ORIGINAL RESEARCH PAPER

Geriatric Health

A COMPARATIVE STUDY OF MMSE AND ACE-R SCALES IN PATIENTS OF DEMENTIA REFERRED FROM SPECIALIZED NEUROLOGY CLINICS IN INDIA.

KEY WORDS: MMSE, ACE-R, corelation

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ABSTRACT

Aim: Aim of the study was to find out whether there is any correlation between MMSE scores of the patients and Addenbrooke's Cognitive Examination-Revised (ACE-R) scores of the same. **Methodology:** Random sampling was carried out in the Outpatient Department of XXXXXXXXX to include 70 subjects in the first phase to do MMSE examination, and same method of sampling was followed after grouping the subjects into two. These were then subjected to statistical analysis and compared against the scores of MMSE to find correlation between the findings of ACE-R and MMSE. **Results:** Spearman correlation coefficient tests yielded following results: MMSE Scores vs ACE-R scores. MMSE scores are strongly correlated with ACE-R scores (Spearman's correlation coefficient 0.836, $p<0.001$). The analysis in detail discussed the individual correlation of MMSE with the five cognitive domains of ACE-R. **Conclusion:** There was a significant difference in the mean of ACE-R in patients ($U=13$, $p=0.01$). These results suggest that those with normal MMSE scores are highly likely to have normal ACE-R scores and vice versa. Also when MMSE score is correlated with ACE-R score, the correlation becomes stronger when the MMSE score is abnormal i.e. less than 24.

INTRODUCTION

Dementia is defined by the International Classification of Mental Disorders (ICD 10), as a syndrome due to disease of the brain, usually of a chronic or progressive nature, in which there is disturbance of multiple higher cortical functions, including memory, thinking, orientation, comprehension, calculation, learning capacity, language, and judgment (1). It is a progressive condition in which behaviour and personality changes leading to a person unable to carry out activities of daily living. The most common form of dementia is 'Alzheimer's dementia' mainly associated with a case of progressive aphasia, apraxia and agnosia, associated with the specific histopathological finding of neurofibrillary tangles and plaques, first described in 1907.

Dementia is not a normal part of ageing however aged people are more prone to Dementia. The world population is ageing as people are living longer due to the advancement of the medical fraternity, improvement of healthcare access, conquering some of the communicable / infectious diseases, awareness of medical conditions and betterment of life style and the state of art in the healthcare system. The population aged 65 and over is projected to increase from 16 % in 2008 to 23 % by 2033 in UK, like rest of the European countries (2). The dementia study in India considering educational background, social status, urban/rural living, and understanding of assessment process and validation of the assessment tools, concluded that large families living together for generations in the same house provide supportive care to the elderly. This in turn has an effect on the negative economy due to lack of income generation by care taker in addition to the emotional and psychosocial stress faced by them (3).

Census (2001) shows that the elderly population (above the age of 60 years) of India increased by 32% in the decade to 77 million (4). According to the Population Census (2011), it was observed nearly 104 million elderly persons in India; 53 million females and 51 million males. India is one of the fastest growing countries in the world with current average life expectancy over 68 years. There is also a rapid epidemiological transition of increase in aging population (5). The projections for the ageing in Indian population show that the current 'cone' shaped pyramid will swell in the middle and at the top with a huge rise in the older adult population growth (6). According to Dementia India Report, 2010, there were 3.7 million Indians with dementia and the total societal cost is about 147 billion rupees. There are about 5.3 million people above the age of 60 (1 in 27) have dementia in India in 2020. It is predicted that the current number of people with dementia would be 7.6 million by 2030 (3.69 million to), and the immediate consequence would be that the cost of care would be almost three fold (7). The current life style changes and disorders like Type 2 diabetes, hypertension, stroke etc. might be the additional risk factors for dementia in India.

The awareness of dementia in India 20 years back was lacking in general population to the extent of not being able to identify the common symptoms and signs as culturally this symptomatology was considered as normal ageing, madness in elderly, childishness, weak brain etc. (8), (9). Factors responsible for this lack of awareness are lack of structured training in recognition and management of dementia among professionals, lack of support for patients and their care givers; and the lack of government healthcare organizations and media in promoting awareness in communities. Though off the late people realized the signs and symptoms of dementia, 'it is an organic brain syndrome and is part of a medical condition was not acknowledged for long' (10). Older people with dementia cannot in India be viewed as a separate group in society and many a times the patient's and caregivers needs are unmet, which results in the psychological strain and economic disadvantage which in turn will have a negative impact on all family members leading to impoverishment, educational disadvantage, and gender inequality that constitute the major barriers to successful social and economic development.

The services provided for dementia care in India is quite fragmented and patchy depending on the geographical areas in addition to rural or urban locations. For huge elderly population and straining socio-economic condition there are 6 Residential care facilities (respite facility, family support); 10 day care centres (medical attention and supervision); 6 domiciliary care services (advice and tips for caring families); 100 memory clinics (provide assessment, support, information and advice) and 10 dementia help lines. The most significant barrier in implementing services for dementia is low human resources such as neurologists, psychiatrists and psychologists for all mental disorders.

Some initiatives have been taken by the Government and Alzheimer's and Related disorder Society in India (ARDSI), along with other social governmental and nongovernmental organizations in implementing training programs for the caregiver and professionals to pursue career in geriatrics. Over and above certificate course, post graduate diploma in geriatric care, training NGOs and establishment of ARDSI-school of geriatric care, need of appropriate undergraduate psychiatric training has been highlighted for a long time. There exists rift between psychiatry and the rest of medicine, which is detrimental to both the disciplines; and this gap, can be filled to a great extent by incorporating psychiatry education in the undergraduate curriculum (11).

Empowering the medical officers with psychiatric knowledge during their undergraduate training can go a long way in increasing psychiatric care in India. There is a need on all fronts including government, NGOs, professionals, policy makers and people to create awareness and understanding of dementia for better opportunities of training for care givers, economical support and allowance, education and awareness of families supporting their loved ones (12). These informal caregivers do save the government a huge amount of revenue and that will yield results in huge economic investment.

As in any chronic medical illness, early detection and diagnosis will be helpful in dementia. Dementia is a condition with no cure available but prevention is possible; so early intervention to prevent the onset or postpone the onset in normal population is important. It is estimated that the proportion of dementia cases that are theoretically preventable through elimination of various identified risk factors is about 40% in India. There are several potentially modifiable and non-modifiable risk factors associated with cognitive decline or Alzheimer's disease (AD) in dementia. The potentially modifiable risk factors are less childhood education, midlife hearing loss, hypertension, obesity, later-life smoking, depression, physical inactivity, social isolation, and diabetes (13). It is generally considered that a fifty percent reduction in population prevalence of dementia can be achieved by a five year delay in the onset of symptoms (ADI, 2014). Primary prevention (interventions applied before the condition occurs) plays a major role in prevention of dementia (14).

It is essential that in case of any of the symptoms pertaining to dementia found, the person should be referred to the psychiatrists to undergo the Mini-Mental State Examination (MMSE). It is commonly used in medicine and allied health to screen for dementia. It is also used to estimate the severity and progression of cognitive impairment and to follow the course of cognitive changes in an individual over time; thus making it an effective way to document an individual's response to treatment. The MMSE or Folstein test is a 30-point questionnaire that is used extensively in clinical and research settings to measure cognitive impairment (15).

Any score of 24 or more (out of 30) indicates a normal cognition. Below this, scores can indicate severe (≤9 points), moderate (10–18 points) or mild (19–23 points) cognitive impairment. The raw score may also need to be corrected for educational attainment and age (16).

The Addenbrooke's Cognitive Examination (ACE) and its subsequent versions (Addenbrooke's Cognitive Examination-Revised, ACE-R and Addenbrooke's Cognitive Examination III, ACE-III) are neuropsychological tests used to identify cognitive impairment in conditions such as dementia (17).

The Addenbrooke's Cognitive Examination (18) was originally developed as a theoretically motivated extension of the Mini-Mental State Examination (MMSE)(19) which attempted to address the neuropsychological omissions and improve the screening performance of the latter (20). The ACE encompassed tests of five cognitive domains: attention/orientation, memory, language, verbal fluency, and visuospatial skills (18). It is scored out of 100, with a higher score denoting better cognitive function. At the recommended cut-off scores of 88 and 83, the ACE was reported to have good sensitivity and specificity for identifying different forms of dementia and other impairments of memory and judgement (0.93 and 0.71; 0.82 and 0.96, respectively) (21). The ACE also incorporated the MMSE, such that this score (out of 30) might also be generated (18) (20).

The investigation of the diagnostic validity of the Addenbrooke's Cognitive Examination - III (ACE-III), Mini-ACE (M-ACE), Montreal Cognitive Assessment (MoCA), Hasegawa Dementia Scale-Revised (HDS-R), and Mini-Mental State Examination (MMSE) to identify mild cognitive impairment (MCI) and dementia, shows that ACE-III is a useful cognitive instrument to detect MCI. For distinguishing dementia patients from non-dementia patients, the ACE-III and M-ACE are superior to the MoCA, HDS-R, and MMSE (22).
A study have been carried out on conversion between Addenbrooke's Cognitive Examination III (ACE-III) and Mini-Mental State Examination (MMSE) scores, to predict the MMSE result based on ACE-III, thus avoiding the need for both tests, and improving their comparability (23). It concluded that the conversion table between ACE-III and MMSE denoted a high reliability which suggests that MMSE may be estimated based on the ACE-III score, which could be useful for clinical and research purposes.

AIM

Aim of the study was to find out whether there is any correlation between MMSE scores of the patients and Addenbrooke's Cognitive Examination-Revised (ACE-R) scores of the same.

Research Design

A thorough secondary study was conducted by reviewing various earlier studies on the similar context from several journals. This was followed by a primary study, which was a cross- sectional study. 70 subjects were included in the first phase of the study in which MMSE was carried out in 70 subjects and MMSE ratings were given. This was followed by the second phase in which the subjects were grouped into two groups on the basis of their MMSE score and in each group, ACE-R scoring was done in 11 subjects in each group.

Sampling Design

Random sampling was carried out in the Outpatient Department of XXXXXXXXX to include 70 subjects in the first phase to do MMSE examination, and same method of sampling was followed after grouping the subjects into two.

Data Analysis

Quantitative study was used and data analysis was done by using Statistical Package for Social Science (SPSS) version 18.0. The statistical tools used included descriptive statistics, Spearman correlation coefficient as well as Mann-Whitney U test.

The subjects were grouped into two groups of 11 subjects each, based on their MMSE scores. The case group consisted of those with MMSE score lower than 23 and the control group consisted of those with MMSE score higher than 24.

The ACE-R scores for all the included subjects were calculated with all the cognitive domains.

Mann-Whitney U test was conducted to compare mean ACE-R value in patients with abnormal MMSE scores and those with normal MMSE scores.

Multiple Spearman correlation coefficient tests were carried

out to find out the following:

- Correlation of MMSE score with ACE-R score and its cognitive domains
- Correlation of abnormal MMSE score with ACE-R score and its cognitive domains
- Correlation of normal MMSE score with ACE-R score and its cognitive domains

RESULTS

Spearman correlation coefficient tests yielded following results: MMSE Scores vs ACE-R scores. MMSE scores are strongly correlated with ACE-R scores (Spearman's correlation coefficient 0.836, $p<0.001$)

- MMSE scores are also correlated with all five cognitive domains of ACE-R, however the correlation is strong in all except 'Visuopatial' domain. (all others at 0.01 level, Visuopatial domain at 0.05 level)
- Patients with normal MMSE Scores (Correlation with ACE-R scores) (11 samples):
- MMSE scores are correlated with ACE-R, however correlation is not strong (Spearman's correlation coefficient 0.537, $p<0.05$)
- Only 'Language' is a strongly correlated domain out of the five cognitive domains (0.01 level), while the other domains are not correlated with MMSE scores.
- Patients with abnormal MMSE Scores (Correlation with ACE-R scores) (11 samples):
- MMSE scores are strongly correlated with ACE-R (Spearman's correlation coefficient 0.794, $p=0.002$)
- Only 'Attention' is a strongly correlated domain out of the five cognitive domains (0.01 level), while the other domains are not correlated with MMSE scores.

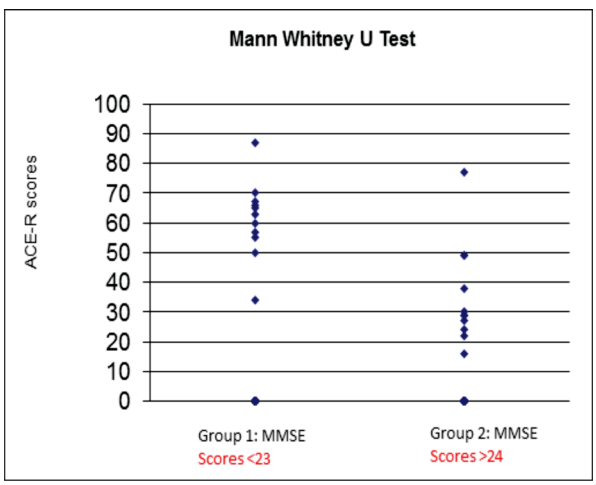
Mann Whitney U test also yielded significant results and there was a significant difference in the mean of ACE-R between patients with normal MMSE scores and those with abnormal MMSe scores ($U=13, p=0.01$) at 99% confidence level.

CONCLUSION

There was a significant difference in the mean of ACE-R in patients ($U=13, p=0.01$). These results suggest that those with normal MMSE scores are highly likely to have normal ACE-R scores and vice versa.

Spearman correlation coefficient findings reflect that ACE-R score and MMSE scores are correlated with each other in all the patients irrespective of MMSE scores. Thus, not only in terms of Normal and Abnormal MMSE scoring, but also in terms of the grades of MMSE scores – Mild, Moderate and Severe, the corresponding ACE-R scores are likely to reduce respectively.

Thus, MMSE score is correlated with ACE-R score and the correlation becomes stronger when the MMSE score is abnormal i.e. less than 24.



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