Geriatric Patients with Epilepsy

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Introduction

Elderly patients with epilepsy share many characteristics with their younger cohort, but there are important differences between these groups that are relevant for the neuropsychologist working with older adults. Elderly patients with epilepsy have unique risk factors for comorbidities and complications that put them at increased risk of neurocognitive sequelae. The medical, cognitive, and psychosocial characteristics of this group often result in different referral questions and approaches for the development of clinical hypotheses, selection of tests, interpretation of results, and provision of recommendations.

Because the prevalence and incidence of epilepsy are greatest in those over age 60, neuropsychologists who conduct evaluations with adults with epilepsy are likely to be asked to assess these patients. It is also important for neuropsychologists conducting dementia evaluations to understand the interface between dementia and epilepsy because of the overlap in symptoms between, and co-occurrence of, these two disorders.

This chapter provides the clinician seeing elderly patients information about the presentation of epilepsy in this population, including characteristics of epilepsy, cognitive functioning, psychosocial considerations, and treatment alternatives. This is followed by practical considerations when completing a neuropsychological evaluation with an elderly epilepsy patient, including interview, test selection, result interpretation, and recommendations. Finally, a case is presented that illustrates these unique considerations in an elderly patient with epilepsy.

In this chapter, "elderly" will be used to indicate individuals aged 60 years and older. We acknowledge that this is a fairly young point at which to start applying this descriptor, but this age range is not completely arbitrary, since the incidence of unprovoked epilepsy sharply increases after age 60 (Hauser, Annegers, et al., 1993), and age-related physiological changes that complicate pharmacokinetics and pharmacodynamics of antiepileptic drugs (AEDs) are often evident by age 65. Incidence of relevant medical comorbidities such as stroke increases after about age 55 years (Thorvaldsen, Asplund, et al., 1995). Studies on older adults in the literature generally define the elderly as over 55 or 60. Because of the above findings, and to maintain consistency with existing literature, this chapter defines the elderly as those aged 60 and older unless stated otherwise.

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Background

Prevalence and Incidence of Epilepsy in Elderly Patients

Epilepsy has an increased prevalence and incidence in elderly patients, as suggested by studies from several countries (e.g., de la Court, Breteler, et al., 1996; Hauser, Annegers, et al., 1991; Wallace, Shorvon, et al., 1998). Data from the Rochester Epidemiology Project collected from 1935 to 1984 revealed a relatively high incidence of "unprovoked" epilepsy (i.e., recurrent seizures with no identified immediate precipitant) during the first year of life (82/100,000) that declined throughout childhood and remained generally low until it started rising again at age 55–60, peaking in those aged 75 years and older (139/100,000; Hauser, Annegers, et al., 1993; Hauser, Annegers, et al., 1996). See Fig. 3.1 for a graphical representation of these results. Likewise, *prevalence* of active epilepsy steadily increased over adulthood and reportedly affected approximately 1 % of the population over 75 years of age (de la Court, Breteler, et al., 1996; Hauser, Annegers, et al., 1996). Because older individuals make up the most rapidly growing sector of the population in the industrialized world, the number of elderly people with epilepsy will continue to rise.

Unique Characteristics of Epilepsy in Elderly Patients

Types of Seizures

While the incidence of both focal and generalized unprovoked epilepsy increases in older adults, the most dramatic increase is in focal epilepsy (Hauser, Annegers, et al., 1993). In those over age 65, focal seizures with alteration of consciousness are the most frequent seizure type (48 %), followed by generalized (29 %) and focal seizures without alteration of consciousness (13 %) (Hauser, 1992). In elderly patients with chronic rather than new-onset epilepsy, seizures may become briefer and less elaborate over time, and generalized tonic-clonic seizures may become less frequent or even disappear (Tinuper, Provini, et al., 1996). Whereas focal seizures most often arise from the temporal lobe in the general population, these seizures in elderly patients often originate from extratemporal or frontal regions frequently affected by stroke (Ramsay, Rowan, et al., 2004).

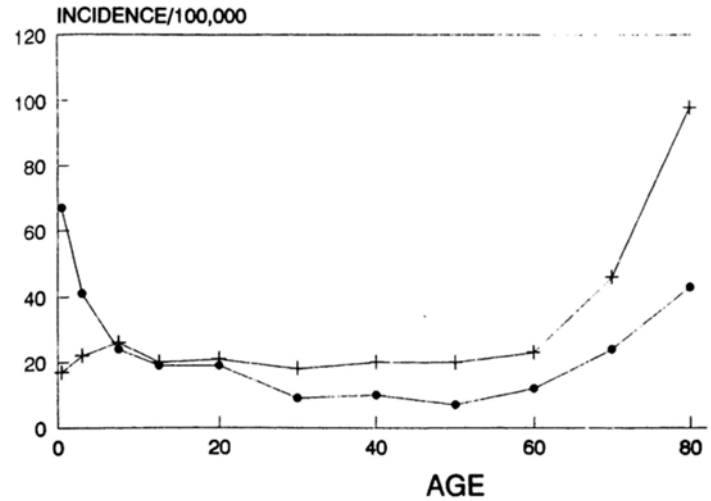

Fig. 3.1 Age-specific incidence of generalized-onset (*solid circles*) and partial-onset (*plus signs*) unprovoked epilepsies based on data collected in the Rochester Epidemiology Project from 1935 to 1984 (Hauser et al., 1993) Used with permission from *Epilepsia*

Etiology of Seizures

Cerebrovascular disease is the most common non-idiopathic etiology of new-onset epilepsy in those aged 65 and older, accounting for 28 % of cases (Hauser, Annegers, et al., 1993). Approximately 20 % of cases were attributed to degenerative diseases, and less than 5 % were related to CNS tumors, trauma, or infection. Etiology remains unknown in 25–50 % (Hauser, Annegers, et al., 1993; Ramsay, Rowan, et al., 2004). See Fig. 3.2 for a comparison of etiologies of newly diagnosed epilepsy across the life span.

Diagnostic Complications

Diagnosing epilepsy in elderly patients can be complicated, and there is increased risk of both over- and underdiagnosis in this group. It is important for neuropsychologists conducting evaluations with older adults to keep this in mind, since presenting symptoms may reflect undiagnosed seizures. Older adults who presented with tonic-clonic seizures were correctly diagnosed 66.7 % of the time, although only 25.4 % of those with focal seizures without alteration of consciousness received an initial correct diagnosis (as described in Ramsay, Rowan, et al. (2004)). In patients with TIAs or strokes, the diagnosis of seizures was almost always delayed. It took an average of 1.7 years before correct diagnosis was made in this sample. This diagnostic difficulty is based, in part, on the limited knowledge of seizure semiology in the elderly, the reduced frequency of interictal discharges, the variety of EEG patterns seen, and the increased incidence of other conditions that may mimic seizures in this population (Van Cott, 2002). Further, it may be difficult to understand the presence or characteristics of spells in elderly individuals because patients are often more socially isolated (i.e., are more likely to live alone, be unemployed, have fewer social activities) and may have more memory problems than their younger cohort.

Because seizures tend to originate from extratemporal foci more often among elderly patients, they are less likely to exhibit the typical clinical manifestations characteristic of temporal lobe seizures (Ramsay & Pryor, 2000). Seizure symptoms are often nonspecific and may include altered mentation, staring, unresponsiveness, blackouts, and auras of dizziness (Ramsay &

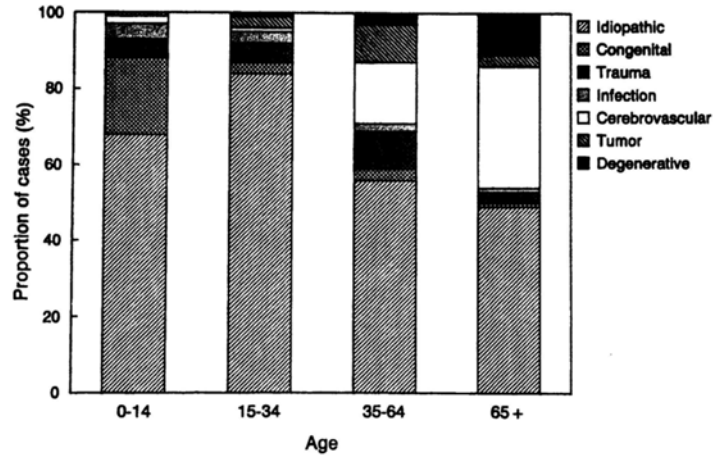

Fig. 3.2 Proportion of cases of newly diagnosed epilepsy assigned to specific etiologic categories within age groups, including idiopathic/cryptogenic category. Area: idiopathic (*gray cross-hatched*), congenital (*dashed*), trauma (*dotted*), trauma (*widely dotted*), infection (*hatched*), cerebrovascular (*closely dotted*), tumor (*black*), degenerative (*light cross-hatch*)

Pryor, 2000). Postictal confusion may persist for several days in older patients, compared to minutes in younger patients (Cloyd, Hauser, et al., 2006; Sheth, Drazkowski, et al., 2006).

These nonspecific symptoms make seizures more difficult to diagnose based on description alone. Several types of disorders or events may mimic seizures in elderly patients. Focal seizures with alteration of consciousness may be mistaken for TIAs or other cardiovascular disease, syncope, dementia, arrhythmias, or fluctuations in blood pressure or blood sugar levels (Sheorajpanday & De Deyn, 2007). The most common initial diagnoses in patients in the VACS 428 study whose diagnoses were later confirmed as epilepsy included altered mental status (41.8 %), confusion (37.5 %), blackout spells (29.3 %), and syncope (16.8 %) (Brodie & Kwan, 2005; Ramsay, Rowan, et al., 2004). See Table 3.1 for the primary differential diagnosis of seizures in elderly patients.

Status epilepticus (SE) often presents with no convulsive activity in elderly patients and may appear simply as confusion or minimal motor movements. In a prospective study, nonconvulsive SE was diagnosed in 16 % of elderly patients presenting with confusion of unknown origin (Baxendale, 1998). Thus, SE may go undiagnosed for several days in ambulatory elderly patients with ictal confusion (Sheth, Drazkowski, et al., 2006). This is concerning since even after it is treated, SE can result in persistent cognitive dysfunction. Further, SE is more common and has a higher morbidity rate in elderly patients (DeLorenzo, Hauser, et al., 1996).

Finally, further complicating an epilepsy diagnosis, EEG is less sensitive and specific for epilepsy in elderly patients (Brodie & Kwan, 2005). Absence of interictal epileptiform activity on routine EEG does not rule out the diagnosis, since its presence decreases with age and only occurs in 35 % of patients with preexisting epilepsy (mean age = 65) and 26 % of elderly patients with new-onset seizures (mean age = 70) (Drury & Beydoun, 1998). Conversely, benign EEG changes are associated with normal aging and have the potential to be misinterpreted as indicating a seizure tendency (Van Cott, 2002). Therefore, video-EEG monitoring may be valuable in establishing the diagnosis (Brodie & Kwan, 2005; McBride, Shih, et al., 2002; Van Cott, 2002).

Table 3.1 Main differential diagnosis of seizures in elderly patients

Neurological
– Transient ischemic attack
– Transient global amnesia
– Migraine
– Restless leg syndrome
– Dyskinesia
Cardiovascular
– Vasovagal syncope
– Orthostatic hypotension
– Cardiac arrhythmias
– Structural heart disease
– Carotid sinus syndrome
Endocrine/metabolic
– Hypoglycemia
– Hypocalcemia
– Hypomagnesemia
Sleep disorders
– Obstructive sleep apnea
– Narcolepsy
– Rapid eye movement sleep disorders
– Hypnic jerks
Psychological
– Nonepileptic psychogenic seizures

Adapted from (Brodie & Kwan, 2005)

Cognition in Elderly Patients with Epilepsy

Effect of Age on Cognition in Epilepsy

Epilepsy is associated with cognitive impairment, the cause of which is often multifactorial and may include underlying seizure etiology, ictal and interictal neuronal discharges, AED side effects, and psychosocial confounds (Kwan & Brodie, 2001). This is no different in elderly patients with epilepsy (Caramelli & Castro, 2005) and several factors may increase the risk of cognitive dysfunction in this group.

First, there is a subset of elderly patients with epilepsy who have had epilepsy for many years. There is evidence for greater cognitive morbidity when epilepsy has been long-standing (Helmstaedter, Kurthen, et al., 2003; Hermann, Seidenberg, et al., 2006).

Second, even "healthy" aging is associated with decreased processing speed and fluid intelligence, likely resulting from neurophysiological changes including loss of synapses, neurons, neurotransmitters, and neuronal networks (Fillit, Butler, et al., 2002). Furthermore, normal aging often results in mild levels of cerebral atrophy, ventricular enlargement, hippocampal atrophy, and deposition of beta-amyloid peptide and neurofibrillary tangles (Smith & Rush, 2006). The presence of epilepsy potentially exacerbates these changes.

Third, both aging and epilepsy have been associated with increased incidence of dementia and other disorders and lifestyle factors that can cause cognitive dysfunction (Hermann, Seidenberg, et al., 2008b). Compared to population-based controls, individuals with epilepsy had an increased relative risk of being diagnosed with Alzheimer's disease at least 1 year *after* epilepsy diagnosis, with relative risk values ranging from 1.2 to 4.0 (Breteler, van Duijn, et al., 1991). Hermann (2008b) makes a compelling case that chronic epilepsy has been associated with several risk factors for poorer cognitive aging. As a group, those with chronic epilepsy have greater vascular risk factors, including more ischemic heart disease, hypertension, heart failure, diabetes, and cerebrovascular disease (Gaitatzis, Carroll, et al., 2004; Tellez-Zenteno, Matijevic, et al., 2005). This may be partially attributable to side effects (e.g., metabolic disorders, increased homocysteine) associated with select AEDs such as valproic acid and enzyme-inducing medications (Hamed & Nabeshima, 2005; Isojarvi, Rattya, et al., 1998; Luef, Waldmann, et al., 2004; Ono, Sakamoto, et al., 1997; Pylvanen, Knip, et al., 2003; Schwaninger, Ringleb, et al., 2000; Sheth, 2004). Elderly patients with epilepsy who had no preexisting cerebrovascular disease were at 2.89 times the risk of experiencing a first ever stroke compared to an elderly control group (Cleary, Shorvon, et al., 2004). Epilepsy has also been associated with increased inflammatory markers, both through the effects of seizures themselves (Vezzani & Granata, 2005) as well as AED effects (Verrotti, Basciani, et al., 2001). Finally, Hermann (2008) describes lifestyle factors which are both associated with poor cognitive aging and epilepsy, including decreased social networks and physical activity (Bjorholt, Nakken, et al., 1990; Nakken, 1999).

Although the above factors raise concern that elderly patients with epilepsy may be at greater risk of cognitive dysfunction than younger patients with epilepsy or older individuals without epilepsy, there has been little research published in this area. Older adults with chronic epilepsy performed more poorly across most cognitive measures compared to healthy older controls, both in a sample of medically intractable patients (Martin, Griffith, et al., 2005) and a sample in which 63 % were successfully controlled with medications (Piazzini, Canevini, et al., 2006). Griffith and colleagues (2006) found that memory deficits in older adults with chronic epilepsy were similar to deficits in patients with amnestic mild cognitive impairment, and the patients with epilepsy had greater difficulty on measures of executive functioning. Further suggestive of memory impairment in this group, elderly patients with chronic epilepsy did not demonstrate practice effects on a measure of verbal memory at 2–3-year follow-up compared to healthy elderly controls tested over the same interval (Griffith, Martin, et al., 2007), suggesting that elderly epilepsy may be associated with failure to learn compared to healthy elderly subjects.

Although these studies support cognitive morbidity associated with epilepsy in elderly patients, no study has directly investigated if this cognitive dysfunction is any greater than that experienced in younger adults with epilepsy, and evidence for accelerated cognitive decline associated with epilepsy in older adults is mixed. A recent cross-sectional study by Helmstaedter and Elger (2009)

suggested *against* accelerated deterioration of episodic memory with older age in patients with TLE. Examination of verbal learning and memory in 1,156 patients with TLE and 1,000 controls over the life span revealed that the slow linear decline in verbal learning exhibited by normal controls after age 25 was mirrored in patients with TLE (although at a much lower level). Thus, although the TLE group had a lower level of performance, the rate of decline was the same between the groups. There was no relative decrease in memory in the TLE group compared to controls with advancing age. However, although patients ranged in age from 6 to 70 years, most were 50 years and younger, with only 17 patients over 60 years of age.

Conversely, there are other data supporting the possibility of age-accelerated cognitive decline in select patients with epilepsy. Another cross-sectional study by this same group suggested an age-accelerated decline in the retention of auditory information in preoperative patients who had temporal lobe epilepsy not confined to mesial temporal sclerosis (e.g., normal imaging or other lesions such as tumor) (Helmstaedter, Reuber, et al., 2002). Further, in a longitudinal study, Hermann et al. (2006) found that older age was one of the several predictors of decline in simple and complex psychomotor speed, but not other cognitive domains including memory, relative to expected values over a 4-year period in patients with chronic temporal lobe epilepsy. However, patients were relatively young in both of the above studies, with the average age in the low 30s.

In summary, there are several unique risk factors for cognitive morbidity in older adults with epilepsy. The few published studies examining the relationships among epilepsy, aging, and cognition suggest that older adults with epilepsy have more cognitive dysfunction than older adults without epilepsy and younger adults with epilepsy. It is unclear if this is due to additive or interactive effects of epilepsy and aging. However, most participants in these studies have been under 60 years old. More research is needed to determine the relationship between epilepsy and cognition as patients reach older age when the above comorbidities are more likely to start showing effects.

Epilepsy and Dementia

There is evidence for a bidirectional relationship between epilepsy and dementia. It is well established that those with dementia are at increased risk of developing epilepsy, and there is also some evidence that those with epilepsy may be at increased risk of developing dementia. Patients with dementia have a five- to tenfold increase in risk of seizures (Hesdorffer, Hauser, et al., 1996). Most of this research has been conducted in Alzheimer's disease (AD), although there are a few studies reporting the presence of seizures in dementia with Lewy bodies (Weiner, Hynan, et al., 2003) and Creutzfeldt-Jakob disease (Marchiori, Yasuda, et al., 1996). It is estimated that between 10 and 22 % of patients with AD will experience at least one seizure (Mendez & Lim, 2003). The incidence of seizures increases with the severity of the dementia (Hesdorffer, Hauser, et al., 1996; McAreavey, Ballinger, et al., 1992; Mendez & Lim, 2003), with seizure onset often 7 years after dementia diagnoses (Mendez, Catanzaro, et al., 1994). However, seizures can begin at any time during the course of the illness (Hauser, Morris, et al., 1986), even as early as 3 months after diagnosis (Hesdorffer, Hauser, et al., 1996). The mechanism causing seizures in Alzheimer's disease remains unknown, but suspected factors include the accumulation of amyloid-β plaques, neurofibrillary tangles, selective loss of inhibitory neurons, comorbid vascular lesions, and excessive neuronal cell loss in hippocampal and parietal cortices (Forstl, Burns, et al., 1992; Mendez, Catanzaro, et al., 1994; Mendez & Lim, 2003). The onset of seizures has been associated with a faster progression of cognitive and functional impairment in patients with AD (Volicer, Smith, et al., 1995).

There is also evidence that those with epilepsy may be at increased risk of developing a progressive dementia. Breteler et al. (1991) reviewed four studies that examined the relative risk of a subsequent diagnosis of Alzheimer's disease in those with an epilepsy diagnosis. Diagnoses were

based on interview with an informant in three studies and medical record review in the other. Compared to population-based controls, individuals with epilepsy had an increased relative risk of being diagnosed with AD at least 1 year after epilepsy diagnosis (relative risk values ranging from 1.2 to 4.0). The reason for the increased risk of subsequent AD diagnosis in those with epilepsy is unknown, although data from this study suggested that cumulative effects of long-standing seizures did not appear to be a factor in the development of dementia. The greatest risk for a diagnosis of AD was in patients who had epilepsy less than 10 years (relative risk = 2.4) versus 10 years or more (relative risk = 1.4). Alternatively, seizures may represent early pathological dementia-related changes in these patients, or the presence of both seizures and dementia may reflect shared risk factors. In a follow-up study, Breteler et al. (1995) found that patients diagnosed with epilepsy had a relative risk of 1.5 for being diagnosed with dementia over the next 8 years compared to other hospital patients. In an investigation of all patients diagnosed with probable AD by a neurologist over a 6-year period, 6.8 % had a history of epilepsy and/or were taking AEDs at the time of diagnosis (Lozsadi & Larner, 2006). In half of these cases, seizure onset occurred at about the same time as the onset of cognitive decline, with no identified acute cause of the seizures identified. Data from the Canadian Study on Health and Aging found that a diagnosis of epilepsy in those aged 65 years and older had a relative risk of 1.56 for being diagnosed with dementia over the next 5 years compared to community-dwelling controls without epilepsy, although this did not meet statistical significance (Carter, Weaver, et al., 2007).

Another way to determine whether epilepsy increases the risk of dementia is to compare brain tissue from epilepsy patients with tissue from patients and unaffected, age-matched controls. Mackenzie and Miller (1994) compared the number and location of senile plaques in temporal lobe tissue from epilepsy patients and normal controls. The age-related incidence of senile plaques was significantly higher in epilepsy patients. However, no patient showed any evidence of dementia on cognitive testing, and no other AD-related pathology was identified. Postoperative follow-up (mean 3.7 years, range 2–7) of the ten patients with senile plaques revealed no clinical suggestion of dementia, suggesting that the senile plaques were not associated with dementia or cognitive deterioration for at least several years (Mackenzie, McLachlan, et al., 1996). Overall, these findings suggest that TLE is associated with increased formation of senile plaques, but these plaques do not have an apparent effect on cognition, including the development of dementia.

Psychosocial Considerations in Elderly Patients with Epilepsy

Epilepsy can have profound effects on mood, anxiety, and quality of life (QOL). Elderly patients may be particularly vulnerable to these symptoms because they often live alone and may have additional physical and cognitive vulnerabilities that put them at increased risk for loss of independence.

The concern for worse QOL in the elderly compared to younger patients with epilepsy has not been born out in research findings. Comparisons between QOL measures in the elderly and younger adults suggest similar QOL in these groups (Baker, Jacoby, et al., 2001; Laccheo, Ablah, et al., 2008) or that older patients may even cope better with epilepsy than middle-aged peers (Pugh, Copeland, et al., 2005). A potential confounding factor is that QOL measures are generally developed and normed for those under 65 years of age. When Martin and colleagues (2005) gave a group of community-dwelling elderly adults a blank paper to list their concerns regarding living with epilepsy, results were similar in content to concerns voiced by younger epilepsy patients and included driving/transportation (64 %), medication side effects (64 %), personal safety (39 %), AED costs (29 %), employment (26 %), social embarrassment (21 %), and memory loss (21 %). Thus, the elderly with epilepsy may not have worse

perceived QOL than younger patients but do report lower QOL than the general population (Laccheo, Ablah, et al., 2008) or older adults without epilepsy (McLaughlin et al. 2008).

Depression and anxiety rates are higher in patients with epilepsy in general, and this has been shown to extend to the elderly with epilepsy (Haut, Katz, et al., 2009). Further, many elderly people have been found to suffer from "subsyndromal" depression, in which they report significant depressive symptomatology but fail to meet formal diagnostic criteria for major depression (Strober & Arnett, 2009). Mental health disorders can be more difficult to diagnose in elderly patients with a neurological disorder compared to younger, otherwise healthy, individuals due to several factors including atypical presentation, difficulty distinguishing between symptoms of the mental health disease and epilepsy, and lack of assessment tools developed specifically for this population (Strober & Arnett, 2009). Nevertheless, it is often the responsibility of the neuropsychologist to determine whether or not a patient has a mental health disorder that requires treatment. It is important to understand unique characteristics of the presentation and treatment of mental health problems in the elderly with epilepsy. It has been suggested that depression in elderly individuals may present with more weight loss and fewer feelings of worthlessness and guilt than younger people (Frey, 2007), and depressive symptoms in patients with epilepsy may present as intermittent irritability, lack of energy, anxiety, and somatic symptoms such as pain (i.e., interictal dysphoric disorder). Many of the commonly used self-report inventories for depression do not have established cutoff scores for identifying depression in the elderly with epilepsy, although a recent review of depression assessment in the elderly with neurological disorders summarized the recommended cutoff scores for common measures when used with neurological populations (Strober & Arnett, 2009). The atypical presentation of depression in the elderly with epilepsy heightens the importance of a thorough clinical interview of the patient's symptoms and lack of strict adherence to formal diagnostic criteria.

There is also little known about the most effective treatment for depression and other mental health disorders in the elderly with epilepsy. Cognitive behavioral and interpersonal are two therapy modalities that have received the most empirical support for treatment of depression (Barlow, 2001), although these studies have not specifically examined the elderly with epilepsy. Referral to a psychiatrist with specialized knowledge in treating emotional distress in those with epilepsy is often very helpful. The patient's AED regimen should also be examined, since select AEDs have been associated with adverse mood side effects, most notably those such as phenobarbital, primidone, vigabatrin, topiramate, and levetiracetam (Frey, 2007). Finally, stressing medication compliance is especially important in this group, since depressed elderly medical patients were found to be less compliant with medications than nondepressed elderly medical patients (Carney, Freedland, et al., 1995).

Treatment of Epilepsy in Elderly Patients

AEDs

Epilepsy is more frequently controlled with AEDs in patients aged 65 years and over compared to younger patients (Mohanraj & Brodie, 2006). After starting AEDs for newly diagnosed epilepsy, approximately 80 % of patients aged 65 years and older remained seizure-free at 1-year follow-up (Brodie & Kwan, 2005).

Unfortunately, elderly patients are also generally more susceptible to the adverse effects of drugs than younger patients. Overall, AED side effects are more pronounced in elderly patients, there are more adverse drug interactions, and risk of toxicity is greater (Sheorajpanday & De Deyn, 2007). It is important for the neuropsychologist to be aware of situations in which AEDs may be contributing to cognitive deficits. Adverse side effects are more likely to occur with the specific AEDs described below, fast dose escalation rates, high doses, and polypharmacy (Sheorajpanday et al. 2007).

Despite these concerns, elderly individuals are underrepresented in AED clinical trials, and much of the information about AEDs used in elderly patients is derived from studies with younger adults (Beghi, Savica, et al., 2009). The few data available suggest that greater cognitive side effects of AEDs in elderly patients may be associated with polypharmacy (Griffith, Martin, et al., 2006; Piazzini, Canevini, et al., 2006) and old generation AEDs (Massimiliano, Rodolfo, et al., 2009). In addition, although cognitive side effects of topiramate have not been specifically examined in the elderly with epilepsy, there is reason to suspect that it carries cognitive risk based on the side effects seen in studies not restricted to the elderly (Sommer & Fenn, 2010).

Research has supported the effectiveness and tolerability of lamotrigine (LTG) and gabapentin (GBP) in elderly patients. Randomized controlled trials that have specifically recruited elderly patients found that LTG and/or GBP resulted in less early termination compared to carbamazepine (CBZ) with similar efficacy (Brodie, Overstall, et al., 1999; Rowan, Ramsay, et al., 2005; Saetre, Perucca, et al., 2007). An exception to this is one study that found no significant difference in effectiveness and tolerability of LTG and CBZ in elderly patients, although there were trends for greater tolerability of LTG and greater seizure-free rates of CBZ (Saetre, Perucca, et al., 2007). Several additional studies also found a good tolerability profile for, and effectiveness of, LTG in patients aged 60 or 65 and older (Arif, Buchsbaum, et al., 2010; Ferrendelli, French, et al., 2003; Giorgi, Gomez, et al., 2001; Mauri Llerda, Tejero, et al., 2005). Treatment guidelines from the International League Against Epilepsy state that, in focal epilepsies in elderly patients, LTG and GBP should be considered for initial monotherapy due to the available efficacy and effectiveness data (Glauser, Ben-Menachem, et al., 2006). Not all evidence is convergent on the superiority of LTG and GBP in elderly patients, however. A recent survey of patients aged 65–90 found no differences in adverse effects between LTG, CBZ, and sodium valproate (Brodie & Stephen, 2007), and Saetre et al. (2010) found that neither LTG nor CBZ caused significant changes in health-related quality of life. Other medications have not received as extensive study in the elderly with epilepsy, although oxcarbazepine appeared promising regarding tolerability in patients 65 years and older (Kutluay, McCague, et al., 2003).

Surgery

Epilepsy remains intractable to medications in approximately 20 % of elderly patients (Mohanraj & Brodie, 2006). Surgery is a successful treatment option for many patients with medically intractable epilepsy, and a recent study demonstrated similar rates of seizure outcome (i.e., Engel classes I and II) after temporal lobectomy with pathologically confirmed hippocampal sclerosis in those 50 and older (i.e., 95.2 %) compared with those under age 50 (i.e., 90.3 %) at follow-up approximately 10 years later. However, there has been some hesitancy to provide surgical treatment to elderly patients (Acosta, Vale, et al., 2008; Grivas, Schramm, et al., 2006; Sirven, Malamut, et al., 2000), in part due to concerns that surgery may exacerbate age-related cognitive decline (Grivas, Schramm, et al., 2006; Sirven, Malamut, et al., 2000).

The extent to which concern is warranted for poor cognitive outcome from surgery in elderly patients is unknown. Cross-sectional studies raise the possibility that temporal lobe surgery may accelerate memory decline with increasing age (Helmstaedter, Reuber, et al., 2002; Rausch, Kraemer, et al., 2003). Helmstaedter et al. (2002) found age-accelerated decline in postoperative verbal learning scores in patients after anterior temporal lobectomy compared to controls. This effect was not present in preoperative scores, in which age regression was similar to controls, suggesting that standard anterior temporal lobectomy has worse memory outcome for older individuals. However, there are sederal careats. First, age-related memory decline was specific to patients who underwent standard anterior temporal lobectomy for TLE that was not confined to mesial temporal sclerosis (e.g., normal imaging or other lesions such as tumor), as age-accelerated memory decline was not found in the

selective amygdalohippocampectomy group with MTS. Second, older patients may have had a later age of epilepsy onset and longer duration of epilepsy, both of which were correlated with poorer memory, so results may, at least in part, reflect these factors. Finally, the average age of subjects in that study was 30 years, with no patient aged 60 or older. Similarly, Rausch et al. (2003) found that patients showed increasing deviation from age-corrected normative data on episodic auditory memory tests both 1 year and ~12 years after left temporal lobectomy. However, patients were rather young in this study as well, with an average age of 40 years at the long-term follow-up.

Two studies have been published to date that directly compare cognitive outcome in older versus younger patients after surgery for epilepsy. Both found that the older adults did not demonstrate greater memory declines than younger adults. Sirven et al. (2000) found no difference in memory change between 17 older (approximate age range 50–66) and 180 younger (approximate age range 18–49 years) patients before and after temporal lobectomy. Similarly, Grivas et al. (2006) did not find significant differences in memory changes between 34 older adults (approximate age range 50–71) and 359 younger adults (age <50 years) before and after temporal lobectomy. However, there was a trend for greater decline in postoperative auditory memory performance in the eight patients over 60 years of age than in those under 60 years of age.

Further, elderly patients appear to be at greater risk of cognitive decline after major surgery in general compared to younger adults, even when the surgery does not involve the heart or brain. A well-designed study by Monk and colleagues (2008) found that although about 31–40 % of non-demented adult patients experience cognitive dysfunction (i.e., deficits in episodic memory, executive functioning, and processing speed compared to control group) at hospital discharge with no difference between those who are young adult, middle aged, or elderly, the elderly patients were at significantly higher risk of cognitive deficits 3 months after surgery compared to young adults or middle-aged patients, as well as elderly controls. While prevalence of cognitive dysfunction in the younger groups returned to the levels of age-matched controls at 3 months after surgery (i.e., young adults 5.7 % and middle aged 5.6 %), the prevalence of cognitive dysfunction in the elderly group was significantly higher (12.7 %). Additional predictors of cognitive dysfunction at 3-month follow-up included cognitive dysfunction at hospital discharge, increased age, history of cerebral vascular accident with no residual impairment, and years of education. These results are similar to those of another similar large-scale study (Moller, Cluitmans, et al., 1998). Thus, older age appears to be a risk factor for cognitive dysfunction after major surgery in general.

In summary, the elderly may be at increased risk of postoperative cognitive decline after any major surgery. Regarding cognitive risk associated specifically with surgery for epilepsy, preliminary cross-sectional data suggest that anterior temporal lobectomy may accelerate age-related memory decline in patients with pathology other than MTS, although this increased cognitive risk for elderly patients has not been born out in direct comparisons of memory decline in older versus younger adults. However, the few available studies in this area have been limited by a small sample size of older patients, with few if any of the samples composed of those over age 60 years.

Methods

Role of the Neuropsychologist Assessing Elderly Patients with Epilepsy

There are several different reasons why a neuropsychologist may be asked to conduct an evaluation of an elderly patient with epilepsy. Referral questions can include those typical of a younger adult with epilepsy, such as characterizing the

impact of seizures, AEDs, or surgery on cognition; obtaining a baseline of cognitive functioning by which to measure any changes in the future (e.g., after surgery, AED changes, or ongoing seizures); and providing insight into the level of cognitive functioning in order to help estimate functional abilities. Additionally, in the elderly with epilepsy, it may be important to determine whether or not the patient appears to be experiencing a comorbid progressive neurodegenerative process. Any neuropsychological evaluation for an elderly patient with epilepsy should take into account the unique etiology, cognitive considerations, psychosocial functioning, and treatment implications of this group that are outlined above.

Neuropsychologists are often asked to evaluate the cognitive functioning and comment on the potential etiology of deficits in elderly patients with episodes of confusion, memory complaints, and changes in behavior in the absence of epilepsy. It is important to be mindful of the possibility that seizures may be occurring in these patients presenting with rather nonspecific symptoms. Since there is a great deal of overlap between symptoms of dementia and epilepsy, careful history taking and evaluation of any focal area(s) of neurocognitive deficit are key features of the examination in order to determine whether seizures are a potential etiology that deserve further neurological investigation.

Appointment Scheduling

Elderly patients with epilepsy may require slight modifications of the assessment procedure. Obtaining a collateral report is particularly important when conducting a neuropsychological evaluation of elderly patients with epilepsy due to possible difficulty describing seizure-related details and unawareness of cognitive symptoms, particularly in the case of suspected progressive dementias. Elderly patients may become fatigued more quickly during testing, and a shorter battery is often required. Alternatively, in some settings, testing could be broken up into multiple sessions. It may be helpful to structure testing so that measures within a specific cognitive domain are spaced throughout the evaluation to avoid an entire domain being affected by fatigue towards the end of a testing session, as well as maximizing the chance of getting a variety of cognitive domains assessed even if the patient has to discontinue before the end of the evaluation. Scheduling testing for the morning is often preferred, since evidence suggests that older adults perform better on cognitive tasks in the morning than in the afternoon (Hasher, Chung, et al., 2002).

Interview

In addition to obtaining standard background information in a neuropsychological interview, when assessing the elderly with epilepsy, it is even more important to gain a complete and detailed understanding of the history of onset and progression of cognitive, behavioral, and mood symptoms and how these overlay any changes in seizures, AEDs, other medications and medical problems, and other relevant life events (e.g., retirement, death of a spouse). The information obtained in the interview is often the most valuable data for establishing a list of possible etiologies for subjective or objective cognitive impairment. Common etiologies of cognitive dysfunction to consider include:

- Acute and chronic effects of seizures
- AED or other medication side effects
- Progressive dementia
- Cerebrovascular disease
- Head trauma
- Sleep problems
- Emotional distress
- Other medical comorbidities, including any known cause of epilepsy

Cerebrovascular etiology or comorbid disease should be considered in all elderly patients with epilepsy, since cerebrovascular disease accounts for about one third of newly diagnosed cases of epilepsy in elderly patients. Furthermore, elderly patients with epilepsy are at a higher risk of

experiencing a first ever stroke than the elderly without epilepsy (Cleary, Shorvon, et al., 2004). Similarly, evaluations should consider the presence of possible progressive dementias, since about 12 % of newly diagnosed cases of epilepsy in elderly patients are attributed to degenerative disorders, and some evidence suggests that epilepsy increases the risk of developing AD (Breteler, van Duijn, et al., 1991). Other conditions affecting cognition in older adults not listed above also need to be considered as comorbid conditions, although they are not necessarily associated with epilepsy specifically. These include, but of course are not limited to, Parkinson disease, normal-pressure hydrocephalus, hypothyroidism, vitamin B12 deficiency, thiamine deficiency, and sleep breathing disorders. Finally, it is also particularly important to assess activities of daily living, since this is helpful in differential diagnosis and forming recommendations.

Test Selection

General Considerations

Neuropsychological evaluation of any elderly patient requires special considerations. There are limited normative data on many common neuropsychological measures for people of advanced age, although this has improved over the past decade. Test selection should take into careful account the robustness of the norms for older adults. The MOANS and MOAANS studies in particular provide good normative data for individuals between the ages of 56 and 95 (e.g., Ivnik, Malec, et al., 1996; Lucas, Ivnik, et al., 2005). Increased frequency of motor and sensory deficits in this population requires understanding any limitations of the patient and adapting tests appropriately. For example, grooved pegboard performance may be affected by peripheral injury, and results would not reflect brain dysfunction per se. Unique mood, quality of life, and functional issues in elderly patients suggest the use of specific questionnaires developed for this population. Consideration should be given to measures targeting cognitive symptoms specific to common medical comorbidities in this population, such as dementia and cardiovascular disease, even if not directly related to the referral question to help track possible changes in the future (e.g., inclusion of a dementia screening measure). Finally, as in any neuropsychological evaluation, test selection should take into account the specific referral question. In the epilepsy population, measures to help localize and lateralize dysfunction should be included. Considerations for interpreting data in the context of the common referral questions listed above are addressed in the below section "Reporting the Findings."

Domains Assessed

Based on the issues listed above, recommended tests are listed in Table 3.2. This is not meant to be an all-inclusive list of useful tests, nor is this meant to suggest that all tests need to be administered. Rather, this list is provided as a core of select measures useful in the elderly epilepsy population and could be modified based on the specific referral question, the clinician's preliminary impression, and any restrictions posed by a patient such as fatigue or sensory/motor problems.

Some clinicians may prefer to use the Wechsler Fourth Editions rather than the older versions of these measures. At the time of this writing, research regarding the applicability of the newer measures in this population was not available.

Reporting the Findings

Characterize Results

As in a typical neuropsychological report, a good first step is to describe the cognitive profile of strengths and weaknesses. Emotional, personality, and functional data should also be reviewed, including the results of depression and anxiety rating scales, personality questionnaires, quality of life ratings, and activities of daily living scales. Report whether or not cognitive or behavioral/emotional impairment exists, and if so, the nature of the impairment (e.g., affected cognitive domain(s) and severity). If relevant, report the extent to which results are lateralizing or localizing.

Table 3.2 Recommended tests for neuropsychological assessment of elderly patients with epilepsy

Attention and working memory
– Digit Span (WAIS-III/WMS-III)
– Spatial Span (WMS-III)
– Arithmetic (WAIS-III)[a]
Processing speed
– Oral Symbol Digit Modalities Test
– Trails A[b]
– Digit Symbol Coding (WAIS-III)[a]
Motor
– Finger tapping
– Grooved pegboard
Language
– Reading subtest from the Wide Range Achievement Test—Fourth Edition
– Boston Naming Test[b]
– Verbal fluency: Categories[b] and CFL[b]
– Token Test[b]
Visuospatial/constructional skills
– Rey-Osterrieth Complex Figure. If figure may be too difficult, the Greek cross may be substituted
– Clock Drawing Test
– Judgment of Line Orientation[b]
– Picture Completion (WAIS-III)[a]
Executive functioning
– Trails B[b]
– Wisconsin Card Sorting Test
– Similarities (WAIS-III)[a]
– Stroop[b]
Memory
– Logical Memory (WMS-III)
– Rey's Auditory-Verbal Learning Test[b]
– Brief Visual Memory Test
Dementia screening
– Dementia Rating Scale—II (includes orientation items)[b]
Mood/QOL/ADL
– Quality of Life in Epilepsy Inventories (i.e., QOLIE-89 Devinsky, Vickrey, et al., 1995; QOLIE-31, Cramer, Perrine, et al., 1998). These are freely available online at http://www.rand.org/health/surveys_tools/qolie/
– Questionnaires to determine ability to manage the basic and instrumental activities of daily living
– Measure of psychological variables including as depression, such as the Neurological Disorders Depression Inventory for Epilepsy (Gilliam, Barry, et al., 2006); anxiety; and motivation

[a]WAIS-III subtests to be used to calculate Full-Scale IQ (Donnell et al., 2007)

[b]MOANS norms available

Address Referral Questions

Providing Differential Diagnosis for Cognitive Symptoms

The referral questions often include, either explicitly or implicitly, discussion of the etiology of objective and/or subjective cognitive impairment. This requires integration of information obtained from a variety of sources including interview with the patient and a collateral source, medical history including brain imaging, behavioral observations, and test scores. Potential etiologies discussed above should be considered. Differential diagnosis will often depend on the reported onset and progression of cognitive problems or lack thereof, corroboration from imaging data, and cognitive profile.

Evaluating for a comorbid progressive neurodegenerative process may be difficult. No study to date has attempted to establish measures differentiating diagnoses of epilepsy and progressive dementia. Griffith et al. (2006) found that older patients with epilepsy demonstrated reduced executive functioning and similar memory performance compared to patients with amnestic mild cognitive impairment. Factors helpful in diagnosing a progressive dementia versus cognitive impairment due to epilepsy include the onset and progression of cognitive symptoms and the patient's neurocognitive profile of strengths and weaknesses, and how these overlap with their onset, progression, and type of epilepsy or epilepsy treatments compared to the characteristic profile of progressive dementias. However, cognitive dysfunction in epilepsy is not always focal, even in the case of a focal epilepsy (Hermann & Seidenberg, 2002). If the reported onset and progression of cognitive difficulties or the pattern of subjective or objective cognitive-behavioral symptoms are not sufficient to distinguish the etiology, serial assessment may be required to differentiate the cause of the symptoms.

Characterizing the Impact of Epilepsy on Cognition

Epilepsy, particularly when chronic, has been associated with cognitive dysfunction. Several variables have been associated with increased

cognitive impairment, primarily in temporal lobe epilepsy. While not all studies have found similar results, the most commonly reported variables of note include younger age of onset, longer duration of epilepsy, smaller hippocampal and total brain volume, poor seizure control, involvement of the dominant lobe, history of generalized tonic-clonic seizures, and lower baseline IQ (Glosser, Cole, et al., 1997; Hermann, Seidenberg, et al., 2002; Hermann, Seidenberg, et al., 2006; Oyegbile, Dow, et al., 2004; Strauss, Loring, et al., 1995; Thompson & Duncan, 2005). Again, the extent of corroborating evidence between seizure localization data (e.g., EEG, MRI) and the onset, static, or progressive course and pattern of neurocognitive strengths and weaknesses can provide evidence for or against seizures being a primary etiology of cognitive dysfunction.

Determining AED Cognitive Side Effects

As noted above, AEDs carry risk for cognitive side effects. Determining the contribution of various medications to any given patient's cognitive dysfunction requires a careful review of the timing of medication changes (the introduction and discontinuation of medications, changes in dosages, and speed with which changes are made) and the onset or exacerbation of cognitive complaints. Overlooking the possibility that medications are responsible for some cognitive inefficiencies potentially precludes the effective treatment of those symptoms by modifying the medication regimen.

Assessing Risk of Cognitive Decline After Surgical Resection

As reviewed above, there have been limited data addressing the potential for increased risk of postoperative cognitive decline due to advanced age. The available data suggest a cautious approach is prudent, but there are no direct data to suggest that advanced age alone is a strong contraindication for surgery from a cognitive standpoint. Rather, in the absence of strong evidence in either direction, the unique risk factors should be examined for each individual patient, including the well-established predictors of memory decline, including dominant mesial temporal resection, normal imaging, and later age of seizure onset, as well as risk factors associated with major surgeries in general that have emphasized the importance of cerebral reserve (i.e., education and previous cerebrovascular injury; Monk, Weldon, et al., 2008). There is indirect evidence from Helmstaedter and colleagues (2002) that selective amygdalohippocampectomy may carry less age-associated cognitive risk than standard anterior 2/3 temporal lobectomy for temporal lobe epilepsy, but this requires further study.

Recommendations

Recommendations will obviously be made on an individualized basis, but there are several that deserve special consideration among elderly patients with epilepsy.

Modification of Activities

Reduction in activities and functional assistance may be warranted based on the interview, medical history, and examination results. An occupational therapy assessment of specific functional capacities may be helpful to determine if modifications in the patient's activities are required. Basic safety concerns may include confusion regarding medication management, inability to consistently remember to take medications, forgetting to turn off the stove or iron, and wandering/getting lost. Financial issues should be considered, such as the ability to manage the household finances and balance a checkbook. Return to work issues are less common in the elderly, but occasionally arise. Several potential issues must be balanced, including the personal and financial benefits that often accompany continued work with the risk of overexertion that can result in physical and emotional fatigue and further medical/emotional problems, as well as financial risks of losing legitimate disability benefits if the patient fails to perform well and is let go. Gradual reintroduction to the position is often prudent, such as resuming work a few hours per day and increasing the time every few weeks

until they find their optimal schedule. If the seizures are controlled and the patient wants to resume driving, it is important to make sure the patient is cognitively able to drive in a consistently safe fashion and navigate well. To this end, results of the neuropsychological evaluation may suggest that a formal driving evaluation is warranted. Finally, medical decision-making abilities should be considered, as these have been found to be impaired in elderly patients with chronic focal epilepsy, even in those living independently in the community (Bambara, Griffith, et al., 2007).

Review of Medications

A recommendation may be warranted to consider changing AEDs and/or other medications with suspected adverse cognitive or behavioral side effects.

Additional Assistance in Differentiating Potential Etiologies

Understanding the extent and type of any cognitive progression through serial neuropsychological evaluations may be required to delineate etiology of cognitive dysfunction. Other medical referrals may also help to determine etiology, such as a neurological evaluation to determine if brain imaging, additional lab work, or other tests may be appropriate.

In some cases, a patient may be referred without a diagnosis of epilepsy but present with seizure-like symptoms such as unexplained brief episodes of confusion or disorientation. This is particularly relevant for elderly patients, where seizures can be difficult to diagnose but are often treatable with AEDs. As discussed above, only 25 % of elderly individuals with new-onset focal seizures without alteration of consciousness were correctly diagnosed with epilepsy at symptom onset, and it took an average of 18 months to diagnose (Ramsay, Rowan, et al., 2004). Thus, if seizure activity is suspected, referral to an epileptologist or expert neurologist for seizure evaluation is recommended. In addition to a comprehensive neurological workup, they will often order routine serum laboratory tests, neuroimaging (preferably MRI), and EEG. Because interictal epileptiform discharges are less common in older adults (Drury & Beydoun, 1998), if there is strong suspicion of seizures, video-EEG may be warranted. Finally, because of the broad differential diagnoses and common comorbidities, neurologists may order additional tests to rule out other associated problems (e.g., cerebrovascular, cardiac) (Van Cott, 2002).

Improve Quality of Life

Epilepsy is associated with greater impairment in quality of life, increased frequency of depression and anxiety, and decreased social resources (Hermann, Seidenberg, et al., 2008a). Many elderly with newly diagnosed epilepsy and their families may have little knowledge of what epilepsy is, and education about basic facts about epilepsy and its cognitive and mood implications can be empowering. Reassurance that perceptions and treatment of those with epilepsy have changed over the years may be important. There are several excellent online resources for education and online forums specific to seniors with epilepsy:

- Epilepsy Foundation has a section devoted to seniors with epilepsy: senior-specific education about epilepsy, online discussion forum, and information on practical issues of living with epilepsy: http://www.epilepsyfoundation.org/living/seniors/
- This site provides educational information about seniors with epilepsy: http://www.epilepsy.com/info/seniors
- Epilepsy Ontario has a special section for seniors with epilepsy regarding education and practical life issues. The section on support services, however, is targeted mainly to those in Ontario: http://www.epilepsyontario.org/client/EO/EOWeb.nsf/web/Seniors+Living+with+Epilepsy+(kit)
- Many states and cities have local epilepsy groups that can be helpful for locating services for the individual patient.

Referral to a psychotherapist, counselor, or psychiatrist may be indicated to address mood and/or behavioral concerns. Consultation with a social worker is often helpful to provide

information regarding community resources such as support groups, job placement services, and other potential services. Finally, referral for occupational or speech therapy can assist in learning skills to compensate for identified cognitive problems.

Case Presentation

Background

Our patient is a 66-year-old, right-handed, African-American, widowed woman with 12 years of formal education. She was referred by her epileptologist as part of a comprehensive evaluation for epilepsy surgery. Her seizures started at age 41 following the birth of her son and were characterized by an aura of a nonspecific "funny feeling" followed by chewing movements and hand automatisms. She was amnestic for these events. Seizures lasted up to a few minutes and were followed by postictal confusion. She typically experienced one to three seizures per day, most days of the week. Seizure frequency had waxed and waned with no obvious change over the past several years, and she had never been seizure-free for more than 1 month since epilepsy onset. However, because she lived alone, seizure frequency was difficult to determine with certainty. She had been taking Carbatrol (800 mg, four times daily) and gabapentin (400 mg, twice daily) and denied experiencing medication side effects. Video-EEG monitoring of AEDs suggested bitemporal seizures, and brain MRI showed left MTS and mild nonspecific white matter lesions. PET showed hypometabolism in the left anterior temporal lobe and mesial temporal structures, as well as mild hypometabolism in the right anterior temporal regions.

When asked about cognitive functioning, the patient described difficulty recalling conversations and remembering to take her medications. She perceived her thinking speed as slowed, and she reported the onset of word-finding difficulties. Her daughter corroborated these changes but at greater severity; she said that her mother frequently repeated herself, her thinking speed had significantly slowed, and she had difficulty making decisions. The patient's daughter said that these problems had progressed over the past 2–3 years and were accompanied by functional impairment; she had lived alone since her husband died 20 years ago, and her daughter had started to help her manage her medications, finances, and appointments. The patient's two daughters checked on her daily. She continued to groom herself and cook independently without obvious difficulty. She was reportedly diagnosed with Alzheimer's disease 2 years earlier by a doctor at an outside hospital, but no additional information about this was available. Her daughter denied any obvious relationship between previous changes in AEDs and cognitive or functional changes.

She worked as a housekeeper for most of her career before retiring several years ago. The patient denied a history of depression or other significant emotional distress, with the exception of an incident 16 years ago in which she seemed confused and left town without the family's knowledge. She was found wading in a river and admitted to a psychiatric hospital. She denied alcohol, tobacco, and recreational drug use.

Medical history is otherwise unremarkable. There is no family history of neurological disorder. Her only medications included Carbatrol and gabapentin.

Neuropsychological Evaluation

Evaluation Results

Behavioral observations were most notable for the patient's difficulty providing a detailed and well-articulated history. She was unable to recall two previous car accidents reported by her daughter or the incident of wandering 16 years earlier, even when prompted by the daughter. She reported that her husband died 4 years ago rather than 20 and said she had six, rather than nine, grandchildren. Word-finding difficulties were noted in casual conversation, and she appeared to process information slowly. She did not initiate conversation with the examiner and, at times, was

unresponsive to questioning. Eye contact was poor and she often sat with her eyes closed. Affect was very flat. She was oriented to the day of week and time of day, but was off on the date by 1 day. She was oriented to the city and state, but not hospital. She often appeared confused during the testing portion of the evaluation and frequently required repetition of task instructions. Her performance on the Token Test was well below expectation; therefore, it is unclear how well she understood task instructions. Although she performed within expectation on a formal effort measure, her poor comprehension and apparent confusion suggested that the current test results may have underestimated her actual level of functioning.

Tests were selected based on several factors, including (1) the presence of adequate normative data for a 66-year-old African-American woman, (2) the nature of her cognitive complaints and suspected epileptogenic focus, (3) the support in the literature regarding prediction of postoperative decline, and (4) the need to maintain core elements of an existing clinical/research battery. Results are presented in Table 3.3.

Summary, Interpretations, and Recommendations

If taken at face value, this patient's assessment was notable in multiple respects. In the context of baseline abilities estimated to have been in the low average to average range, she demonstrated marked language and memory difficulties. Her confrontation naming was particularly poor, attaining only 12/60 words. Memory deficits were characterized by impairment in both auditory and visual memory. Poor performance was also observed on measures of working memory and executive functioning. Conversely, she performed within the expected range on tests of processing and motor speed, simple and complex visuomotor sequencing, and visuospatial intellectual abilities. Some of the typical "hold" indices such as vocabulary and information may have been affected by word-retrieval problems, as scores on these measures were lower than expected based on her education and WRAT-III reading subtest. Her phonemic verbal fluency was better than expected in the context of other language problems observed. She did not report any significant current symptoms of depression. Although the possibility that her confusion and difficulty comprehending task instructions undermined her performance cannot be ruled out, her test performances were consistent with significant cerebral dysfunction.

There are several possible etiologies of the patient's deficits in language, memory, working memory, and executive functioning. It is likely that some of her current impairments are due to many years of frequent seizures. Her cognitive profile was somewhat more complicated than the auditory memory and language deficits often associated with dominant temporal lobe epilepsy. Visual memory was impaired in addition to auditory memory, which could be attributed to nondominant temporal lobe involvement suggested by bitemporal seizures on video-EEG monitoring and PET mild hypometabolism on the right side. The deficits in working memory and executive functioning can also be observed in patients with temporal lobe epilepsy (Hermann & Seidenberg, 2002). However, concern was raised for a progressive neurodegenerative disorder based on her daughter's report of slowly progressive cognitive and functional declines over the past 2–3 years. Importantly, these changes did not appear to correspond to changes in AEDs or obvious changes in her seizure frequency or semiology. Finally, the mild nonspecific white matter lesions noted on MRI may also be contributing to her cognitive deficits, including the more recent progressive declines. It was recommended that other etiologies of cognitive decline be ruled out, such as endocrine/metabolic abnormalities and vitamin deficiency.

Results also raise concern for cognitive decline if she were to undergo surgery, presumably a left temporal lobectomy. Aside from her age and potential progressive dementia, patients with bilateral poor memory and bitemporal seizures and imaging abnormalities are at increased risk of memory problems after surgery (Baxendale, 1998). As discussed above, there is mixed evidence regarding age as a risk factor, but there is some research suggesting that it may be

Table 3.3 Test results for case presentation

Measure		Raw	Standard score[a]
WAIS-III	Full-Scale IQ		75
	Verbal Comprehension Index		74
	Perceptual Organization Index		82
	Working Memory Index		65
	Processing Speed Index		91
	Vocabulary		80
	Similarities		80
	Arithmetic		65
	Digit Span		80
	Information		70
	Letter Number Sequencing		70
	Picture Completion		85
	Digit Symbol		95
	Block Design		90
	Matrix Reasoning		80
	Symbol Search		90
WMS-III	Auditory Immediate		65
	Visual Immediate		78
	Auditory Delayed		64
	Visual Delayed		65
	Auditory Recognition		75
	Logical Memory I	14	65
	Faces I	29	85
	Verbal Paired Associates I	0	70
	Family Pictures I	21	80
	Word List total I	25	95
	Word List learning slope	4	95
	Spatial Span	10	80
	Logical Memory II	2	65
	Faces II	26	75
	Verbal Paired Associates II	0	75
	Family Pictures II	13	70
	Word List long delay	0	80
	Word List recognition	14	65
Trails A[b]		61 (1 error)	95
Trails B[b]		219 (3 errors)	90
Wisconsin Card Sorting Test	Total correct	69	
	Total errors	59	84
	Perseverative errors	26	93
	Categories	0	<1 percentile
	Set failures	3	6–10 percentile
Ruff	Total unique designs (corrected)	32	67
	Error ratio	0.2857	82
Finger tapping	Dominant	29.6	84
	Nondominant	31.8	93
Grooved pegboard	Dominant	113	90

(continued)

Table 3.3 (continued)

Measure		Raw	Standard score[a]
	Nondominant	114	93
Boston Naming Test[b]		12 (1/7 semantic cues; 5/14 phonemic cues)	60
COWAT[b]		30	100
Animal fluency		4	60
Token Test[b]		27	70
WRAT-3	Reading	38	95
Beck Depression Inventory-II		6	"minimal"

[a]Higher standard scores indicate better performance
[b]Based on MOAANS. All other norms are based on the manuals with the exception of Heaton Norms (2008) used for grooved pegboard and finger tapping

associated with further memory decline after temporal lobectomy. Finally, risk to patients with a potential progressive dementia is also unknown, but there is evidence to suggest that those with less cognitive reserve going into surgery may not fare as well as those with more cognitive reserve (Moller, Cluitmans, et al., 1998; Monk, Weldon, et al., 2008). Taken together, these results suggest that the patient was at increased risk for further memory declines following a left, presumably dominant temporal lobectomy.

The patient's cognitive difficulties raised concern about her ability to live independently. In order to ensure her safety, it was recommended that she not use the stove or oven independently and that she receive assistance in managing her medications. Finally, it was recommended that the family begins the discussion of power of attorney for health care and financial decision-making.

Medical Follow-Up

Neurologists disagreed about cognitive and functional surgical risks in the context of an underlying dementia. They recommended social interventions to optimize medication compliance as well as efforts to obtain an accurate description of seizure frequency. Repeat video-EEG monitoring was recommended while on her typical AEDs, so that seizure burden could be estimated and to determine if seizures, while on medication, arise only from the left side.

Results of repeat video-EEG monitoring suggested much more frequent seizures while on AEDs than previously thought (i.e., 3–4 per hour). All arose from the left temporal region. Based on discussions between the epilepsy team, the patient, and her family, it was decided to modify her AEDs to optimize seizure control. If her seizures continued to occur frequently despite further medication trials, surgical options would be considered. One and a half years after these AED changes, the patient has been doing better, with an estimated one to two seizures per week. Social work has followed the patient, who continues to live independently with daily calls and visits from family.

Significance for Neuropsychological Evaluations of the Elderly with Epilepsy

It may be difficult to differentiate progressive dementia and epilepsy etiologies, and much will depend on the onset and progression of cognitive symptoms in relation to seizures, as well as a neurocognitive pattern consistent with that expected for dementia versus where the seizures are thought to arise from. There is no consensus and little data on which to base a decision regarding risk of cognitive and functional decline after

epilepsy surgery in elderly patients with possible progressive dementia. It is often difficult to determine seizure frequency in patients who live alone, and video-EEG monitoring can be helpful in this regard. Finally, it is important to address common psychosocial issues in the elderly with epilepsy, such as ability to living alone, safety concerns including driving, and medical decision-making abilities.

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