Original Research Paper

Volume-8 | Issue-4 | April-2018 | PRINT ISSN No 2249-555X

Physiology

COMPARISON OF MONTREAL COGNITIVE ASSESSMENT SCORE BETWEEN YOUNG AND OLD TAXI DRIVERS WORKING IN MUMBAI

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ABSTRACT With increasing age chance of impairment of cognitive functions increases. Doing stressful activities for prolonged time also affects the cognitive functions. Montreal Cognitive Assessment (MOCA) is a widely used test for mild cognitive impairment. Taxi drivers, as they undergo a lot of stress everyday, were chosen as subjects in present study.

Cognitive assessment was done with the MOCA Test on 52 taxi drivers working in Mumbai. They were divided into two groups, Group - 1 (younger, aged between 25 to 40 years, Mean 32.654) and Group - 2 (older, aged between 50 to 65 years, Mean 57.346). Printed MOCA Test questionnaires (Hindi & Marathi), were used to carry out the test.

Younger drivers performed better compared to older drivers. The comparison between the two groups was statistically significant.

This study indicates that cognitive performance is better in young taxi drivers as compared to old taxi drivers.

KEYWORDS : MOCA, Taxi Drivers, Cognition, Mumbai.

Introduction

Driving is a skilful job. For driving, one needs proper neurocognition and neuromotor activities. Among different types of driving, taxi driving is one of the most challenging job. During driving a taxi, the driver faces problems not only from other vehicles of the road but also from the passengers, traffic police and fellow taxi drivers.[1,2]

Driving a taxi in a crowded and congested city like Mumbai is not an easy job. The taxi drivers have to face huge amount of stress everyday. This stress might take a toll on their mental health as well as neurocognition.[3]

Also, the duration of time for which a person is driving a taxi is an important factor regarding chance of neurocognitive impairment. The more time a person is driving, there is more chance of him to be suffered from neurocognitive impairment. With increasing age chance of impairment of cognitive functions increases. Doing stressful activities for prolonged time also affects the cognitive functions.[4,5]

Montreal Cognitive Assessment (MOCA) test is a comparatively newer test to assess neurocognition.[6] It is actually a set of questions which assesses the subject's neurocognitive deficits.[7] This test makes assessment of 7 cognitive functions, visuospatial, naming, memory, attention, language, abstraction and orientation.[8]

The present study was aimed at assessing the MOCA score in young taxi drivers and old taxi drivers working in the city of Mumbai and to compare the results and note that whether prolonged driving has any detrimental effects on neurocognitive functions.[9,10]

As old taxi drivers were facing stress for prolonged period of time compared to young taxi drivers, they were at a higher risk of developing neurocognitive deficits.

By comparing the results of the MOCA score of these two groups we have tried to estimate whether any particular group had better neurocognition.[11] We could also assess whose cognitive functions were better or which group was suffering more along with the extent and intensity of this problem.[12]

Methods

The study design was observational and cross sectional. The study was conducted in the Department of Physiology, Seth G.S. Medical College and K.E.M. Hospital, Parel, Mumbai, India. The study was approved by Institutional Ethics Committee (IEC) of Seth G S Medical College and K.E.M. Hospital, Parel, Mumbai, India. The study participants were recruited from the city of Mumbai. To reduce bias, taxi drivers from all over the Mumbai were invited to participate in this study. After thorough counseling, 60 subjects were selected, among which 52 finally appeared for the study. The written informed consent was obtained from all the study participants. A total 52 study participants (all of them were male) were recruited for the study. The participants were then sub categorized into following two groups on the basis of their age.

- **Group 1 (Young Taxi Drivers)**

Participants between age group of 25 to 40 years driving taxi for 8 hours per day for at least 5 years on the roads of Mumbai and suburbs were included.

- **Group 2 (Old Taxi Drivers)**

Participants between age group of 50 to 65 years driving taxi for 8 hours per day for at least 20 years on the roads of Mumbai and suburbs were included.

The study participants having history of alcohol, smoking, hypertension, known case of cerebrovascular accident, stroke, acute and chronic illnesses affecting cognition (parkinsonism, meningitis, alzheimer's, dementia, cerebellar ataxia) or any history of medication were excluded from the study.[13,14] History taking, general examination and systemic examination were carried out for all the participants before the experiments of the study.

Following equipments were used for performing the experiments

- Mercury Sphygmomanometer
- Pencil, Eraser, Pen
- Printed MOCA test Questionnaire (Hindi & Marathi)
- Standard Weighing Scale

The participants were asked to come to the Physiology Department in the morning after having light breakfast. After informed consent, blood pressure was measured and body weight has been taken using Mercury Sphygmomanometer and Standard Weighing Scale respectively.

- **Montreal Cognitive Assessment Test (MOCA)**

Each and every participants were given a printed MoCA test questionnaire, downloaded from the *mocatest.org*.[15] The questionnaires were in Hindi and Marathi. Each participants were allowed enough time to answer all the questions present in the questionnaire. After that, the score was assessed. Only one examiner checked all the answer sheets and assessed the MOCA score to avoid bias.

The MOCA assesses several cognitive domains:

- The short-term memory recall task (5 points) involves two learning trials of five nouns and delayed recall after approximately five minutes.
- Visuospatial abilities are assessed using a clock-drawing task (3 points) and a three-dimensional cube copy (1 point).

- Multiple aspects of executive functions are assessed using an alternation task adapted from the trail-making B task (1 point), a phonemic fluency task (1 point), and a two-item verbal abstraction task (2 points).
- Attention, concentration, and working memory are evaluated using a sustained attention task (target detection using tapping; 1 point), a serial subtraction task (3 points), and digits forward and backward (1 point each).
- Language is assessed using a three-item confrontation naming task with low-familiarity animals (lion, camel, rhinoceros; 3 points), repetition of two syntactically complex sentences (2 points), and the aforementioned fluency task.
- Finally, orientation to time and place is evaluated by asking the subject for the date and the city in which the test is occurring (6 points).

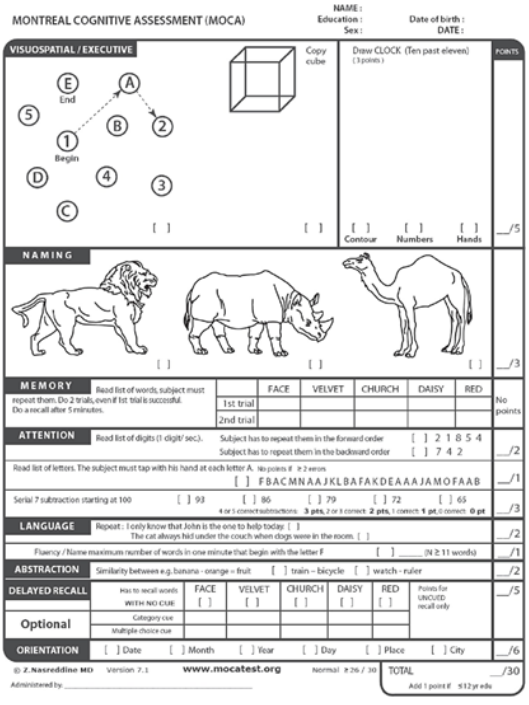

Image 1 : Montreal Cognitive Assessment Test sheet

According to MOCA test questionnaire, the highest possible score is 30. A score equal to or above 26 was considered as normal whereas 25 or below scores were taken as abnormal.[16]

Though primarily the test was in the language of English, authentic and pretested Hindi & Marathi versions of the same test had been acquired from the *mocatest.org*.[15]

- **Statistical Analysis**

Data of the different parameters measured were entered in Microsoft Excel (2010). The mean and standard deviation was calculated for all the parameters. Statistical analysis was done using n-Master 1.0 as per SPSS 16.0 and Graphpad Prism software. The statistical tests used were as per data requirement and our objectives of the study. Data was presented as Mean ± Standard deviation.

Results

Total 52 subjects were divided into two equal groups consisting of 26 people in each groups. The groups were as follows.

- **Group 1** : Young taxi drivers (Age 25 to 40 years, driving taxi for 5 years)
- **Group 2** : Old taxi drivers (Age 50 to 65 years, driving taxi for 20 years)

Table 1 : Comparison of Age between Group 1 and Group 2

Groups	Mean Age (in years)	Standard Deviation	Range (in years)	Sample Size
Group 1 (Young)	32.654	5.261	25 - 40	26
Group 2 (Old)	57.346	4.534	50 - 65	26

- Group 1 (young taxi drivers) consisted of 26 people, whose age ranges from 25 to 40 years. The mean age in Group 1 (young taxi drivers) is 32.654 (5.261) years.
- Group 2 (old taxi drivers) also consisted of 26 people, whose age ranges from 50 to 65 years. The mean age in Group 2 is 57.346 (4.534) years.
- The age differences in those two groups were statistically significant, as p value is < 0.05.

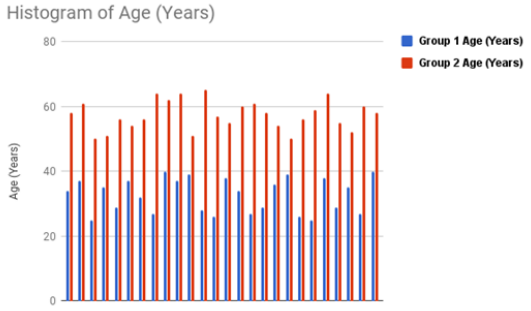

Figure 1 : Comparison of Age between Group 1 and Group 2

Table 2 : Comparison of MOCA score between Group 1 and Group 2

Groups	Mean MOCA Score	Standard Deviation	Range (MOCA Score)	Sample Size
Group 1 (Young)	27.115	1.608	24 - 29	26
Group 2 (Old)	25.192	1.524	22 - 28	26

- Group 1 (young taxi drivers) consisted of 26 people, whose MOCA score ranges from 24 to 29 out of total possible score of 30. The mean MOCA score in Group 1 (young taxi drivers) is 27.115 (1.608).
- Group 2 (old taxi drivers) also consisted of 26 people, whose MOCA score ranges from 22 to 28 out of total possible score of 30. The mean MOCA score in Group 2 is 25.192 (1.524).
- The MOCA score differences in those two groups were statistically significant, as p value is < 0.05.

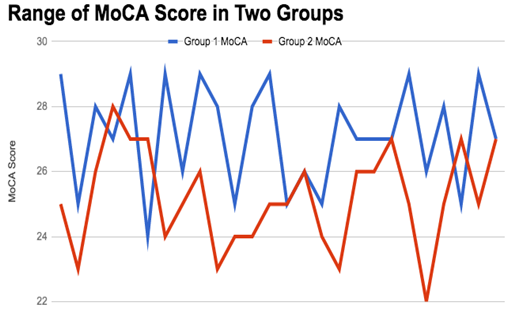

Figure 2 : Comparison of MOCA score between Group 1 and Group 2

Discussion

Decrease in the cognitive function with age, is an issue which is affecting people all over the world. Along with age other factors including stress play an important role. In our study, the taxi drivers of younger age group (Group 1) performed better (Average score 27.115 with SD of 1.608) than the older taxi drivers (Group 2, Average score 25.192 with SD of 1.524). Though a person can score from 0 to 30 in the MOCA test, the cut off value is 26 and above. Clearly the Group 1 taxi drivers had scored above the acceptable normal value, whereas the Group 2 taxi drivers had scored below that. The reason behind the better performance of the younger taxi drivers may be contributed to the amount of time they had spent during the driving (5 years), which is much less compared to the older taxi drivers who were driving for more than 20 years. Though both the groups were driving for at least 8 hours a day, the older drivers are on the road for much longer duration of time.

The average MOCA score of Group 1 (younger taxi drivers) are almost comparable to the same age normal individuals (not driving taxi) and it is higher than the cut off value of 26 out of 30.[17] On the other hand the average MoCA score of the Group 2 (older taxi drivers) are below the average normal value of the same age group individuals (not driving taxi).[18] So, it can be assumed that the tremendous amount of stress which they had faced throughout the entire period (which is more than 20 years), may have taken a toll on their mental health along with neuro cognition.

Though the average MOCA score of Group 2 (older taxi drivers) is below the cut off value for the normal, it is above the average score of the persons with cognitive impairment.

Bowers et al had found similar results in their 2013 study.[19] The relationship between increasing cognitive impairment along with driving had been proved in a study done by Kay et al in 2009.[20]

Conclusion

In this study we can conclude that,

- Along with increasing age, stress also plays an important role in the impairment of cognitive functions of an individual.[21]
- A skillful and hectic job like taxi driving contributes to the mental health and cognitive functions of a person.[22]

So, it is necessary to take care of the individuals who are placed in a stressful job for a longer duration of time. Stress plays an important role in the gradual declining of cognitive functions. Periodic health check up (both physical & mental) along with implementation of proper care and rehabilitation for the persons suffering from cognitive impairment should be done.[23]

Limitations

- The study has moderate sample size from a particular region which may play an impact on the outcome.
- The educational qualifications and socio economic status of the taxi drivers may contribute in the assessment of MOCA score.
- No female drivers were included due to unavailability at the time of this study. This may have influenced the final outcome of the study.
- Along with MOCA, if a battery of other tests were included, they would have given more precise results.

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