction with other potential causes of visual acuity loss often seen in older people such as cataract.

Healthcare providers should also be aware of potential safety issues that may develop in patients taking supplements such as those used in AREDS. Zinc may increase the risk of genitourinary hospitalizations, especially in men. Vitamin E usage may need to be coordinated with a primary care provider when older people often may be on medications which can affect the coagulation pathway, such as Coumadin.

Management of Neovascular AMD

When CNV is suspected or detected on examination, such as through visualization of thickening of the macula, subretinal hemorrhage, lipid, or pigment epithelial detachment in an older person with drusen, clinical imaging with OCT and angiography may be indicated to confirm the diagnosis and guide management.

Because no effective treatment for neovascular AMD was available until the early 2000s, the natural history of active neovascular AMD is well appreciated: progressive distortion and destruction of macular tissue, ultimately resulting in macular fibrosis and scar formation, often associated with loss of central visual function. Such eyes typically lose the ability to recognize faces, read standard print sizes, and pass a driving test over weeks to months. However, such end-stage eyes from an AMD perspective often retain some degree of peripheral visual function.

While no treatment is yet available for the advanced form of dry AMD, GA, clinical blockade of VEGF has revolutionized the management of neovascular AMD since introduction in the early 2000s [3, 4, 21, 22]. VEGF is a key mediator of neovascular AMD, stimulating angiogenesis and vascular permeability [23]. Prior to the approval of VEGF inhibitors for the management of neovascular AMD, treatment from the late 1980s through the early 2000s was limited to laser photocoagulation as defined by the macular photocoagulation study (MPS) [24] and photodynamic therapy with verteporfin [25]. These trials demonstrated limited utility with application in select patients. In comparison, anti-VEGF treatments for neovascular AMD rapidly transformed neovascular AMD management and expectations; for the first time, on average, patients with neovascular AMD experienced rapid and sustained significant visual gains instead of progressive and permanent visual loss.

Three pharmacologic VEGF-blocking agents are currently available for intravitreal injection for treatment of exudative retinal diseases: ranibizumab (Lucentis, Genentech, San Francisco, USA) and aflibercept (Eylea, Regeneron, New Jersey) are FDA approved for the treatment of neovascular AMD, while bevacizumab (Avastin, Genentech, San Francisco, USA) is used in an "off-label" fashion.

Intravitreal injection of bevacizumab, ranibizumab, and aflibercept has proven exceptionally effective against CNVM in AMD patients. Bevacizumab is a full-length humanized antibody first FDA approved for the treatment of metastatic colon cancer [26]. Ranibizumab is a modified antibody fragment approved by the FDA in 2006 for the treatment of neovascular AMD based on ANCHOR and MARINA trials in which, for the first time, neovascular AMD patients experienced an average visual improvement. Specifically, on average patients gained about 6.6–10.7 letters of vision, 33–41% of patients gained at least 15 letters of vision, 38–42% of patients achieved 20/40 or better vision, and 95–96% of patients' vision decrease by fewer than 15 letters [3, 4]. Aflibercept, a receptor decoy protein created by fusing an

immunoglobulin G (IgG) constant Fc portion to components of VEGF receptors 1 and 2, showed clinical equivalence to ranibizumab and was FDA approved for the treatment of neovascular AMD in 2011 based on the VIEW1/2 phase III trial program [27] in which aflibercept was given either monthly or every other month after three initial monthly loading doses.

The introduction and widespread employment of VEGF inhibitors for the treatment of neovascular AMD has fundamentally changed expectations in its management, making a global impact on the rate of AMD-related visual impairment. An observational study in Denmark assessed the incidence of AMD-associated legal blindness in individuals ≥50 years of age: from 2000 to 2010, the incidence decreased nearly 50%, from 52.2 cases per year per 100,000 to 25.7 cases per year per 100,000, coinciding with the introduction and clinical implementation of VEGF inhibitors [28]. This trend was supported by an American study which estimated that because of anti-VEGF therapy, the incidence of AMD-attributable visual impairment and legal blindness was reduced by 37% and 72%, respectively [29].

While the appropriate use of anti-VEGF pharmaceutical agents leads to excellent clinical outcomes in many patients, current anti-VEGF treatment is not a cure for neovascular AMD. Repeated injections are often required to maintain optimal visual benefits. Both MARINA and ANCHOR employed monthly ranibizumab dosing, and subsequent analyses have confirmed that monthly treatment may lead to maximal visual and anatomic benefit compared to many other forms of re-treatment. However, monthly doctor visits can be both difficult and impractical for some patients and their caregivers. Therefore, in most circumstances, clinicians employ either a pro re nata (PRN) or a treat and extend treatment approach in attempt to minimize treatment burden while maximizing visual outcomes.

Most large, controlled PRN trials have reported good clinical outcomes but less visual gains with PRN therapy when compared to monthly dosing [30–32]. However, these trials have demonstrated a remarkably wide range of clinical need for ongoing anti-VEGF dosing for the treatment of neovascular AMD, indicating that management tailored to a given patient's clinical response may be optimal. Underscoring this concept, intraocular levels of VEGF vary among patients with phenotypically similar diseases over a wide range of diagnoses [33].

A treat and extend management strategy starts with monthly injections until signs of exudation have resolved with clinical and OCT confirmation. The interval between visits is then sequentially lengthened, typically by 12 week intervals as long as there are no signs of recurrent exudation. Treatment is rendered at every visit, but the time between visits is individualized based on a patient's response to treatment. When recurrent disease is detected, the treatment interval is reduced. The goal is to maintain an exudation-free macula while minimizing the patient burden with fewer office visits, tests, and treatments. Many studies have confirmed this approach, and this is the most commonly used management strategy for neovascular AMD across the United States. Treat and extend protocols can significantly reduce the burden of care for patients and physicians while decreasing the cost of care delivery and have been validated prospectively [34–36].

Impact on Patient's Perception of Quality of Life Because of Vision

Healthcare providers working with older people should be aware of the implications of AMD and its treatment on both the mental health function and the physical well-being of elderly patients. Studies [37] have shown that anti-VEGF treatment of CNV can have a profound effect on patient function such as distance activities (such as watching television or driving), near activities (such as reading or sewing), depending on others because of vision, or mental health because of vision.

Special thanks to Neil M. Bressler, MD, who authored this chapter in the first edition in 2010.

Case Resolution

Systems-Based Practice, Professionalism, and Practice-Based Learning and Improvement

Our patient underwent OCT and FA and was found to have choroidal neovascularization involving the center of the macula in the left eye in association with subretinal blood, presumably representing recent disease progression. The patient was asked if her family wanted to join her for a discussion of the management of her condition since so much information needed to be relayed. Furthermore, it was offered to send this information to her primary care provider with a copy to her to share with any of her other healthcare providers, since the management might be relevant to a large number of her providers. She was told that anti-VEGF treatment had a substantial possibility of improving her visual acuity and that appropriate ongoing re-treatment had a high probability of maintaining functional visual acuity. She was also told that substantial improvement without treatment was quite rare and instead progressive further visual acuity decline was expected in the absence of treatment. Furthermore, she was told that while it was unlikely that she would experience substantial vision loss with appropriate treatment, there was still about a 10% chance that such loss could occur, an important fact to share in case she was under the assumption that the treatment led to good outcomes in everyone. She was reassured that the major risks of rapid vision loss that she heard could happen due to AMD previously likely do not apply to her because of benefits seen with anti-VEGF treatment either for her left eye or, if needed in the future, for her right eye. Also, she was told that commonly she might experience a subconjunctival hemorrhage after an intravitreal injection, even though the needle is very small and the injection can be performed without pain in the office with topical anesthesia. Furthermore, she might have some irritation from topical antiseptic betadine [38] *but that with meticulous attention to antisepsis, endophthalmitis was very unlikely, occurring in approximately 1 out of between 1000 and 5000 injections* [39].

She was also told that multiple visits would be needed, as often as monthly, to provide treatment or determine if additional treatment is needed, so that coordination with family or friends or other transportation arrangements would be needed. Finally, the financial situation of treatment was discussed at length. Every insurance carrier is different in what medications are preferred or allowed for treatment of neovascular AMD.

Once the discussion of management of her left eye is complete, attention is given to the management of her right eye. Because of the volume of information, this discussion, which is not urgent, might be reserved for an upcoming follow-up in conjunction with subsequent visits for repeated intravitreal injections of the left eye. She should be aware that the intermediate stage in her right eye puts her at risk of progressing to the advanced stage, and she should monitor for this progression by checking her right eye by itself (covering the left eye) at least weekly to look for a change in the central vision such as a scotoma or metamorphopsia. A readily available free monitoring system to use is the Amsler grid. Such symptoms should result in her contacting the office which should be aware of the need for prompt evaluation to determine if these symptoms are from the development of neovascularization. Furthermore, even if she does not note these symptoms, she should have periodic monitoring by her ophthalmologist to identify the onset of asymptomatic neovascular AMD, so that treatment, if indicated, could be initiated before substantial vision loss has occurred as earlier treatment of neovascular AMD leads to be better long-term visual outcomes.

She should be advised that a NIH-sponsored study determined that taking a certain formulation of supplements might reduce her risk of progressing to the advanced stage of AMD in her right eye. However, she should provide this information to her primary care provider to be certain there are no problems with her taking this collection of vitamins and minerals, and if she does start to take these supplements, she should bring a bottle of what she purchased with her, so her ophthalmologist can confirm that the over-the-counter supplement is indeed consistent with the formulation used in AREDS2.

Finally, she should be aware that this intensive management of this one diagnosis does not remove her need to continue her comprehensive eye care. The challenge is to add this AMD management to her comprehensive eye care and her comprehensive medical care.

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Low Vision: When Vision Fails

Jennifer Doyle and Gwen K. Sterns

Case Vignette

An 80-year-old woman and her 85-year-old sister visited their ophthalmologist due to decline in vision over the past few months. The younger sister had assumed many of the homecare responsibilities as her older sister had some visual limitations and early cognitive impairment. Until recently, the younger sister had been able to drive, prepare meals, read prescription labels, and pay the bills without any hesitation. Lately, she was finding managing the home to be more difficult due to vision impairment, and she was hoping a new pair of glasses would help. The older sister was content with her life situation and was happy with audiobooks and a reading radio service. Since her sister drove and prepared meals, she noticed little loss in her daily activities and was just hoping to get some stronger reading glasses. Unfortunately, both sisters were found to have macular degeneration, and glasses were unlikely to help.

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Practice-Based Learning and Improvement

As our population ages, the incidence of patients with impaired vision increases. The 2015 National Health Interview Survey found that 7.3 million adults 65 and older reported having experienced significant vision loss [1]. When this vision loss cannot be corrected with glasses, medical treatment, or surgical intervention, the loss of visual function is referred to as low vision (Fig. 1). As eye doctors, it is important to determine which patients fall into that category. Identifying their loss and providing treatment options are essential to maintaining productivity and independence. The cost of caring for those with blindness and vision impairment is rising yearly. A study by Rein et al. (2006) estimated the cost of total financial annual burden in the United States to care for major adult visual disorders to be $35.4 billion ($16.2 billion in direct medical costs, $11.1 billion in other direct costs, and $8 billion in productivity losses) and that the annual governmental budgetary impact is $13.7 billion [2]. Another study by Frick et al. (2007) estimated medical costs due to low vision to be $5.5 billion per year and that the value on the loss of quality of life was $10.5 billion per year [3]. With these two studies combined, Prevent Blindness America reported that cost of adult vision problems approaches $51.4 billion per year [4].

Fig. 1 Low-vision aids facilitate the pursuit of the activities of daily living (in this case telescopic lenses for TV viewing)

The impact on the patients and their families is not only economic but also social due to the significant increase in depression associated with vision loss [1]. Loss in vision can lead to a decrease in social interaction and functioning, which can lead to a decrease in physical activity. As older individuals are less active, they can lose strength and become less independent. Additionally, with a decline in physical activity and social interaction, emotional well-being may also decline. It is estimated that among older people with vision impairment, 57.2% are at risk of mild or moderate depression [5]. If patients are suffering from both vision loss and depression, they may not be as successful at low-vision intervention and vision rehabilitation. If they are not getting the most out of their vision rehabilitation, this can also lead to a loss of independence and a vicious cycle ensues.

In this case report, these sisters had depended on each other for many years – emotionally, socially, and financially. They had pooled their retirement resources to secure safe housing, and they functioned independently. Now that the younger sister could no longer drive safely or perform visually as she had previously, they needed outside assistance. Their ophthalmologist provided information from the American Academy of Ophthalmology low-vision and rehabilitation website [6], along with information about resources available in the community and a copy of low-vision smartphone applications.

Medical Knowledge

The ophthalmologist performed a complete eye examination on both sisters and determined that they would not be candidates for laser treatment or intraocular medication. It was felt that both sisters should continue taking the AREDS II formula multivitamins and be given the best-obtained refraction with a higher reading add to enable them to see print with greater ease. The ophthalmologist was aware that almost a quarter of patients with impaired vision have trouble managing their household duties. In a study by Brody et al., approximately a third of patients with advanced macular degeneration demonstrated a depressive disorder [7]. With this in mind, the ophthalmologist wanted to maximize their usable vision and referred them to a local Vision Rehabilitation Center for evaluation and low-vision treatment.

Patient Care

The sisters visited the low-vision center together. They had the opportunity to speak with a social worker who was able to assess their living situation and provide them with a referral to an eldercare agency. The agency was able to provide services including transportation to shopping and to medical appointments. They also provided aides to help them maintain their home by helping with every day tasks. Alternative living scenarios were suggested, and visits to assisted living homes were arranged. A social worker was assigned to help evaluate the sisters' success in

performing IDLS (instrumental activities of daily living skills) such as meal preparation, using the telephone, housekeeping, handling finances, and taking medications safely.

Interpersonal and Communication Skills

The ophthalmologist discussed their findings with the primary care provider (PCP) who was caring for the sisters. The PCP agreed to encourage the sisters to look into available services and possibly assisted living as there were no local family members to check in on them and provide support. Both the ophthalmologist and the internist had known the sisters a long time, and their relationship with them was such that the sisters were receptive to the doctors' suggestions. The sisters got involved in a low-vision support group that participated in social outings with other low-vision patients. Through the low-vision clinic, they were set up with a physical therapist who enrolled them in a strength building class for those at risk for falls. With their new physical strength and social confidence, they were able to maneuver within their world despite their impaired vision. Because the ophthalmologist and internist made the time to help connect these patients to outside resources, they made a difference in the sister's lives. Taking the extra time from a busy practice to make sure the proper referrals are made could be the difference between a poor outcome and a good quality of life.

Professionalism

Their ophthalmologist went the additional step. After providing initial low-vision care on site by improving and maximizing the sister's vision with a stronger reading add and updated refraction, they referred them to a Low Vision Center. They were plugged in with occupational and physical therapy to keep them physically active. They also were referred to an elder care agency, which helped them navigate the often complex system. Communication and linkages between providers were initiated.

Systems-Based Practice

A study by Javitt et al. (2007) showed that Medicare beneficiaries with a coded diagnosis of vision loss incurred significantly higher costs than those with normal vision. Of these costs, 90% were actually non-eye related because any degree of progressive vision loss was associated with increased odds of depression, injury, skilled nursing facilities utilization, and long-term care admission [8]. By providing the sisters with appropriate intervention, their risk of depression and injury and

perhaps long-term care admission could be reduced. Taking all of this into account should play a role in each provider's plan of care for his or her patients. By doing this, the patient receives the best care in the most efficient, cost-effective way with attention to the whole person and not just the visual system.

Case Resolution

The sisters each received a comprehensive low-vision evaluation. The older sister enjoyed her nonoptical low-vision aids such as a talking watch, talking clock, and audiobooks. She also utilized a magnifier with built-in light that she could wear around her neck that allowed her read large print playing cards, notes left for her by her sister, and a list of emergency phone numbers. The younger sister made use of several magnifiers to help her complete daily tasks such as reading labels on medication bottles, directions on food packages, reading the mail, and paying bills. A closed-circuit TV (CCTV) was demonstrated, and she will consider this if and when her vision deteriorates (Fig. 2). A rehabilitation teacher for the visually impaired spent a few hours with the sisters in their home and marked the microwave, oven, washer, and dryer with marks that were raised and bright so that they could see and feel the dials to utilize them properly. The rehabilitation teacher also looked around the home for other ways she could simplify their vision concerns and make the home safe. Additional services were offered and lists of groups for older adults with vision impairments were presented for support. The vision rehabilitation process was explained as an ongoing relationship.

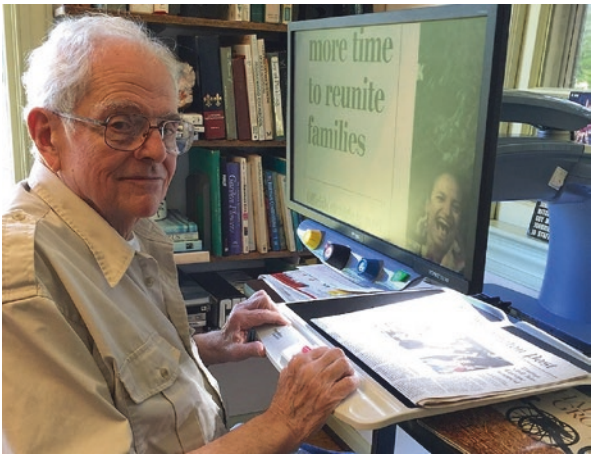

Fig. 2 Low-vision aids being demonstrated (in this instance a closed-circuit television)

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Visual Loss and Depression

Malkit K. Singh and Andrew G. Lee

Case Vignette

A 95-year-old woman is brought in by her family for poor vision. She only provides "yes" or "no" answers to questions and seems to have a blunted affect. Her family members report that she has been complaining about her vision being poor "for years" and that the three other ophthalmologists she saw previously had told them she was "just getting older." She had undergone uncomplicated cataract extraction with intraocular lens placement bilaterally 10 years prior. Her previous visual acuity had been 20/25 OU with correction. Over the last few years, however, she developed moderate geographic atrophy of the retinal pigment epithelium centrally. Her vision is now 20/70 OU, but her glasses have not been changed in years. She complains that she is no

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longer able to read and do her crossword puzzles. The family reports that she seems more withdrawn recently and is not eating very well. They are concerned that perhaps it is because she cannot see her food. She is on no medications and lives in a retirement home.

Introduction

Visual loss can be a devastating comorbidity with clinical depression. About one-third of visually impaired older adults experience clinically significant symptoms of depression and/or anxiety, which is a prevalence at least twice as high as in the general older population [1]. The loss of vision and the secondary effects on ambulation, mobility, and activities of daily living can produce pathologic grief reaction, increased anxiety, and depressed mood. The acute and chronic psychosocial consequences of visual loss can predispose, worsen, or even precipitate clinical depression in the elderly patient. The role of the ophthalmologist is to recognize, triage, and refer patients with visual loss who exhibit signs or symptoms of depression (Fig. 1). Depression is a medical condition, simple screening can be an effective diagnostic tool, and treatments can significantly reduce morbidity and mortality. The ophthalmologist should be aware that visual loss is a risk factor for treatable depression.

Fig. 1 The goal of the clinician is to provide the patient with the best quality of life, optimizing the potential activities of daily living for each elderly patient including identifying risk factors such as depression

Practice-Based Learning and Improvement

Depression, like other comorbidities with visual loss, can be a disabling, but often under-recognized, disorder in the elderly. The ophthalmologist should be aware that visual loss can worsen depression in older patients. Appollonio et al. reported that uncorrected visual loss was associated with a significant and independent impairment of mood, self-sufficiency in instrumental activities of daily living, and social relationships [2]. The impact of depression in older patients with visual loss extends beyond the two disorders alone and can affect quality of life and mortality. The non-adjusted 6-year mortality rate for men with uncorrected sensory impairment was almost twice that of the control groups, possibly due to indirect effects on "global physical health status" and perhaps other "social relationships." Rovner et al. reported a correlation of disability between depression and loss of vision ($p = 0.013$) [3].

In a population-based sample of 2520 older adults, Zheng et al. assessed white and black individuals aged 65–84 years in 1993–1995 at baseline and at 2, 6, and 8 years later to determine the longitudinal relationship between visual acuity and depressive symptoms. While the study estimated that the relationship between a change in visual acuity and a change in depressive symptoms was minimal ($r = -0.027$, $p = 0.719$), there was a correlation between baseline depressive symptoms and a change in visual acuity over time ($r = 0.17$, $p < 0.001$). They concluded that depression may have a significant adverse effect on visual acuity, and older adults with symptoms of depression could experience worse vision decline over time [4].

Depression and symptoms of depression are common in the low-vision population and are more highly related to disability than the vision loss per se. In a population-based cross-sectional study of 13,900 patients aged 75 years and older, Evans et al. reported that visually impaired older adults had 13.5% prevalence of depression compared to 4.6% prevalence among people with good vision. However, controlling for confounders, particularly impairment of activities of daily living, reduced the strength of the association between visual impairment and depression (OR, 1.26; 95% CI, 0.94–1.70). Although the authors could not establish a cause-effect relationship in a cross-sectional study, they proposed that older adults' depression could be attributed to resulting functional impairment more so than the visual impairment alone [5].

Rovner and Ganguli reported on 872 noninstitutionalized elderly persons aged over 68 years, in which impaired vision and depression were both also associated with functional impairment [6]. Depression increased the odds of functional impairment independent of the vision impairment. Visual impairment as a chronic condition can affect physical functioning through decreased ability to walk and complete everyday tasks [7]. As noted above, loss of function increases the risk of depression. These three factors, vision loss, loss of function, and depression, therefore can create a cycle of disability in the visually impaired elderly.

There is a rationale for early recognition and treatment of the depression and functional impairment components of visual loss. The treatment includes not only

medical and surgical therapies for recognized ophthalmic disorders but also low-vision rehabilitation. Carabellese, in a study of 1191 noninstitutionalized elders (aged 70–75 years), reported that single sensory impairments (i.e., visual or auditory) were significantly and independently associated with increased risk for depression (odds ratio: 2.3) [8].

A survey and eye screening of 339 older participants residing in retirement homes or single older-adult households found that living in a retirement home or in an institutionalized setting conferred a higher rate of depression (28.0%) compared to those living in a single older-adult household (15.0%) ($p = 0.009$) [7]. People living in retirement homes are less likely to participate in organized social activities and visit neighbors and family members, which can lead to loneliness and depression [9]. Another study by Jongenelis et al. reported that the prevalence of depression was three to four times higher in an institutionalized population as compared to those living in the community [10].

Visual impairment in other studies has also been shown to be an independent risk factor for impaired social relationships. The ophthalmologist should be aware that depression and visual impairment are known comorbidities. In addition, visual symptoms may be the presenting or only manifestation of underlying depression in the elderly. Screening patients for depression might be useful for patients with visual loss [11, 12]. Galaria et al. reported a shorter version of the Geriatric Depression Scale (GDS) for screening visually impaired older patients [12].

As part of a randomized controlled trial on the cost-effectiveness of a stepped-care intervention, van der Aa et al. conducted a pretest-posttest study of 265 visually impaired older adults with depression and/or anxiety. The study showed that "watchful waiting," which involves an active decision by the patient and health care provider to not immediately treat a condition and instead intermittently assess disease status after certain periods, could be an appropriate first step in a stepped-care approach in some patients with mild symptoms of depression. However, female gender, problems with adjustment to vision loss, higher depression and anxiety symptoms, and a history of depression or anxiety disorder conferred a disadvantage to watchful waiting; these patients had higher odds of developing more severe symptoms during the watchful waiting period [13].

The ophthalmologist might be able to help patients with depression and visual loss by identifying patients at risk, treating and providing rehabilitation for patients with low vision, and referring patients with depression for treatment. Horowitz et al. reported the effects of vision rehabilitation using low-vision clinical services, skills training, counseling, optical device use, and adaptive devices on depression in 95 older adults with age-related vision impairments. These interventions improved depression in these patients as well as physical and psychological functioning [14]. Brody et al. reported the effectiveness of a self-management program of health education and enhancement of problem-solving skills on patient mood and function in 231 patients with age-related macular degeneration. The self-management group showed significant improvement in measures of mood and function versus controls [15].

Interpersonal and Communication Skills

A patient who is clinically depressed might not ask for help. Elderly patients with depression may present with visual loss as their chief complaint and may manifest symptoms that might be mistaken for "old age" or "dementia." Patients with new visual loss could be screened for depression with simple and easy-to-administer questions. Patients with evidence for depression on the screening test should be referred for further evaluation and treatment.

Lee et al. screened 50 consecutive ophthalmology clinic outpatients for depression using a single question for depression (i.e., "Do you often feel sad or depressed?"). Of the 50 patients, 20% were positive for the depression screen. The test takes only 30 s to administer and might be useful for patients who are at high risk. The ophthalmologist worried about depression in the elderly patient should ask the patient and family if the patient is depressed and should offer the patient the opportunity for further evaluation and treatment for depression as needed [11].

In addition, older patients with both hearing and visual impairments, known as dual sensory impairment, face unique communication difficulties. While dual sensory impairment is associated with social isolation, depression, reduced independence, mortality, and cognitive impairment, the services and supports required by people with both hearing and visual impairments are a combination of those required by people with single vision and hearing loss [16].

Systems-Based Practice

Kohn and Epstein-Lubow reported that depression in the elderly is often underrecognized and undertreated. Patients with low vision may be at particularly high risk [17]. Ophthalmologists can help patients with visual loss to reduce the functional impact of the comorbidity of depression in these patients through early recognition and appropriate referral for treatment.

In addition, depression can produce somatic symptoms, including decrements in vision, which cannot be accounted for by the severity of their underlying ocular disease, and may be related in part to the patient's own adaptive strategies and self-perception of visual loss [18, 19]. The role of the ophthalmologist is to recognize and refer patients who might have depression as the root cause of their complaints and not necessarily to initiate treatment.

Coordinating the evaluation and management of any concomitant depression in the older patient requires an understanding of the system of care for an individual patient and accessing the necessary caregivers to ensure appropriate follow-up and treatment as necessary. While screening for depression is the first step in ensuring patients gain access to treatment through appropriate referrals, screening alone is insufficient to improve outcomes for older visually impaired adults. Combining screening with effective treatment and follow-up is also important [20].

Professionalism

Ageism is a pervasive and destructive process. A patient's chronological age is not as important as their functional abilities and health. Elderly patients should not be denied care simply because they are older. Sensitivity to the older patient's specific needs and desires is an important part of her evaluation and management and integral to maintaining the patient's dignity, respecting their autonomy, and allowing them to participate in their own care and decision-making.

In van der Aa et al.'s cross-sectional study in 871 visually impaired older adults from outpatient low-vision rehabilitation services, 43.4% patients reported having unmet need for mental health services. Of these patients, 31.5% cited a lack of knowledge on where to receive mental health services as the primary barrier to receiving sufficient care. This was followed by a number of perceived primary barriers to receiving mental health services, including self-reliance (16.1%), a waiting list (13.8%), asking for treatment and not getting it (11.4%), already being in treatment (10.3%), pessimism that treatment would help (5.6%), stigma against mental health problems (4.2%), and financial limitations (3.7%) [1]. Overcoming these perceived barriers through "communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served" is the definition of professional competence in medicine [21].

Case Resolution

*This 95-year-old woman has a main complaint of poor vision and was brought in by her family, but there are clearly other issues involved besides her visual problems. Because she can only provide "yes" or "no" answers to questions and has a blunted affect, it would be tempting to simply address the questions and instructions for care to the family, but this should be avoided if possible. Part of the communication competency is dispelling any misinformation or miscommunication from the prior providers and perhaps providing reassurance to both the patient and to her family members. She may have been complaining about her poor vision "for years," but this does not diminish the significance of the complaint or the possibility that it is due to treatable pathology. In addition, although the three prior ophthalmologists she saw previously had told them she was "just getting older," the prevalence of many of the major blinding disorders in the United States rises with increasing age (*e.g.*, diabetic retinopathy, cataract, glaucoma, and age-related macular degeneration). Ageism in the evaluation and diagnosis of older patients is just as pervasive and destructive as discrimination based on age for availability of treatments.*

Assessment of the affect and mood in this patient is helpful in determining that depression might be an issue compounded by her visual loss and the loss

of function and activities of daily living. Upon further questioning, she reported that not being able to read and do her crossword puzzles has a significantly negative impact on her daily quality of life. The astute clinician picked up on the family's report that she seemed more withdrawn recently and was not eating very well, and although it might be worsened by her vision, these were felt to be signs of overlying depression.

The ophthalmologist simply asked the patient, "Do you feel sad or depressed often?" She responded "yes" and elaborated on the additional issues concerning her loss of function and independence and the impact on her daily life. The ophthalmologist contacted the patient's primary care physician, and the patient was evaluated and treated medically for depression. A low-vision consultation was obtained, and the low-vision specialist was able to improve the patient's vision with optical aids to the point where she was able to resume her crossword puzzles. Four months later, the patient's family sent a letter to the ophthalmologist thanking her for "giving their grandmother back to them." The patient returned 6 months later after treatment for her depression and was accompanied by her grateful family members.

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Visual Loss and Dementia

Ariel Chen and Andrew G. Lee

Case Vignette

*A 75-year-old tenured college professor is brought in by his wife with a chief complaint of "inability to read." The wife is already physically disabled and in a wheelchair and relies on her husband for many of her activities of daily living. He has been to five ophthalmologists already and been given a dozen pair of new glasses which the wife has brought to the doctor in a brown paper bag. She states that he used to do the checkbook for the household but now cannot seem to balance the account properly. He has gotten lost in the grocery store three times this year, and she would not drive with him anymore because she states that "he can't see the road signs." The patient is well groomed, articulate, and soft spoken. He makes several substitution errors during conversation but quickly corrects himself (*e.g.*, he stated that he drove*

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his car to the airport today when he meant to say that he drove to the office visit). His students have been complaining to the dean that he rambles in lecture and often seems disorganized in class, but he has full tenure and is the Chair of his department, so no one wants to tell him about his problems.

The vision is 20/20 in both eyes. The pupil exam, slit-lamp biomicroscopy, intraocular pressure, motility, and fundus exam were all normal. He could not read the near card even though he identified all of the letters correctly on the J1 near line in each eye. He had a right complete homonymous hemianopsia on formal visual-field testing. The patient had undergone a magnetic resonance scan of the head prior to the visit which showed only "cerebral atrophy" but no stroke, tumor, or other structural lesion in the left retrochiasmal pathway. A markedly abnormal screening clock draw test for visuospatial difficulties is shown in Fig. 1.

Introduction

Visual loss has long been associated with dementia or delirium [1–21]. Uhlmann et al. studied 87 older patients with mild-to-moderate Alzheimer's disease and 87 nondemented age- and sex-matched controls [18]. The prevalence of visual impairment was higher in cases than in controls. Visual impairment was associated with both an increased risk for and an increased clinical severity of Alzheimer's disease. Visual loss can be a devastating comorbidity with dementia, and patients with dementia may present with visual complaints (e.g., visual variant of Alzheimer's disease). The patient with dementia may seem appropriate at first glance, but probing for insight, memory, and executive function might reveal neurocognitive

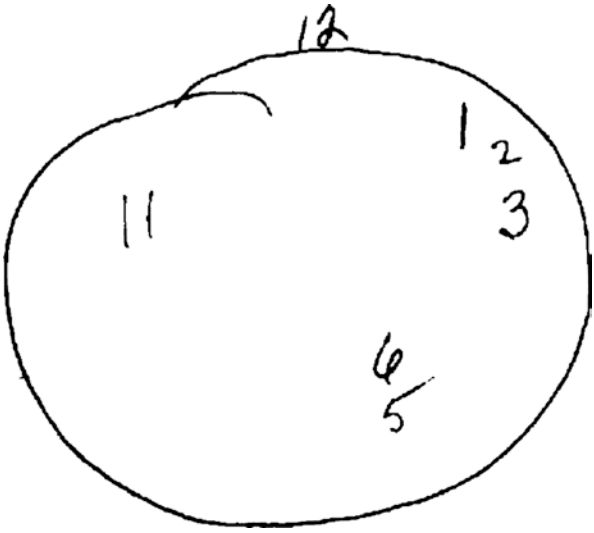

Fig. 1 Clock drawing of a patient with visual-variant Alzheimer's dementia. (Reprinted with permission from the Department of Ophthalmology, The University of Iowa Carver College of Medicine)

deficits. Lee and Martin described a retrospective case series of eight patients with Alzheimer's disease presenting with predominantly visual complaints [21].

All of the patients had seen multiple eye care providers prior to referral to the neuro-ophthalmology clinic for visual complaints but without a diagnosis. Interestingly, four of these patients had homonymous hemianopic visual-field loss, and two had presumed cortical visual impairment without a structural lesion on imaging. Neuroimaging studies in these cases showed either normal brain (one patient) or cerebral atrophy of the parietal or occipital areas but no structural lesions (seven patients). Fluoro-18-deoxyglucose positron emission tomography (PET) scans in five cases showed hypoperfusion in the parieto-occipital areas. Formal neurocognitive testing revealed visuospatial deficits in all five patients tested. These authors concluded that visual symptoms might be the presenting or only manifestation of Alzheimer's disease and that clinicians should be aware of the visual variant of Alzheimer's disease, perform formal neuropsychological testing to document the deficits, and order magnetic resonance imaging (MRI) or PET scans to confirm the diagnosis and rule out other etiologies [21].

The visual variant of Alzheimer's disease is often used synonymously with posterior cortical atrophy (PCA) [4, 21, 22]. PCA is a more generic term described as a neurodegenerative syndrome that presents with predominantly visual processing symptoms that may progress to cognitive decline [22, 23]. The most common underlying etiology of PCA is Alzheimer's disease [11, 24–26]. Snowden et al. examined 523 patients and found that 5% of them presented with visual symptoms (PCA) with a mean age of onset at 58 years old [27]. There has been a push to use the more generic term PCA which includes other etiologies such as Lewy body dementia, corticobasal degeneration, prion disease, and subcortical gliosis [22, 23, 28, 29]. For the remainder of the chapter, PCA will be used for consistency unless the cited study uses the term visual variant of Alzheimer's disease.

Because visual symptoms might be the presenting or only manifestation of the more classic memory or neurocognitive signs and symptoms of dementia, the ophthalmologist should be aware of the presentation of PCA. The patient complaints are variable but can include difficulty reading (i.e., alexia), difficulty writing (i.e., agraphia), difficulty with staying on the correct line of text or finding the next line (e.g., homonymous hemianopsia), problems navigating even familiar environments, difficulty recognizing familiar objects (i.e., visual agnosia), difficulty with colors (i.e., dyschromatopsia), difficulty recognizing faces (i.e., prosopagnosia), or problems interpreting a complex scene (i.e., simultagnosia). The ophthalmologist may have difficulty making the diagnosis because the visual acuity is often normal (i.e., 20/20 OU), and the structural eye examination is unrevealing. Patients often arrive with multiple pairs of unhelpful glasses and a myriad of nonspecific or vague complaints. One of the big red flags for visual presentations of dementia is whether the chief complaint is "brought in by spouse for poor vision," which might suggest a lack of insight on the part of the patient for their own deficits.

Levine et al. reported a patient with difficulty reading, problem driving, and peripheral visual-field constriction. Over a 12-year period, the visual symptoms progressed, and at the postmortem examination, there was cortical atrophy with abundant neurofibrillary tangles present in the occipitoparietal areas [4]. Kiyosawa and Bosley reported five patients who had Alzheimer's dementia with prominent visual

symptoms. Three patients had relative right homonymous hemianopsia on visual-field testing. Prolonged saccade initiation, saccadic pursuit, unstable fixation, poor stereopsis, and impaired figure copying were also reported in these patients [3]. Kaeser et al. reported ten patients with visual variant of Alzheimer's disease. The patients presented with difficulty reading, "visual blur," and difficulty writing. Upon further testing 80% of patients had partial homonymous visual-field defect, and all patients had color vision impairment with Ishihara pseudoisochromatic plates. Cerebral MRI of these patients all revealed parieto-occipital cortical atrophy [30].

Complex visual disorders are common in posterior cortical atrophy, including spatial and environmental agnosias (e.g., getting lost in familiar surroundings), simultagnosia (e.g., difficulty locating or identifying objects in a complex visual scene), prosopagnosia (i.e., inability to recognize faces), alexia, and optic and ocular apraxia. Giannakopoulos et al. used formal neuropsychological tests to characterize visual loss in Alzheimer's disease [2]. These authors reported that associative visual agnosias reflected the density of neurofibrillary tangles, but not senile plaques in visual-association cortex. They differentiated apperceptive visual agnosias (i.e., perception of elementary properties of color or motion) from associative visual agnosias (i.e., the recognition of specific images such as faces and words). These authors concluded that associative visual agnosia represented visual-association cortex involvement and that apperceptive agnosia represented more diffuse cortical disease.

Rizzo et al. described impairments in static spatial-contrast sensitivity, visual attention, shape-from-motion, color, visuospatial construction, and visual memory testing in Alzheimer's dementia [15]. Tang-Wai et al. reported two patients who presented with visuospatial dysfunction who were pathologically diagnosed with corticobasal degeneration [31]. Benson et al. described five cases with memory loss, alexia, naming deficits, Gerstmann's syndrome (i.e., agraphia, acalculia, finger agnosia, and right–left disorientation), and Balint's syndrome. All patients showed occipital and parietal lobe atrophy consistent with PCA, and the postmortem evaluation in these patients has included Alzheimer's dementia, subcortical gliosis, and indolent Creutzfeldt-Jakob disease (CJD) [10]. Hof et al. reported 11 cases of PCA, and five had isolated visual disturbances. The diagnosis of visual-type Alzheimer's dementia was made in these patients, and there was a posterior distribution of their "senile" plaques and neurofibrillary tangles compared with nonvisual variant cases [12].

It may be that PCA is not a separate entity but on the spectrum of presentations for dementia. I believe, however, that it is clinically useful for ophthalmologists to consider the diagnosis of PCA since the visual symptoms may be the presenting sign prior to other neurocognitive disorders and these patients are often seen by ophthalmologist first.

Perimetry

Ophthalmologists should consider posterior cortical atrophy in the differential diagnosis of patients who have a homonymous hemianopsia or cortical visual loss in the absence of a structural lesion on neuroimaging (e.g., stroke or tumor). Visual-field

testing in patients with dementia may show nonspecific constriction, a homonymous field loss, or bilateral homonymous loss. Trick et al. performed automated perimetry (i.e., Humphrey 30–32) on patients with Alzheimer's dementia (n = 61 patients with 61 age-matched controls). In this study, the differential luminance sensitivity was decreased (especially in the inferonasal and inferotemporal arcuate regions) in the Alzheimer's group compared with the age-matched controls [7]. Brazis et al. described homonymous hemianopic visual-field defects in patients without a structural lesion on neuroimaging. One of these patients had Alzheimer's dementia [13]. Formaglio et al. described six patients with homonymous hemianopsia associated with higher visual processing dysfunction such as simultagnosia, alexia, prosopagnosia, and hemispatial neglect. All patients eventually developed dementia, five with Alzheimer's disease and one with corticobasal degeneration [32]. Lee and Coleman also reported six patients with Goldmann perimetry testing, and four of these patients had paracentral homonymous hemianopsia [21]. Two of the patients however could not perform a reliable or valid formal visual-field test, but confrontation visual-field testing showed nonspecific constriction OU. The inability to perform an accurate formal visual-field test may also be a sign of underlying dementia and should prompt consideration of PCA in older patients with visual complaints and a normal eye exam otherwise.

Neuroimaging

As mentioned above, the structural neuroimaging such as computed tomography or MRI may be normal or interpreted as "normal." Typically, patients with the posterior cortical atrophy show cerebral atrophy in the occipital and posterior parietal lobes. As opposed to structural imaging (e.g., MRI), functional imaging (such as positron emission tomography (PET) scanning) can show decreased function (i.e., hypometabolism) in the involved parietal or occipital cortex in visual-variant Alzheimer's disease.

Practice-Based Learning and Improvement

Ophthalmologists do not need to diagnose and treat dementia, but they should be able to recognize the signs and symptoms of both posterior cortical atrophy and neurocognitive disorders in their patients and make an appropriate referral. Earlier diagnosis and treatment are critical for the best results of therapy with the newer agents for dementia.

Interpersonal and Communication Skills and Professionalism

Discussing difficult decisions with the patient with dementia requires special skills and tact. The patient with dementia often lacks insight into their own disability and

may be brought in by their family members or spouse. Patients with dementia may insist on continuing in activities for which they are no longer competent such as driving or working. These activities (e.g., driving) may pose a hazard not only to the patient but to others. Careful and compassionate discussion with the patient and their family regarding the deficiencies and dangers requires extra time with the patient. A separate appointment might be a more appropriate time to discuss the issues in depth and with time for questions. In addition, timely communication with the primary care service or treating neurologist might be useful in discussing the special visual symptoms or needs of the patient with dementia and visuospatial presentation.

Systems-Based Practice

The patient with visuospatial manifestations of dementia needs a comprehensive and multidisciplinary solution. This includes the family members, the spouse, the primary care team, and the treating neurologist. Patients might need to undergo formal evaluation for driving risk. The patient is also the caregiver for the wife who suffers from severe rheumatoid arthritis. She is concerned that she will not be able to live independently anymore.

Case Resolution

The patient underwent a useful field-of-view test that showed high risk. He voluntarily surrendered his driver's license. He was seen by a neurologist, and formal neurocognitive testing was performed that demonstrated widespread and severe deficits in multiple domains but predominantly in visuospatial function. He was started on Aricept and had some modest improvement in his subjective function and agreed to step down as chairman of the department. The patient and his wife relocated to an assisted living facility.

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Visual Loss and Hearing Loss

Paul D. Chamberlain and Andrew G. Lee

Case Vignette

A 65-year-old woman has age-related macular degeneration in both eyes. She has severe visual loss and can only see hand motions. Her family members report that she lives in a nursing home now but does not hear very well. She is depressed by her living situation and does not appear to recognize her family members. She has grown increasingly uncommunicative during family visits.

She is clearly having difficulty hearing during her eye examination in your office, and the technician has to shout in her ear to get any response from her. The ophthalmologist who saw her previously had documented bilateral geographic atrophy secondary to age-related macular degeneration with 20/200

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vision in both eyes. She was told "nothing more can be done" and comes to see you for a second opinion. The doctor becomes frustrated talking to the patient because she cannot hear well and begins to explain the situation to the accompanying spouse. The patient reacts angrily and states "Talk to me, not him."

Introduction

Visual loss and hearing loss often occur together in the elderly, with an estimated prevalence of dual loss between 9% and 21% of adults over the age of 70 [1–5] and a 5 year incidence of 1.6% in adults older than 55 [6] (Fig. 1). The presence of both sensory impairments increases the functional impact of either deficit alone [7–11]. An ophthalmologist should recognize hearing loss and make an appropriate recommendation or referral for treatment in patients especially if visual loss is present as a comorbidity with the hearing loss.

Practice-Based Learning and Improvement

Numerous studies have documented that hearing loss and visual loss are comorbidities that affect function and activities of daily living in older patients [12–14]. Appollonio et al. reported that hearing and visual impairment resulted in higher mortality rates in an urban population of 1140 noninstitutionalized elderly subjects (aged 70–75 years). Keller et al. described the prevalence of visual and auditory

Fig. 1 Many elderly patients suffer from the comorbidities of vision loss and hearing loss (note hearing aid)

impairment in frail older persons and evaluated the association between sensory impairment and overall functional status. Combined impairments of vision and hearing were common in the frail older outpatient population that was studied using the instrumental activities of daily living (IADL) scales. In addition, functional status was diminished for the sensory-impaired subjects and combined vision, and hearing impairments had a greater effect on patient function than single sensory impairments alone. These results persisted even after controlling for decrease in mental status and other comorbid illnesses, and more recent studies have also confirmed these results [3]. Interventions to improve sensory function may result in greater functional independence, although further study is needed in these areas.

Klein et al. in the Beaver Dam study documented the frequent coexistence of age-related macular degeneration (ARMD) and hearing loss [15]. More recently another study by Wittich et al. found that combined ARMD and presbycusis accounted for over 30% of patients with dual hearing and visual loss [16]. Because ARMD is a common cause of visual loss in the elderly, the potential impact of hearing loss as a comorbidity is extremely important. Concomitant hearing loss in this ARMD population is associated with difficulties in communication and diminishes other aspects of independent function (e.g., mobility, transportation) in patients who already have vision-related functional loss. Patients with dual sensory loss are more likely to have depressive symptoms and experience difficulty with communication, social isolation, reduced independence, increased mortality, and cognitive impairments [7–11, 17–19]. McDonnall found that a likely mediator of increased depressive symptoms in patients with combined hearing and vision loss was the effect this dual sensory loss had on the "social factor," suggesting that rehabilitation services and assistive devices that target communication problems and loss of activity may help alleviate these depressive symptoms [20]. Combined hearing and vision loss was found to be associated with the greatest likelihood of cognitive and functional decline [21–30], and emerging evidence suggests that treatment of both impairments can decrease this effect on functional decline [31, 32]. Self-reported vision and hearing loss are associated with greater disability, decreased physical functioning, poorer mental health, and less social interaction 1 year after initial evaluation [33, 34]. It is important that the ophthalmologist be cognizant of the evidence that comorbid hearing loss can worsen the functional impact of visual loss.

Interpersonal and Communication Skills

The ophthalmologist confronted with the elderly patient with both vision and hearing loss may become frustrated or tempted to "give up" on the patient. Although the evaluation and treatment of hearing loss are beyond the scope of practice for the eye care provider, it is the responsibility of every doctor to consider the needs of the whole patient. Although some forms of hearing loss in the elderly are not reversible, many are amenable to evaluation and treatment. Referral should be considered when hearing loss is apparent (e.g., having to shout at the patient), particularly if there has been no prior evaluation or attempt at treatment (e.g., hearing aids). The ophthalmologist in this setting has a duty to recognize the problem and appropriately refer the patient.

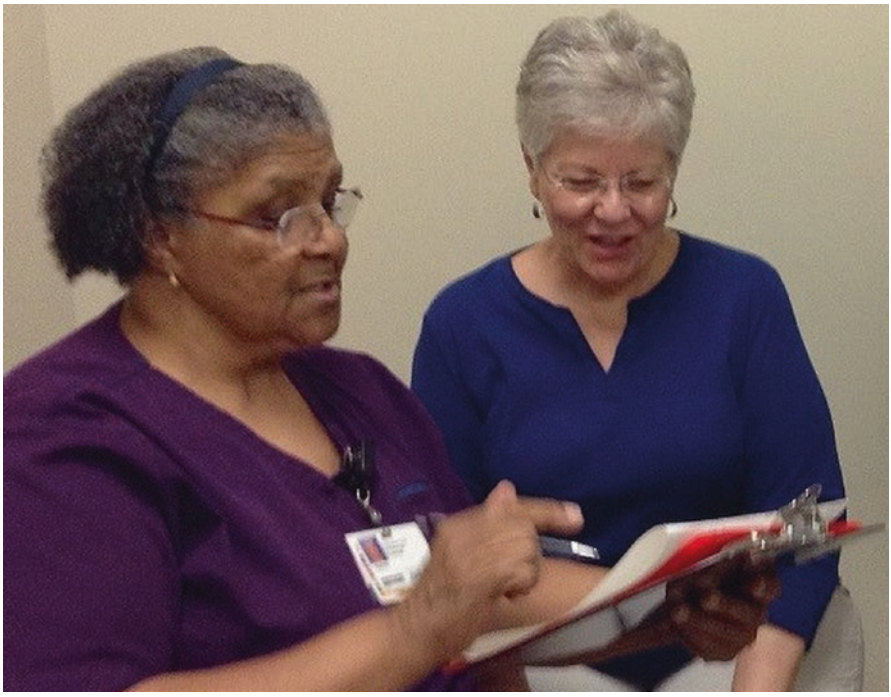

Fig. 2 The appropriate use of visual aids, as well as counseling the patient in a quiet environment, and the use of written as well as oral communication for patients with multisensory loss aids in communication

Professionalism

Part of the professionalism competency is recognizing and being sensitive to the unique needs of elderly patients with hearing loss. Talking to the spouse rather than directly to the patient isolates and marginalizes the patient. Not taking the history because the patient is unable to hear is suboptimal care. Patients with hearing loss who require extra effort or time can be asked to bring their questions in writing to their visit or to come to the office at a time when the provider is less pressed for time (Fig. 2). In addition, providers may increase the ability of patients to hear them by modulating their voice to speak in lower tones, which are easier for those with hearing loss to understand. Recognizing that the hearing loss is a unique extra need for this particular patient is part of the professionalism competency for ophthalmology.

Systems-Based Practice

Ophthalmologists are not expected to treat hearing loss in the elderly, but appropriate recognition of this important comorbidity and communication with the primary care provider or otolaryngologist might result in interventions that will improve the

hearing loss and quality of life of the patient. Non-referral of the visually handicapped hearing-impaired patient is a missed opportunity. In addition, the ophthalmologist may be the first or only point of contact for the patient with the medical system.

Case Resolution

The diagnosis of age-related macular degeneration OU was made, and low-vision service referral improved the patient's functioning. The patient was referred to an otolaryngologist and underwent an audiogram. She was fitted with hearing aids bilaterally, and although she still lives in a nursing home, the family reports that she is better able to function in her activities of daily living. Although she initially seemed depressed by her living situation and had not been very communicative during family visits, after the hearing aid placement she "returned to her normal friendly and happy self" according to the daughter. When the patient returned to the ophthalmologist's office, she was pleasant and talkative and thanked the eye doctor profusely by helping her with her vision and hearing. She had been told by the other eye doctor that "nothing more can be done," and she expressed her gratitude and satisfaction with her second opinion with you.

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Visual Loss and Falls

Weijie Violet Lin and Andrew G. Lee

Case Vignette

A 75-year-old woman with age-related macular degeneration (ARMD) presents with new loss of vision in her right eye. Her past medical history is significant for hypertension, diabetes, and high cholesterol. Her medications are atenolol, insulin, simvastatin, and one aspirin per day. The patient is markedly hard of hearing and often forgets to turn on her hearing aids. She smokes one pack of cigarettes per day and has one glass of wine each evening. Her family history is significant for ARMD in her mother. The vision in the left eye was lost 2 years prior to presentation due to a subfoveal neovascular membrane from ARMD. She is the sole care provider for her elderly husband with Alzheimer's dementia, and they live together in their single-family two-story home 30 miles from your office. The patient had driven herself and her husband to the appointment. Her daughter has been concerned about the increasing frailty of both

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parents, but the patient has refused to move previously. The patient has had four recent falls and was hospitalized 1 year ago for a hip fracture. The visual acuity was 20/200 in the right eye and counting fingers in the left eye. The pupillary, motility, slit-lamp, external, and intraocular pressure measurements were all normal. Visual field testing showed a central scotoma bilaterally. Ophthalmoscopy showed an old disciform macular scar from the prior subfoveal neovascular membrane in the left eye. The right eye showed a new subfoveal hemorrhage and underlying choroidal neovascular membrane.

Introduction

Visual loss is an important risk factor for falls in the elderly. The roles of the ophthalmologist include (1) identification of at-risk elderly patients in the eye clinic; (2) risk reduction for falls; (3) low-vision assistance for patients with impaired vision that might reduce the risk for falls; and (4) communication of the risks and the risk reduction techniques to the patient and the patient's caregivers. Vision plays an important part in stabilization of posture, and visual impairment may increase the risk for falls independently of environmental hazards.

In the elderly population, falls are the leading cause of injury-related death and the most common cause of hospital admissions resulting from injury [1]. One estimate says that up to one-third of older adults (age 65+) fall each year and the risk of falls increases with advancing age [2]. Another study estimates about 22% or seven million Medicare beneficiaries fell in 2011 [3]. In 2000, injuries and deaths from falls cost over $19 billion, and this cost was projected to rise to more than $54.7 billion by 2020 [4].

Fall risk highly correlates with frailty syndrome, a nebulously defined physiologic state in which there is reduced ability to recover from stressors [5]. Vision impairment directly impacts frailty via substantial reduction in functional capacity [5]. Another study verified a significant association between ophthalmologic surgery experience and falls in community-dwelling elderly populations [6] (Fig. 1).

Practice-Based Learning and Improvement

As visual loss is a well-documented risk factor for falls in the elderly, the ophthalmologist should be cognizant of the risks in an individual elderly patient. De Boer et al. examined a cohort of 1509 men and women and identified visual impairment as an independent risk factor for falls and fractures [7]. In the Blue Mountains Eye Study, the 2-year risk of fractures in patients with visual acuity loss, visual field deficits, and the presence of posterior subcapsular cataracts was found to be significantly higher than in persons without these findings at baseline [8]. Lord et al. studied 156 community-dwelling elderly persons and reported that impaired vision is an

Fig. 1 Assisting elderly individuals who have mobility difficulty in sitting, rising, and walking to navigate the clinic will decrease the risk of falls when outside of their home environment

independent risk factor for falls, with depth perception and distant-edge-contrast sensitivity being particularly important for maintaining balance as well as detecting and avoiding environmental hazards [9]. In another prospective cohort study assessing the impact of vision on likelihood of falling, women with declines in visual acuity over 4–6 years were found to have significantly greater odds of experiencing frequent falling during the subsequent year [10]. Yet another study of fall risk assessed 1285 persons over 65 years of age and found previous falls, visual impairment, urinary incontinence, and the use of benzodiazepines to be the strongest predictors of fall risk [11]. More recently, additional studies have specifically verified visual acuity as a significant risk factor for falls and mortality in multiple settings (the USA, Sweden, Japan, Taiwan, Nigeria) and populations (independently living elderly, elderly women, patients with hip fractures, Medicare beneficiaries) [12–17].

Notably, central acuity alone may not be the only factor that is important. Lord and Menz assessed that contrast sensitivity and stereopsis are important for posture control under challenging conditions (although no effect was seen on a stable surface) [18]. Källstrand-Eriksson et al. found that stereopsis was a significant determinant of falls, along with visual acuity [13]. Pineles et al. noted that Medicare beneficiaries with disorders of binocular vision (strabismus, diplopia, amblyopia, nystagmus) had higher odds of sustaining musculoskeletal injuries, fractures, and falls [19].

Lord and Dayhew found that wearers of multifocal glasses have impaired edge-contrast sensitivity and depth perception and that the use of multifocal eyeglasses substantially increases the risk of a fall [20]. Furthermore, the population-attributable risk of falls in this cohort was found to be 35% for those wearing multifocal eyeglasses [20].

History of correction by ocular surgery also has a demonstrable association with fall risk. Schwartz et al. found that patients improved significantly in multiple postural stability indices after cataract surgery [21]. Following this, Sach et al. confirmed a decreased incidence of falls after cataract surgery using an economic analysis [22].

Practice-Based Improvement

Buckley et al. studied the impact of visual impairment on the mechanics of landing during stepping down by elderly patients ($N = 12$) and concluded that correcting common visual problems might be an important intervention strategy for elderly persons negotiating stairs [23]. A separate review reported that stair negotiation remains an important hazard for older persons [24]. In a randomized controlled trial, Campbell et al. assessed the efficacy and cost-effectiveness of a home safety program and a home exercise program to reduce falls and injuries in community-dwelling older people with low vision (391 women and men aged 75 years or older with visual acuity of 6/24 or worse) [25]. Participants received a home safety assessment and modification program delivered by an occupational therapist ($n = 100$), an exercise program prescribed at home by a physiotherapist plus vitamin D supplementation ($n = 97$), both interventions ($n = 98$), or social visits ($n = 96$) [25]. The main outcome measure was the number of falls and injuries resulting from falls. These authors found fewer falls occurring in the group randomized to the home safety program but not in the exercise program [25]. In light of findings from multiple studies, one systematic review reported that visual intervention strategies to improve visual function and prevent falls in older people are warranted [26].

Some studies have worked toward developing frameworks for screening, monitoring, and prevention programs that target visually impaired elderly populations [27, 28]. The proposed screening methodology includes visual acuity and visual field tests, red reflex to screen for cataracts, and dilated slit-lamp examination [27] (Fig. 2). In a randomized controlled trial, Barban et al. found that combined motor and cognitive training delivered via a touchscreen computer was effective in reducing fall risk in elderly patients [28].

Fig. 2 Formal visual field testing can reproducibly delineate the pattern and extent of peripheral and central vision loss and is helpful to grade and track the progress of many ocular conditions

There has also been a surge of promising research into the use of newer technology to monitor and predict falls [29–31]. Bourke et al. conducted a study incorporating machine learning to develop a lumbar sensor algorithm to detect falls [29]. A similar study conducted by Hsieh et al. uses a multiphase model to develop an algorithm for fall detection using sensors [31]. A meta-analysis aimed to develop a unified strategy for evaluating multiple fall detection algorithms and noted that dissimilarities between studies have been a barrier toward delineating common parameters associated with falls [32]. However, given the rapid expansion of studies into using sensors in elderly populations to assess falls, it is encouraging that these technologies will help significantly in preventing falls.

Fall reduction techniques and screening and monitoring programs have been shown to be useful for elderly patients with impaired or low vision. There is clear evidence that fall prevention is superior to fall treatment for elderly patients, hence the importance of steady ophthalmological care in geriatric populations.

Systems-Based Learning

The ophthalmologist should consider contacting the patient's primary care provider as well as caregivers to inform them of the risks for falling posed by the visual loss in this elderly patient. Clinicians should be sensitive to the fact that an elderly patient may also be caring for an even more disabled or frail spouse. The

loss of vision in this elderly caregiver thus might impact the care and quality of life of the spouse as well as the patient. The ophthalmologist may need to call upon the resources of a social worker, community assistance, or the family. Home safety inspections and home health visit to the patient's living quarters might provide an opportunity for fall risk reduction. Ophthalmologists should be aware of the factors that might increase the risk for falling in their elderly patient with visual loss (e.g., poor physical conditioning and lack of activity, muscle weakness, poor balance, pre-existing difficulty with activities of daily living like dressing or bathing, cognitive impairment, dementia, and medications such as beta blockers, tranquilizers, sedatives, antidepressants). Ophthalmologists can help with fall prevention by recognizing patients at risk, including elderly patients with visual loss, and having a preprinted handout available for patients and their families that can address potential environmental home hazards (e.g., reducing clutter; improving stair railings; eliminating loose throw rugs or electrical extension cords, installing hand railing in the bathroom; and improving lighting and contrast especially on stairs). Falls in the elderly obviously impact the entire system of care including the patient and their caregivers and create potentially preventable costs to the healthcare system [3, 4, 22, 33–38].

Interpersonal and Communication Skills

The ophthalmologist may be in a position to assist the caregivers in counseling a frail, elderly patient that transfer to an assisted living situation may be helpful in reducing the risk for falls and improving the quality of life. There is also an increasingly positive outlook that newer technologies may help to monitor falls even in independently living elderly patients. Empathetic and compassionate discussions with the patient and their family might be warranted for all involved parties to make an appropriate and informed decision on placement. Patients with visual loss often have hearing loss, and the risk for morbidity increases for patients with both hearing and visual loss. A delicate and sensitive conversation with the patient may be necessary regarding the issue of the legality and safety of driving in the setting of severe visual loss.

Case Resolution

The ophthalmologist should recognize that visual loss is a risk factor for falls. Patients with visual loss would benefit from specific counseling regarding risk factor reductions and home hazard reductions to reduce fall risk. The ophthalmologist in this case helped with fall prevention in the patient by recognizing that the patient was at risk for falls including the presence of the visual loss. The ophthalmologist provided the patient and her family a handout to address potential environmental clutter. The patient and her family were very interested in the information and made numerous changes to help reduce the chance of falls.

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Elder Abuse

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Case Vignette

An 88-year-old female is transferred late in the day with a report of falling the previous night and striking her eye on the bedside table. She was initially evaluated at an outside emergency room and then was seen by the local ophthalmologist with a diagnosis of an open globe injury. She was subsequently referred to the university hospital for further evaluation and treatment. She is agitated, abusive, and quite unhappy at having multiple exams by both the resident on service and the faculty. She threatens to leave without allowing further evaluation or surgical correction. The emergency room nurse checks the patient's blood pressure, which is elevated and has been climbing throughout her visit. The clinician sits and speaks quietly with the patient and family, eventually gaining her trust and cooperation.

The patient is confused regarding the cause of her fall. She habitually prefers an edge-of-bed sleeping position and states she may have rolled out of bed. Her family reports some generalized increase in confusion within the last few months, as well as an increasing problem with urinary frequency, both of which may have contributed to the fall as she has been getting up at night more to urinate. They report a past medical history of treated hypertension, and her review of recent symptoms shows a series of recent falls. These falls do not appear to be due to poor prior vision. She has already undergone

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bilateral cataract surgery and functions well visually but preoperatively had been highly myopic. Her exam confirms scleral rupture with uveal prolapse as well as multiple fading bruises on the extremities and trunk.

The clinician discusses the injury and the multiple ecchymoses with the patient again while she is alone. They ask her several times by varying approaches if she feels safe in her home and if she feels she is physically threatened or afraid. She states she feels unsafe in her home but that it is "all her fault" and that her children help her with her personal needs "whenever she asks for help." She denied that she has received any direct physical threats and has had no items taken from her against her wishes. Her children are all well employed, lead busy lives, and are financially stable without asking her for funds. The patient undergoes orbit and head CT in the emergency department and subsequent repair of an extensive scleral rupture with repositioning of prolapsed uvea, but she remains no light perception vision.

The postoperative course becomes complicated the next morning. The patient develops poorly controlled hypertension and worsening generalized confusion, prompting a consult to internal medicine. Their service modifies her medications and recommends physical therapy and occupational therapy in preparation for eventual discharge. Additionally, although they consider her mentally competent, they feel she is physically unable to independently return to her home. Physical therapy finds that she is only able to walk halfway across the room without assistance. You discuss this with her daughter; a family meeting is scheduled to discuss employing an "in-home" elder care worker. A home review for falling hazards is also arranged through the patient's family physician, including installment of bed rails and evaluation for trip hazards. Physical and occupational therapies begin a program of rehabilitation with the goal of reconditioning her to allow independent living.

The clinician and patient discuss hospital protocol, which requires a living will and medical power of attorney to be filed in the medical record for all admissions. The patient expresses a strong preference to retain a full code status. The clinician prepares her for transfer to a skilled care facility to work on strength training and during a review of her electronic record reviews the final radiology report from her admission orbital CT. The radiologist suspects normal pressure hydrocephalus (NPH) based on the brain imaging associated with the orbital films. The clinician performs a review of the clinical signs and symptoms of NPH and then speaks with the children at the family meeting. Each child maintains loose contact with the mother, and they reveal that she has been partially bedridden for several months with depression over the recent loss of her spouse. The patient states that her falling episodes preceded his death and after some questioning reveals that the falls and her urinary symptoms have been increasing. She is reluctant to discuss her physical condition and insists that she is fine, but the children together are able to determine that she is now falling several times weekly. She still maintains that she is able to

return home unassisted. The clinician consults the neurology service, which confirms a likely diagnosis of NPH, recommending physical and occupational therapy to maximize the patient's physical condition. They reserve making a final diagnosis of NPH without demonstrated improvement in independent functional status after a high-volume lumbar tap. This assessment would not be currently interpretable given the patient's debilitated physical state. Both neurology and physical therapy recommend skilled care nursing for physical rehabilitation prior to an attempted high-volume lumbar tap. This is arranged through a Social Work Consult. The patient continues to be followed by ophthalmology and her primary service, and her vision remains no light perception. The oculoplastic service is therefore consulted for anticipated enucleation within 2 weeks from her injury. She undergoes an uneventful enucleation, is placed in safety lenses, and is discharged to skilled care on postoperative day one.

Patient Care

This scenario gives an excellent demonstration of the patient care competency. The clinician communicates well throughout the case, first seen in the emergency department, where they calm the patient and gain her trust and that of the family. The clinician helps the patient to maintain her dignity, taking the medical history directly from her despite her confusion; the family was included in the discussion to ensure the accuracy of the history.

The patient care competency covers maintenance of health and prevention of further medical problems. In this case, the most important immediate health maintenance issue is the possibility of elder abuse. There are 700,000–1.2 million cases of elder abuse annually in the United States [1, 2]. Ten percent of elderly adults are felt to be abused annually in the United States with a medical cost of $5.3 billion. However, it is estimated that currently only 1 in 24 cases is reported. Many of these patients report to emergency departments for trauma and are released without the abuse being identified. Recognizing injury patterns in elder abuse, similar to recognizing patterns in child abuse, would be useful for emergency personnel and consultants. Rosen et al. reviewed all emergency department records on patients with confirmed diagnoses of elder abuse from 1981 to1994 and ranked the probability of the visit causes having been from abuse. Thirty-one visits of 26 patients caused by abuse were compared to 108 visits of 57 patients with indeterminate probability of abuse and with accidental trauma. They found that upper extremity, lower extremity, and head or neck injury were the presenting complaint in 45%, 32%, and 42% of visits felt to be from abuse, with bruising noted in 39%. Although bruising was in multiple regions in 69% when present, the most common location of bruising was the eye/orbit and of injury was the upper extremity. Bruising of the ulnar or lateral right arm and fractures of the midface and left zygoma (right-handed abuser) were more common in abuse and less commonly found in accidental trauma. In the indeterminate group, injuries 1 day or older and those to the maxillofacial region or upper extremity were felt to be more suspicious for nonaccidental trauma [3]. Other

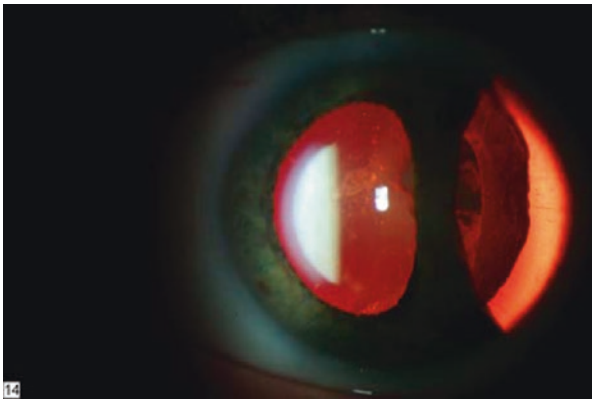

Fig. 1 Any evidence of significant ocular trauma in an older patient should raise the possibility of elder abuse. This patient received blunt trauma resulting in a traumatic cataract and iridodialysis. (Reprinted with permission from the Department of Ophthalmology, the University of Iowa Carver College of Medicine)

ophthalmic findings of adult abuse include lens dislocation, cataract, orbital fracture, and retinal detachment (Fig. 1) [4].

Internationally 2–10% of patients over the age of 65 report a history of maltreatment [5], and some extreme cases include labeling elderly women as "witches," seizing of their property, and abandonment [5, 6]. The US Adult Protective Services report a 19.7% increase in reports of elder abuse from 2000 to 2004, with a similar rise in substantiated reports during that time of 15.6% [7]. Unfortunately, less than 10% of estimated cases of older adult mistreatment are ever reported [1, 2, 8, 9].

Although elder mistreatment includes physical abuse, it also includes neglect, exploitation, and abandonment and may be manifested through unwanted sexual contact, psychological abuse through humiliation or intimidation, and financial exploitation [1, 2, 5, 6, 8, 10, 11]. Interestingly, neglect can also include "self-neglect" (when the patient is unwilling or unable to care for themselves), but this may coexist with caregiver neglect where the caregiver fails to intervene in the self-neglect [1, 7, 9, 11]. Although some abused elder patients complain of mistreatment, some patients may simply exhibit unexplained signs of physical trauma, poor hygiene, malnutrition, or dehydration [1, 8, 10]. In other patients, they may simply appear to be withdrawn or may manifest symptoms of nonspecific anxiety or depression. The possible warning signs may be as simple as broken spectacles without explanation, noncompliance with prior treatment instructions, or unexplained missed appointments and thus do not have to include direct evidence of ocular or periocular trauma. Cases of suspected abuse should be reported to the authorities, and reporting is mandatory in 42 states [10, 12]. The clinician in this case recognizes the risk of abuse in this elderly patient and pursued it appropriately. The diagnosis is suggested not only by the severe ocular trauma in this case but also by multiple ecchymoses evidencing past trauma of different times.

A highly sensitive but nonspecific test for elder abuse is the Elder Assessment Instrument (EAI). This 41-point Likert scale reviews signs, symptoms, and complaints consistent with elder mistreatment and requires approximately 12–15 min to complete. The EAI includes a general assessment of clothing, hygiene, nutrition, skin, and any evidence of trauma or sexual abuse. It includes self-reported

comments of neglect, abuse, abandonment, or exploitation, evidence of depression, and any physical signs of neglect including decubiti, contractures, diarrhea, urine burns, impaction, and evidence of poorly monitored medication (over or under-medication) or healthcare regimens. Additional evidence of either misuse of finances or caregiver demands for financial reimbursement and abandonment by the caretaker for periods inappropriate to the patient's needs conclude the EAI. Although there is no specific scoring protocol for the EAI, any evidence of abuse, neglect, exploitation, or abandonment should be reported to the proper authorities for further investigation [1]. Currently health professionals underreport suspected mistreatment, in part from missed diagnoses and in part due to conflicts over reporting the information counter to the wishes of their competent older patient. These patients may have guilt about or fear of retribution, institutionalization, or embarrassment by the exposure of their situation and may refuse assistance [1, 2, 5, 9, 11].

Five Common Manifestations of Adult Maltreatment (Adapted from Lachs et al. [5])

- Physical abuse: intentionally causing physical pain or injury
- Psychological abuse: intentionally causing emotional pain or injury
- Sexual assault.
- Material exploitation: misappropriation of money or property
- Neglect: failure of caregiver to meet the needs of dependent elderly

Among the types of elder abuse, self-neglect is the most common; both suspected and confirmed self-neglect have been found to increase the frequency of hospital admission. Dong et al. in the Chicago Health and Aging Project (CHAP) studied 1165 of 6864 total participants, identified by social services for suspected self-neglect as an independent variable, evaluated after eliminating confounding variables of older age, lower socioeconomic status, number of comorbid conditions, cognitive function, and overall health. This group was found to have higher rates of annual hospitalization (RR, 1.47, 95% CI, 1.39–1.55). Greater severities of self-neglect were found to have serially higher rates of annual hospitalization (mild self-neglect (PE, 0.24; SE, 0.05; RR, 1.28, 95 CI%, 1.16–1.41, $p < 0.001$), moderate self-neglect (PE, 0.45; SE, 0.03; RR, 1.57, 95% CI, 1.48–1.67, $p < 0.001$), and severe self-neglect (PE, 0.54; SE, 0.11; RR, 1.72, 95% CI, 1.39–2.12, $p < 0.001$)). Similar results were found in cases with confirmed self-neglect [13].

Abuse increases mortality in elderly patients [5], and the psychosocial health of the patient may influence the effect of abuse on the mortality rate. Our patient was known by her family to be more socially withdrawn and depressed after the death of her spouse. Though there was family living near the patient, their busy lives led to infrequent visits. Dong et al. studied the association of elder abuse, psychosocial health, and mortality through the Chicago Health and Aging Project (CHAP). The psychosocial categories considered were depression, social support (children, relatives, and friends seen at least monthly), and social engagement (social activities

outside the house). Dong further differentiated between reported and confirmed elder abuse in these patients 65 and older. When evaluating depressive symptoms, the presence of reported abuse increased the mortality rate in the most depressed (HR 1.54, 95% CI 1.04–2.28) and middle tertile of depression (HR 1.76, 95% CI 1.05–2.96), though there was no increased risk to those in the lowest tertile of depression. Reported elder abuse increased mortality in the lowest tertile of social networking (HR 1.74, 95% CI 1.18–2.56), as well as in patients with the lowest tertile in social engagement (HR 1.89, 95% CI 1.29–2.77). Confirmed abuse increased mortality among the most depressed tertile (HR 2.60, 95% CI 1.58–4.28) and middle tertile (HR 2.18, 95% CI 1.19–3.99), the lowest tertile (HR 2.42, 95% CI 1.52–3.85) and middle tertile (HR 2.65, 95% CI 1.52–4.60) of social networking, and the lowest tertile (HR 2.32, 95% CI 1.47–3.68) and middle tertile (HR 2.59, 95% CI 1.41–4.77) of social engagement. This indicates that both reported and confirmed abuses are associated with an increased mortality in lower levels of both social networking and engagement and in higher levels of depression, emphasizing the importance of psychosocial health in this population [14]. This underlines the importance of immediate (family network) and local (social engagement) systems of care competency.

In our case, the clinician contributes to preventative health by addressing the patient's future risk of falling. They notified the primary physician, who arranges for home bed rail installation and fall hazard assessment. The ophthalmologist also recognizes the increased risk of ocular injury in the remaining eyes of monocular patients and prescribes the patient full-time safety glasses at discharge from the hospital. The children living closer to our patient committed to more frequent and scheduled visits in an effort to help their mother regain her independent living. They are further planning for home elder care after her discharge from rehabilitation.

Finally, the patient care competency covers not only clinician competence in medical and surgical procedures but also recognition of the need for external consultation for problems outside of an individual clinician's training. In this scenario, the clinician competently cared for her ocular injury and surgically managed her globe rupture. They interacted with outside healthcare providers for issues outside of ophthalmology, including those in emergency medicine, radiology, internal medicine, neurology, occupational therapy, physical therapy, social work, and oculoplastics. The primary ophthalmologist continued to coordinate care for the patient and to counsel the patient and the family regarding her ongoing options for treatment.

Medical Knowledge

The practitioner used their general medical knowledge to analyze the multiple presenting symptoms, diagnosing and treating the patient's ocular, hypertensive, and neurological problems. Those areas of medical care outside of the practitioner's area of practice were appropriately triaged, a coordination of care which demonstrates overlap between the medical knowledge competency and that of patient-centered care. The clinician entertained but discounted the likelihood of elder abuse as a unifying diagnosis in this case. The presentation of an elderly, confused female with severe ocular trauma and multiple ecchymoses of varying ages matches the

common profile of the abused older patient. Such abuse is usually performed in the patient's home; 90% of the time abuse is performed by the children or spouse. The victim is often physically and socially isolated, dependent, demented, elderly (especially over the age of 80), and female. Unlike the caregivers in this case, the perpetrators of elder abuse are often financially dependent on their victim. Caregivers may be under personal stress and may be ignorant about and frustrated by the demands of caring for an elder relative. The abuser manifests their desperation by intentionally inflicting pain, injury, or anguish on their elderly charge. The risk of abuse rises when there is other violence within the household, and the acts may be exacerbated by caregiver substance abuse or mental health disorders [1, 5, 8–11]. The risk is greater for the elderly living alone as there is less opportunity for contact and conflict. Abuse also occurs in institutionalized settings. Financial abuse, however, is more frequent for elders living alone. Sadly, the 3-year relative mortality in older patients with a history of abuse is 3 times that of age-matched controls [5].

Our patient was engaging in self-neglect by not reporting or seeking assistance for her falls, deconditioning, depression, and other progressing medical conditions. Self-neglect is the most common form of elder abuse and is linked to elevated morbidity and mortality, with greater neglect being associated with greater mortality. Self-neglect is associated with higher risk of nursing home placement, use of social behavioral services, and hospitalization. The Chicago Health and Aging Project (CHAP) found one in nine elderly experiences self-neglect. Using the CHAP, Dong and Simon reported an increased risk of 30-day readmission in patients with reported self-neglect (RR, 2.50, 95% CI, 2.02–3.10); increased severity of self-neglect was associated with increased 30-day readmission, increasing from mild self-neglect (PE, 1.09; SE, 0.19; RR, 3.00, 95%, 2.07–4.34, $p < 0.001$) to moderate self-neglect (PE, 0.84; SE, 0.13; RR, 2.33, 95% CI, 1.81–2.98, $p < 0.001$) to severe self-neglect (PE, 1.24; SE, 0.40; RR, 3.45, 95% CI, 1.57–7.58, $p = 0.002$) [15].

Eight Red Flags for Elder Abuse (Adapted from Purdy [12])

- Repeated visits for medical care (ER or office)
- Conflicting, non-credible history from caretaker or patient
- Unexplained delay in seeking treatment
- Unexplained, inconsistent, vague, or poorly explained injuries
- History of being "accident-prone"
- Patient ambivalence, anger, or fear toward caregiver
- Poor compliance with scheduled follow-up or care regimen
- Physical evidence of abuse

Interpersonal and Communication Skills

The sections within the interpersonal skills and communication competency also overlap with those of patient-centered care. In this case, the clinician updates the patient and their family as various medical and ophthalmologic issues develop. This

includes the care of the initial open globe injury, the subsequent poorly controlled hypertension, the diagnosis of NPH, the eventual need for enucleation, and the need for skilled care nursing for physical rehabilitation. Communication skills are needed for the discussion of the patient's mental competence and for the discussion leading to documentation of code status, a living will, and medical power of attorney.

It is important in this case to communicate with both the patient alone and also in conjunction with her family. The initial history is confirmed by the family, given the patient's confusion at presentation, but repeated with the family absent when investigating the possibility of elder abuse. The potential abuse history should be taken in a nonconfrontational, nonjudgmental fashion, as abused older patients often suffer a sense of guilt and shame regarding the abuse. Patients may deny the occurrence of maltreatment and may decline intervention on their behalf.

Nine Questions to Ask a Suspected Victim of Adult Mistreatment [2]

- Has anyone at home ever hurt you?
- Has anyone ever touched you without your consent?
- Has anyone ever made you do things you didn't want to do?
- Has anyone taken anything that was yours without asking?
- Has anyone ever scolded or threatened you?
- Have you ever signed any document that you didn't understand?
- Are you afraid of anyone at home?
- Are you alone a lot?
- Has anyone ever failed to help you take care of yourself when you needed help?

Professionalism

The professionalism competency interweaves ethics and medicine and involves putting patient and societal needs above those of the doctor. This competency relies on the competencies of communication and patient care, without which it is difficult to recognize the patient's needs or to coordinate appropriate care. In this example, it would have been far easier for the treating ophthalmologist to address only the open globe and to discharge the patient to the care of the family and the primary physician. This would have not have addressed the possibility of elder abuse and would not have uncovered the diagnosis of NPH nor optimized her care with skilled nursing placement and rehabilitation.

Other professionalism issues arise in this case. It is in society's financial interest to address the spectrum of her acute and subacute diagnoses. Part of the professionalism domain includes placing the patient's and society's interests ahead of the physician's interests. The clinician also respects the patient's wishes for aggressive treatment despite pressure from the family. Although the patient is older and has times of confusion, she is competent to make her own decisions. She is within her

rights to prefer a full neurologic evaluation to maintain and hopefully to improve her quality of life and her activities of daily living.

Finally, by becoming involved in the extensive evaluation of this patient, the ophthalmologists themselves learned more about NPH and fall prevention in the older patient, and both educated the ophthalmology resident and the other medical teams about eye trauma. This scenario demonstrates professional, patient-centered, preventative care by addressing all of the patient's medical needs and by addressing ongoing professional development and education in both the clinician and the consulting services.

Practice-Based Learning and Improvement

There is also overlap between the practice-based learning and improvement and the professionalism competencies. The professional physician applies new knowledge gathered from each patient encounter to learn and to improve their own patient care. The physician in this scenario applies skills learned from past trauma cases and recognizes the dangers of falls in the elderly for fractures and mortality. The practice-based learning competency covers the use of information technology in managing patient care. The clinician in this case uses computer information technology to access the electronic medical record, reviewing the final CT report, as well as to access online information about NPH. Their literature search led both to specific questioning of the family and patient and to consultation of neurology.

This case was ultimately presented to departmental morning rounds as a Clinical-Pathological Conference (CPC). The CPC covered both the pathological findings and a discussion of patient-centered care, systems-based practice, and medical knowledge competencies. This case therefore provided the entire ophthalmology department an opportunity to learn, exemplifying the definition of the practice-based learning and improvement competency.

Systems-Based Practice

The system of care is particularly important in cases of suspected elder abuse. Every individual who comes in contact with older patients should be aware of the prevalence of elder mistreatment and recognize the possibility of self-neglect as abuse. A clinician suspecting neglect or abuse should access their state's reporting network. Every state has laws governing elder mistreatment, and in most states, the reporting of elder abuse is mandatory [1, 2, 10].

Elder abuse is both a social and a medical condition, as are child abuse and domestic violence. The findings of elder abuse are not specific, and there is not a specific definition of nor a specific test for the condition [5]. The abuse itself is rarely witnessed, and the victim often tries to hide the condition out of shame and to refuse intervention on their behalf [5, 9, 11]. Complicating the issue further are cultural variations on both the perception of what constitutes abuse and the

willingness to portray the family in a negative light [5, 6]. It is important as a clinician to recognize the possibility of abuse and to report suspected cases to those authorities trained to assess the individual and situation. This needs to be done without further endangering the older patient or risking loss of access to that individual [5]. In many cases, the optimal solution is not to remove the elderly person but to treat the abuser's underlying social and psychological problems, retaining the family unit and allowing the older patient to remain at home [9].

Elder Abuse Resources (Adapted from Aravanis [2] and Kleinschmidt [9])

- Hotlines, 24 h: available in most states
- Social services
- Adult Protective Services or Department on Aging: Are state run with legal responsibility and authority to investigate complaints and provide services for elder well-being
- Law enforcement officials
- National Center on Elder Abuse
  202–682–2470, 202–898–2586
  Fax 202–898–2583
  http://interinc.com/NCEA
  NCEA@nasua.org
  www.elderabusecenter.org
  1201 15th Street, NW, Suite 350
  Washington, DC 20006
- Long-Term Care Ombudsman Program: A federally legislated program for reporting suspected abuse of institutionalized patients
- Medicaid Fraud Control Unit: Run by the state attorney general's office, required by federal law to investigate and prosecute provider fraud or elder abuse in facilities receiving Medicaid funding

Elder abuse is recognized as a serious and ongoing social and medical issue on both national and international levels, leading to increased awareness of and interest in diagnosing, treating, and preventing adult abuse. The 2015 White House Conference on Aging (WHCOA) listed it as a top priority and an item to be readdressed at future WHCOA. Rates vary in studies from 7.6% to 11% and are generally felt to be 10% of the US population age 60 and older, translating to 5,600,000 victims in the United States. Rates are 3–5 times higher in cases of dementia, applying to dementia found in both the abused and the caregiver. The WHCOA used the US Department of Justice and Department of Health and Human Services 2014 Elder Justice Roadmap, as well as scientific studies of abuse, recognizing elder mistreatment as a widespread, serious problem in the United States. They have committed to research extending the understanding of elder abuse, providing direct services for patients and for training, and developing social policy to help decrease the prevalence of elder abuse [16].

Elder abuse is recognized by the World Health Organization as a violation of the right to be safe and free from violence [14].

Abuse and self-neglect affect the various systems of care, including local readmissions, state social services, and national public health. The patient is the central and enduring component of all of these various systems of care. Currently, one in five Medicare recipients discharged from the hospital is readmitted within 30 days, and preventable readmissions cost US$25 billion annually. The CHAP study by Dong suggests that without influencing the rates of patient self-neglect, and intervening when this is identified as a health risk, we will be hard-pressed to meet the Medicare goals of a 20% decrease in readmission in elderly patients as required in the Affordable Care Act [15].

Elder abuse is a recognized problem not just in the United States but in other developed and developing countries as well. Skirbekk and James studied a population age 60 and older from 7 of the oldest states in India and found similar rates of elder abuse and neglect (11%) as estimated in the United States (10%). They found that increasing levels of education serially decreased both all abuse and also the subsets of abuse studied (physical, verbal, economic, disrespect, and neglect). Eight or more years of formal schooling were associated with a statistically significant decrease in abuse. This paper suggests that the system of care for adult abuse extends outside of the medical systems of care and supports the provision of education to all [17].

This case description encompasses the entire system of care in an elderly patient with an open globe. The system of course goes beyond the traditional "doctor-patient relationship" and includes the outside emergency department, physician, and referring, consulting, and treating ophthalmologists; the university emergency department, physician, nurses, and the rest of the ophthalmology staffing team; the internal medicine, radiology, neurology, and oculoplastic services; physical and occupational medicine, social work, and skilled care nursing; as well as the dietary, nursing, and custodial services for the inpatient ward. The system of care is a network involving everyone who participates in a patient's care and thus also included the patient's family, her primary care practitioner, her insurance entity, and their insurance regulations. Each member of this extensive healthcare team provided a unique and valuable contribution. It is up to the admitting physician to help the patient to navigate the system for the best care. Doing so interweaves the competencies of communication skills and patient-centered care, professionalism, and clinical knowledge, maximizing the best use of resources without compromising care.

Case Resolution

After consultation with the children, they preferred to defer the large-volume tap and possible subsequent shunt procedure and request that neurology not further address NPH directly with the mother. The clinician explains that because their mother is considered mentally competent, she must be legally allowed to make her own medical decisions. The family discusses their concerns with the patient, and she elects to pursue follow-up care with neurology

after physical rehabilitation. She is presented with the evaluation from physical therapy and finally agrees she is unable to navigate her own house. She is willing to be admitted for skilled care and rehabilitation with the goal of returning home. Her family, though individually busy, agree to visit with her on a rotating basis providing adequate oversight. This scenario demonstrates an example of self-neglect and the absence of an identified family caregiver or group family caregiver mentality. Social intervention is able to redirect the patient and her family, allowing her to return eventually to her own home once it is modified for an elderly individual.

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Functional Impairment and Visual Loss

Jennifer Doyle and Gwen K. Sterns

Case Vignette

Mrs. Johnson, an 87-year-old woman with poor vision due to age-related macular degeneration, recently lost her husband of 65 years. While her husband was alive, she was able to carry out many of her daily activities independently without his help apart from driving. She needed occasional assistance with the remote control and phone and used a magnifying glass. She prepared meals with his assistance reading small print recipes but operated the stove and microwave without difficulty.

With his passing, there was concern that she may not be able to continue living alone because of her poor vision. Her daughter requested that her mother move into the daughter's home. Mrs. Johnson was hesitant because she did not want to be a burden and was quite comfortable in her home of 60 years. While she had friends who offered to take her shopping and out to socialize, there was no one close to help her with activities of daily living. Her daughter prevailed, and her mother sold her home and moved in.

At first, things seemed to be going well, but when Mrs. Johnson was left alone in the house for several hours, there were some concerning issues. When using the stove, she often set the temperature too high and had burned

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several items; on one occasion, she forgot to shut off the gas burner. It was also noted by her daughter that Mrs. Johnson stopped watching her favorite television shows. On questioning, she stated she was unable to get the television channels she liked. Over a short time, she had withdrawn from family activities, stopped visiting with her friends, seemed to be losing weight, and appeared depressed.

Mrs. Johnson's daughter took her to see a doctor who specialized in geriatrics and set up a visit with her ophthalmologist to see if there had been any decline in vision.

Practice-Based Learning and Improvement

Functional visual loss can be exacerbated by both progression of disease and change in social or environmental setting. Most persons with permanent vision loss can be assisted with properly selected optical and nonoptical aids along with low-vision training. While the vision may not be correctable, the goal is to maximize the vision patients do have to restore the person's ability to function and maintain a sense of self-sufficiency. For the elderly person, visual assistance may provide a new outlook on life, preventing depression because of an inability to read, write, or maintain hobbies (Fig. 1) [1]. In visually impaired older patients, 13.5% have depression, compared to 4.5% of those with good vision [2]. For those with macular

Fig. 1 The loss of strength and mobility with age is compounded by the loss of vision, increasing the risks of falls and fracture. Addressing the reversible causes of vision loss can greatly increase an elderly patient's independence

degeneration, the same disease our patient has, between 10% and 30% develop clinically significant depression; vision loss complicated by depression is associated with higher levels of disability, medical costs, and mortality than vision loss alone [3]. Because of this, exploring the opportunities available for the visually impaired is extremely gratifying for the patient and the provider.

As people age, a change in physical surroundings can prove difficult, and this is exacerbated in those with visual impairment. People with visual impairments become familiar with surroundings, enhancing their ability to perform daily tasks in the setting of decreased vision. For example, a visually impaired patient may know it takes ten steps to get from their bed to their bathroom. When these patients move to a new environment, not only do they have to adjust to their new surroundings, but they have to relearn tasks that were previously very easy for them, such as going from the bed to the bathroom.

For our patient, when she was first diagnosed with macular degeneration, she had difficulty reading labels on medications, reading the newspaper, and following directions on food items. She learned to use a magnifier to help with this, and when that didn't work, she would ask her husband for help. She could not see the dials on her microwave or the stove, but with low-vision aids and a low-vision rehabilitation specialist, she was able to master these tasks in her own home. Her husband was there to assist her when she had some difficulty, but for the most part, she functioned very independently. When moving to her daughter's home, she could still use magnifiers to help with some items, but she would need to relearn and label other items. Recognizing these changes and providing training in the home could aid in increasing her independence in a new environment. With certain changes and updating her low-vision devices, she may even be able to function without assistance.

Patient Care

It is the role of the doctors caring for these patients to make sure low-vision care is provided either during an office visit or by referral to a low-vision specialist. The doctor caring for this woman needs to relate her eye disease to how the patient is functioning at home. Information should also be obtained about what areas could use improvement and inquire about the goals and expectations of the patient and family. Then the doctor can begin to provide information about appropriate low-vision aids or referral to low-vision resources for more specialized training and care. The clinician should also be cognizant of the link of vision loss to depression. A recent study found that in addition to providing vision training, providing some behavioral therapy can significantly improve depression. The low-vision depression prevention trial in AMD showed that an integrated mental health and low-vision intervention halved the incidence of depressive disorders relative to standard outpatient low-vision rehabilitation alone in patients with AMD [3]. Behavioral therapy referral provides another means to aid low-vision patients beyond prescribing low-vision aids. The link between vision loss and depression demonstrates the importance of communication between the ophthalmologist and the patient's other medical providers.

Medical Knowledge

Functional vision loss caused by ocular or neurological disease can affect people in different ways. The relationship between eye disease and functional vision has been well described by Eleanor Faye, MD. Her work on this subject enhanced our understanding of the functional implications of medical disease [4, 5]. Understanding these concepts has led to improved evaluation and management of patients in need of low-vision rehabilitation.

From a low-vision function standpoint, visual deficits are broadly divided into three categories: cloudy media, central field deficit, and peripheral field deficit. Cloudy media may cause a generalized blurring or haze. Patients with recent vitreous hemorrhage or a dense cataract may complain of blurry vision. Details may be hidden, and patients may be troubled by glare. Sometimes patients will also complain of color distortion or that everything looks a shade darker, like "looking through a dirty windshield." In these instances, absorptive lenses may help by improving contrast and reducing the glare. Central deficits, as seen in patients with macular degeneration, may make near tasks difficult. Details of faces may be distorted or blurred in the center, although they should be able to see peripheral parts of the face such as forehead, ears, and chin. Reading and fine work may be difficult, but magnification may help improve the performance of the patient with a central field loss. Peripheral deficits can be caused from diseases such as advanced glaucoma, retinitis pigmentosa, or neurologic disease affecting the visual pathways. Patients with peripheral deficits may have difficulty with mobility or seeing in dim illumination. Affected patients may have trouble crossing the street or moving easily in a crowded mall. Sometimes they may walk into walls or seem easily startled when people approach them from the side with limited vision. Depending on the severity and involvement of the eye, diabetic retinopathy can cause both central and peripheral vision loss. Central loss in diabetics can be seen when the macula is involved and peripheral loss may follow a dense vitreous hemorrhage or a traction retinal detachment. Peripheral loss may even be due to the laser treatment used to help control the diabetic retinopathy. Considering the type of functional vision loss can help the practitioner to plan for the optimal rehabilitation of the patient.

This patient has macular degeneration, and in her new environment, she had difficulty with reading the remote control, setting the stove, and operating the microwave oven. Her ability to function independently was threatened. An understanding of the functional loss before the move may have enabled smoother transition so that the appropriate optical and nonoptical aids could have been introduced and updated for the new environment.

Interpersonal and Communication Skills

The ophthalmologist recognized the concerns of both the patient and her daughter. The physician was able to put the daughter at ease that her mother's eyes were stable and that she had not lost any further vision. They were also able to reassure the patient that she was not developing any new eye disease. They discussed her

problems since she moved and was able to understand the difficulties she was experiencing. Moving in with her daughter had exacerbated the depression she developed over the loss of her husband. She had lived in her home for 60 years and had adapted well there after she started losing vision. In addition to leaving her familiar home, complicating her daily activities, she moved away from her friends and from the senior center she frequented. This alone would have been enough to exacerbate her depression, but the environmental change in the setting of impaired vision and with little preparation to the new home left her in a dependent position.

Professionalism

The ophthalmologist put the family in touch with local vision rehabilitation services. An appointment with a vision rehabilitation specialist and a low-vision physician was arranged. The ophthalmologist also contacted the internist to discuss the medical condition of this patient and to discuss the depression she was experiencing. They asked the internist to see and evaluate the patient for possible intervention.

Approach to the Visually Impaired Patient

When greeting a visually impaired patient, the doctor or the doctor's assistant should introduce themselves to make the patient aware of their presence. The person accompanying the patient through the office should always offer their arm to the blind person. With their hand lightly on the arm, the patient is able to feel the movement of the assistant's body. The assistant should remain slightly ahead of the patient in order to lead them, as being propelled from behind can be awkward. One should ask a blind person if they need any help, not forcing assistance. The patient should be escorted to the examination room, and the patient should be told where the furniture is within the room. The patient's hand is placed on the chair or table so the patients can seat themselves properly.

Any paperwork to be completed by the patient should be handled in a private setting by an office staff member rather than a driver or friend. The patient may not want to share confidential medical information with another person. If a blind person has been left alone, they should be informed about their surroundings. It is desirable to orient the visually impaired person to the room by telling them where things are such as a table, chair, or wall and to let the patient know if the door will be left open, so the patient can call out for assistance if needed.

Systems-Based Practice

The effect of eye disease on functional vision loss needs to be recognized. Most persons with irreversible subnormal vision can be assisted with properly selected optical aids or proper training.

It is the role of the doctors caring for these patients to make sure that they receive the help they need to maximize their independence in the setting of impaired vision. Low-vision care either on site or by referral to a low-vision specialist should be discussed. The vision loss should be treated as a medical problem as it can lead to other medial problems if not properly addressed. The doctor needs to make sure that despite vision loss, the patient has the resources to perform tasks such as taking their medicines and getting to other medical appointments. If the patient cannot complete these things, further referrals need to be made with the help of the primary care physician. It is very important to communicate with the patient's primary care physician about the status of visual function. The primary physician is a valuable resource in referring the patient to the appropriate resources. When we really understand the patient's current level of functioning along with their needs and goals, we can then begin to treat and provide needed low-vision care and assistance.

Case Resolution

The patient went to her ophthalmologist for an exam to confirm her diagnosis and to be sure that her eye condition was stable and that nothing else was developing that would need treatment. She informed the doctor of her life changes, and she was referred to the low-vision clinic. The low-vision clinic provided her with some new low-vision aids and devices that she had not used before. They also set her up with an occupational therapist to come to her new home to help make some environmental changes and provide in-home training to increase her independence.

The ophthalmologist took care of the patient by making appropriate referrals to treat the whole patient and not just the eye pathology. They explained the relationship of vision loss to loss of independence and depression. They connected the functional vision loss of the patient with the decline in her activities of daily living. Being able to see the whole picture enabled this ophthalmologist to provide the best care.

The patient visited the low-vision clinic where she was able to have her low-vision aids adjusted for her new environment. She also was put in touch with a low-vision support group so she might be able to share her experiences. A vision-rehabilitation teacher visited the home and marked the dials on the kitchen appliances, enabling the mother to see them. A large-numbered telephone was purchased as well so she did not have to try to see the cordless phones with "tiny" numbers located around the house. Additionally, a new remote control device for the TV was purchased. Both daughter and mother learned to share their fears and concerns and agreed to keep each other informed so they could have open communication.

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The Research Agenda-Setting Project (RASP)

Andrew G. Lee

In 2001, the John A. Hartford Foundation and the American Geriatrics Society set out to publish in a book format a research agenda-setting project (RASP) to achieve the following goals: (1) to increase research activity in the field of geriatrics within specific surgical and related medical specialties; (2) to attract new specialty researchers to study and subsequently meet the unique needs and requirements of the older patient in these specific surgical and related medical specialties; (3) to increase the number and quality of age-related research grant applications (e.g., National Institutes of Health, the Department of Veterans Affairs, and other agencies); and (4) to improve the well-being of older patients in specialty care. The process involved the selection of faculty members from each specialty to serve as content experts and writers and to review and eventually to update the present status of research on the geriatrics aspects within their respective specialties. For ophthalmology, these authors were Anne Coleman, MD, and Andrew G. Lee, MD. The content experts met at the RAND Corporation in Santa Monica, California, in February of 2001 to receive systematic instructions on "how to conduct a systematic literature review," "how to classify research by type of study design," and "how to develop preliminary search strategies." The searches were coordinated by professional RAND librarians and an iterative process followed by contribution from the senior writers, the

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content experts, and the librarians. The group revised their search strategies and individually reviewed selected titles, abstracts, and eventually specific full papers. The content experts were at liberty to expand the searches independently, but in all cases, the reference lists were searched for additional relevant earlier publications. The literature reviews were conducted using an English-language search, limited to human subjects of MEDLINE (through PubMed or DIALOG). The search terms were for "65 or older" or "aged" or "geriatric," followed by a list of content topics of importance in each specialty. The earliest year searched varied (1980–1994), and the latest year was the first half of 2001. A research consultant maintained a full list of titles from each literature search in an EndNote database, and the project director and the research consultant reviewed the titles and abstracts (where necessary) for relevance to the crosscutting issue section. The research consultant also obtained full-text copies of the papers, forwarded these papers to the senior writing group, added new references as needed to the EndNote database, and verified the accuracy of the final list of citations.

The first drafts were reviewed by the editors, and additional revisions were made and finalized at a face-to-face conference in Potomac, MD, in November 2001 cosponsored by the Agency for Healthcare Research and Quality (AHRQ). The RASP is the final product of this effort. Ophthalmology is proud to have participated in the RASP.

Each RASP chapter includes the following: (1) key elements of the literature review for that specialty or for the crosscutting issues; (2) a complete reference section at the end of each chapter; (3) individual sections ending with the pertinent research agenda-setting items with a unique section identifying number to facilitate cross-referencing and citation; (4) discussion of the issues of most concern in the care of older patients by practitioners in the specific discipline; (5) key research questions with the highest priority in the opinion of the experts participating in the project; and (6) examples of hypothesis-generating and hypothesis-testing research needed to address each key question. Each of the agenda items in each section was labeled with a letter from A to D (designating the type of research design and the clinical priority or importance of the proposed study). In the RASP, the word level was not intended to imply degrees of quality and was defined instead as follows:

- Level A identifies important studies with hypothesis-testing intent, using such designs as randomized controlled trials, certain nonrandomized controlled trials, or those cohort studies that focus on a single hypothesis.
- Level B identifies important studies with hypothesis-generating intent. Designs would include exploratory, multi-targeted cohort and case-control studies; retrospective or prospective analysis of large databases; cross-sectional observational studies; time series; outcome studies; retrospective case series; or post hoc analyses of randomized controlled trials.
- Level C identifies hypothesis-testing studies judged by the content experts to be of lesser importance and priority than those labeled A.
- Level D identifies hypothesis-generating studies judged to be of lesser importance than studies labeled B.

In the RASP, the proposed A (or C) studies generally must be preceded by B (or D, respectively). Although A studies in general would rank higher in terms of the quality of the evidence they would provide, B studies often have sequence priority over A studies because of cost, logistical, and ethical issues surrounding designing and implementing an "A" study. All of the elements in the RASP book are indexed by topic with discussions of the literature in all the specialty fields and for each crosscutting issue, specific studies by name, tables and figures, the agenda items and key questions, descriptions of research design, as well as the project history and methods. A follow-up to RASP 1 (i.e., the RASP supplement) was performed to update the literature from 2000 to 2005 and used a similar methodology to the above. For ophthalmology, the authors were Andrew G. Lee, MD, and David Steven Friedman, MD. The entire RASP book and the supplement are available through the AGS at http://newfrontiers.americangeriatrics.org/ [1].

Some examples of the research questions from the RASP supplement for ophthalmology are listed below:

- Ophth KQ1: Does visual improvement or stabilization, including low-vision rehabilitation, reduce the severity, incidence, and prevalence of depression, dementia, delirium, falls, driving accidents, loss of function or quality of life, and hospital complications in the elderly population?
- Ophth KQ2: What is the best timing for and what are the best methods for intervention in visual loss in the elderly person, and what are the best outcome measures for documenting success?
- Ophth KQ3: What are the risk factors for functional vision impairment in the elderly person, and what screening intervals and methods and what instruments for measuring visual function would be best for identifying an older person's risks for such impairment?

It is hoped that the RASP will assist researchers in the field of geriatric ophthalmology by providing ideas and background for research (Fig. 1). The interested reader is directed to the AGS website for further information. http://newfrontiers.americangeriatrics.org/ [1].

Fig. 1 Progress in medical research has given new hope to many elderly patients facing the ophthalmic diseases of aging. The research agenda-setting process hopes to bring clinical research to application at the chairside

Acknowledgement The authors of the chapter would like to thank Dr. David Steven Friedman for his contribution toward this chapter.

Reference

1. American Geriatric Society website. http://newfrontiers.americangeriatrics.org/.

Screening for Comorbidities

Sushma Yalamanchili

Case Vignette

An 82-year-old white female is referred from an assisted living facility to the eye clinic for "redness" of the left eye. She does not answer questions when spoken to and appears to have a blunted affect. She is uncooperative in reading the eye chart. It is very difficult to assess her visual acuity. According to the assisted living facility, she does wear glasses and has a history of cataract extractions in both eyes. She is currently only on medication for hypertension. Recently she has become less and less responsive to her environment.

Introduction

This is a patient in whom the history and exam are difficult. Despite the challenges, it is important in these cases to do a comprehensive exam and to screen for possible comorbidities that normally would be able to be elicited on history from a more cooperative patient. From the ocular standpoint, does she have cataracts, glaucoma, age-related macular degeneration, or another retinal disorder? Is there any sign of hypertension or diabetes on retinal exam? Does she have a history of depression or dementia? Does she have a history of severe hearing loss? Is there a family history of depression or dementia? Has there been a recent traumatic event in her life? Does she speak another language that she would prefer to use? These are all important

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questions to ask and consider during the history and physical. Addressing the competencies in patients in whom the cooperation is poor is a particularly challenging aspect to working with elderly patients in institutional settings.

Practice-Based Learning and Improvement

In assessing a patient who is unable to communicate, it is sometimes more efficient to start with a thorough exam first. One should assess for other possible comorbidities. It is very important, for example, to look for the common and treatable problems first like refractive error. A cross-sectional population-based study done in Australia of almost 5000 elderly people found that uncorrected refractive error was the most common cause of bilateral visual loss [1]. If a patient is uncooperative with the exam, it is also reasonable to do a cycloplegic refraction and autorefraction or retinoscopy to assess for a potential refractive error. It is important not to miss the basics and address possible common problems first (Fig. 1).

Since most major eye diseases occur with greater frequency among older adults, the rates of visual impairment will increase as the population ages. The leading cause of blindness in white Americans is ARMD, but for black Americans, the leading causes are cataract and glaucoma [2]. In a large population-based study in India, cataract was a common cause of visual impairment even in people in their 50s [3]. Thus, it is important to pay particular attention for these treatable possibilities on the exam. Doing a thorough retinal exam, including ultrasonography to visualize the posterior segment if there is a dense cataract, helps to rule out a retinal detachment or mass.

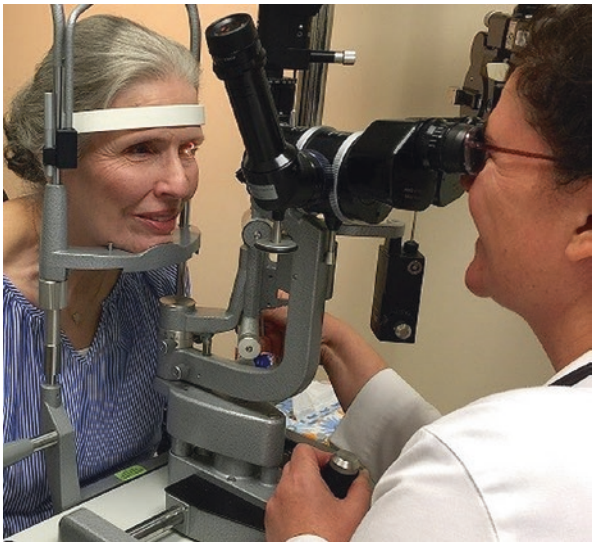

Fig. 1 Routine history and physical examination may reveal systemic comorbidities of aging and prompt referral to primary care

Systemic conditions may also contribute to a decline in vision. Wallhagen et al. found that vision and hearing loss self-reported by patients have strong independent effects on disability, physical functioning, mental health, and social function 1 year after initial evaluation [4]. In one large cohort study of risk factors for cognitive and functional decline, combined hearing and visual loss were found to be associated with the greatest likelihood of cognitive and functional decline [5]. Hence, a referral to an otolaryngologist may be in order.

Depression and dementia also should be considered. Horowitz et al. conducted a descriptive study of the effects of specific rehabilitation services (e.g., low-vision clinical services, skills training, counseling, optical device use, and adaptive device use) on depression among 95 older patients with age-related vision impairments. Hierarchical regression analyses indicated that low-vision clinical services, counseling, and the use of optical devices each significantly contributed to a decline in depression [6]. During the exam, it is thus important to assess the patient's overall affect and body language. Are they more withdrawn lately or less responsive than usual? Depression can also mimic or exacerbate ocular complaints and should be considered and investigated.

A recent study in China showed that age-related cataract was related to the presence of depressive symptoms among older adults, particularly in poorly educated ones. The study also suggests cataract surgery may help alleviate depression levels. The study observed nearly 4600 adults, aged 60 and above. The participants were required to complete a depression questionnaire and to undergo a clinical examination to assess the existence and severity of cataracts. Older respondents with visual impairment were more likely to exhibit signs of depression independent of socioeconomic status, lifestyle, and visual acuity. The likelihood of depression was 33% in people with cataracts. The link between cataracts resulting in clouding of vision and depression was 50% more in those without formal education.

Though the association between cataracts and depression is evident in the study findings, the researchers were unable to determine if vision loss among aged adults caused them to suffer from depression or if depression had resulted in them showing less eagerness to seek necessary medical interventions for cataracts. These results suggest that ophthalmologists should think beyond the direct effects of cataracts on visual impairment and consider the broader impact that vision loss may have on mental health and well-being [7].

In addition, hypertension and diabetes may contribute to decrease in vision. There may be a vitreous hemorrhage, a tractional retinal detachment secondary to diabetes, or an unrecognized vascular occlusion. A retrospective study of the charts of 93 inpatients (half of whom had suffered strokes) who were referred to a low-vision rehabilitation clinic found that on average, the visual acuity was moderately impaired and that this interfered with the activities of daily living. A high proportion of those referred were believed to benefit from new eyeglasses correction or vision aids [8]. In conclusion, all patients whether or not they are able to communicate their needs must be assessed in an open-minded arena.

Interpersonal and Communication Skills

Although the evaluation and treatment of some of the diseases above are beyond the scope of practice of the eye care provider, it is the responsibility of every doctor to consider the needs of the whole patient. Thus, appropriate referrals should be made. Every aspect of the patient should be addressed. If there is any change in physical appearance or demeanor, it should be stated in the chart and addressed for this may be early signs of depression, dementia, or neglect.

Nonverbal exams are important in patients that cannot communicate. Nonverbal exams are traditionally done in children too young to communicate or with other disorders such as autism. However, there are a growing number of adult patients with cognitive impairment and neurological disorders such as cerebral palsy, muscular dystrophy, severe depression, and traumatic brain injury. Begin the examination as soon as the patient walks in the room by observing eye movements and behaviors**.** Because many nonverbal patients are especially sensitive to touch, clinicians must be careful to approach them in a nonthreatening manner. This allows the physician to complete the exam without triggering any traumatic response in the patient. The clinician must be willing to be spontaneous and creative and focus on what the patient will allow the ophthalmologist to do in that moment [9].

Systems-Based Practice

The ophthalmologist should consider calling the primary care provider as well as caregivers to inform them if there are any new ocular problems contributing to the blunted affect or vice versa. The ophthalmologist may need to use social workers, community assistance, or family to help with any adjustments in vision. Patients with new visual loss might benefit from significant counseling regarding home hazard reduction and adjustments in daily living. Ophthalmologists are not expected to treat depression, dementia, diabetes, hypertension, or hearing loss. However, appropriate recognition of comorbidities and communication with the primary care provider or subspecialists might result in interventions that will improve these diseases and quality of life for the patient.

Depression is a common risk for people who have lost their vision from age-related macular degeneration (AMD), but a study shows that an integrated mental health and low-vision intervention halved the incidence of depressive disorders. The trial recruited 188 participants with bilateral AMD from an ophthalmology practice affiliated with Wills Eye Hospital in Philadelphia. The participants were 84 years of age on average, 70% were women, and 50% lived alone. All had a best-corrected vision of less than 20/70. Each participant had mild depressive symptoms and was at risk for developing clinical depression based on a nine-item depression subtest of the Patient Health Questionnaire, or PHQ-9. One group received behavior activation from an occupational therapist specially trained in the approach. The occupational therapist worked with participants to guide them on using the low-vision devices, to make changes around the home (such as using brighter lights and high-contrast tape),

to increase their social activities, and to help them set personal goals and break these down into manageable steps. The second group of participants served as a control group. They talked about their difficulties to a therapist, but did not receive behavior activation or low-vision occupational therapy. The first group halved the incidence of depressive disorders relative to standard outpatient care in patients with AMD. Thus, increasing interactions between ophthalmology, optometry, rehabilitation, psychiatry, and behavioral psychology may prevent depression in the low-vision population [10].

Professionalism

Part of the professionalism competency is recognizing and being sensitive to the unique needs of elderly patients who may not be able to express their own needs. Thus talking to family members and the assisted living facility to obtain an adequate history would assist in providing optimal care to the patient. A patient's chronological age is not as important as their ability to function daily and meet their social needs. It is important to be sensitive to an older patient's specific needs and desires and try to improve on them.

Older adults with vision loss are three times more likely to report difficulty in (1) walking, (2) managing medications, and (3) preparing meals. In fact about 39% of people with severe vision loss experience activities of daily living ADL limitations, compared to 7% of those with better vision. ADLs include eating, bathing, dressing, toileting, walking, and continence. Thus, if there is vision loss, it is important to communicate with the primary care physician and other healthcare professionals as it might impact the patient's activities of daily living [11].

Case Resolution

In this particular patient, the diagnosis of acute depression was made by her primary care physician most likely secondary to the recent death of her spouse. She had a prior history of hearing loss that was corrected with hearing aids. However, with the recent loss of her spouse, she did not wear either her hearing aids or her glasses.

A new refraction was given to the patient based on a cycloplegic retinoscopy exam. The patient was referred to a psychiatrist and support group. After appropriate antidepressants and therapy were started, the patient returned to the ophthalmologist and was able to communicate enough to obtain a visual acuity and express her needs. She stated she was happy with the glasses given to her, but her eyes sometimes felt scratchy. The patient was given a prescription for artificial tears and expressed her gratitude for the care provided. She was still very affected by the death of her husband but was now having frequent visits with her primary care physician and children.

In this case, there are clearly other issues involved than her visual problems. It is important to first rule out ocular disease on exam such as cataracts, glaucoma, and ARMD; and then it is important to address other possible issues such as depression, dementia, or hearing loss. Comorbidities are important to be aware of and screen for in all patients but in particular the elderly.

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Refer Comorbidities

Sushma Yalamanchili

Case Vignette

A 67-year-old man has a 3-week history of new binocular diplopia. The diplopia became worse over the past week but then stabilized. Currently his left eye "droop" has improved. In the first 2 weeks, he had also noticed severe retro-orbital pain on the left side, but this pain has since become minimal. He has a history of cataract extraction in the left eye and stable vision. His past medical history is significant for hypertension and diabetes. He cannot remember the names of his medication or his most recent blood sugar level. He smokes a pack of cigarettes a day. He denies any facial numbness, recent headache, jaw claudication, or other neurologic deficits.

Examination reveals a visual acuity of 20/25 on the right and 20/25 on the left. Pupils are 3 mm bilaterally, and both react well to light and near. There is no relative afferent pupillary defect. Visual field testing and color plate naming were normal. He has complete ptosis of his left eyelid and markedly impaired levator function. He cannot adduct, elevate, or depress the left eye, but he can fully abduct the eye. Attempts at depression of the left eye result in intact incyclodeviation of the eye. Motility is normal in the right eye. There is no proptosis, facial sensation is normal, and general neurologic exam is otherwise normal. Fundus exam reveals severe bilateral diabetic retinopathy without disc pathology and mild attenuation of the vessels (Fig. 1).

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Fig. 1 Fundus photography helps document ocular pathology to allow establishing a baseline for future reference

Introduction

It is important to look at the patient as a whole and not just treat his ocular condition. This patient appears to have an isolated pupil-spared, third nerve palsy without associated neurologic findings. Risk factors such as diabetes, heart disease, hypertension, and cholesterol, as well as compressive lesions should be considered. This particular patient is known to have diabetes. Referring this particular patient to his primary care physician to check his hemoglobin A1C level and manage his diabetes and hypertension are important initial steps. Although the detailed management of third nerve palsy is beyond the scope of this chapter, we would like to emphasize the competency-based aspects of dealing with this multidisciplinary clinical problem. Hence, it is very important to address comorbidities (e.g., diabetes, heart disease, and hypertension) and refer these patients to the appropriate physicians for adequate care.

Practice-Based Learning and Improvement

The severe ptosis and marked impairment of elevation, adduction, and depression in the right eye with a normal pupil exam is compatible with a pupil-sparing, complete motor third nerve palsy. The sixth nerve and fourth nerve appear to be spared since the patient still has full abduction and incyclotorsion on downgaze [1]. Isolated third nerve palsies with no pupillary involvement are most commonly caused by ischemia, especially diabetes mellitus. Diabetes is the most common etiology

accounting for 46% of all cases with pupil sparing documented in 68–86% of the cases [2]. The most likely reason for pupillary sparing is the fact that in diabetic third nerve palsy, there is lack of damage to the periphery of the nerve where the majority of pupillomotor fibers are thought to pass [3].

In patients over the age of 55, giant cell arteritis must be ruled out. Ask about jaw or tongue claudication, fever, chills, myalgias, weight loss, lack of appetite, temporal headache, polymyalgia rheumatica symptoms, ear or neck pain (carotidynia), and scalp tenderness. If there is any degree of suspicion, an immediate sedimentation rate and C-reactive protein should be drawn, steroids started, and a temporal artery biopsy scheduled [4].

Myasthenia gravis must also be ruled out in the elderly. Myasthenia may mimic a third nerve palsy where the patient has ptosis and diplopia. It is important to ask the following questions. Do you have any generalized muscle weakness, hoarseness, difficulty breathing or swallowing, any family history of myasthenia, or thyroid disease? If one is suspicious for myasthenia because of fluctuating or fatiguing ptosis or ophthalmoplegia, a tensilon test, acetylcholine receptor antibody, and thyroid function tests could be ordered [5].

Vaculopathic risk factors, especially diabetes mellitus, hypertension, and increased cholesterol, should be sought and controlled. Strabismus surgery or lid surgery may be helpful in selected patients with unresolved ophthalmoplegia, diplopia, or ptosis.

The patient should be followed at 1- to 2-month intervals to see if the third nerve palsy improves. Complete resolution for ischemic third nerve palsy is expected to occur in 3–6 months. If no improvement is evident by 3 months after onset, neuroimaging for a compressive lesion is typically recommended [6]. Hence, all comorbidities need to be considered, referred, and ruled out by the appropriate physicians (e.g., primary care, cardiology, neurology, radiology, and neurosurgery).

Interpersonal and Communication Skills

Despite having primary care physicians and knowing they have systemic diseases, sometimes patients are still noncompliant with medications and suggested treatment plans. The ophthalmologist who suspects inadequately controlled blood sugar levels or high blood pressure should encourage further evaluation and treatment for their systemic diseases. Contacting the primary care physician or cardiologist about their ocular complications and possible systemic etiology may both alert them to seek a better plan for their patient and stress compliance importance with the patient.

One study followed 315 consecutive elderly patients admitted to an acute care hospital to determine the percentage of elderly hospital admissions due to noncompliance with medication regimens or adverse drug reactions, their causes, consequences, and predictors. Eighty-nine of the elderly admissions (28.2%) were drug related, 36 due to noncompliance (11.4%), and 53 due to adverse drug reactions (16.8%). One hundred three patients had a history of noncompliance (32.7%). Factors statistically associated with a higher risk of hospitalization due to

noncompliance were poor recall of medication regimen, seeing numerous physicians, female gender, medium income category, use of numerous medications, and having the opinion that medications are expensive [7]. Thus, as an ophthalmologist, it is important to communicate with the elderly patient about the importance of taking their medications and how noncompliance can cause ocular complications from HTN, DM, and other conditions. Difficulty with medication schedules, confusion connecting the correct drug with the correct disease, and financial hardship may all factor into noncompliance; it is important to communicate directly with the primary care physician about controlling the underlying systemic disease process with medications that the patients can afford and understand how to take.

Systems-Based Learning

Many elderly patients have multiple medical problems, requiring an integrated treatment team to treat comorbidities. Ophthalmologists and neurologists may work together to care for patients with third nerve palsy. In addition, physicians who manage diabetes, high blood pressure, or other underlying causative conditions will be involved in these patient's care.

Screening for and referring comorbidities is part of the role as an ophthalmologist. In this particular case, the following possibilities must be ruled out and/or referred to the appropriate physician.

An internist will do an initial workup of a pupil-sparing, third cranial nerve palsy without any other evidence of aneurysm for arteriosclerotic risk factors, including diabetes and hypertension. Certain patients may require screening for collagen vascular disease, systemic vasculitis, sarcoidosis, or other granulomatous systemic diseases. If carcinomatous meningitis is diagnosed on cerebrospinal fluid workup, then a search for systemic metastatic disease, an occult primary carcinoma, lymphoma, or leukemia is warranted [8].

Neurosurgery or neurology needs to be consulted if suspicious of a pupil involved third cranial nerve palsy due to a berry aneurysm, with or without concomitant subarachnoid hemorrhage [9].

The ophthalmologist provides symptomatic treatment for diplopia using occlusion. Special lenses with prisms may also improve diplopia. In addition, surgery on the eye muscles or eyelid may be necessary in some cases, although most clinicians recommend waiting 6 months from onset so that the patient's condition stabilizes and recovery is maximized.

One particular study of third nerve palsy shows the importance of coordination of care between clinicians in multiple specialties. In this study 59 of 61 patients with isolated third nerve palsy were above the age of 60 years. Out of 23 patients (38%) which had the characteristic clinical features of an ischemic oculomotor nerve palsy cases, 11 had diabetes mellitus, and 8 had an abnormal glucose tolerance test, while in 4 the latter was normal. Almost all had hypertension and were overweight, and half were smokers. In 18 patients, 4 or 5 vascular risk factors were present [10]. This study again highlights the importance of screening for and treating vasculopathic risk factors in conjunction with the primary team.

Professionalism

Recognizing and being sensitive to the needs of an elderly patient with multiple medical problems is a must. Speaking with the family as well as the patient may improve compliance; the family may provide support to take medications on time, make doctor's appointments, provide transportation, and help compliance with dietary and lifestyle modifications.

By the year 2030, a projected 71 million Americans will be age 65 or older, an increase of more than 200% from the year 2000, according to the US Census Bureau. One of the biggest problems physicians face when dealing with older patients is that their wide range of life experiences and cultural backgrounds often influence their perception of illness, willingness to adhere to medical regimens, and ability to communicate effectively with health-care providers. Also, effective communication and compliance with recommendations can be hindered by the normal aging process. Hearing loss, decline in memory, slower processing of information, lessening of their real or perceived power and influence over their own lives, retirement from work, and separation from family and friends can all affect mental processing needed for maximal self-care. Allow extra time for older patients; maintain eye contact; listen; speak slowly, clearly, and loudly; and simplify and write down your instructions. Bring a family member or friend in during the consultation to ensure information is understood, and give patients an opportunity to ask questions and express themselves [11].

Case Resolution

The patient above was diagnosed with an ischemic isolated third nerve palsy most likely from diabetes mellitus. The third nerve palsy was already improving at initial evaluation and subsequently did improve with simple observation over 3 months; thus no neuroimaging was performed. In the second month, he did patch the eye for symptomatic relief from the diplopia.

It is important to refer patients for comorbidities. In this case, the patient was sent to his primary care physician the day after the diagnosis was made. His blood sugar level was in the 300 s. He was started on insulin for better management of his diabetes. He was also found to have elevated cholesterol and triglyceride levels and was started on appropriate medications and dietary modifications. The patient is much more compliant with medications at this time and checks his finger sticks daily. He states that he had quite a scare with the double vision and his retinopathy has also improved. It is very important to refer for possible or even known comorbidities. In this case, it was known that the patient had both diabetes and hypertension; yet, he was placed on a better treatment program after this incident. In addition, he decreased smoking, modified his diet, and started an exercise regimen. In conclusion, referring him to his primary care physician for better control of his diabetes and hypertension will aid him in having a better quality of life.

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