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ASSOCIATION BETWEEN COGNITIVE FUNCTION WITH RISK OF FALL IN ELDERLY PATIENTS

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Abstract

Background: Fall is a problem that often occurs in the elderly. The incidence of falls continues to increase from middle age and peaks at the age of more than 80 years. The risk of fall is closely related to cognitive impairment in the elderly. Impaired cognitive function can result in postural instability and increase the risk of falls. Impaired cognitive function causes poor judgment and decision making, impaired reaction, attention and speed of information processing.

Objectives: To determine the relationship of cognitive function with the risk of fall in elderly patients.
Research Methods: This study is a cross-sectional study with consecutive sampling techniques, where elderly people over 60 years who go to neurology and geriatric polyclinics who meet the exclusion and inclusion criteria are included in this study. The study was taken as many as 51 subjects consecutively. Data analysis using fisher exact test and pearson correlation test.
Result of the study: Demographic characteristics of research subjects are the most age range at age 60-69 years, female sex, high school education level, housewife occupation. The average MoCA INA score was 22,82 ± 3,99 and the balance scale berg score was 46.29 ± 6.62. The abnormal MoCA INA score is more for respondents with moderate fall risk, namely 14 people (38,9%) and there was a relationship between cognitive function and risk of fall with $p = 0.000$ ($p < 0.001$) with a positive correlation direction with strong correlation strength ($r = 0.679$).
Conclusion: there is a significant relationship between cognitive function and the risk of fall in the elderly.

Introduction

The aging process makes the needs and problems more complex. One of the problems faced is a decline in cognitive function.[1] Fall is a problem that often occurs in the elderly. The incidence of falls continues to increase from middle age and peaks at over 80 years of age. The highest prevalence of injury due to falls is at the age of 75 years and over, amounting to 78.2%.[2] Balance disorders are suspected to be a major risk factor for falls in the elderly. Elderly with decreased cognitive function are more likely to have balance disorders than elderly without cognitive impairment.[1]Decreased cognitive function is associated with impaired attention and executive function, where there is a decrease in the ability to modulate gait, planning and decision-making while walking causes delays in stabilizing the balance control system resulting in postural instability and increases the risk of falls.[1]

Method

Study sample

This study sample was taken from elderly patients in Adam Malik General Hospital Medan with consecutive sampling techniques. This research subjects consisted of 51 elderly patients who aged ≥60 years, able to speak Indonesian, aware and cooperative, able to read and write and willing to take part in the study by signing a research informed consent sheet.

Study design

This study is a cross-sectional design without treatment. This study assess cognitive function using MoCA-INA. To assess the risk of falls in patients using a Berg Balance Scale (BBS) consisting of 14 items of balance components.

Statistical analysis

Data from the research was analyzed statistically using the SPSS computer program (Statistical Product and Science Service) to analyze the relationship between research variable. The relationship between cognitive

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function with MoCA INA and the risk of falling with BBS analyzed with Fisher exact test and Pearson correlation test.

Result

There were 51 subjects at H. Adam Malik Hospital Medan in Januari to June 2020 participated in this study. There were 27 women (52.9%) and 24 men (47.1%) out of 51 subjects in this study. The average age of the subjects was 67,47±5,71 years with the most age group were 60-69 years. The education level of the most subjects was Senior High School (SMA) with a total of 25 people (45.1%). The demographic Characteristic are show in the table 1 below.

Table 1. Demographic Characteristic of Research Subject (n=51)

Characteristics	Frequency n=51	Percentage %
Age average ±SD (years)	67,47±5,71	
60 – <70 years old	35	68,6
70 – <80 years old	14	27,5
≥80 years old	2	3,9
Sex		
Male	24	47,1
Female	27	52,9
Education		
Not completed in		
Primary School	3	5,9
Primary School	4	7,8
Junior High School	9	17,6
Senior High School	23	45,1
Diploma	2	3,9
Bachelor	10	9,6
Occupations		
Housewives	20	39,2
Retired	13	25,5
Entrepeneur	7	13,7
Private Employees	5	9,8
farmer	4	7,8
Government Employees	2	3,9
Tribe		
• Batak	27	52,9
• Karo	10	19,6
• Java	10	19,6
• Malay	3	5,9
• Aceh	1	2,0

The results of the cognitive function of subjects using MoCA INA showed that 36 subjects (70.6%) subjects had abnormal values. There were 15 subjects (29.4%) who experienced normal values. The average MoCA INA score was 22.82 ± 3.99. The proportion of the risk of falls based on the Berg Balance Scale score is divided into the risk of mild fall as many as 36 subjects (70.6%) and the risk of moderate fall as many as 15 subjects (29.4%) with average Berg Balance Scale score 46,29±6,62. This can be seen in table 2 below.

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Table 2. Characteristic of MoCA INA Score and BBS Score

Variable	Mean ±SD	N (71)	Percentage (%)
MoCA INA Score	22.82 ± 3.99		
Abnormal		36	70.6
Normal		15	29.4
BBS Score	17,24±5,17		
Mild risk of fall		36	70.6
Moderate risk of fall		15	29.4

From the result of this study, subjects with the abnormal MoCA INA category had a moderate risk of fall as much as 14 (38.9%), while the low risk of fall was 22 (61.1%). Subjects with the normal MoCA INA category had a moderate risk of fall as much as 1 (6.7%), while the low risk of fall was 14 (93.3%), so it can be concluded that the percentage of moderate fall risk was more in subjects with abnormal MoCA INA score than subjects with normal MoCA INA score. Fisher exact test results showed the value of p = 0.04 (α <0.05), means that there is a relationship between cognitive function and risk of falls. This can be seen in table 3 below.

Table 3. Association between cognitive function and fall risk

	Moderate risk of fall	Mild risk of fall	p
MoCA INA			
Abnormal	14 (38,9%)	22 (61,1%)	0,04
Normal	1 (6,7%)	14 (93,3%)	
Total	15 (29,4%)	36(70,6%)	

Statistical analysis was carried out to find the strength of the relationship. Pearson correlation test was used because the data distribution was normal. Based on the Pearson correlation test of 51 research subjects, it was found that there was a significant relationship between cognitive function and the risk of fall with p value of 0.000 (p <0.001) The correlation r value obtained was 0.679 indicating the direction of positive correlation with strong correlation strength. This can be seen in table 4 below.

Table 4. Strength of relationship between cognitive function and fall risk

	Berg Balance Scale Score
MoCA INA Score	r = 0,679 p < 0,001 n = 51

Discussion

The average age characteristics of this study are relevant to previous studies conducted by Woo, et al. (2017) which mention the average age of elderly are 65-74 years old.[1] Age is a risk factor that can also affect cognitive function where cognitive function decreases with age, especially in patients 60 years or older.[3,4]

This study involved 51 respondents who were elderly, which most of elderly (27 subjects) were women. Research conducted by Woo, et al (2017) concerning the relationship between cognitive impairment with risk of fall in elderly in Singapore found that more women subjects than men.[1] Gender is also one of the risk factors that can also affect cognitive function where women are more at risk than men experiencing cognitive decline.[5] This is due to the role of endogenous sex hormone levels. Estrogen receptors are found in areas of the brain that play a role in learning and memory functions such as the hippocampus. Low estradiol levels have been associated with decreased general cognitive function and verbal memory.[5,6]

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In this study, the highest educational level of elderly patients was mostly high school as many as 27 subjects (52.9%). This result is relevant to previous research conducted by Lestari et al (2017) which states that subjects with secondary education are the highest level of education among the elderly.[7] Education is one of the most important factors in preventing cognitive dysfunction. The higher the level of education, the slower the cognitive decline experienced. This is associated with increased synapse density in the brain in early life can delay the onset of cognitive impairment in old age.[8]

MoCA INA examination in this study found that 36 subjects (70.6%) who had abnormal results with an average MoCA score of 22,82± 3,99. Relevant research states that 85.5% of elderly people have abnormal MoCA INA score.[9] Another study conducted by Lestari, et all in 2017 in one nursing home located in Pekanbaru, it was stated that 90.3% of the elderly had decreased cognitive function.[7] Decreased of cognitive function in elderly can be physiological or pathological. Some of the causes include reduced of gray and white matter volume, accumulation of beta amyloid in the cerebral, decreased hippocampal volume, reduced neuron volume and reduced communication between neurons.[10] Cognitive disorders in the elderly can occur due to atrophy of the hippocampus (memory and learning centers), this is can the release of the hormone cortisol in the hippocampus excessively and impaired secretion of glucocorticoids resulting in toxic effects which can cause stress, then stimulate inflammation and hyperactivation of the pituitary adrenal hypothalamus (HPA) resulting in cognitive impairment.[11]

Berg Balance Scale score in this study found that the mean of the Berg Balance Scale score was 46.29±6.62. The proportion of the risk of falling based on the Berg Balance Scale score was divided into low risk of fall as many as 36 subjects (70.6%) and moderate risk of fall as many as 15 subjects (29.4%). Research conducted by Sina, et al in 2019 found that the risk of mild falls was 43 subjects (82.7%) and the risk of moderate falls was 9 subjects (17.3%).[12] Another study states 58% of subjects with a BBS score below 45.[13]Based on Shumway-Cook et al, in the range of 56 to 54, any 1 point decrease in BBS is associated with a 3% to 4% risk of falling. In the range of 54 to 46, each drops 1 point referring to a 6% to 8% increase in risk of fall, and <36 points of risk fall near 100%. Therefore, changes in 1 point in the BBS can produce very different percentages because it depends on the total score and, accordingly, represents a different risk of fall.[14]

Based on fisher's exact test and pearson correlation test statistical analysis of 51 subjects, the results showed that there was a significant relationship between cognitive function and risk of fall in elderly patients with positive correlation and strong correlation strength. Research conducted by Woo, et al (2017) it was said that there was a significant relationship between cognitive function and the risk of fall in the elderly who were just getting old with an odds ratio of 1.87.[1] Relevant research states that there is a relationship between cognitive function and balance function.[15] This may be due to structural and functional changes in the brain, hippocampal volume associated with the ability to maintain posture and balance. Reduced gray matter density in the middle frontal gyrus and superior frontal gyrus is associated with the risk of fall in the elderly with cognitive impairments.[16,17]

Another study conducted by Hesti et al.(2018) which concluded that there was a significant relationship between cognitive impairment and balance disorders with a value of p = 0.048 and the domains that had a significant relationship were attention, memory and executive function.[18]

Research conducted by Whitman and Tong (2011) on the relationship between cerebral substance abnormalities and movement disorders in the elderly also found that the elderly who had decreased balance function tended to experience substance abnormalities in the brain. The disorder that occurs is an increase in the volume of white matter hyperintensity. The white matter of the brain plays a role in the synthesis of Acetyl CO-A which functions in the formation of the neurotransmitter acetylcholine. Neurotransmitters in the brain help to carry out cholinergic activities such as cognitive function. In white matter there are many axons that function to deliver afferent impulses like exteroseptic and propioseptic.[19]

This study has limitation because only assessed the relationship between cognitive function and risk of fall without assessing other factors that can affect both. Several other factors that can affect cognitive function in the elderly such as illnesses suffered by respondents other than those contained in the exclusion criteria, socioeconomic factors, stress factors and other things were not analyzed in this study. In addition, the fall risk assessment is only assessed using a berg balance scale

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Conclusion

There is significant relationship between cognitive function and fall risk in elderly patients.

Suggestion

Further research needs to be done on the other factors that influence cognitive function and the risk of falling in elderly and there should be a combination of the various fall risk screening tests. In elderly patients who routinely go to the polyclinic, it is necessary to check the risk of fall regularly.

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