Original Article

Comparison of two screening instruments to detect dementia in Indian elderly subjects in a clinical setting

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Abstract

Objective: Cognitive screening in elderly patients receiving treatment for chronic medical conditions in a busy outpatient clinical setting is crucial to detect dementia at an earlier stage. Although Hindi Mini-Mental State Examination (HMSE) is an established screening tool for the geriatric population in India, but cannot be administered with the informant. Our study aims to compare two screening instruments, Informant based - Eight-item Interview to Differentiate Aging and Dementia (AD8) and HMSE among elderly patients attending medical outpatient service (OPD) in a tertiary care hospital. **Method:** A total of 776 subjects aged ≥65 years and receiving treatment from medicine OPD in a tertiary care hospital were screened for dementia using AD8 and HMSE. The clinical diagnosis was established after detailed clinical assessment using ICD-10 criterion. Sensitivity and specificity were calculated for both screening tools and ROC curves were plotted considering ICD-10 diagnosis as the gold standard. **Results:** Comparison of receiver operating characteristic (ROC) curves showed that HMSE (AUC = 0.77) were better than AD8 (AUC = 0.61) in detecting dementia. Although increasing the cut-off value of AD8 from a recommended score of ≥2 to ≥3 improved sensitivity from 35% to 48.9%, high false-positive rate limited its utility as a cognitive screening tool. **Conclusion:** Although AD8 is easy to use and quickly administered with either patient or informant, it does not seem to be a suitable cognitive screening test for Indian elderly with chronic medical disorders. HMSE at a cut-off score of ≤23 is able to find out dementia among geriatric patients in a busy medical setting.

Keywords: AD8, dementia, Hindi mental state examination, screening

Introduction

In view of demographic aging, the proportion of elderly in Indian population is bound to increase in near future.[1] Despite increased life expectancy, quality of life is likely to deteriorate due to increased prevalence of chronic medical disorders in old age.[2,3] Both aging and chronic medical disorder (CMD) are known risk factors of dementia.[4,5] Cognitive decline will further impair functionality with an increased risk of hospitalization.[3] It is important to address co-existing cognitive impairment in elderly which may go undetected and/or overlooked in busy clinical settings.[6,7] Considering the large number of geriatric population in India and majority of them living in rural area, it is the need of hour to involve primary care services in prevention, early diagnosis and treatment of dementia.[8] Studies assessing the accuracy of dementia identification in primary care physician (PCP) has revealed that mild cognitive impairment (MCI), an early stage remain undiagnosed in primary care setting.[9,10] A recent metanalysis has shown that cognition-oriented treatments can improve cognitive performance in geriatric age group if started at early phase before the onset of clinical dementia.[11] Therefore in order to identify cognitive impairment at early phase, PCP treating geriatric patients for various CMDs require a quickly administered cognitive screening test, applicable with both informant or patient.

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The Mini-Mental State Examination (MMSE) is a widely used cognitive screening tool for the population of diverse ethnicity and culture.[12] However, its utility in developing countries like India, particularly in the elderly group, is limited due to confounding biases involving language, cultural and education aspect of the society.[13,14] Therefore, Hindi Mental State Examination (HMSE) was developed and found suitable to screen cognitive impairment in elderly people in India.[15,16] Physician finds it difficult to apply MMSE or HMSE with patients who are uncooperative or have a sensory impairment. Both MMSE and HMSE cannot be administered with an informant. AD-8 (Eight-item Informant Interview to Differentiate Aging and Dementia) is a brief screening instrument that has the advantage that it can be applied to either informant or patient. It has been found specifically useful to detect dementia in general practice.[17] Its applicability over the phone with informant offers an additional advantage.[18] Its utility as a cognitive screening tool in Indian elderly patients is yet to be confirmed. This study compared the suitability of both AD 8 and HMSE for cognitive screening in elderly patients seeking treatment for chronic medical conditions in Medicine Outpatient Department (OPD) of a tertiary care hospital in India.

Material and Methods

The present study was conducted in the medical OPD of a tertiary care teaching hospital in North India. Patients aged ≥65 years receiving treatment for chronic medical problems in medicine OPD were included in this study. Patients with impaired consciousness or suffering from severe mental illness or taking psychotropic drugs were excluded from the study.

Instruments of study

AD-8 (The Eight-item Informant Interview to Differentiate Aging and Dementia): It is a quickly administered cognitive screening test which is brief and applicable with either the informant (preferable) or the patient. It reliably differentiates between non- demented and demented individuals. It has sensitivity >84%, specificity >80%, positive predictive value >85% and negative predictive value >70%.[17] This suggests that the AD-8, a brief informant-based test, may improve detection of dementia in general medical practice.

HMSE (the Hindi Mental State Examination): The HMSE, a Hindi adaptation of the MMSE, was developed specifically to counter the bias in screening rural illiterate elderly people for cognitive impairment in India.[13] HMSE cut off ≤23 has sensitivity (94%) and specificity (98%).[19] The following changes in MMSE were adopted to design HMSE: The orientation of the year, a piece of information which is not common knowledge among older people of India, was substituted with the time of day. The attention subtest requiring backwards spelling of the word "WORLD" was substituted with the task of naming the days of the week backwards. The written sentence generation subtest was substituted with the oral task "tell me something about your house". The constructional praxis (copying) task, in which a simpler diagram of a diamond within a square replaced the more-complex intersecting pentagons of the MMSE. HMSE has been used as screening tool for dementia in Indian community population aged 60 years or more.[20]

Geriatric clinical performa

It was used to collect socio-demographic data. Patients found positive on both screening and clinical assessment underwent further assessment using International Classification of Diseases, Tenth Revision, (ICD 10) Diagnostic Criteria for Research (DCR).

Statistical analysis

All Statistical analysis was done using SPSS version 22

Ethical consideration and permission

The study protocol was presented before the ethics committee of the institute and approval was granted (IEC Letter No.F.1/Acad/MC/JU/13/4239). As AD8 is a copyrighted instrument, the primary investigator obtained permission to use it from the Alzheimer's disease Research Centre, Washington University, St. Louis, Missouri.

Results

Socio-demographic details of subjects screened are given in Table 1. A total of 776 elderly patients participated in the study and the majority of them did not have any formal education (74.2%). During screening a higher number of subjects were positive on AD 8 (37.5%) than HMSE (6.6%), as shown in Table 2. Screening positive subjects underwent detailed clinical assessment by a physician and psychiatrist. Only 51 (5.8%) subjects met the criterion for dementia as per ICD -10 and among them, 14% and 88% were detected at screening stage by AD-8 and HMSE respectively. False-positive rates (FP) and Positive predictive values (PPV) for AD-8 was 86% and 5.5%, respectively. HMSE had FP and PPV, 12% and 88% respectively and was better in predicting dementia cases than AD 8.

The sensitivities and specificities of several cut-off scores for AD8 are shown in Table 3. AD8 with recommended cut off score of 2 was less sensitive (35.56%), more specific (62.38%) and both aspects improved on raising the cut-off.

However, neither sensitivity nor specificity reached up to >80% before the cut- off score of 4. Neither increasing nor decreasing the cut-off score of HMSE decreased its specificity below 80%. However, its sensitivity reduced at cut off scores beyond 23 and reached 58.33% with a cut-off score of ≤25.

As shown by receiver operating characteristic (ROC) curves both cognitive screening instruments in Figure 1, the area under the curve (AUC) was 0.61 (95% confidence interval, 0.55-0.68) and 0.77 (95% confidence interval, 0.69-0.84) respectively for AD8 and HMSE. A steep rise was observed in ROC curve of AD8

Table 1: Socio Demographic Characteristics of Subjects Screened for Dementia

Variables	Sex (%)		Total (%)
	Male	Female	
Age groups (Yrs.)			
65-74	417 (72.4)	166 (83.0)	583 (75.1)
75-84	151 (26.2)	29 (14.5)	180 (23.2)
≥85	8 (1.4)	5 (2.5)	13 (1.7)
Total	576 (74.2)	200 (25.8)	776
Education			
College	178 (30.9)	33 (16.5)	211 (27.2)
School	96 (16.7)	13 (6.5)	109 (14.0)
Illiterate	302 (52.4)	154 (77.0)	456 (58.8)
Marital status			
Married	518 (89.9)	191 (95.5)	709 (91.4)
Single	58 (10.1)	9 (4.5)	67 (8.6)
Occupation			
Professionals	142 (24.7)	32 (16.0)	174 (22.4)
Skilled/semiskilled	74 (12.8)	11 (5.5)	85 (11.0)
Unskilled	227 (39.4)	92 (46.0)	319 (41.1)
Unemployed	133 (23.1)	65 (32.5)	198 (25.5)
Residence			
Rural	213 (37.0)	31 (15.5)	244 (31.4)
Urban	363 (63.0)	169 (84.5)	532 (68.6)

Table 2: Result of cognitive screening by HMSE and AD8

Age Group	N*	C† (%)		
		AD8	HMSE	ICD-10
65-74	583	241 (41.3)	37 (6.3)	31 (5.3)
75-84	180	75 (41.7)	12 (6.7)	12 (6.7)
85-above	13	5 (38.5)	2 (15.4)	2 (15.4)
Total	776	321 (41.4)	51 (6.6)	45 (5.8)

*N=Number of subjects screened. †C=Number tested positive after screening with AD8 or HMSE and clinical assessment

Table 3: AD 8 tests at different cut off score

	Cut off Score			
	≥1	≥2	≥3	≥4
Sensitivity	26.67%	35.56%	48.89%	100%
Specificity	53.76%	62.38%	67.58%	99.86%
Positive Likelihood Ratio	0.58	0.95	1.51	731
Negative Likelihood Ratio	1.36	1.03	0.76	0.0
Positive Predictive Value*	3.43%	5.50%	8.49%	97.83%
Negative Predictive Value*	92.25%	94.02%	95.55%	100%
Accuracy*	52.19%	60.82%	66.49%	99.87%

(*) These values are dependent on disease prevalence 5.80% (95% CI=4.26%-7.68%)

towards the cut off score ≥4, while there was flattening in the ROC curve of HMSE from cut off score of ≤24 to ≤25.

Discussion

Primary prevention of dementia is not possible due to unmodifiable risk factors such as increasing age, female gender, and south Asian ethnicity. Secondary prevention requires early detection and halting its progression; therefore, reducing overall disability and hospitalization rates among elderly patients. This

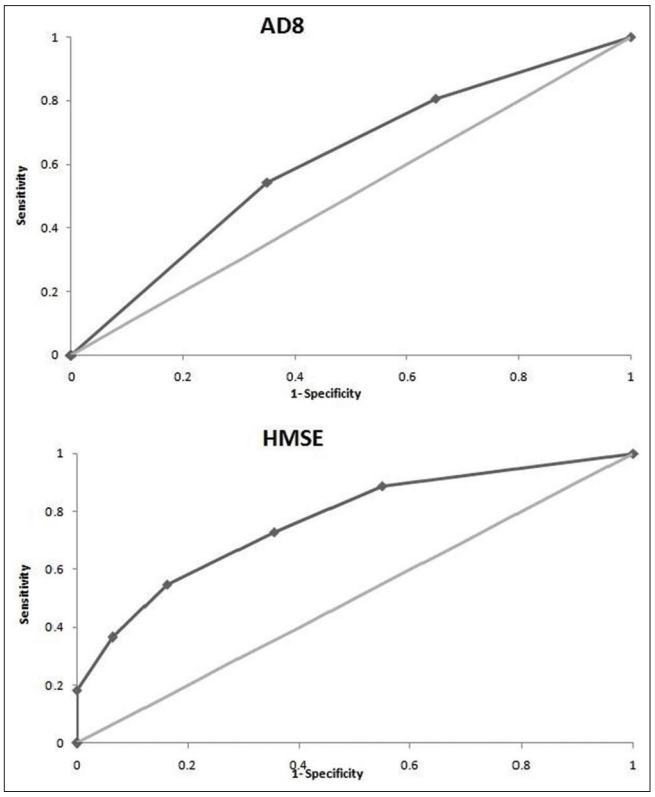

Figure 1: Receiver operating characteristic (ROC) curves of the informant-reported AD8 and HMSE

strategy can have a major impact on the finances involved in the health care of the elderly. It is not uncommon in a busy clinical setting that cognitive impairment is either seen as part of aging or overlooked or remains undetected, hence cognitive screening is important in geriatric patients.

Therefore, physicians treating geriatric patients require screening tests which can detect dementia with accuracy, completed in a short time and applicable with both patient and informant.

There are many screening tests available to use like Mini-Mental Status Examination (MMSE), Hindi Mental State Examination (HMSE), and clock drawing tests, memory impairment screen and AD8 to identify cognitive impairment at an earlier stage.[21,22] AD8 is recently developed quick informant-based test, sensitive enough to differentiate dementia from age- related cognitive impairment regardless of the etiology. These qualities make AD8 a suitable cognitive screening tool for a geriatric patient attending outpatient clinical service for a variety of medical disorders. However, its usefulness in Indian geriatric patients suffering from chronic medical disorders was not explored.

Therefore, it is worth to compare AD8 with HMSE which has shown diagnostic accuracy for cognitive screening in Indian elderly population with low education status.

This study was conducted to compare AD8 with HMSE in Indian elderly population attending a busy clinical setting. This study

was a cross-sectional hospital-based study involving 776 elderly patients seeking treatment from medicine OPD. Irrespective of gender, the majority of subjects screened were in the age group of 65 to 74 years (75.1%) and almost three-fourth of them were men. The number of individuals in the age group ≥85 years was very less (1.4% males and 2.5% female). It does not seem to be unusual stats for any hospital-based study in India. Male dominance in the screening sample was seen in another study conducted among 5,260 elderly patients in a tertiary care hospital in South India.[23]

The lack of formal education was observed in more than half of the subjects (58.8%) screened, 52.4% in male and 77% in females. The finding is consistent with previous research conducted in other regions of India.[24] A large proportion of the elderly population, both in the rural and urban area, has no formal education. Although ours is a cross-sectional study, follow up study done previously has also established age and female gender as independent risk factors for dementia in population with the same level of education.[25,26]

Both screening tests and clinical assessment found a higher prevalence of dementia in ≥85 years old. Aging is a well-established risk factor for dementia irrespective of ethnicity and culture.[4,5] Dementia prevalence among females, in age groups of 75-84 years (20.7% and ≥85 years (20.0%) was higher than the age group of 65-74 years (8.4%). A higher proportion of females (12%) affected with dementia compared to males (4.7%) confirms that women are at higher risk for dementia than men. A large sample size study of 2000 elderly subjects have also revealed that the majority (66%) of individuals demented were females.[24]

Among subjects with cognitive impairment, more than half were uneducated and had unskilled occupation or were unemployed (58.3%). This finding is consistent with previous studies reporting lower educational and occupational attainment as risk factors for developing dementia.[27]

This study found HMSE to be a more sensitive screening tool for detecting cognitive deficits as compared to AD-8 which has a high false-positive rate. A study conducted in a rural medical setting has also found higher positive rate after the cognitive screening with AD8 (66.8%), but it had not been compared with any other screening tool or standard clinical assessment.[28] Lower specificity of AD8 in this study could be because many items may not be suitable for the elderly Indian population where a large number of subjects are not educated and familiar with modern appliances or gadgets. For example, item 4 of AD-8, Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control), informant, usually relatively younger member of the family in Indian scenario, may report false positive for these items. Similarly, another item No. 6 in AD-8 Trouble handling complicated financial affairs (e.g., balancing a cheque book, income taxes, paying bills)' may be falsely positive for Indian elderly subjects with or without cognitive deficits who routinely do not do financial things and are helped by an educated family member. ROC curves plotted for cognitive screening tests showed that accuracy of HMSE (Sensitivity: 1.0, Specificity: 99.18, AUC: 0.77) was better than AD 8 (Sensitivity: 0.36, Specificity: 0.62, AUC: 0.61). The Epidemiology of Dementia in Singapore (EDIS) study recruited similar no of subjects (761) from China, Malay, and Indian ethnicities and found that AD8 performed poorly in detecting very mild dementia (AUC: 0.69, sensitivity: 0.62 and specificity: 0.73) and needs to be combined with another screening tool.[29]

Although changing the cut off of AD 8 from a score of ≥ 2 to ≥ 4 was able to increase sensitivity from 35% to 100% but high false positivity rate (0.62) remained a major limitation of its use for cognitive screening of geriatric patients with chronic medical disorders. Another study examining clinical utility of informant AD8 as dementia case-finding instrument has also found that at the cut off ≥ 3, AD8 became superior to MMSE.[30] This could be understood by items in AD8 assessing the aspects of functioning in elderly persons which could be impaired by medical morbidities than age disproportionate cognitive impairment. Higher AUC of AD8 in studies conducted in developed countries could be the effect of higher educational attainment.

Unlike AD8, HMSE requires a cooperative patient and cannot be administered with an informant. However, it is more likely to tap true positive cases of dementia. Because changing the cut off of HMSE did not result in any improvement in its diagnostic accuracy, recommended cut off score of ≤ 23 is well suited for Indian elderly patients on treatment for medical disorders.

Limitation of study

This is a hospital-based cross-sectional study in geriatric population with chronic medical disorders. Therefore, the finding cannot be extrapolated to the geriatric population living in the community.

Conclusion

This study revealed both screening tools, AD8 and HMSE, were able to find out dementia in an elderly patient on treatment for chronic medical disorders. HMSE better predicted dementia but had a limitation that it cannot be administered with an informant. Therefore, primary care physicians working in community settings need a test similar to AD8 in nature but accurate as HMSE for cognitive screening in elderly patients on treatment for chronic medical disorders.

Key Message

HMSE is more reliable screening tool to identify significant cognitive impairment in Indian geriatric population. AD-8 has advantage that it is quick to administer and can be completed with care giver only. However, its use for screening in Indian population is limited due to its high false positive rates. Further studies are required to modify either its questions or cut off

score to explore its potential as screening tool for dementia in Indian elderly population.

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Conflicts of interest

There are no conflicts of interest.

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