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Language Preference and Development of Dementia Among Bilingual Individuals

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Abstract

In bilingual individuals, regression to a primary language may be associated with development of cognitive impairment and increased risk for development of dementia. This report describes two bilingual patients who presented with early symptoms of dementia after regression to their primary language. The results of this study may help clinicians identify aging bilingual patients who are beginning to develop cognitive impairment or dementia and suggest that further studies on the long term cognitive effects of bilingualism and interactions with the aging process are indicated.

Introduction

Dementia is a major health care problem in this country affecting up to 10 percent of those over the age of 65 years,[1] and resulting in economic costs approaching $100 billion per year.[2] The importance of dementia as a healthcare concern will also likely continue to increase as the mean age of the United States population rises.[3, 4] Due to the lack of definitive tests or biomarkers, the diagnosis of dementia typically depends on careful examination and application of clinical criteria.[3] Cognitive testing is an important aspect of the assessment and is often essential in establishing the clinical diagnosis.[5]

Previous studies have demonstrated that while age and education are the most important determinants of normal variation in performance on cognitive testing,[6, 7] ethnicity and language may also affect selected items of standard cognitive screening instruments.[8–13] This may be particularly important when assessing bilingual patients who may vary in comprehension and performance on cognitive tests depending on the language used to administer the tests. Additionally, loss of language abilities is a common finding in demented individuals that may precede other aspects of cognitive decline.[14] Maintaining proficiency in multiple languages requires increased cognitive demands compared to a

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single language, consequently non-primary languages may be particularly vulnerable to the effects of cognitive decline.[5] In the elderly retreat to a primary language may be an early indicator for development of cognitive decline or dementia.

This report describes two bilingual patients who regressed to the use of their primary language before developing symptoms of dementia. These patients underwent general physical and neurological examinations, blood tests for treatable or reversible causes of cognitive impairment and neuropsychological testing. The cases described in this report illustrate how regression to a primary language among bilinguals may be useful to clinicians caring for aging bilingual patients and assist in identification of bilingual patients at risk for cognitive impairment or early dementia.

Methods

Subjects

The two bilingual patients included in this study presented to a University affiliated Memory Disorders Clinic (MDC) during a one-year period from 2/1/2007 to 2/1/2008 with chief complaint of cognitive impairment and met the Diagnostic and Statistical Manual-IV criteria for dementia.[14] This study was approved by the University of Hawai'i Committee on Human Studies. Both patients were of Japanese ethnicity and had been born and raised in Hawai'i, with Japanese as their primary language and English as their secondary language. For both patients, the clinical diagnoses were established prior to obtaining MRI imaging. Neither of the bilingual patients had structural lesions on the MRI or cortical strokes.

The bilingual patients were screened for treatable causes of cognitive impairment including vitamin B12 deficiency, thyroid function abnormalities, neurosyphilis, and normal pressure hydrocephalus. All medical illnesses and medications were reviewed for cognitive effects. Neither of the patients had diagnoses of medical or psychiatric disorders that could affect cognition. Additionally, neither of the patients were on psychoactive medications (including antidepressant, antipsychotic, or benzodiazepine medications), acetylcholinesterase inhibitors, or other medications that could affect cognition.

The patients underwent neuropsychological tests at the time of initial presentation. The measures included the Mini-Mental State Examination (MMSE); digit span forwards and backwards; serial threes; language assessment including: verbal fluency, assessment of comprehension and repetition, the Mini-Boston Naming Test (MBNT), and brief reading comprehension and sentence writing tests; a ten-item Auditory Verbal Learning Test (AVLT); constructions from the Consortium to Establish a Registry in AD (CERAD); simple arithmetic calculations including single and two digit addition, multiplication, and an algebra problem; and frontal-executive functions including: interpretation of idioms and proverbs, category assignment, the Luria Hand Sequence test, the Go/NoGo Test, alternate tapping, and the Luria alternating programs.[5]

Illustrative Case Reports

Bilingual patient Number 1 was a 67-year-old Japanese-American man with past medical history significant for hypertension and type 2 diabetes, brought by his wife to the MDC for

problems with his memory and cognitive abilities. He was born on O'ahu, and spoke both Japanese and English fluently for his entire life. His wife reported that ever since retiring at the age of 65 years he spoke Japanese mostly at home and had not spoken English on a regular basis. On interview, the patient's wife described his insidious development of memory problems exemplified by forgetting items said to him during conversation, asking repetitive questions, misplacing items and forgetting to pay bills. There was no report of motor or sensory change. Neurological examination revealed only bilateral absent ankle jerk reflexes, diminished patellar reflexes, decreased vibration sensation in the lower extremities at the toes, ankles and knees, and mildly wide based gait, all consistent with a peripheral neuropathy. Magnetic resonance imaging (MRI) of the brain showed only mild generalized brain atrophy.

Bilingual patient number 2 was an 85-year-old Japanese-American man with past medical history significant for hypertension, benign prostatic hypertrophy, bilateral hearing loss and cataracts. He was referred to the MDC by his primary care physician for suspected early dementia. The patient was accompanied by his wife who provided the majority of the history information. She described him as having an insidious and slowly progressive development of memory difficulties including forgetting items said to him during conversation, misplacing items, forgetting to turn the stove off after cooking, and not being able to find his car in a store parking lot. There was no report of motor or sensory change. Neurological examination revealed normal cranial nerve functions, grossly intact strength and sensation, normal and symmetrical deep tendon reflexes, and a gait with normal base and stride. Magnetic resonance imaging (MRI) of the brain showed moderate atrophy including the medial temporal lobes and hippocampi bilaterally. His wife reported that while he spoke both Japanese and English fluently during his adult years, he had stopped speaking English at home approximately 3 years ago and for two years prior to evaluation had spoken only Japanese.

Results

All subjects in the study were Japanese-American men. Demographic characteristics of the patients are given in Table 1. The two bilingual patients demonstrated poor performance on the MMSE and tests of verbal memory and visuospatial constructions (Table 1). They also displayed poor performance on delayed recognition of word list items resulting from increased frequency of false positive responses, possibly related to decreased self monitoring. The bilingual patients did not demonstrate significant impairment on measures of attention, mental control, frontal executive functions or calculations.

Discussion

This report illustrates the importance of language in detection of development of dementia. Regression to a primary language may indicate deterioration or decline in cognitive abilities and serve as an early indicator for development of cognitive decline or dementia. The cases described in this report supports the hypothesis that regression to the use of primary language among bilinguals may be associated with poor cognitive performance and diagnosis of dementia.

Language proficiency is affected both by normal aging and development of dementia. Loss of language abilities is a common finding in demented individuals, and can be one of the most debilitating aspects of cognitive decline.[14] In Alzheimer's disease and other neurodegenerative dementias, language difficulties are often present early in the disease course, with word-finding difficulties, decreased verbal fluency, or difficulties with naming, and comprehension frequently occuring.[5] Language difficulties may be particularly evident among demented bilinguals, possibly related to the increased cognitive demands associated with maintaining proficiency in multiple languages.[5] Indeed, even normal elderly individuals have decreased ability to maintain fluency in multiple languages, with older bilinguals often reverting to a single language despite a lifetime of dual language use.[15]

In the elderly, retreat to the primary language could result from the increased cross-language interference that typically occurs with advancing age or simply reflect declining cognitive abilities.[15] Cross-language interference refers to deviations from the language being spoken due to the involuntary influence of the "deactivated" language. Because people who are bilingual never totally deactivate either of their two languages, this can result in interference and intrusions.[15] Bilingual demented patients also tend to mix languages, and have special problems with language separation.[5] Additionally, language impairment in dementia may be asymmetrical, with preferential preservation and use of the first acquired language.[16] A symmetric language deficits is common among bilinguals suffering from neurological disorders or after cerebral damage. This may be particularly evident in development of aphasia following stroke, in which bilinguals often demonstrate different levels of recovery for each language.[16] In these circumstances the language with the best recovery may be the earliest acquired language, the language of greater use, or the language spoken in the patient's environment.[16] In dementia recently acquired information is typically most affected with relative preservation of older information, which is consistent with regression toward earliest acquired language in demented bilinguals.

In non-demented individuals, understanding the cognitive effects of bilingualism is an active area of research including differential language loss following brain injury, language recovery after stroke, and functional neuroimaging studies of language processing. Additionally, a recent epidemiological investigation demonstrated potential beneficial interactions between bilingualism and the aging process, resulting in delayed development of dementia in bilinguals compared to monolinguals.[17]

However, results of studies on bilingualism are sometimes difficult to interpret or compare between studies due to use of different definitions and classification systems for bilingualism.[18] One of the earliest classification systems for bilingualism differentiates specific types of bilinguals based on language proficiency.[19] In this system, balanced bilinguals denotes individuals with approximately equal language proficiency in two languages and dominant bilinguals denotes individuals in which one language is determined to be "dominant" either by frequency of use or greater proficiency.[19] The term "semilingualism" is controversial, and used to imply a low level of language development of two or more languages without normal proficiency in either language. Another commonly used classification system distinguishes types of bilingualism based on the method of acquisition, which is theorized to influence cortical language representation.[18] In this

system, coordinate bilinguals denotes individuals who learn two languages in separate environments, theorized to result in separate semantic representations within the brain. Conversely, the term “compound bilingual” denotes individuals who learn two languages in the same context, theorized to allow coinciding representations of both languages with semantic knowledge.

Some studies report that bilingualism itself affects neuropsychological test performance. In coordinate bilinguals a detrimental effect on certain aspects of cognitive performance has been suggested to occur due to increased cross-language interference, while in compound bilinguals there may be beneficial effects on some areas of cognitive performance.[18] For example, compared to monolinguals, bilinguals have been reported to perform less well on language based memory tests and measures of verbal fluency, possibly due to cross-language interference.[20] In these studies, poorer performance among bilinguals was not dependent on the language used and was observed when tested in either the primary or secondary language.[20] This finding has been replicated in studies of bilingual children and college students as well.[21] Slower response times on list recognition and lexical decision tasks in bilinguals have been reported, which is also consistent with cross-language interference.[22] Additional evidence supporting the occurrence of cross-language interference includes decreased performance on semantic but not phonemic or spontaneous verbal fluency tests in bilinguals compared to monolinguals.[23] Two possible theories of cross-language interference have been suggested to explain this pattern of results.[23] First, relatively greater impairment in semantic verbal fluency may result from increased cross-language interference, since concrete nouns may share more elements of their representations across languages than non-concrete words; alternatively, increased cross-language interference may result from a greater state of second language activation in the semantic task.

Compound bilingualism, in contrast, is theorized to have beneficial effects on cognitive abilities. Supporting evidence may include reports of higher levels of phonological awareness,[24] increased cognitive flexability,[25] and faster development of grammatical awareness in some bilingual children.[26] Compound bilingualism is also reported to improve performance on animal word list generation, a finding proposed to suggest the presence of richer associative networks for language.[27]

Functional neuroimaging has been used to investigate cortical language representations in bilingual individuals. In subjects bilingual for Italian and English, different patterns of cortical activation associated with presentation of material in primary compared to secondary language have been demonstrated.[28] In this study, presentation of material in the non-primary language produced patterns of cortical activation more similar to presentation of the material in an unfamiliar language than in the primary language.[28] While these differences may in part reflect language proficiency, the subjects were considered fluent in English, indicating that even subtle differences in language ability may affect cognitive processing of information.[28] Addtionally, task specific differences in language activation in older bilinguals have previously been suggested to result from differences in language processes that occur with performance of semantic versus phonemic fluency tasks.[23] This is consistent with functional neuroimaging studies of monolinguals which demonstrated frontal

lobe activation in phonemic generation and temporal lobe activation in semantic word generation.[29] However, other studies have failed to demonstrate different cortical representations for language processing systems in bilinguals.[30–32]

In general, learning a second language may have both beneficial and detrimental effects in specific cognitive areas. Furthermore, the cognitive effects of bilingualism likely depend not only on type, but also on factors such as age of second language acquisition, proficiency, and number of years the second language was used. The results of this study support regression to primary language in bilingual individuals as possibly predictive of poor cognitive performance and development of dementia.

Even when patients are able to perform occupational and social activities using a secondary language without difficulty, the challenge of cognitive testing may reveal subtle deficiencies in language ability that would normally remain unnoticed, confounding detection of the cognitive deficits for which the tests were developed. Consequently, the value of regression to use of a primary language is likely greatest in ethnically diverse populations in which multiple languages are commonly used. In this setting, many individuals are likely to have functional knowledge of multiple languages. In this setting a patient's regression to the use of their primary language should be considered a possible early sign of cognitive impairment or development of dementia. Further studies on the long term cognitive effects of bilingualism and interactions with the aging process are warranted.

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Table 1

Patient Characteristics

		Patient 1	Patient 2
Age		67 Years	85 Years
Education		12 Years	10 Years
Mini Mental State Examination (MMSE)		23	22
Attention	Digit Span Forward/Reverse	5/3	6/4
Mental Control	Serial “3’s”	5	5
Memory	Word List trials 5	7	6
	Word List Delayed Recall	0	1
	Word List Recognition	13	15
	Non-verbal Delayed Recall	0	1
	Non-verbal Recognition	2	2
Visuospatial Constructions		1	0
Calculations		3	3
Abstract Reasoning	Category Assignment	Non-impaired	Non-impaired
	Proverb Interpretation	Non-impaired	Non-impaired
Frontal/Executive	Alternating Programs	Non-impaired	Non-impaired
	Luria Hand Sequence	Non-impaired	Non-impaired
	Repetitive Designs	Non-impaired	Non-impaired
	Go/No-go	Non-impaired	Non-impaired