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Original Article

Relationship between Depression and Cognitive Impairment among Elderly: A Cross-sectional Study

Zahra Aajami[1], Leila Kazazi[2], Mahdi Toroski[1], Malihe Bahrami[3], Vahidreza Borhaninejad[4*]

[1]Department of Pharmacoeconomics and Pharmaceutical Administration, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran
[2]Iranian Research Center on Ageing, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[3]Department of Nursing, Islamic Azad University Shahr-e Babak Branch, Kerman, Iran
[4]Social Determinants of Health Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran

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Corresponding Author:
Vahidreza Borhaninejad,
Email: v.borhaninejad@kmu.ac.ir

Abstract

Introduction: Depression and cognitive impairment are common mental health problems among elderly, although few studies have examined their co-occurrence in aging population. So the aim of this study was to determine the relationship between depression and cognitive impairment in older adults.

Methods: This cross-sectional population-based study was conducted on 506 older adults were presented to the health centers of the municipality of Tehran, Iran. Data were collected using the sociodemographic questionnaire, Mini-Mental State Examination (MMSE) and Geriatric Depression Scale (GDS). Data were analyzed by using SPSS-17 with correlation analysis and logistic regression.

Results: The mean age of the participants was 65.71 years. Older people (>75 years) had more twice risk (95% CI: 1.01-4.90) for cognitive dysfunction. There was a significant correlation between MMSE and GDS. Elderly with collegiate education had 85% (95% CI: 0.1-0.5) and employed elderly had 56% (95% CI: 0.04-0.74) lower risk for cognitive dysfunction. Elderly with severe depression had twice risk (95% CI: 1.41-4.8) for cognitive dysfunction.

Conclusion: Findings suggest there is a relationship between depression and cognitive impairment among the elderly. These findings emphasis on assessing cognitive impairment and depression in geriatric assessment in elderly.

Introduction

Because of psychological problems such as depression and cognitive impairment, the aging of population will be one of the most important health problems in the future.[1] The greatest challenge is the prevention of disability and improving the quality of life for *older adults.*[2] Population aging is considered to describe the burden of elderly population to the health systems, so general health programs must be responsive to this inevitable phenomenon.[3]

The prevalence of clinical symptoms of depression among the elderly has been estimated to be between 8% to 15%. This rate reaches 30% in the elderly living in nursing homes.[1] In Iranian elderly residents at home with the beck is 95.64% and with the GDS 81.85%. The prevalence of depression in the elderly living at home with the Geriatric Depression Scale (GDS) was 57.58%.[4] In other study in Iran prevalence of depression among elderly was estimated to be 43% (95% confidence interval [CI]: 30%-55%), and the prevalence of very severe, severe, moderate, and mild depression levels were estimated to be 5%, 19%, 33%, and 38%.[5]

Depression is one of the main reasons for disability among the elderly that has been associated with risk of mortality and morbidity.[6,7] Although aging alone is not a factor for developing depression, the loss of relatives, especially the spouse, being away from children, especially in today societies in which widespread families have been replaced with nuclear families, having chronic physical illnesses, using different drugs and loss of cognitive power have made the elderly prone to depression.[8]

Other problems of aging are cognitive impairment. Cognition is defined as perceiving, processing and administrating information, and it is one of main component of self-determination and autonomy in elderly.[9] The normal function of brain systems is responsible for

the individual's proper cognitive function. Thus cognitive disorders occur in proportion to age increase and deterioration of the elements involved in these systems which the severity of these disorders is diverse and makes a wide range in elderly people.[10] Cognitive disorders are closely associated with decline in cognitive abilities including attention, memory, language, orientation, performance, judgment and problem-solving skill.[11] In the elderly, both types of total cognitive processes and specific processes naturally collapsed. Studies have shown that about 5% of the elderly have a severe cognitive disorder, 47.5% have the moderate disorder, 30% have the small cognitive disorder and only 5.17% have no disorder.[12] The prevalence of cognitive disorder in Swedish, German and American elderly people is 4.5 %, 7.7%, and 4.9, respectively.[13,14] Depression and cognitive impairment can lead to a disability of the elderly. Some studies have shown a significant relationship between disability and the individual's mental health status, cognitive impairment and depression.[15,16]

Over the last decades, life expectancy has grown in Iran, and currently, over 7.4 million people age 60 years and older, about 9.27% of the population, live in Iran and there was high prevalence of depression and cognitive impairment in elderly in Iranian studies.[4,5,17] So the aim of this study was investigate relationship between depression and cognitive disorders among the elderly in Tehran-Iran. Based on the above mentioned literature review, to the best of author's knowledge, little has been done to explore the interaction of cognitive impairment and depression status among older adults of health centers. Therefore, the current study contributes to our knowledge by addressing two important issues; first, finding the prevalence of cognitive impairment and depression; secondly, investigating the relationship between cognitive impairment and depression among older adults.

Materials and Methods

This cross-sectional population-based was implemented on older people who were presented to the health centers of the municipality of Tehran.

The minimum sample required was calculated 510 considering an age related cognitive decline prevalence of 21%,[17] a margin of error of 5%, a 95% level of confidence, 20% *drop* out in sample size and entering potential confounders as covariate into the model of regression. *A* total of 506 community dwelling older adults aged 60 years and above, who were presented regularly in the health centers of Tehran Municipality for baseline medical assessments and social and recreational services, were selected for the study. Subjects were selected by using stratified random sampling. Health centers of municipality include elderly institutes which were formed to increase participation and effectiveness of older adults especially in the field of social and cultural affairs. We got the permission letter for health centers of ten areas from different parts in Tehran. In order to provide a represented sample, the sampling with probability proportional to size was used.

The inclusion criteria were: age equal or above 60 years, citizen of Iran, and ready to provide informed consent to use data and participate. The exclusion criteria based on medical and medications history were having diseases which may lead to extreme functional decline or mortality such as history of stroke in the previous 12 months or end stage cancer, affecting by uncorrected visual and/ or auditory impairment, having major psychiatric disorder, including schizophrenia and bipolar disorder, affecting by major neurodegenerative illnesses, including Parkinson disease, use of medications known to impair cognition and illiteracy person. The questionnaires were self-administered for participants.

Informed consent of the participants was obtained before they enter the study. The information was obtained by questionnaires. The Mini-Mental State Examination (MMSE) was administered to determine cognitive impairment. The MMSE was developed by Folstein et al., and since then, different cut-off points have been reported.[18] The psychometric properties of MMSE in Iranian older population were investigated and a cut-off point of 21 was obtained for cognitive dysfunction. We assumed at least four years of education as inclusion criteria to be sure of the level of literacy required for responding to the MMSE items. The psychometric properties of MMSE in the Iranian older population was investigated, and results showed good reliability (ά=0.78) of this instrument. At a cut-off point of 21, the sensitivity of 90% and specificity of 80% was calculated.[19,20]

GDS was used to assess depressive symptoms. The validation of the Iranian version of GDS revealed its good reliability with Cronbach's coefficients reaching to 92%.[18]

An internal reliability of questionnaires was also performed in the pilot phase with 30 subjects; and Cronbach's alpha for various questionnaires used was estimated to be: MMSE (0.77), GDS (0.87). So provided high Cronbach's alpha values, for these questionnaires.

Descriptive statistics were employed to describe the subjects' characteristics. The correlation between MMSE and GDS scores and its dimension was done using the Pearson correlation coefficient. The relation between MMSE and GDS scores was investigated by Multivariate Regression Analysis. All analyses were done using Statistical Package for the Social_Sciences (SPSS), version 21 (Armonk, NY: IBM Corp). Normality of distribution was tested by using Kolmogorov-Smirnov test.

Results

The mean (SD) age of the participants was 65.71(5.97) years. Table 1 shows the demographic characteristics of the participants. Clinical and health-related conditions of the participants have been shown in Table 2; as is presented the mean (SD) score of GDS was 3.69)3.63(and the mean

score of MMSE was 26.55 (2.34).

Among 171 (32.8%) of subjects were classified as mild and severe depression and 48 elderlies (9.5%) had cognitive dysfunction. A positive and significant correlation was found between MMSE and GDS score using the Pearson correlation coefficient ($P<0.001$) (Table 2).

Table 3 shows factors influencing participants' cognitive impairment by logistic regression. Our finding showed a significant relationship between age, education, job with cognition. The odds of cognitive impairment were two times higher in people over 75≥ years old (OR=2.22, 95% CI: 1.01- 4.90; $P=0.047$). Elderly with collegiate education had 85% (OR=0.15, 95% CI: 0.1- 0.5; $P=0.001$) and employed elderly had 56% (OR=0.44, 95% CI: 0.04- 0.74; $P=0.018$) lower odds for cognitive dysfunction. The odds of cognitive impairment were 2 times higher in elderly suffering major depression (OR=2.07, 95% CI: 1.41- 4.8; $P=0.038$).

Discussion

We conducted a population-based survey among elderly (≥60 years) diabetes patients from the Tehran city. The aim of this study was to determine relationship between depression and cognitive impairment in older adults.

The results of this study showed that about one-tenth of the elderly had cognitive impairment. In similar studies in Iran, the prevalence of cognitive disorder was reported in 18% of the elderly,[21,22] which is somewhat inconsistent with the findings of this study. Similar studies have been conducted in Taiwan,[23] India,[24] Portugal,[25] Spain,[26] Malaysia[27] and South Korea[28] in which a prevalence of cognitive impairment was obtained as 22.2%, 18%, 9.6%, 19%, 11% and 22.5%, respectively. These differences can be attributed to the differences between the samples and research community. In the present study, most of the elderly had an acceptable education. This study was also conducted among elderly persons of the community who have a more favorable cognitive level. For example, in a study conducted among the elderly persons in a nursing home in Iran, the prevalence of cognitive disorders was reported as 75%.[29] The presence of factors, such as illness, physical disabilities, unemployment, and lack of attention, loneliness and a feeling of disability in controlling the environment resulted in cognitive impairment in the elderly persons in the nursing home.

Based on the findings of this study, about one-third of the elderly had a degree of depression (mild to severe). Similar to the present study, the prevalence of depression in the elderly has been reported to be 35%.[30] In two studies in Iran, findings showed a prevalence of depression in half of the elderly.[31,32] This difference level may be due to differences in the measurement tool, sample size or area and extent of residence. Also, having several diseases simultaneously can lead to an increase in prevalence of depression in the elderly and statistical differences in the amount of depression prevalence.

Furthermore, the results of this study showed that elderly of greater than 75 years old years had higher risk at cognition impairment. These findings of the current study are in line with the other previous studies. But, unlike the findings of this study, there was no significant relationship

Table 1. Socio-demographic characteristics of the participants

Socio-demographic data		No. (%)
Age (years)	60-74	454(89.7)
	75≤	52(10.3)
Gender	Male	276(54.5)
	Female	230(45.5)
Marital status	Single	14 (2.8)
	Married	391 (77.3)
	Widowed	86 (17.0)
	Divorced	15 (3.0)
Education	Primary	111 (21.9)
	Under diploma	87 (17.2)
	Diploma	156 (30.8)
	Collegiate	152 (39.0)
Job	Unemployed	414 (81.8)
	Employed	92 (18.2)

Table 2. The MMSE and GDS score of the participants

Clinical finding	Scale	No. (%)	Mean (SD)	Pearson correlation Statistical indicator
GDS	Normal	335 (66.2)	3.69 (3.63)	R=0.183 $P<0.001^*$
	Mild	97 (19.2)		
	Major	74 (14.6)		
MMSE	Normal	458 (90.5)	26.55 (2.34)	
	Cognitive impairment	48 (9.5)		

Abbreviations: GDS, Geriatric Depression Scale; MMSE, Mini Mental State Examination, SD, standard deviation.
*Statistically significant.

Table 3. Factors influencing participants' cognitive impairment by multivariate logistic regression

Characteristic		Cognitive impairment		
		OR	**(95% CI)**	***P***
Age	60-74	-	-	-
	75≤years	2.22	1.01 - 4.90	0.047*
Gender	Male	-	-	-
	Female	1.11	0.61 - 2.02	0.719
Marital status	Single	-	-	-
	Married	0.98	0.48 - 2.0	0.974
Education	Under diploma	-	-	-
	Diploma	0.19	0.06 - 0.36	0.001*
	Colleague	0.15	0.10 - 0.50	0.001*
Job	Unemployed	-	-	-
	Employed	0.44	0.04 - 0.74	0.018*
Depression	Normal	-	-	-
	Mild	1.52	0.7 - 3.2	0.27
	Major	2.07	1.41 - 4.8	0.038*

Abbreviation: OR, Odd Ratio.
* Statistically significant

between age and cognition impairment.[27,28] The reason for this is not clear but it may be due to the increase in literacy rates. There was no statistically significant difference between gender and cognitive impairment in this study. But contrary to the findings of our study, in some other studies the prevalence of cognitive impairment had significantly different in men and women.[21-23] The reason for this difference can be due to the different role of elderly men and women in different societies. In some communities, the presence of more men in the workplace and society may lead to quick detection of any changes that could initiate cognitive disorder in them. In terms of marital status, there was no difference in the prevalence of cognitive impairment between the two married and single groups. A similar study in Portugal showed that although being single or widower is effective in the prevalence of cognitive disorders, this effect is not significant.[25] But in other studies, the most rates of cognitive impairment symptoms belonged to single, widow and divorced men and women. This finding supports the role of marriage in reducing the incidence of cognitive disorders in elderly people. The present study showed that the prevalence of cognitive impairment symptoms had an inverse relationship with education, which is in line with other research findings.[24,27,28] As we found in another phase of this study, depression and educational level were assumed as potential confounder in relation between age associated cognitive decline and health related quality of life. The results of study have been described elsewhere.[32] It seems that people with high education level use their brain abilities effectively. Mental activities (such as education and other complicated brain activities) play an important role in preserving and improving memory and brain resources and is a good way to reduce dementia in the elderly people. Another important finding was the protective role of having a job for the elderly in order to decrease the incidence of cognitive impairment. It seems that being active and having active involvement with society play an important role in the physical and mental health of the elderly, and from this view, successful aging is equal to active aging. Activity can be physical or mental (intellectual), but basically is referred to active roles in the society. In this order, the elderly person must strengthen the interests, habits, roles and new relationships to replace those that are lost or faded away. Thus, the loss of job in retirement stage can be replaced with recreational or voluntary activities, to avoid the harmful effects of the retirement on the elderly.

Finding of this study showed the relationship between depression and cognitive impairment in the elderly. The elderly with severe depression had twice risk of cognitive impairment. This finding has been affirmed in several studies.[34] Tha Cach county longitudinal study reported prevalence of depression in 16.9% of older adults with cognitive impairment, 29.9% in participants with dementia and 4.9% in elderly with normal cognitive function.[35] One of the causes which is associated with correlation of cognitive impairment and depression is the theory of cognitive changes depends on the age of the frontal.[36] Another possibility is that, even low level of depressive symptoms may influence hippocampus and other neural system which regulate the stress axis and making them vulnerable to neurodegenerative changes.[37] Generally, depression could accompanied by cognitive impairment, because they may manifesting of the same brain disease, or some individual with cognitive deficits may experience depressive symptoms when become aware of their poor function.[38] However, what is crucial is that the elderly population will increase noticeably in the near future, a great part of the population will be living in developing countries[39]. Diagnosing depression and cognitive impairment such as Alzheimer disease are complicated and clinically can be indistinguishable.[40] Therefore, on time screening for these disorders may be helpful for early detection and early treatment. Based on our findings, there is an emphasis of assessing cognitive impairment in the elderly as part of a scientific approach to managing depression and vice versa.

One of the important limitations of this study is conducting it in one city. Therefore, performing similar studies in different parts of Iran and cohort studies are advised to diagnose the risk factors of cognitive impairment in the elderly. Another limitation of this study was inability to express the causal relationship between cognitive impairment with depression and using a screening test to diagnose cognitive impairment and depression. It is advised that, in future studies, definitive diagnosis or detection of cognitive impairment and depression be carried out by a neurologist and analysis the causal relationship between cognitive impairment and depression by analytic studies such as case-control.

Conclusion

This study has argued that depression in elderly may lead to cognitive impairment and as such, the best method of diagnosing cognitive impairment is depression screening. Cognitive impairment is lower in younger elderly people (60-74) with more education level and the elderly who are still working. Based on the findings of the present study, it is recommended that treatment of cognitive impairment, screening and treatment of depression in the elderly and also, educating the group and making opportunities for active participation in the community should be given special attention. On the other hand, increasing the population of the elderly and consequently, increasing the prevalence of physical and mental disorders, offer new challenges to health policymakers and double the need to provide evidence in confrontation with this phenomenon in the area of service providing and financing. Since, healthcare for the elderly has its own specific features and conditions. Evaluating the current status of the elderly in view of issues, such as depression and cognitive

Research Highlights

What is the current knowledge?

The mental disorders in elderly that accompanies with cognitive impairment is real complex. Depression is a risk factor for dementia and also the fact that existing dementia is positively correlated with a high score of GDS.

What is new here?

Cognitive impairments often remain after remission of other symptoms of depression. So assessing cognitive impairment and depression in the elderly have to be part of a scientific approach in Comprehensive Geriatric Assessment (CGA).

impairment, can play a significant role in elderly health policymaking.

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Ethical Issues

This study was approved by the ethics committee of the University of Social Welfare and Rehabilitation Sciences (ethical code: IR.USWR.REC.1395.88).

Conflict of Interest

The authors declared no potential conflicts of interest.

Author's Contributions

Conceptualization: ZA, Lk; Methodology: all authors; Investigation: all authors; Writing, Original Draft: all authors; Writing, Review & Editing: ZA, Lk, VB; Funding Acquisition: all authors; Supervision: VB.

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