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Systematic Review
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Factors Influencing Events Dysfunction Cognitive Post Operation on Patient Elderly: Systematic Review

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ABSTRACT

Background: : Improvements in global life expectancy have led to a significant increase in the elderly population, which in turn results in a growing number of elderly patients undergoing surgery. This condition raises the risk of postoperative complications, such as postoperative cognitive dysfunction (POCD). POCD can reduce quality of life, prolong the length of hospital stay, and increase mortality. This study aims to identify and synthesize the factors that influence the occurrence of POCD in elderly patients.

Subjects and Method: This study is a Systematic review with PICO. The article used in research were obtained from several databased including Google Scolar, Scopus, and PubMed Keywords to find articles are "postoperative cognitive dysfunction," "elderly patients," and "geriatrics". This articles used are failing to directly discuss risk factors for postoperative cognitive dysfunction in elderly patients, or identified as opinion pieces, conference abstracts without full text, or narrative reviews, will be excluded. Articles were selected using PRISMA flow diagram.

Results: a total 8 articles reviewed in Systematic Review showed that The incidence of POCD in the elderly shows significant variation between studies, ranging from 8.33% to 37.7% . Risk factors that have been consistently identified as having a significant influence on the incidence of POCD include advancing age, low level of education, number of comorbidities, high ASA score, long duration of anesthesia, intraoperative hypotension, history of cerebral infarction, and low oxygen saturation at induction. The use of certain anesthetic agents such as sevoflurane and midazolam has also been shown to increase the risk of POCD. Instead, use dexmedetomidine preoperative, analgesia preemptive and the combination of general anesthesia with epidural block were identified as protective factors.

Conclusion: The main risk factors advanced age, education level, comorbidities, and type and duration of anesthesia.

Keywords: anesthesia, elderly, pocd, risk factors

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BACKGROUND

People worldwide are living longer. Today most people can expect to live into their sixties and beyond. Every country in the world is experiencing growth in both the size and the proportion of older persons in the population. By 2030, 1 in 6 people in the world will be aged 60 years or over. At this time the share of the population aged 60 years and over will increase from 1 billion in

2020 to 1.4 billion. By 2050, the world's population of people aged 60 years and older will double (2.1 billion). The number of persons aged 80 years or older is expected to triple between 2020 and 2050 to reach 426 million.

The rate of older people undergoing surgical procedures is increasing faster than the rate of population ageing. This is due to advances in surgical technique and anaesthetic management coupled with changes in patient and professional expectations and behaviours (Li et al., 2025). Despite this progress, older surgical patients remain at increased risk of adverse postoperative outcome in comparison to younger patients. This is both in terms of morbidity and mortality. Factors contributing to this increased risk include an aged related reduction in physiological reserve, an increase in multi-morbidity and the geriatric syndromes.

Along with increasing hope global life, population elderly experience significant growth. Elderly estimated will covers more of 20% of the world's population by 2050 (WHO, 2021). This impact straight to the upgrade amount patient elderly who undergo action surgery, which is no direct participate increase number incident complications post-operative, may be complicated by factors such as multiple comorbidities, low functional performance, frailty, reduced homeostatic capacity, and cognitive impairment (Grape et al., 2012). An integrated multidisciplinary approach to management is, therefore, essential in this population including dysfunction cognitive post-surgery (Postoperative Cognitive Dysfunction or POCD).

POCD is disturbance neurocognitive that occurs post anesthesia, marked with decline performance cognitive like disturbance memory, information processing, attention and change atmosphere heart and personality (Cartailler et al., 2021). Condition This more general occurs in patients age continue and can influence quality alive, extending the treatment period stay, improve risk dependency, as well as relate with number more death tall (Evered and Silbert, 2018). Prevalence of POCD in patients elderly people vary greatly, there are various factor the risks that have been associated with POCD, including age continued, cognitive status low preoperative, education low and disturbance metabolic, Besides that, kind anesthesia and duration anesthesia is also one of the factor the occurrence of POCD (Wu et al., 2023).

POCD is cognitive disorders that occur post-operative in elderly patients characterized by a decline in cognitive functions such as memory, attention, executive, orientation, coordination, and verbal abilities. POCD usually occurs within a few days to weeks after surgery, and can last for months or even longer (Zhao et al., 2024). The incidence of POCD in elderly patients (> 60 years) was approximately 25.8% within seven days after surgery and 10% within three months after surgery. The risk factors and etiology that lead to POCD can be reduced by good patient education, patient care and proper sanitation can prevent the tendency of POCD symptoms in these patients (Arefayne et al., 2023).

Studies shows 25% of patients carry on age experiencing POCD in a number of Sunday first postoperatively, and about 10% may experience disturbance term long (Huang et al., 2025). Moment this not yet there is results study about which factors are the most significant in trigger the occurrence of POCD, especially in Indonesia. This show the need study more carry on for identify factor risk specific that can made into base in effort prevention, screening early, and management of POCD among patient elderly.

Study This aiming for identify factors risks that affect to incident dysfunction cognitive post-surgery on patient elderly. Therefore that, is needed search article scientific related factor factors that influence events dysfunction cognitive post-surgery in the elderly. It is expected results study study This can give contribution in development of more perioperative strategies safe and effective for patient carry on age.

SUBJECTS METHOD

1. Study Design

Study This use approach Systematic Review (SR), namely a designed method for identify, evaluate, and synthesize in a way systematic proof scientific from various relevant studies to a question study particular. Approach This used as base for taking decision based on evidence (evidence-based practice), specifically in field health. Search process literature done through three main databases namely Google Scholar, Scopus, and Pub-Med, with the keywords used "postoperative cognitive dysfunction, " "elderly patients," and "geriatrics."

2. Steps of Systematic Review

1) Formulate research questions using the PICO model (Population = Elderly patients. Intervention = Influencing factors POCD. Comparasion = Groups with or without influencing factors POCD. Outcome = Postoperative Cognitive Dysfunction)
2) Search for research artivles from online database namely Google Scholar, Scopus, and PubMed.
3) Conduct screening and assess the quality of the research articles obtained.
4) Data extraction and risk of bias assessment are systematically performed by independent reviewers, gathering key study characteristics, population details, interventions/exposures, measured outcomes, and main findings, while simultaneously evaluating methodological quality and potential biases using design-appropriate tools.
5) Interpret the results and draw conclusions

3. Inclusion Criteria

The established inclusion criteria are publications from 2015 to 2025, articles written in Indonesian or English, and a direct discussion of risk factors for postoperative cognitive dysfunction in elderly patients.

4. Exclusion Criteria

The article used in this research are failing to directly discuss risk factors for postoperative cognitive dysfunction in elderly patients, or identified as opinion pieces, conference abstracts without full text, or narrative reviews, will be excluded.

5. Operational Definition

Post Cognitive Dysfunction: Any documented negative change or measurable decline in an individual's cognitive function after surgery, including but not limited to postoperative delirium or Postoperative Cognitive Dysfunction (POCD) evidenced by significant drops in standardized neuropsychological test scores.

Influencing Factors: Any variable or characteristic identified and analyzed in primary studies as a predictor, trigger, or protective element for postoperative cognitive dysfunction in elderly patients, encompassing pre-operative demographic/ clinical factors.

Elderly Patients: Individuals aged ≥60 years or older at the time of surgery, as defined and reported in the primary studies, with slight variations in age thresholds.

6. Study Instrument

This systematic review followed the guidelines set by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) in determining the articles included in the discussion.

7. Data Analysis

The extracted data were analyzed using a descriptive approach to describe the characteristics of the included studies. A comprehensive table was compiled to present the main findings from each study, including information on study design, research location, and factors influencing the occurrence of Postoperative Cognitive Dysfunction

RESULTS

This article search process was carried out through several journal databases including Google Scholar, Scopus, and PubMed. The review process for related articles can be seen in the PRISMA flowchart in Figure 1. Research related to factors influencing cognitive dysfunction post-operation on elderly patients totaled 8 articles. The initial search process produced 1380 articles; after the deletion process, 1170 articles were obtained, 25 of which met the requirements for further full-text review. Furthermore, 8 articles that met the quality assessment were included in the synthesis, Syatematic Review

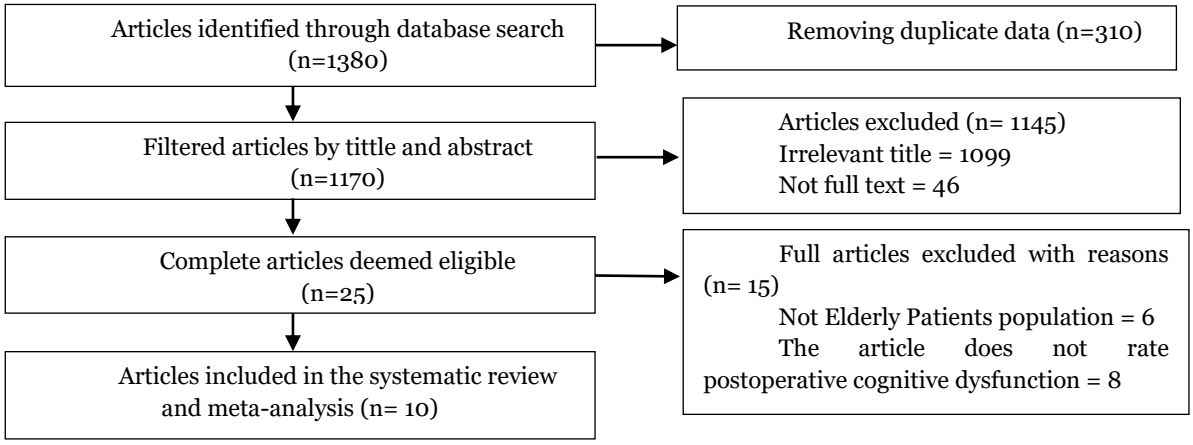

Figure 1. PRISMA Flow diagram

Table 1. Summary Result of the main study of Factors Influencing Events Dysfunction Cognitive Post Operation on Patient Elderly

Author	Methods	Result	Conclusion
Shoair et al. (2015)	Cohort study	The study found that postoperative cognitive dysfunction (POCD) occurred in 15.9% of older adults 3 months after major noncardiac surgery, and was associated with carrying the APOE4 genotype, using one or more highly anticholinergic or sedative-hypnotic drugs prior to surgery, and receiving sevoflurane for anesthesia.	The study concluded that postoperative cognitive dysfunction was observed in 15.9% of older adults after major noncardiac surgery, with carrying the APOE4 genotype, using one or more highly anticholinergic or sedative-hypnotic drugs prior to surgery, and receiving sevoflurane for anesthesia identified as associated risk factors.

Author	Methods	Result	Conclusion
Fan et al. (2021)	Cohort study	11.89% of elderly patients developed POCD after laparoscopic surgery, with risk factors including cerebral infarction history, low SpO_2 during induction, and long surgery times, while PCEA, general anesthesia with epidural block, preoperative dexmedetomidine, and preemptive analgesia were protective.	Clinicians should be vigilant in screening and early intervention for POCD in elderly laparoscopic surgery patients with identified risk factors to improve their quality of life, despite current limitations in diagnostic scales and the inability to implement certain serological indicators like serum S-100b in this study, which highlights the need for future research into more sensitive indicators.
Wu et al. (2023)	Cohort study	The study results indicate that 33.1% of elderly patients undergoing oral malignancy surgery experienced postoperative cognitive dysfunction (POCD) within seven days postoperation. Multivariate logistic regression analysis identified six significant independent risk factors for POCD: advanced age, low education level, hypertension, dyssomnia, prolonged anesthesia duration, and intraoperative hypotension. These factors significantly increased the likelihood of cognitive impairment after surgery.	In conclusion, a significant proportion (33.1%) of elderly patients undergoing oral malignancy surgery develop postoperative cognitive dysfunction (POCD) within a week. Key independent risk factors for POCD were identified as advanced age, lower education, hypertension, dyssomnia, prolonged anesthesia, and intraoperative hypotension, highlighting the need for targeted vigilance and potential interventions in these vulnerable patients.
Somnuke et a. (2024)	Cohort study	The study results indicated that the incidence of postoperative delirium (POD) was similar between patients with MCI (Mild Cognitive Impairment) and	This study concluded that although MCI was not directly associated with an increased incidence of delirium, elderly patients without MCI were actually

Author	Methods	Result	Conclusion
		non-MCI (16.6% vs. 14.3%, p = 0.839). However, the incidence of postoperative cognitive dysfunction (POCD) was higher in the non-MCI group compared to the MCI group (50% vs. 24.3%, p = 0.001). The decline in cognitive scores in the visuospatial, attention, and orientation domains was more prominent in the non-MCI group, especially after cardiovascular surgery (CVT).	more susceptible to POCD. Therefore, postoperative cognitive assessment and monitoring are crucial for all elderly patients, regardless of their baseline cognitive status.
Li et al. (2019)	RCT	The results indicate that the incidence of POCD at 7 days was lowest in the propofol group (18.2%), compared to dexmedetomidine (40%) and midazolam (51.9%) ($p<0.05$). However, at one year post-operation, no significant difference was found between the groups regarding the incidence of POCD.	Propofol showed the mildest short-term cognitive impact, while midazolam was most associated with short-term postoperative cognitive dysfunction in elderly patients.
Parami & Ryalino, (2020)	Descriptive	A total of 7 patients (8.33%) experienced POCD at 48 hours, and this remained consistent at four weeks post-operation. The majority of participants were an average of 66 years old, male, and had an education level ranging from elementary to high school.	No surgicalcomplications were found, and most patients underwent general anesthesia.

Author	Methods	Result	Conclusion
Farhan et al. (2021)	Cross-sectional	53 elderly patients analyzed, 37.7% experienced POCD. Analysis revealed that the number of comorbidities and ASA score were significantly associated with the incidence of POCD ($p<0.05$). Other factors such as age, sex, type of surgery, type of anesthesia, and education level did not show a significant association.	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.
Putra et al. (2024)	Cross-sectional	This study involved 22 geriatric patients who underwent surgery with general anesthesia. The results showed that 9.1% of these patients experienced postoperative cognitive dysfunction (POCD) on the third day after the procedure. However, there was no significant difference between MMSE scores before and after surgery ($p = 0.142$). Additionally, no statistically significant association was found between POCD and factors such as age, sex, education level, ASA classification, medical history, surgical history, type of surgery, or duration of anesthesia administration.	Despite the incidence of POCD, this study did not show a significant effect of general anesthesia on postoperative cognitive function in elderly patients.

DISCUSSION

Postoperative Cognitive Dysfunction (POCD) is a cognitive disorder that occurs after surgery in elderly patients, characterized by a decline in cognitive functions such as memory, attention, executive functioning, orientation, coordination, and verbal abilities. POCD typically occurs within a few days to weeks after surgery and may persist for months or even longer (Zhao et al., 2024). Based on a literature review of eight relevant journals, the incidence of POCD among elderly patients varies across studies. The reported incidence ranges from 8.33%

within 48 hours to four weeks post-surgery in a study conducted at Sanglah General Hospital (2020), to 37.7% within 72 hours after surgery in a study at Dr. Soetomo Hospital (2021). Another study reported a 9.1% incidence of POCD on the third postoperative day at Prof. Dr. I G.N.G. Ngoerah General Hospital (2024), and 11.89% POCD following laparoscopic surgery in a retrospective study (2021). According to Somnuke et al. (2024), the incidence of POCD was higher in the non-MCI (Mild Cognitive Impairment) group (50%) compared to the MCI group (24.3%) in a study conducted in Bangkok, indicating that elderly patients without prior cognitive impairment are also vulnerable to developing POCD. Overall, POCD in elderly patients is a significant issue, with incidence rates varying depending on research methodology and timing of assessment

Age has been identified as a significant risk factor for Postoperative Cognitive Dysfunction (POCD) events. The number of comorbidities and ASA (American Society of Anesthesiologists) scores correlate significantly with POCD. Other independent risk factors include advanced age, low educational attainment, hypertension, dyssomnia, prolonged anesthesia, and intraoperative hypotension. Cerebral infarction history and low SpO2 during anesthesia induction are also significant risk factors. Preoperative anticholinergic or sedative-hypnotic drug consumption and sevoflurane use were found to increase POCD risk. Conversely, postoperative PCEA, general anesthesia with epidural block, pre-surgical dexmedetomidine, and preemptive analgesia are protective factors. However, some studies indicate no significant relationship with gender, operation type, or education level. Nevertheless, the consistency of several risk factors emphasizes the importance of comprehensive preoperative evaluation and careful perioperative management in elderly patients to minimize POCD. POCD not only impairs patient quality of life but also prolongs hospitalization, increases dependency risk, and contributes to increased postoperative mortality (Evered & Silbert, 2018).

1. Age and education level with POCD incident

In a study conducted at Sanglah Central General Hospital, Bali, Parami & Ryalino (2020) reported that 7 out of 84 elderly patients (age ≥ 60 years), or 8.3%, developed POCD within 48 hours to 4 weeks postoperatively. POCD was defined by a decrease of ≥ 20% on two of the three cognitive measurement tools. These findings align with a study by Putra et al. (2024) at Prof. Dr. I.G.N.G. Ngoerah General Hospital, which observed a higher prevalence of 60.5%, particularly in patients aged ≥ 70 years. The highest incidence in the latter study was noted in oncology, trauma, and vascular operations. Such variations can be attributed to differences in anesthesia methods, surgical durations, and cognitive evaluation instruments. Patients over 60 years old are more susceptible to perioperative stress due to a decline in brain neuroplasticity and reduced cognitive reserve (Rundshagen, 2020).

Wu et al. (2023) indicate in their study that a low education level serves as an independent risk factor for Postoperative Cognitive Dysfunction (POCD) events in elderly surgical patients. Consequently, alongside age and surgical type, educational status warrants consideration during perioperative risk assessment to identify older patient cohorts susceptible to POCD. Education level is also a contributing factor to cognitive reserve, a condition that significantly aids in managing physiological stress, including that induced by surgical

procedures and anesthesia (Evered & Silbert, 2018).

2. Comorbid disease with POCD incident

The presence of comorbidities like hypertension, diabetes mellitus, and sleep disorders increases a patient's risk of developing Postoperative Cognitive Dysfunction (POCD) (Farhan et al., 2021). These co-existing diseases lead to chronic systemic conditions that can disrupt cerebral homeostasis during surgery. Moreover, a high ASA status, indicative of poorer health, has been correlated with an elevated risk of POCD (Skvarc et al., 2018). Such conditions can diminish the brain's physiological resilience to surgical stressors, systemic inflammation, and intraoperative hemodynamic fluctuations.

Neurological comorbidities further contribute to an increased risk of POCD. Specifically, a history of cerebral infarction is a significant factor associated with postoperative cognitive impairment. A study by Fan et al. (2021) demonstrated that elderly patients with a history of stroke or cerebral infarction exhibit heightened vulnerability to POCD, largely due to pre-existing cerebral network damage exacerbated by perioperative stress and intraoperative blood pressure instability. Furthermore, low oxygen saturation levels (SpO2) during anesthesia induction have also been linked to an increased risk of POCD, as transient hypoxia can induce dysfunction in oxygen-sensitive neurons.

3. Anesthesia duration with POCD incident

The prolonged duration of anesthesia has been demonstrated as a significant risk factor for postoperative cognitive dysfunction (POCD), particularly in geriatric patients. Extended anesthetic exposure can precipitate neurotransmitter dysregulation, oxidative stress, and inflammatory responses within the brain, thereby contributing to post-surgical cognitive decline. Specifically, a study by Wu et al. (2023) statistically identified extended anesthesia duration as an independent risk factor for POCD in elderly patients undergoing oral surgical procedures. Physiologically, prolonged anesthesia induces heightened microglial activity and the release of pro-inflammatory cytokines, including IL-6, TNF-α, and IL-1β, in the hippocampus. This process can disrupt neuronal homeostasis and diminish neuroplasticity, as documented by Li et al. (2022).

Moreover, lengthy anesthesia can lead to neurotransmitter imbalances, impaired cerebral autoregulation, and an accumulation of neurotoxic metabolites such as β-amyloid, which is a hallmark of cognitive impairment. A meta-analysis conducted by Lin et al. (2020), encompassing 14 studies and 3,000 patients, concluded that anesthesia duration exceeding ≥ 3 hours was significantly correlated with the incidence of POCD, yielding an odds ratio of 1.58 (95% CI: 1.20–2.08). This particular study highlights that anesthesia duration not only reflects the inherent complexity of surgical interventions but also serves as a crucial indicator of physiological stress exposure capable of inducing postoperative biochemical alterations in the brain. Furthermore, the utilization of anesthesia depth monitoring technologies, such as Bispectral Index (BIS) or Surgical Pleth Index, has been shown to reduce anesthesia duration by 18 minutes and mitigate the incidence of POCD within the initial 72 hours post-surgery (Ling et al., 2022). These collective findings emphasize the critical importance of judiciously managing anesthesia duration to minimize the potential for postoperative cognitive impairment, especially in vulnerable

populations characterized by diminished cognitive reserve, such as the elderly.

4. Anestesia drugs with POCD incident

The use of volatile anesthetic agents like sevoflurane, anticholinergics, and sedative-hypnotics before surgery has been linked to an increased incidence of Postoperative Cognitive Dysfunction (POCD). These agents can influence the cholinergic system and reduce the brain's neuroprotective activity (T. Zeng et al., 2023). A study by Li et al. (2019) demonstrated that the type of sedative used during regional anesthesia significantly affects POCD incidence. In a randomized clinical trial, elderly patients who received midazolam had the highest incidence of POCD (51.9%) compared to those given dexmedetomidine (40%) and propofol (18.2%) one day post-operation. These findings suggest that midazolam, as a GABA-A agonist, can disturb short-term memory more significantly than propofol, which has a shorter half-life and faster offset. Similar results were obtained by K. Zeng et al. (2023) in a meta-analysis, concluding that sevoflurane and midazolam pose a high risk for POCD due to their ability to reduce brain cholinergic activity and enhance neuroinflammation.

Shoair et al. (2015) reinforce these findings by identifying sevoflurane, anticholinergic drugs, and sedative-hypnotics as significant risk factors for POCD. In their prospective cohort study, sevoflurane use increased the risk of POCD (OR = 6.43), while the consumption of anticholinergic drugs before operations was also significantly correlated with cognitive decline three months post-operation. Another study by T. Zeng et al. (2023) found that sevoflurane exposure triggers glucose metabolism disorders in the hippocampus and lowers the expression of neuroprotective factors like BDNF, strengthening the suspicion that inhaled anesthesia contributes to neurotoxicit.

Postoperative cognitive dysfunction (POCD) in elderly patients is a multifactorial condition influenced by a series of interrelated factors, encompassing patient demographic characteristics, preoperative clinical status, and perioperative management. A systematic analysis of eight relevant studies identified consistent primary risk factors: advanced age, low educational attainment, the presence of comorbidities such as hypertension and sleep disorders, elevated ASA scores, and extended anesthesia duration. Intraoperative elements, including hypotension and reduced oxygen saturation during induction, as well as a pre-existing history of cerebral infarction, were also demonstrated to elevate patient vulnerability to POCD.

From a pharmacological standpoint, the administration of specific anesthetic agents, namely sevoflurane and midazolam, exhibits a significant correlation with an increased risk of POCD. Conversely, several interventions have been identified as potential protective factors, including the preoperative application of dexmedetomidine, preemptive analgesia, and the utilization of combination anesthesia techniques (e.g., general anesthesia with an epidural block). Collectively, these findings affirm the imperative for comprehensive preoperative risk evaluation and meticulous, individualized perioperative care. The development of effective preventative strategies, which prioritize the modification of identified risk factors and the selection of safer anesthetic protocols, is paramount to mitigating POCD incidence and, ultimately, improving the outcomes and safety of elderly patients undergoing surgical interventions.

AUTHORS CONTRIBUTION

Ratna Kusuma Astuti is the main researcher who chose the topic, explored and collected the article. Nindita Arum Veibiani have a role in analyzing data and reviewing study documents

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CONFLICT OF INTEREST

There was no conflict of interest in the study

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