Original Article

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Cognitive Impairment among the Elderly Population of Rural Haryana, India and its Association with Smoking, Alcohol Intake and Impairments in Vision, Hearing and Activities of Daily Living

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Abstract:

Objective: The study aimed to estimate the prevalence of cognitive impairment among elderly people in rural Haryana, India and determine its association with smoking, alcohol consumption and impairments.

Material and Methods: This was a community-based cross-sectional study carried out among 575 elderly people aged 60 years and above in the rural field practice area of a medical college in the Haryana state of India. Cognitive impairment was evaluated by the Mini-Cog test. To determine factors associated with cognitive impairment, unadjusted odds ratios with a 95% confidence interval were obtained and binary logistic regression analysis was carried out to calculate adjusted odds ratios.

Results: Cognitive impairment was found in 4.5% of the elderly subjects. Those aged 75 years and more, currently not married, illiterate, elderly living alone, current smokers, currently consuming alcohol and elderly with visual, hearing or activities of daily living (ADL) impairments had significantly higher cognitive impairment. Binary logistic regression analysis revealed that illiteracy (adjusted OR=3.173, p-value=0.033), living alone (adjusted OR=6.299, p-value=0.015), current tobacco smoking (adjusted OR=5.393, p-value=0.029), current alcohol drinking (adjusted OR=7.360, p-value=0.001) and ADL impairment (adjusted OR=6.427, p-value=0.001) were independently associated with cognitive impairment.

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Conclusion: Tobacco smoking, alcohol consumption and ADL impairment were independently associated with cognitive impairment in the elderly people of Haryana state of India. Early screening and timely intervention for signs of cognitive decline may help in improving their quality of life.

Keywords: activities of daily living, cognitive impairment, elderly, mini-cog, smoking

Introduction

Aging is commonly associated with cognitive impairment as it affects brain functioning resulting in progressive alterations in the thought processes and behavior of elderly people.[1] A neurologically degenerative disorder is the underlying cause in the majority of cases of cognitive decline.[2] People with cognitive impairment have increased dependency on others for daily activities, are socially isolated and also experience a low quality of life (QOL).[3]

The number of older persons is growing continuously worldwide owing to the widespread availability of recent advancements in the diagnostic and treatment facilities. According to the United Nations Department of Economic and Social affairs, globally 9.3% of the population in 2020 was aged 65 years and above which is expected to rise to 16.0% by 2050.[4] This alteration in population structure with an increased number of older persons will lead to an increase in the global prevalence of cognitive impairment in the coming years.

Cognitive impairment being a progressive disease is one of the major mental health problems in elderly people.[5] With the advances in dementia treatments available, identification of cognitive impairment and subsequent laboratory diagnosis early in the course of the disease is beneficial for the health care of the elderly.[6] A comprehensive public health response through early screening and management of cognitive impairment among the elderly will help in improving their QOL, prevention of functional impairments and reduction in health expenditures.

The present study was carried out to estimate the prevalence of cognitive impairment among elderly people in a rural area of Haryana state in India and determine its association with sociodemographic factors, smoking, alcohol consumption and impairments in vision, hearing and ADL.

Material and Methods

Study design and study population

This was a community-based cross-sectional study carried out for a period of one year from July 2017 to June 2018 in a rural area of Haryana, a northern state of India. This study included elderly persons aged 60 years and above selected randomly from the rural field practice area of a medical college in Haryana, India.

Sample size and sampling technique

The sample size was estimated using the formula, $N=4p(1-p)/pd^2$ where p is anticipated prevalence and d is relative precision. Taking the anticipated prevalence of 16.0% based on a study from Aligarh[7] which is a district from another North Indian State, a sample size of 604 subjects was obtained at 20% relative precision and a 15% non-response rate. The study subjects were selected by a simple random sampling technique from the list of all elderly residents aged 60 years and above obtained from the field survey register of the Rural Training Health Center of the medical college.

Data collection – tools, techniques and measurements

Elderly people who were sick and in whom cognitive impairment could not be assessed and those who refused to give consent for participation in the study were excluded from the study. Finally, out of 604 randomly selected subjects, 575 elderly people participated in the study. A semi-structured questionnaire was used to collect information from the selected subjects through home visits. Data regarding socio-demographic profile, smoking and alcohol intake were collected. Impairments in vision, hearing, ADL and cognition were assessed in the selected subjects. Visual impairment was checked using a multi-letter Snellen chart for literate individuals and a C Snellen chart for illiterate ones. Subjects were placed 6 meters away from the Snellen chart and asked to read the chart with each of the eyes when the other eye was occluded at the same time. Individuals with visual activity of below 6/12 were considered to have visual impairment.

Hearing impairment was assessed by tuning fork tests. The base of a 512 Hertz vibrating tuning fork was placed on middle of the forehead, and if the subject reported lateralization of sound towards one ear, then hearing impairment was present. In the other test, the base of a vibrating 512 hertz tuning fork was first placed on the mastoid process and then about 1 cm from the external auditory meatus. If the sound heard at the mastoid process was louder than at the external auditory meatus, then the subject was considered to have hearing impairment.

ADL impairment was determined by the Barthel index, which is a 10-item index for measuring performance of activities of daily living. The 10 items are feeding, bathing, dressing, grooming, toileting, bladder control, bowel control, transfer from bed to chair, walking, and stair climbing.[8] Individuals requiring assistance in performing one or more of the 10 activities were categorized to have impairment in activities of daily living.

Cognitive impairment was evaluated by the Mini-Cog test which consists of two components, a 3-item recall test for memory and a clock drawing test (CDT). The task for CDT is to draw a clock-face with all the numbers and draw the hands to show a specified time. Subjects are classified as having cognitive impairment if they are unable to recall any of three words (after performing the clock drawing) or if they recall only 1 or 2 words and draw an abnormal clock (i.e., any of the circle, numbers and hands are incorrect).[9]

Statistical analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 20.0. (Armonk, New York: IBM Corp.). Unadjusted odds ratios with 95% confidence intervals were calculated to find the associations between cognitive impairment and various factors. The study variables with a p-value<0.05 were entered into binary logistic regression analysis using the "forward conditional method" and predictors of cognitive impairment in study subjects with adjusted odds ratios were obtained. All p-values of less than 0.05 were considered to be statistically significant.

Ethical considerations

The data were collected from the subjects after assurance of confidentiality of the data and obtaining informed written consent from them. Ethical approval was obtained from the Institutional Ethics Committee of the medical college before data collection.

Results

Baseline characteristics

Out of the 575 elderly people selected for the study, 336 (58.4%) were male and 239 (41.6%) were female. Among all subjects, 44.2% belonged to age group of 60–64 years and 21.2% were aged 75 years and above. Most of the subjects were Hindu by religion (59.1%) and currently married (76.0%). Nearly half of the subjects (44.3%) were

Table 1 Baseline characteristics of the study participants (n=575)

Parameters	Frequency (%)
Age in years	
60–64	254 (44.2)
65–69	112 (19.5)
70–74	87 (15.1)
≥75	122 (21.2)
Gender	
Male	336 (58.4)
Female	239 (41.6)
Religion	
Hindu	340 (59.1)
Sikh	180 (31.3)
Muslim	55 (9.6)
Currently married	
Yes	437 (76.0)
No	138 (24.0)
Education	
Illiterate	255 (44.3)
Literate	320 (55.7)
Currently employed	
Yes	118 (20.5)
No	457 (79.5)
Socioeconomic status	
Upper & upper middle	105 (18.2)
Middle	119 (20.7)
Lower & lower middle	351 (61.1)
Living alone	
Yes	63 (11.0)
No	510 (89.0)
Tobacco smoking	
Non smoker	187 (32.5)
Current smoker	317 (55.1)
Past smoker	71 (12.3)
Alcohol consumption	
Never	446 (77.6)
Currently	87 (15.1)
Past	42 (7.3)
Visual impairment	
Yes	247 (43.0)
No	328 (57.0)
Hearing impairment	
Yes	151 (26.3)
No	424 (73.7)
ADL impairment	
Yes	117 (20.3)
No	458 (79.7)

illiterate, 20.5% were currently employed and 11.0% were living alone. More than half (55.1%) were current tobacco smokers and 15.1% were current alcohol consumers. 43.0% were found to have a visual impairment, while hearing and ADL impairments were observed in 26.3% and 20.3%, respectively (Table 1).

Prevalence and associated factors

The prevalence of cognitive impairment was found to be 4.5%. Increasing age was associated with a progressive increase in the prevalence of cognitive impairment among the study subjects. Elderly people aged 75 years and more had significantly greater cognitive impairment compared to those in the age group of 60–64 years (unadjusted OR=9.434, p-value<0.001). Currently not married elderly also had significantly higher cognitive impairment than currently married ones (unadjusted OR=5.600, p-value< 0.001). Cognitive impairment was also found to be significantly higher among illiterate subjects compared to literate ones (unadjusted OR=2.962, p-value=0.091), and elderly living alone compared to those living with family (unadjusted OR=11.857, p-value<0.001) (Table 2).

Tobacco smoking and alcohol consumption also had significant associations with cognitive impairment in the study subjects. Current tobacco smokers compared to nonsmokers had more cognitive impairment (unadjusted OR=4.275, p-value=0.020) as did current alcohol drinkers compared to those who didn't consume alcohol (unadjusted OR=9.434, p-value<0.001). Cognitive impairment was also significantly higher in the elderly with impairments in vision (unadjusted OR=2.620, p-value=0.018), hearing (unadjusted OR=4.141, p-value<0.001) and ADL (unadjusted OR=10.227, p-value<0.001) in contrast to those without impairments (Table 2).

Table 2 Association of sociodemographic characteristics, addictions and impairments with cognitive impairment in study participants (n=575)

Parameters	Cognitive impairment Number (%)	UOR	95% CI	p-value
Overall	26 (4.5)			
Age in years				
60–64	4 (1.6)	1		
65–69	4 (3.6)	2.315	0.568–9.426	0.241
70–74	2 (2.3)	1.471	0.265–8.1729	0.659
≥75	16 (13.1)	9.434	3.081–28.884	<0.001*
Gender				
Male	12 (3.6)	0.595	0.270–1.311	0.193
Female	14 (5.9)	1		
Religion				
Hindu	14 (4.1)	1		
Muslim	2 (3.6)	0.879	0.194–3.977	0.867
Sikh	10 (5.6)	1.37	0.596–3.149	0.459
Currently married				
No	16 (11.6)	5.600	2.478–12.655	<0.001*
Yes	10 (2.3)	1		
Education				
Illiterate	18 (7.1)	2.962	1.266–6.929	0.009*
Literate	8 (2.5)	1		
Currently employed				
Yes	4 (3.4)	0.694	0.234–2.053	0.507
No	22 (4.8)	1		
Socioeconomic status				
Upper & upper middle	1 (1.0)	1		
Middle	16 (13.4)	16.155	2.104–124.072	0.008*
Lower & lower middle	9 (2.6)	2.737	0.343–21.856	0.342
Living alone				
Yes	14 (22.2)	11.857	5.196–27.057	<0.001*
No	12 (2.4)	1		
Tobacco smoking				
Non smoker	3 (1.6)	1		
Current smoker	21 (6.6)	4.275	1.258–14.535	0.020*
Past smoker	2 (2.8)	1.759	0.288–10.751	0.541
Alcohol consumption				
Never	13 (2.9)	1		
Currently	10 (11.5)	4.326	1.832–10.215	<0.001*
Past	3 (7.1)	2.562	0.700–9.377	0.155
Visual impairment				
Yes	17 (6.9)	2.620	1.147–5.981	0.018*
No	9 (2.7)	1		
Hearing impairment				
Yes	15 (9.9)	4.141	1.857–9.233	<0.001*
No	11 (2.6)	1		
ADL impairment				
Yes	18 (15.4)	10.227	4.324–24.187	<0.001*
No	8 (1.7)	1		

UOR=unadjusted odds ratio, CI=confidence interval, ADL=activities of daily living
*statistically significant

Binary logistic regression analysis revealed many factors to be independently associated with cognitive impairment among the elderly subjects. These included illiteracy (adjusted OR=3.173 and p-value=0.033 in illiterate compared to literate subjects) and living status (adjusted OR=6.299 and p-value=0.015 in living alone versus living with family) among sociodemographic factors. Other factors independently associated with cognitive impairment were tobacco smoking (adjusted OR=5.393 and p-value=0.029 in current smokers compared to nonsmokers), alcohol intake (adjusted OR=7.360 and p-value=0.001 in current alcohol consumers compared to those who were not consuming) and impairment in ADL (adjusted OR=6.427 and p-value=0.001 in elderly with ADL impairment versus those without impairment) (Table 3).

Table 3 Predictors of cognitive impairment in study participants derived from binary logistic regression analysis

Parameters	AOR	95% CI	p-value
Education			
Illiterate	3.173	1.100-9.154	0.033
Literate	1		
Living alone			
Yes	6.299	1.434-27.683	0.015
No	1		
Tobacco smoking			
Current smoker	5.393	1.185-24.543	0.029
Non-smoker	1		
Alcohol consumption			
Currently	7.360	2.328-23.274	0.001
Never	1		
ADL impairment			
Present	6.427	2.171-19.020	0.001
Absent	1		

AOR=adjusted odds ratio, CI=confidence interval, ADL=activities of daily living

Discussion

The prevalence of cognitive impairment in our study was 4.5%, which is similar to other studies carried out in various North Indian populations, viz., 3.5% in Himachal Pradesh[10], 5.1% in Uttar Pradesh[11], 6.5% in Kashmir[12], and 8.8% in Punjab.[13] On the contrary, in a community-based cross-sectional study carried out in Aligarh, Uttar Pradesh, India, 16.0% of the elderly had cognitive impairment.[7]

Cognitive impairment in the study increased significantly (p-value<0.001) with increasing age. We observed the highest prevalence of cognitive impairment (13.1%) in the elderly aged above 75 years and the lowest prevalence (1.6%) in the elderly aged 60 to 64 years. Several studies carried out in India and other countries have reported similar findings with greater deterioration of cognitive function with increasing age.[7,10-16] Age is the most significant factor associated with cognitive impairment and there is growing evidence about the decline in cognition beginning in early adulthood with accelerated decline with increasing age.[17,18] The speed at which the information processing occurs in the brain gradually reduces with increasing age which appears to result in a decline in cognition.[18]

No significant association was observed between cognitive impairment and gender although females were found to have a higher prevalence of cognitive impairment than males. Similar findings were reported in studies conducted in Punjab, India[13] and in Malaysia[16], although other studies have found gender to be significantly associated with cognitive impairment with females being at higher risk of having a decline in cognition than males.[7,14,15,19] Illiterate elderly people had significantly higher cognitive impairment compared to literate ones. A lower educational level has been consistently reported to be a risk factor for cognitive impairment.[7,10,13,15] Low literacy is often linked to poverty or lower socioeconomic status, which is also

associated with poorer health, poorer access to health care and increased risk of cognitive impairment. On the other hand, a higher level of education provides a "cognitive reserve" that enables individuals to better compensate for pathological brain changes thus reducing the risk of cognitive decline.[20]

Higher prevalences of cognitive impairment were also found in elderly people who were currently not married and those living alone similar to findings reported in a study from Malaysia.[16] Another study from Finland found that, married elderly had a significantly lower prevalence of cognitive impairment than those who were single, separated, divorced or widowed.[21] This may be attributed to the social and intellectual stimulation of the elderly from interactions in society, especially those with a spouse which leads to the preservation of cognitive function.

Tobacco smoking was independently associated with cognitive impairment with smokers at higher risk of having cognitive impairment than non-smokers. The Whitehall II cohort study also reported faster cognitive decline among smokers compared to never smokers and ex-smokers with at least a 10-year cessation who showed no adverse effects on cognitive function.[22] Tobacco smoking has detrimental effects on the vascular system of the brain resulting in cognitive decline, with a dose-response effect evident from the relationship between the amount of smoking and the degree of cognitive decline.[23]

In the present study, an independent association was also observed between alcohol intake and cognitive impairment. Jadav in his study also found significantly higher cognitive impairment in alcohol consumers compared to those who never drank alcohol.[14] Another study reported progressive and proportionate cognitive decline with the duration and degree of an individual's alcohol use.[24] Direct neurotoxic effects of alcohol are believed to induce shrinkage of the cerebral cortex and basal forebrain regions resulting in the decline of cognition in alcohol drinkers.[25]

We also observed a significantly higher prevalence of cognitive impairment in the elderly with visual and hearing impairment. One meta-analysis found that hearing loss was associated with a higher risk of cognitive impairment among elderly people.[26] Lin FR also reported an independent association between hearing loss and cognitive impairment in community-dwelling older adults.[27] In a study carried out among elderly women, visual impairment was independently associated with cognitive impairment and combined visual and hearing impairment was associated with the greatest odds of cognitive decline.[28] Thus visual and hearing impairment may be considered to be important modifiable risk factors for cognitive decline and interventions for their early detection and management may be of significant help in reducing the burden of cognitive impairment among the elderly. In the present study cognitive impairment was also significantly associated with ADL impairment. Similarly, Rashid also reported a higher prevalence of cognitive impairment in individuals with ADL impairment, although the difference was not significant.[16]

Cognitive impairment in our study was assessed by Mini-Cog test. There is good evidence about the excellent screening characteristics of Mini-Cog for diagnosing cognitive impairment and dementia in the early stages compared to other screening tools like the Mini-Mental State Examination, the Clock Drawing Test and AD8.[29,30] In a systematic review and meta-analysis, although the Mini-Mental State Examination was the most frequently used test for dementia screening, the Mini-Cog test had better performance than the other dementia screening tests.[31] Further, Mini-Cog is a simple screening instrument for testing cognition taking 3 to 4 minutes to administer.

With the availability of newer and advanced treatment modalities for dementia and related illnesses, there is a need for a comprehensive public health policy for early identification of cognitive impairment, particularly in the geriatric population. With the growing evidence of

good validity and reliability of screening tools for cognitive impairment, there will be better treatment outcomes for cognitive impairment detected at the early stages. Thus, early identification through screening and prompt intervention for early changes in cognition may slow disease progression and help preserve the functional capacity of individuals.

Conclusion

All elderly people are affected by some degree of cognitive impairment, which is associated with various sociodemographic factors, behavioral factors like tobacco smoking and alcohol consumption and impairments in the ADL. Hence, early screening for cognitive changes with timely intervention among elderly people will help improve their quality of life. This can be achieved by scaling up health services and packages available for elderly people in the country.

Conflict of interest

All authors declare no conflicts of interest.

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