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Evaluation of functional changes in human brain utilising Neuro exploratory questionnaire

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Abstract

Introduction: Aging is accompanied by cognitive decline in a major segment of the population and is the primary risk factor for Alzheimer's disease and other prevalent neurodegenerative disorders. The aim of the present study was To analyze the structural and functional changes of Human brain (ventricle – brain ratios) by using Neuro- Exploratory Questionnaire (NEQ) in different age group samples at semi-quantitative estimation of cerebral atrophy and cognitive decline with the use of indices.

Material and Methods: The study was conducted in the Mamata General & Super specialty Hospital, Khammam, Telangana, in collaboration with Index Medical College, Indore. Neuro Exploratory Questionnaire tool were used in the study.

Results: The latest research has demonstrated that, staying mentally & physically active would translate into improved memory & learning and this provides protection against cognitive decline. The finding of current study has thrown a useful & vulnerable guide to remain mentally alert & with good cognitive capability by using neuronal circuits, by performing mental tasks like counting, memory & rehearsals. This is called "advanced cognitive training for independent & vital elderly".

Conclusion: Thus this study revealed, structural & functional changes definitely occur in old age in brain as well & prophylaxis and prevention of certain systemic diseases, the onset of severity of age related changes in brain. Doctors of medicine can help geriatric individuals by prescribing antioxidants, by regular learning exercises which involve neuronal circuit formation and prescribing physical exercise & counseling, thereby keeping old person independent and vital.

Keywords: Neuro exploratory questionnaire, mini mental status examination; geriatric depression; short portable mental status

Introduction

The human brain is the most fascinating and complex machine in the human body which is composed of hundreds of billions of neurons and that has inspired a great deal of study of the organ. Some of the major functions of the human brain are to control muscles, and coordinate body movement, sensory perceptions, memory, learning, speech, emotions, intelligences and consciousness^[1]. Cerebrum (cerebral cortex) is the major part of the human brain that accounts for about 80% of its total mass. The cerebrum is divided into frontal, parietal, temporal and occipital lobes, where each area has its own functionality such as controlling speech, smell, hearing, vision, memory, complex learning or behavioral responses. It consists of Gray Matter (GM) and White Matter tissue (WM) and Cerebral Spinal Fluid (CSF) in its cavity^[2].

The neurological deficits of aging may be viewed from a developmental perspective. That is, the decline in functional efficiency and deterioration of highly specialized non-dividing neuronal cells is the end point of a maturation process that occurs throughout adult life. Involution to senescence is a normal, inevitable, and inexorable physiological march, the end phase of which is expressed in generally predictable and specifically unpredictable ways. The earliest of these developmental changes occurs long before senescence and the effects of these physiological events quietly accumulate toward expression late in life^[3]

The structures which are seen in the normal axial views have been shown in figures 1.8 to 1.18. The frontal horns of lateral ventricle are best seen in axial view at the level of head of caudate nucleus. Central parts of lateral ventricles are visible at level above head of caudate nucleus.

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The widest third ventricle is seen in the axial view at the level of superior colliculus. The sylvian fissures are very well depicted at the level where thalamus is in largest dimension. At the level of "foramen of Monro", third ventricle is narrowest. The fourth ventricle is seen as a small cavity bounded by pons and cerebellum [4].

Many chronic conditions that lead to mental disability, previously attributed to the aging process, are now known to be potentially preventable. Thus, it becomes increasingly important to screen both for preventable diseases and for functional impairment that may result in mental disability and are amenable to interventions [5]. The aim of the present study was to analyze the structural and functional changes of Human brain by using Neuro- Exploratory Questionnaire (NEQ) in different age group samples at semi-quantitative estimation of cerebral atrophy and cognitive decline with the use of indices.

Material and Methods

Study Setting: The study was conducted in Mamata

The subjects were divided into 6 groups as follows

S. No.	Age Group	Age
1	Group-1	21-30 Years
2	Group-2	31-40 Years
3	Group-3	41-50 Years
4	Group-4	51-60 Years
5	Group-5	61-70 Years
6	Group-6	71 & above Years

Neuro Exploratory Questionnaire (NEQ)

Neuro-exploratory questionnaire is employed to assess the functional status of the older Person. Current study includes the following screening parameters to assess the functional status of older person;

Cognitive function

- Assessment (6) 1. Mini-mental status examination (Format III) 2. Short portable mental status Questionnaire (Format IV)
- Depression (7) 1. Short form geriatric depression scale (Format V)

Cognitive Functional Assessment

Screening cognitive impairment is achieved with instrumentations, which include.

- Mini-mental status examination questionnaire
- Short portable mental status questionnaire

Evaluation of Depression

Depressive symptoms are common in geriatric age group. A screening questionnaire for depression is important given

General & Super speciality Hospital, Khammam, Telangana, in collaboration with Index Medical College, Indore. The study group was drawn from samples (patients) reporting to the department of Radio-diagnosis, for a head CT examination for various indications between January 2019 and December 2019.

Study Design: It was an observational, retrospective, cross-sectional and non- interventional study.

Sampling

One hundred samples were for the structural and functional changes in brain for the purpose of this work, fifty were males and fifty were females.

A baseline study was conducted to measure height, weight, blood pressure and nervous system examination and to exclude diseases like diabetes mellitus, hypertension, thyroid and hypothalamic disorders. Behavior of the subject in relation to attention, speed of response and capability to give relevant answers was assessed.

the common atypical presentation of depression in the very old and the relationship between depression and cognitive dysfunction and increased risk of death, suicide and functional decline. Furthermore, major depression can be easily treated with medication and psychotherapy [8].

Screening and quantification of depressive symptoms was achieved using validated instrument, Short-term geriatric depression scale. A score of 6 or more on the 15-item scale indicate substantial depressive symptoms requiring further evaluation

Alternative depression screening instruments include

1. Center for epidemiologic studies-depression scale
2. General health questionnaire

Statistical Analysis

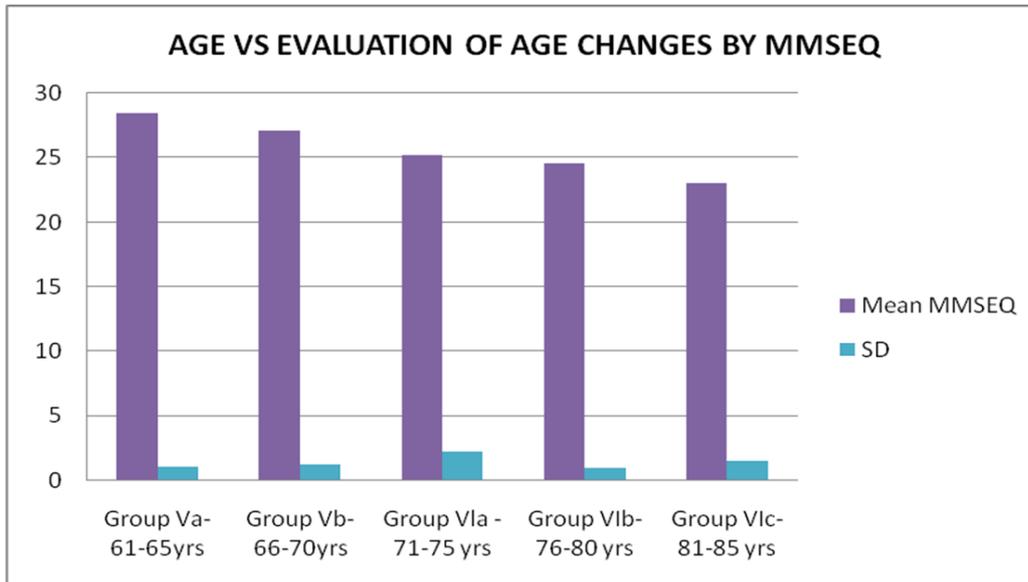
Analysis was done using proportions by using the statistical package for social and science (SPSS) of version 26. Probability value of $p < 0.05$ was considered to indicate significance.

Results

Table 1: Evaluation of Age Changes by Mmseq
Mini Mental Status Examination Questionnaire- Normal value>26

S. No	Age Groups	N	Mean Age	SD	Mean MMSEQ	SD
1	Group Va-61-65 yrs	7	64.14	1.57	28.43	0.98
2	Group Vb-66-70 yrs	11	68.91	1.58	27.09	1.14
3	Group VIa -71-75 yrs	5	74	1.41	25.2	2.17
4	Group VIb- 76-80 yrs	5	78	2	24.6	0.89
5	Group VIc-81-85 yrs	4	82.5	1.91	23	1.41

$P < 0.05$ in 76-85 age group



Age Vs Evaluation of Age Changes by Mmseq

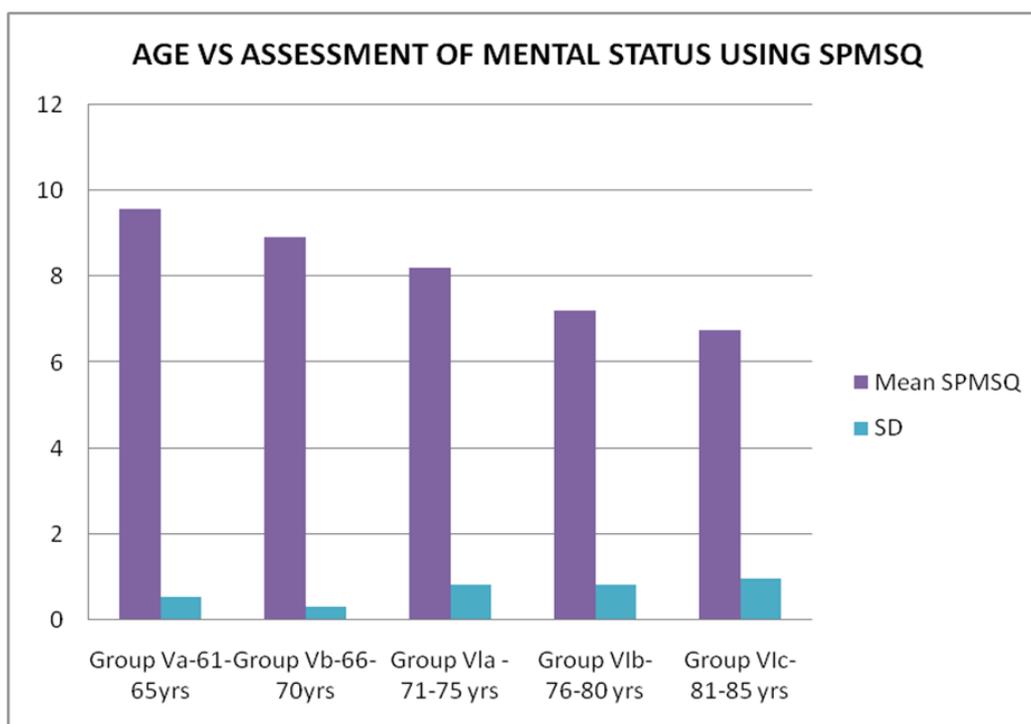
In this assessment of mental status, a standardized questionnaire is employed and score is allotted to each question. Since in groups 1 to 4 no deviation was observed, groups 5 and 6 are evaluated in detail. In this evaluation group 6 has shown reduction in score, which should be

normally 26 to 24.6. The study was extended to few individuals between 81-85 years and this is the group, which has shown deterioration in mental status and cognitive functions.

Table 2: Age Vs Assessment of Mental Status Using Spmsq
Short Portable Mental Status Questionnaire - Normal value >8

S. No	Age Groups	N	Mean Age	SD	Mean SPMSQ	SD
1	Group Va-61-65 yrs	7	64.14	1.57	9.57	0.53
2	Group Vb-66-70 yrs	11	68.91	1.58	8.91	0.3
3	Group VIa -71-75 yrs	5	74	1.41	8.2	0.84
4	Group VIb- 76-80 yrs	5	78	2	7.2	0.84
5	Group VIc-81-85 yrs	4	82.5	1.91	6.75	0.96

$p < 0.05$ in 76-85 age group



Age Vs Assessment of Mental Status Using SPMSQ

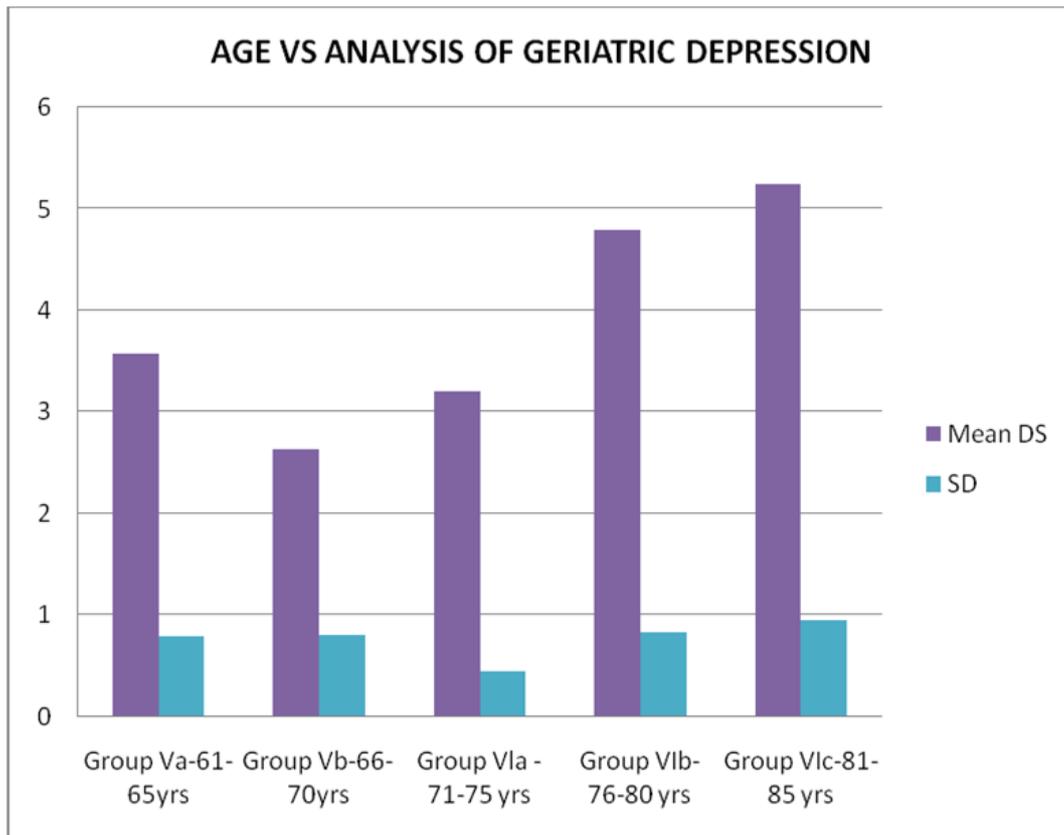
In this there are 10 questions, standardized aiming at getting insight into memory function of the individual and his orientation in space and time. Up to group 5 the score was 100%,. Beyond group 6 with mean of 9.87, there is reduction in score gradually and the minimum score was in

extended group (81-85 years). The result shows that memory function, orientation in space and time, don't shows a setback up to 60-65 years of age. Beyond that age these functions are deteriorated.

Table 3: Age Vs Analysis of Geriatric Depression
Geriatric Depression Scale - Normal value <5

Sl. No	Age Groups	N	Mean Age	SD	Mean DS	SD
1	Group Va-61-65 yrs	7	64.14	1057	3.57	0.79
2	Group Vb-66-70 yrs	11	68.91	1.58	2.64	0.81
3	Group Vla -71-75 yrs	5	74	1.41	3.2	0.45
4	Group VIb- 76-80 yrs	5	78	2	4.8	0.84
5	Group VIc-81-85 yrs	4	82.5	1.91	5.25	0.96

$p > 0.05$ in all age groups



Age Vs analysis of geriatric depression

With regard to geriatric depression scale, score of 5.25 is seen only in extended study group (81-85 years). That means, depression person is not encountered in the study.

Discussion

A term which goes in association with aging is "Ageism". Ageism is a term coined by Robert N Butler and it refers to discrimination towards old person and negative stereotype about old age that are held by younger adults. Old adulthood period i.e., beyond 60-65 years is encompassed with restricted psychosomatic functions as a result of generalized homeostenosis. These psychosomatic changes are based on structural changes in the brain like reduction in weight of the brain and reduction in number of functional neurons and extinction of neuronal circuits, which are not put into frequent use.

The present study was to analyze the structural and functional changes of Human brain by using the Neuro-Exploratory Questionnaire (NEQ) in different age group

samples at semi-quantitative estimation of cerebral atrophy and cognitive decline with the use of indices.

In this assessment of mental status, a standardized questionnaire is employed and score is allotted to each question. Since in groups 1 to 4 no deviation was observed, groups 5 and 6 are evaluated in detail. In this evaluation group 6 has shown reduction in score, which should be normally 26 to 24.6. The study was extended to few individuals between 81-85 years and this is the group, which has shown deterioration in mental status and cognitive functions.

Cognitive abilities are the greatest when people are in their 30's and 40's and they remain at high levels till the age of 50's & 60's. From that age onwards, cognitive abilities begin to decline through 70's, to a noticeable level. By the age of 80 years & above, definite decline in mental ability occurs, manifesting in the shape of difficulty in retrieval of information, delayed acceptance of facts, not accepting reformed ideas, sticking to old dictums reduction in reaction

time & difficulty in word finding. This type of decline in cognitive function is given the term “fluid intelligence” & this includes attention & memory capacity. In contrast to fluid intelligence, old age individuals are at a gain in expertising the old skills & knowledge to solving problems. This is termed as “crystallized intelligence” [9]

The Mini-Mental State Examination (MMSE) is the best-known and the most often used short screening tool for providing an overall measure of cognitive impairment in clinical, research and community settings.

In the present study, assessment of mental status, a standardized questionnaire is employed and score is allotted to each question. There was no significant change in the score observed in the younger age group, a detailed evaluation was done in older group, there was significant reduction in the score was observed when compared with the other tested groups indicating deterioration in mental status and cognitive functions.

Similar observations were also seen by Arevalo-Rodriguez group where, MMSE scores ranged from sensitivities of 23% to 76% and specificities from 40% to 94%. In relationship to conversion from MCI to Alzheimer’s disease dementia, the accuracy of baseline MMSE scores ranged from sensitivities of 27% to 89% and specificities from 32% to 90% [10].

Pfeiffer's Short Portable Mental Status Questionnaire (SPMSQ) is a brief screening test for organic brain syndromes. In the present study, questioner consisting of 10 standardized questions aiming at getting insight into memory function of the individual and his orientation in space and time. There was no change up to middle age group, where as in older age (Above 70 years) there is reduction in score gradually and the minimum score was in extended group (81-85 years). The result shows that memory function, orientation in space and time; don't show a setback up to 60-65 years of age. Beyond that age these functions are deteriorated.

Similar observation was also done by Pfeiffer, where 10-item Short Portable Mental Status Questionnaire (SPMSQ), easily administered by any clinician in the office or in a hospital, has been designed, tested, standardized and validated. Observation shows, a high level of agreement between the clinical diagnosis of organic brain syndrome and the SPMSQ scores that indicated moderate or severe organic impairment [11].

Thus this study revealed, structural & functional changes definitely occur in old age in brain as well & prophylaxis and prevention of certain systemic diseases, the onset of severity of age related changes in brain. Doctors of medicine can help geriatric individuals by prescribing antioxidants, by regular learning exercises which involve neuronal circuit formation and prescribing physical exercise & counselling, thereby keeping old person independent and vital.

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