ISSN No:-2456-2165

Risk Factor Analysis of Post-Operating Cognitive Dysfunction in Elderly Patients

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Abstract:-
Background: The elderly population is increasing as the quality of health care improves. Globally, 50% of all elderly people are estimated to have had at least one surgical procedure and postoperative cognitive dysfunction (POCD) is one of the most common postoperative complications and is often poorly understood in the medical field. this population. Although the issue of POCD has been reported in the literature for more than a century and it remains an interest in anesthetic research today. Until now, there are no studies that can explain the specific mechanism of POCD due to old age. Surgery and anesthesia are also risk factors for POCD.

Methods: This is an observational analytical study with a cross-sectional design. This study involved 61 patients who were evaluated from May to July 2021. Cognitive evaluation using the MMSE was carried out preoperatively and postoperatively. Patients with abnormal MMSE (score <24) were excluded from the study. Evaluation of delirium was performed before postoperative cognitive evaluation with CAM score, if delirium occur, the subject was excluded from the study. Risk factor data were tested bivariate.

Results: In 61 patients who were evaluated from May to July 2021. There were 8 patients who were excluded from the study because 3 patients had abnormal MMSE values before surgery and 5 patients had postoperative delirium so that they were excluded. The bivariate analysis showed that the ASA score and the number of comorbidities were risk factors for the occurrence of POCD (p=0.001 and p=0.002, respectively).

Conclusion: The number of comorbidities and the ASA score were significant as risk factors for postoperative cognitive dysfunction.

Keywords:- *Postoperative Cognitive Dysfunction, Risk Factors, Elderly, MMSE.*

I. INTRODUCTION

The population of elderly patients is increasing in line with the increase quality of health services in Indonesia and throughout the world. By 2030, the population of the United States aged 65 years and over is predicted to double to 70 million people. WHO revealed a significant increase in the elderly population in Europe, and the number of elderly is expected to double in 2050. This will also increase the proportion of patients who will receive health services including anesthesia and intensive treatment. Globally, 50% of all elderly people are estimated to undergo at least one surgical procedure and postoperative cognitive dysfunction (POCD) is one of the most common and often poorly understood postoperative complications in this part of the population (Kotekar, N., et., al., 2016; Lim B.G and Lee, I.O., 2020; Brummel N.E. and Ferrante L.E., 2018).

Elderly patients often require a higher level of care than younger patients during the perioperative period, with higher health care costs. In addition, elderly patients tend to have perioperative comorbidities and sometimes accompanied by a decrease in physiological function and cognitive function so that it can have an impact on perioperative outcomes and the quality of surgical healing. Manifestations of postoperative cognitive dysfunction (POCD) may include impaired memory, attention, or concentration. Although the issue of POCD has been reported in the literature for more than century and remains of interest in anesthetic research today. It is estimated that about 41% of elderly patients show some cognitive impairment after surgery under anesthesia. With the increasing number of elderly undergoing surgery under general anesthesia worldwide, the problem with POCD after surgery is an important topic in clinical medicine (Andriyanto, L., et., al., 2012; Detweiler M.B., 2017; Lim B.G and Lee, I.O., 2020; Chan S.P., et., al., 2019).

Although POCD has been studied more than 30 years ago, to date there are no studies that can explain the specific mechanism of DKPO due to old age. Old age is synonymous with decreased productivity, which also means a decrease in patient independence, which manifests with certain organ dysfunctions. Surgery and anesthesia are also risk factors for DKPO. In surgery, risk factors are associated with a stress response that increases the secretion of catecholamines and cortisol (Lee S.J., et., al., 2020).

The impact of impaired cognition for patients varies, it can be in the form of minor disturbances that may not be felt by the patient but can also hinder the mobilization and rehabilitation of postoperative patients and increase patient dependence. Furthermore, postoperative decline in cognitive function was also associated with an increased risk of death

ISSN No:-2456-2165

one year postoperatively. The purpose of this study was to analyze the risk factors for the incidence of postoperative cognitive dysfunction in elderly patients (Andriyanto, L., et al., 2012; Sahana S., et al., 2020).

II. METHODS

This is a cross sectional study of elderly patient who needs anesthesia while surgery in elective operating room Dr. Soetomo Academic Hospital from May untill July 2021. Patients were enrolled consecutively unless exclusion criteria were applied. The inclusion criteria include age ≥ 60 years, patients with ASA Score II-III and can communicate well (not deaf, not mute, not mentally retarded, and not senile) while completing the cognitive test. The subject will be excluded if refused to be research subjects; patients who has abnormal MMSE evaluation and history of Craniotomy and Psychiatric disorder. If the patient died after surgery or decreasing condition so that can't be evaluated such as postoperative delirium (POD) will be dropped out. The patient will undergo cognitive evaluation 72 hours after surgery and the patient observed in post anesthesia care unit (PACU)

Ethical considerations

Informed consent for access to medical records and interview to get medical history was obtained from each patient. Written informed consent was obtained from participants 1 day before elective surgery. These processes and research protocols were approved by ethical committee in Dr Soetomo Academic Hospital (0198/KEPK/V/2021).

Statistical analysis

Bivariate analysis was conducted to determine the relationship of two independent variable with one dependent variable. P value of <0.05 indicates a significant value. Data analysis was performed using SPSS ver.26.0 (SPSS, Chicago, IL).

III. RESULTS

This study involved 61 patients who were evaluated from May to July 2021. There were 8 patients who were excluded from the study because 3 patients had abnormal MMSE values before surgery and 5 patients experienced postoperative delirium so that cognitive evaluation could not be carried out. Of the 53 patients evaluated, 20 patients (37.7%) experienced POCD and 33 patients (62.3%) did not experience POCD. The proportion of POCD events is shown in Figure 1.

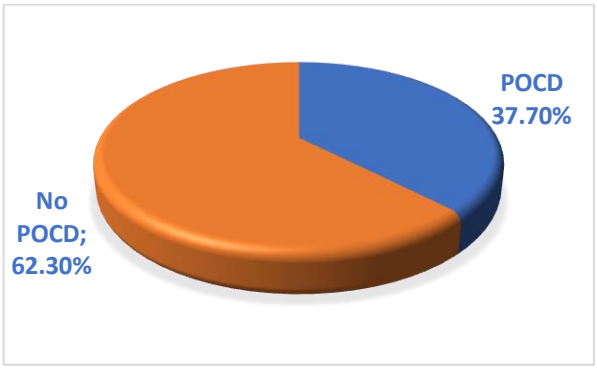

Figure 1. Frequency of POCD

From 53 study subjects we evaluated the patient's recent education. As shown in Figure 2, which shows that most of the patients have a secondary education background/equivalent. Details of educational background consisted of 6 patients (11.5%) who did not finish elementary school, 11 patients graduated from elementary school/equivalent (21.6%), 19 patients graduated from junior high school/equivalent (36.2%), 10 patients graduated from high school/ equivalent (19.2%), while the other 6 patients (11.5%) were able to take and complete the undergraduate level of study. Based on bivariate analysis, there was no significant difference between the last education and the incidence of POCD (p = 0.226).

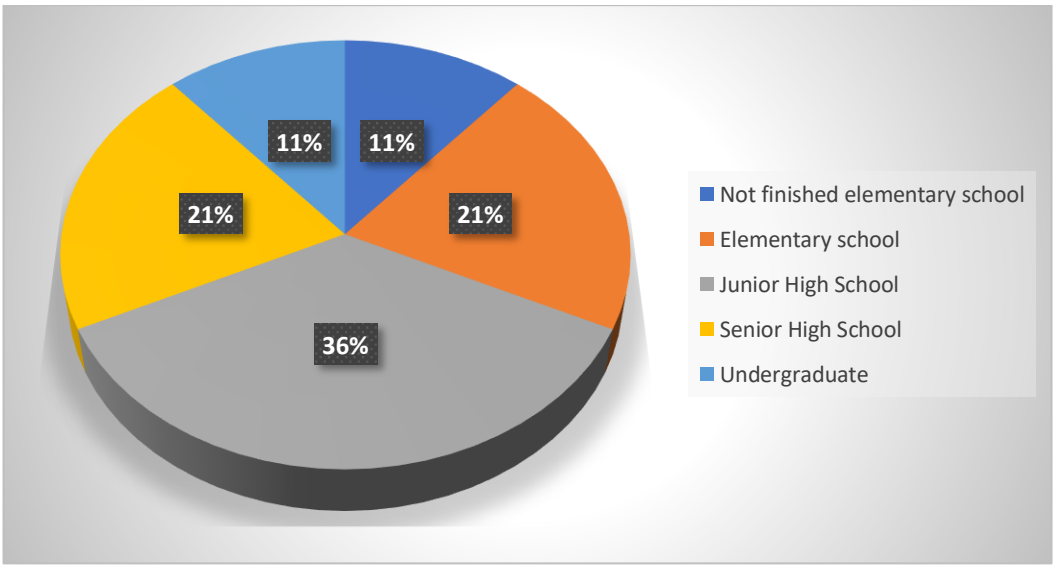

Figure 2. Frequency of patient based on education level

ISSN No:-2456-2165

Table 1. Characteristics of subject study

Characteristics	Mean/Median	POCD		N	p value
		Yes	No		
Age (year)	64 (60-79)	66 (60-79)	64 (60-76)		0.0001
BMI (kg/m2)	23±3.8	22.79 ± 4.25	23.7 ± 3.68		0.200
Gender					0.0001
Male		12 (60%)	21 (63.6%)	33	
Female		8 (40%)	12 (36.4%)	20	
Comorbidity number	3(1-4)	4 (2-4)	3 (1-4)		0.0001
Surgery type					0.0001
Otorhinolaryngology		2 (10%)	6 (18.2%)	8	
Urology		6 (30%)	8 (24.2%)	14	
Digestive		3 (15%)	7 (21.2%)	10	
Orthopedic		7 (35%)	5 (15.2%)	12	
Ophthalmology		1 (5%)	2 (6.1%)	3	
Vascular		1 (5%)	1 (3%)	2	
Gynecology		0	4 (12.1%)	4	
ASA Score					0.0001
ASA 2		8 (40%)	27 (81.2%)	35	
ASA 3		12 (60%)	6 (18.2%)	18	
Anesthesia type					0.0001
General		11 (55%)	20 (60%)	31	
Regional		6 (30.3%)	10 (30.3%)	16	
Combination		3 (15%)	3 (9.1%)	6	

*p value normality: Kolmogorov-Smirnov test

Analysis of risk factors for the occurrence of POCD was carried out by using a bivariate test on predetermined variables. Based on the bivariate test, it was found that the number of comorbidities and the ASA score had statistically significant differences (p = 0.001 and p = 0.002), while other variables including type of surgery and type of anesthesia did not have a statistically significant value with a p value respectively 0.873 and 0.609. Complete data on the risk factor bivariate test can be seen in table 2 below.

Table 2. Risk factors for POCD

Variables	POCD		p value
	Yes	No	
Gender			0.791
Male	12 (60%)	21 (63.6%)	
Female	8 (40%)	12 (36.4%)	
Comorbidity number	4 (2-4)	3 (1-4)	0.001*
Surgery type			0.873
Otorhinolaryngology	2 (10%)	6 (18.2%)	
Urology	6 (30%)	8 (24.2%)	
Digestive	3 (15%)	7 (21.2%)	
Orthopedic	7 (35%)	5 (15.2%)	
Ophthalmology	1 (5%)	2 (6.1%)	
Vascular	1 (5%)	1 (3%)	
Gynecology	0	4 (12.1%)	
ASA Score			0.002*
ASA 2	8 (40%)	27 (81.2%)	
ASA 3	12 (60%)	6 (18.2%)	
Anesthesia type			0.609
General	11 (55%)	20 (60.6%)	
Regional	6 (30%)	10 (30.3%)	
Combination	3 (15%)	3 (9.1%)	

*p<0.05 significant difference

In the bivariate test of risk factors for the incidence of POCD and bivariate were carried out. The bivariate test of patient risk factors including the number of comorbidities and the ASA score had statistical significance with p=0.001 and p=0.002, respectively. Meanwhile, in the bivariate test, the surgical risk factors including the type of surgery did not have statistical significance with p-values of 0.873. In the bivariate test of anesthetic risk factors by taking into account

the type of anesthetic used, the p value = 0.609, which means there is no statistical significance.

IV. DISCUSSION

A total of 53 patients who met the inclusion and exclusion criteria were observed in this study. Detection of cognitive dysfunction using the MMSE found 20 patients had POCD. The number of research subjects who are male with the most types of surgery are Urology 14 patients and Orthopedia 12 patients. The type of anesthesia observed was divided into general anesthesia, regional anesthesia and combination anesthesia groups.

Subject characteristics were arranged based on age, body mass index, gender, educational history, number of comorbidities, type of surgery, ASA score and type of anesthesia. Educational history can affect cognitive stability with age and degradation of brain function. Educational history should also be able to maintain the level of independence of an elderly person even though independence is associated with the presence or absence of multiple comorbidities (Sahana, S., et., al., 2020). In this study, there were 6 patients (11.5%) who did not finish elementary school education, but most of the subjects' education history was junior high school/equivalent (36%) which is the minimum education required by the government through the 9-year compulsory education program. With this Most of the population has sufficient Education.

The independence of elderly patients which in this study was measured by the Barthel index can describe the outcomes of patients who are hospitalized. By analyzing the relationship between POCD and the independence of the elderly, we can predict the outcome of surgery, the rehabilitation process and postoperative recovery. In this study, there were 9 patients who had mild dependence before surgery. While the other 44 patients had a good level of independence. The results of the analysis of the relationship between the Barthel index and the incidence of POCD were not significant (p = 0.255) (Ryg, J., et., al., 2018)

Although it was explained by Sahana et., al., that the higher the age, the higher the chance of POCD occurring, in this study, age had no significant effect on the incidence of POCD (p=0.599). Battelli et., al., said that the extreme age of the condition decreased, namely above 80 years. In this study, the highest age was 79 years. The possibility of age does not affect the incidence of POCD because there is no extreme age group in this study. Obesity will affect the inflammatory process that occurs and has the potential to have a higher inflammatory response tendency when compared to people who are not obese. In this study, there was only 1 patient with obesity, so it was not enough to be analyzed.

Swartz stated that the POCD rate at discharge from the hospital was between 36.6-41.4% (Swartz, 2017). While Mohanty, et., al., stated that postoperative cognitive impairment was 25.8% in patients aged over 60 years in non-cardiac surgery (Mohanty, 2016). When compared in this study, the percentage was similar at 37.7% as was the case in the study of Sahana et., al., which also had a similar percentage of POCD incidence of 37.5% (in the general anesthetic group). In another trial involving 200 elderly patients showed that the incidence of anesthesia under general anesthesia with sevoflurane (33.3%) and propofol (29.7%) (Cottrell, J.E and Hartung, J, 2020). This percentage range seems consistent in this study with other studies.

Risk factors for POCD related to patients include gender, number of comorbidities, status of independence/dependence. In a study conducted by Kotekar, et., al., it was stated that women are more at risk of developing POCD than men, which is thought to come from hormonal factors. (Kotekar, 2018) Furthermore, the article also explained that the risk factors for sex were lower than the increase in age. In this study, the bivariate test showed that there was no relationship between gender and age with the incidence of POCD.

The patient's independence factor is closely related to the level of education and cognitive abilities that are still good in old age. In a study conducted by Riani and Halim who noted that 47% of the total elderly in Indonesia are still working (Riani, 2019). The condition of elderly patients who are still working will maintain their cognitive function compared to the elderly who are not working. In this study, neither the independence status nor the level of education did not affect the incidence of POCD. This can be biased with diverse educational backgrounds.

Risk factors for the occurrence of POCD related to the operation process include the type of operation. Many studies aim to identify the incidence of POCD in certain types of operations. In this study, there were 7 types of surgery which included ENT, urology, digestive, vascular, orthopedia, gynecology, and ophthalmology operations. The bivariate test did not show a significant relationship between the type of surgery and the incidence of DKPO. Likewise, the presence of intraoperative events does not significantly cause POCD.

In the study of Zhang, Y., et., al., who evaluated the risk factors for surgery, it was found that longer fasting triggers POCD while the duration of surgery, the incidence of hypotension, bleeding, transfusion and a significant decrease in Hb were not significant as risk factors for POCD (Zhang, 2019).

Meanwhile, in a study by Shoair, O.A., et., al., in 2021 which selected geriatric subjects who underwent non-cardiac surgery and specialized in orthopedic surgery and simple spine surgery compared to patients who did not receive surgery or anesthesia. The purpose of the study was to determine the risk factors for the occurrence of POCD (Shoair, 2021).

The variables studied in this study included education level and type of anesthesia (which were divided into 3

groups). From the results of the bivariate test, it was found that the type of anesthesia and level of education were not significantly related to use as a risk factor for the occurrence of POCD. This study is in line with this study which was similar in the distribution of types of anesthesia.

In another study conducted by Edipoglu and Celik who examined the difference in the incidence of POCD between general anesthesia and regional anesthesia in Total Knee Arthroplasty (TKA) surgery which showed a significant difference with a higher incidence of POCD under general anesthesia (Edipoglu, 2019).

Another factor that was also investigated was the actual ASA score which was also related to the number of comorbidities the patient had. The higher the ASA score, the more comorbidities and will reduce the body's ability to respond to inflammation that occurs both before, during and after surgery which will have an impact on the postoperative recovery process. Kotekar et., al., stated that the incidence of POCD decreased at the third month compared to 1 week postoperatively with the determinant risk factor being age while the factors that could exacerbate or increase the risk included higher ASA scores, lower education levels, and also more complex types of operations (Kotekar, 2016).

Risk factors for POCD related to anesthesia include anesthetic technique and ASA score. In a study conducted by Sahana, et., al., at RSUP Dr. Hasan Sadikin Bandung who compared the technique of epidural anesthesia with general anesthesia in arthroplasty surgery in elderly subjects. This study which aims to determine the incidence of POCD in these 2 anesthetic techniques involved 48 patients and showed significant results. The incidence of POCD in general anesthesia is higher than in regional anesthesia. No combination anesthetic technique was tested in this study. In contrast to this study, which tested 3 anesthetic techniques, namely general anesthesia, regional anesthesia, and combination anesthesia, it was found that anesthetic techniques were not significantly associated with triggering the incidence of POCD (Sahana, 2020).

The risk posed by the ASA score on the incidence of DKPO is also supported by research by Zhang, Y., et., al., who also stated that in addition to the ASA score, patient-related factors that also significantly trigger DKPO were education level and age. The risk factor that becomes the bias in this study is the varied educational background factor. As in Riani and Halim's research, limiting minimum education (junior high school/equivalent) can reduce cognitive differences due to educational background (Zhang, 2019; Riani, 2019).

V. CONCLUSION

The number of comorbidities and the ASA score were significant as risk factors for postoperative cognitive dysfunction. Further research is needed with more demographically specific subjects.

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