



COGNITIVE DECLINE IN THE ELDERLY: CONTRIBUTING FACTORS IN JARA MARA PATI NURSING HOME

Ni Luh Made Saraswati

Department of Internal Medicine, Karya Dharma Husada Hospital, Buleleng, Bali, Indonesia

Abstract: The life expectancy of the the elderly continues to increase due to the development of medical science. It may cause the rapidly growing of elderly population. To preserve the cognitive function of the elderly become one of the most important approaches to maintain their quality of life. The present study aimed to identify the contributing factors that will influence the cognitive impairment of the elderly to optimize the approach to preserve the cognitive function. We conducted the analytic observational study using cross sectional approach. The data was collected from 35 older adults using total sampling technique in Jara Mara Pati Nursing Home, Buleleng, Bali. The cognitive function was measured by the Bahasa Version of MoCA (Montreal Cognitive Assessment) questionnaire. Hearing impairment was evaluated by the HHIE-S (Hearing Handicap Inventory for the Elderly Screening) questionnaire. Edmonton Frail Scale was used to identify the severity of frail. While, the independency was evaluated using the ADL Barthel Index. Ten out of 35 samples (28,6%) have normal cognitive function while the other twenty-five (71,4%) have from cognitive impairment. From the statistical analysis, it can be found that the gender ($p = 0,030$), former educational level ($p = 0,000$), hearing impairment ($p = 0,022$), and independency level ($p = 0,033$) will influence the cognitive function significantly. Meanwhile, the age ($p = 0,465$), BMI ($p = 0,543$), and frailty state ($p = 0,101$) don't significantly influence the cognitive function. From this study, there are 25 samples (71,4%) who have cognitive impairment. We found that the gender, former educational level, hearing impairment, and the independency level are statistically significant and contribute to cognitive impairment.

Keywords: cognitive, elderly, independency, hearing, frailty.

I. INTRODUCTION

The life expectancy continues to increase due to the development of medical science. In last decades, there has been the rapidly growing of the elderly population. Based on the Socioeconomic Survey in 2019, the elderly population in Indonesia has reached 25,7 million people or approximately 9,6% of the total Indonesian population. This number is predicted to increase to as much as 20% of total population and even reach 25% of the total Indonesian population by 2040 (1). To preserve the cognitive function of the elderly is really important to improve their quality of life. The cognitive function includes the attention, memory, language, visuospatial ability (2). Along with the increasing of age, the elderly may experience many changes including the physical, psychological, and social function which will impact their cognitive function, thereby it will affect their quality of life (2,3).

The cognitive function of elderly is influenced by many factors. On the previous study, the cognitive function of elderly was found to be affected by the former educational level, the occupation, and the social activity (2), thus

it will affect to the limitation of daily activities (4). In addition, the cognitive function may be considered to be affected by the hearing impairment. The hearing impairment may affect the social state of the elderly and may cause the depression, low self-esteem, and also the cognitive impairment (5). Approximately 30-35% of the elderly population above 65 years old is being suffered from the hearing impairment and 1,5-3% of them require the hearing aid (6).

The frailty of elderly is marked by the criteria such as the undesirable weight loss, a decrease in walking speed, the muscle weakness, and low physical activity. The frailty state is considered to affect the risk of fall, disability, and requirement to hospitalize, so that will impact the health condition and also the cognitive function (6).

To identify the contributing factors to cognitive function may facilitate and optimize the approach to preserve the cognitive function. Therefore, the researcher interests to conduct a study which identify those factors in order to improve the quality of life of the elderly.

II. MATERIALS AND METHOD

This was an analytic observational study using the cross-sectional approach. There has been 40 elderly people living in Jara Mara Pati Nursing Home, Buleleng, Bali. Using the total sampling technique, they were recruited for this study. Nevertheless, five of them was excluded because of some reasons, such as suffering from the severe hearing impairment, blindness, and unstable health and mental condition. The data collection was carried out for two days, on 22 and 23 November 2021.

The hearing function was evaluated by the Bahasa version of HHIE-S (Hearing Handicap Inventory for the Elderly Screening) questionnaire. This questionnaire consists of 10 questions which is given score such as; 4 points if the answer is yes, 2 points if the answer is sometimes, and 0 point if the answer is never, for each question. The total score was between 0 (no limitation) and 40 (maximum limitation). The questionnaire was used in this study because in the previous study which conducted by Astari in 2014, it was found that this questionnaire had a sensitivity of 93,24% and specificity of 93,75% as the screening tool for hearing function of elderly.

To evaluate the frailty state of the elderly, we used The Edmonton Frail Scale. It is the instrument which measure the frailty state using 9 domains such as cognitive, general health state, functional independency, social support, the use of medicine, nutrition, mood, incontinentia, functional ability which was evaluated by TUGT (Timed Up and Go Test). The frailty level consists of some categories including vulnerable (pre-frail) which is given score of 6-7, mild frailty which is given score of 8-9, moderate frailty which is given score of 10-11, and severe frailty which is given score of 12-17 (7).

In addition, to evaluate the independency level of the elderly, we used the ADL (Activity Daily Living) Barthel Index questionnaire, which can be interpreted by the criteria such as total dependent which is given score of 0-20, severely dependence which is given score of 25-40, moderately dependence which is given score of 45-55, mild dependence which is given score of 60-95, and independent which was given score of 100.

The cognitive function of the elderly was evaluated by the Bahasa Version of MOCA (Montreal Cognitive Assessment). This questionnaire can assess the cognitive function by some aspects such as the executive, visuospatial, attention, concentration, memory, language, logical thinking, calculating, and orientation function. The highest score is 30 points. The score above 26 is considered normal cognitive function. This test emphasises to assess the executive function and attention compare to MMSE (Mini Mental Status Exam). Moreover, the MOCA test is considered to be more suitable to detect the MCI (Mild Cognitive Impairment) of the elderly, especially for the cognitive impairment due to vascular disorder. Besides that, there were some considerations to use the MOCA test rather than the MMSE, it was due to the complexity of the MOCA test. The MOCA test provide not only more words but also longer time to recall on memory domain. The MOCA test also has high sensitivity and specificity for detecting the cognitive impairment of the elderly (8).

The data that had been collected was processed by SPSS 25.0 program. The statistical analytic used was the univariate and bivariate analytic. The univariate analysis was used to describe the characteristic of each variable, meanwhile the bivariate analysis was used to analyze the influence factors of cognitive impairment. The Chi Square was used to analyze the influence of gender and hearing disorder to the cognitive function. Meanwhile, the One Way Anova was used to analyze the influence of other variables (such as the age, former education level, independency level, Body Mass Index and frailty state) to cognitive function.

III. RESULT

Table 1: The Sample Characteristic and Demographic Data

Demography Characteristic	Total (N=35)	Percentage (%)
Gender		
Male	9	25,7
Female	26	74,3
Age		
60-69 years old	13	37,1 40
70-79 years old	14	22,9
> 80 years old	8	
Former Education Level		
Uneducated	15	42,9
Elementary School	15	42,9
Junior High School	3	8,6
Senior High School	2	5,6
Body Mass Index (BMI)		
Underweight	8	22,9
Normal	24	68,6
Overweight	3	8,5
Independency Level		
Severely dependence	2	5,7
Moderately dependence	3	8,6
Mild dependence Independent	12	34,3
	18	51,4
Hearing State		
Normal hearing state	21	60
Hearing disorder (mild/moderate)	14	40
Frailty State		
Severe frailty	1	2,9
Mild frailty	3	8,6
Vulnerable (prefrail) Normal	11	31,4

From the table 1, it can be seen that the from 35 samples, 26 of them are women and the other 9 are men. The oldest is 88 years old while the youngest is 60 years old. The BMI range is about 14,57 kg/m² to 26,23 kg/m². It is found that 15 people had never any former education, 15 others studied up to elementary school, 3 to junior high school, and 2 to senior high school. The lowest ADL Barthel score is 30 while the highest one is 100 with an average of 93,4.

Table 2: The Analysis of Contributing Factors to the Cognitive Impairment of the Elderly in Jara Mara Pati Nursing Home, Buleleng, Bali

Variable	Cognitive Function		Bivariate p value
	Normal Cognitive function (N = 10)	Cognitive Impairment (N = 25)	
Gender			
Male			
Female	6	3	0,03
	4	22	
Age			
60-69 years old	5	8	0,465
70-79 years old > 80 years old	4	10	
	1	7	
Former Education Level			
Uneducated	0	15	0,000
Elementary School	6	9	
Junior High School	3	0	
Senior High School	1	1	
Body Mass Index (BMI)			
Underweight	1	7	0,543
Normal	8	16	
Overweight	1	2	
Independency Level			
Severely dependence	0	2	0,033
Moderately dependence	0	3	
Mild dependence	1	11	
Independent	9	9	
Hearing State			
Normal hearing state	9	12	0,022
Hearing disorder(mild/moderate)	1	13	

Frailty State

Severe frailty	0	1	0,101
Mild frailty	0	3	
Vulnerable (prefrail) Normal	1	10	
	9	11	

From the tables 2 above, 10 (28,6%) out of 35 samples has normal cognitive function, while the other 25 (71,4%) have impaired cognitive function. The MoCA range score is from 10 to 27, with an average of 17,8. The contributing factors that considered to influence the cognitive impairment are such as gender ($p = 0,03$), former education level ($p = 0,000$), independency level ($p = 0,033$), dan hearing state ($p = 0,022$), meanwhile the other variables such as age ($p = 0,465$), BMI ($p = 0,543$) dan frailty state ($p = 0,101$) don't significantly contribute to the cognitive impairment.

The Dementia is a chronic and progressive disorder, characterized by the cognitive function decline and alteration of mental status. Alzheimer's disease is the most common type of dementia. The incidence of Alzheimer's disease and the other type of dementia is predicted to involve 66 million people in 2030 and may reach 115 million people in 2050. The prevalence also increases with age (5).

The Bahasa Version of MOCA was developed to identify the mild to moderate cognitive impairment. Its sensitivity of 83% is considered suitable to detect the mild cognitive impairment. While the MMSE (Mini Mental State Exam) which is often be applied has sensitivity of 17% to detect the mild cognitive impairment. Therefore, in this study, the researcher preferred to use the Bahasa Version of-MoCA questionnaire rather than the MMSE. Among the 35 samples, it can be found that 10 of them (28,6%) has normal cognitive function while the other 25 samples (71,4%) suffer from the cognitive impairment.

From the population with normal cognitive function, it is found that 60% of them are men, while from the population with the cognitive impairment, 88% of them are women. From the statistical analysis, it is found that gender contribute significantly to the cognitive impairment. Many theories may explain this finding. At the menopausal phase, there will be a decrease in cognitive domains, especially the attention and memory ability. Approximately sixty percents of women which has been at menopausal phase will have memory disorder become the most affected ones. A decrease in processing information ability and verbal memory usually lasts temporarily and get back to normal after the post-menopausal phase. Few studies explained that the low estrogen level after menopausal phase will affect to the declining of cognitive function which cause the deterioration of memory, attention, and information processing speed. Besides that, the brain aging, in the hippocampus and parietal lobe is more common to experience by women rather than the men (9). This difference will also affect the neuropsychiatric problems such as Alzheimer's disease which its prevalence and severity of the disease will be more common to be experienced by women. This finding may also due to a decrease and fluctuation in the estrogen level (9).

In this study, it is also found that the elderly with higher former education level will tend to have normal cognitive function. It is supported by the previous study conducted by Shen et al that the elderly with higher education level will have better score during MMSE (Mini Mental Status Exam) and RBANS (Repeatable Battery for the Assessment of Neuropsychological Status) test (2). In addition, on the previous study by Sattler et al, it was found that the former education level will support the cognitive function and will compensate the aging process impact on cognitive function so that they will have better cognitive function compared to the other with low former education level (10). From the other study, it was showed that in those with low former educational level, their cognitive function will decline more rapidly and consistently long way before to the dementia condition (11). It is also supported by the neuroimaging studies which concerns about the substantia nigra and substantia alba of

the elderly brain composition (12). In addition, the elderly with higher former education level will also have better social interaction which may cause the better cognitive function (13).

In this study, it is showed that the hearing function also considered significantly to influence the cognitive impairment. The disorder of sensoric system including the smelling, visual and hearing abilities will correlate with the neurodegenerative disease of the elderly (5). The hearing disorder either central or peripheral is considered to contribute to cognitive decline (14), the reemerge of new cognitive impairment (15), and the dementia, especially the Alzheimer's disease. Other theories found to support this finding such as the pathological evidence of alzheimer's disease which cause the formation of amyloid plaque in the central auditory region such as cochlear nucleus, inferior colliculi, thalamus, and primary auditory cortex. While the conducting of hearing process, the information will be forwarded from the cochlear nerve to the dorsal cochlear nucleus, before entering the superior olivary complex or inferior colliculus. This pathway will be continuously forwarded to medial geniculate nucleus from thalamus, before finally enter the primary auditory complex on the superior temporal gyrus. It shows that this amyloid plaque will cause the deterioration of cognitive function (16). Besides that, from the other neuroimaging studies, it is showed that the neuroplasticity changes due to the hearing disorder may also affect the cognitive function (17). Meanwhile, on the previous study held by Lin et al showed that the elderly with the hearing disorder will have earlier cognitive impairment due to the rapidly decrease in brain size (18).

In this study, the independency level of the elderly is also found to be significantly influence the cognitive impairment. This finding is supported by the previous study held by Hardywinoto that the cognitive function will correlate to the independency level of elderly. The higher cognitive state of the elderly, the more they become independent to do the ADL (Activity of Daily Living), and vice versa (19). Meanwhile, the other studies revealed that the worse cognitive function of the elderly, the more dependent they become in their ADL (20). In addition, the other study which concerning more about the correlation of independency level and cognitive function, has found that the cognitive domains such as visuospatial and memory function may become the most related domains to the independency level (21). Besides that, there is also a theory which found that the daily activity which most recently studied in the human development stage, will become the earliest activity to be disrupted. From many kinds of ADL, the ability to bathe and groom was the earliest ADL to be affected (22).

In this study, the age is not considered to be significantly influence the cognitive impairment. On the other hand, in the previous Cohort study held by Kujawski et al found that the age was one of the contributing factors to cognitive impairment besides the education level, occupation, and body fat percentage. It was found that every additional one year of age, the MMSE score will decrease as much as 0,18 poin (23).

From this study, the BMI is not considered significantly to influence the cognitive impairment, while on the other hand, some previous study which held by Cova et al found that the prevalence of the dementia and Alzheimer's disease will decrease in the population with higher BMI. While the population with lower BMI have higher risk to suffer from all kinds of dementia (24).

In this study, frailty state doesn't significantly influence the cognitive function of the elderly. On the other hand, the previous study which held by Lina et al, showed that the elderly with frailty will have worse MMSE score. Meanwhile, the elderly with the higher one will have better MMSE score. In addition, the elderly with prefrail category have worse ability for the reading, drawing, writing, recall, memory, time and place orientation, rather than the normal ones (25).

The weakness of this study is such as the limitation of sample and time, which was collected only in one nursing home. It should be better if the study was carried out in few nursing houses to get the larger sample number so that the characteristic of the subjects will vary.

IV. CONCLUSION

Based on the findings of this study, it is found that the 10 (28,6%) out of 35 samples have normal cognitive function, while the other twenty-five (71,4%) have impaired cognitive function.

The factors which considered significantly to contribute to cognitive impairment in this study are gender, former education level, hearing disorder, and independency level. Meanwhile, the other factors such as the age, Body Mass Index and Frailty state don't contribute significantly to the cognitive impairment.

V. RECOMMENDATION

By identifying those factors, the findings of this study may be expected to facilitate the early intervention to reduce the risk for developing cognitive impairment, so that the quality of life of elderly will be preserved. Besides that, the findings are expected to be the cornerstone of the further research with larger sample and longer time.

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