The effect of Anaesthesia on Postoperative cognitive dysfunction (POCD) -----(this review aims to highlight the impacts of anaesthesia in developing POCD)

Samreena zafer[1], Artiz Ashiq[2], Ms Rizwana Ashiq3
[1,2] *MSC Student OT/AT department at University School of Allied Health Sciences Lamrin Tech Skill University Ropar Punjab.*
[3]*Assistant professor in the department of OT/AT at University School of Allied Health Sciences Tech Skill University Ropar Punjab.*

Abstract: **Postoperative cognitive dysfunction (POCD) is a common complication of surgery, affecting up to 30% of patients after major procedures. POCD is characterized by a decline in cognitive functions such as memory, attention, and executive function, significantly affecting patients' quality of life and functional independence. Anaesthesia, a critical component of surgical care, has complex effects on cognitive function. While it ensures pain relief and patient comfort during surgery, it may negatively impact cognition, particularly in older adults. Short-term changes in cognitive performance during the first few days to weeks after surgery are well documented. However, POCD is not formally recognized in the DSM-5-TR. Some studies report a 36% incidence of cognitive decline at 6 weeks and 42% at 5 years post-coronary artery bypass grafting (CABG). The incidence after non-cardiac surgery in patients over 65 is about 26% at 1 week and 10% at 3 months. Multiple factors contribute to POCD, including patient-related variables (e.g., age, education level, comorbidities), surgical variables (e.g., type and duration), and anaesthesia-related factors (e.g., type and dosage of anaesthetics). Research suggests certain anaesthetic agents and techniques, particularly general anaesthesia and agents like benzodiazepines and anticholinergics, may be associated with a higher risk of POCD.**

Keywords: **POCD (Postoperative cognitive dysfunction) ,GA (general anaesthesia) ,SG (surgical variables) ,Coronary artery bypass grafting (CABG).**

INTRODUCTION

Postoperative cognitive dysfunction is a well-recognized yet often underdiagnosed complication following surgery, especially in the elderly. It presents as a decline in memory, attention, and executive function and can severely affect daily functioning and independence. Short-term POCD (up to 3 months) is documented in approximately 10–15% of elderly patients, while long-term cognitive impairment (lasting more than 3 months) can affect around 1%. POCD has been observed following both major and minor surgeries and across different anaesthesia modalities, although its exact etiology remains unclear. Currently, there is no definitive treatment available. Postoperative cognitive dysfunction can complicate a person's recovery after surgery, delay discharge from hospital, delay returning to work after surgery and also reduce the person's quality of life. The possible cause may b cerebral micro emboli (atheroma, fat, platelet aggregates, and air), brain cell damage caused by toxic substances (like general anaesthesia drugs) or hypoxia or surgery- induced release of hormones and inflammatory mediators. Postoperative cognitive dysfunction have significant impact on patients' quality of life , functional independence and overall health outcomes. Patient with postoperative cognitive dysfunction may experience difficulties with daily activities, social interactions and cognitive tasks, leading to decreased quality of life and increased healthcare utilization. The time frame of onset of POCD remains undefined, but it can be detectable from 7 days after surgery. Transient cognitive deficits immediately after surgery have multifactorial causes (emergence from anaesthesia, sleep deprivation, pain, anxiety, polypharmacy, inadequate nutrition and operative complications), and these causes, alongside postoperative delirium, will significaly undermine neurophysiological testing for POCD. It is our belief that changes in cognition earlier than 7 days after surgery cannot be accurately tested and attributed to POCD. Neuroimaging has been studied to discern brain alterations related to POCD. A systematic review found weak evidence to suggest

that POCD correlates with reduced thalamic volume, reduced hippocampal volume, pre- existing white matter pathology and reduced blood flow. With a commitment to appropriate testing and consent that leads to robust research methodology, there will be increasing strength of evidence to confirm which adjustments to anaesthetic management do indeed give the patient the best quality of life after surgery .Postoperative cognitive dysfunction (POCD) denotes a decline in neurocognitive function following anaesthesia and surgical procedures, constituting a complication of the central nervous system. POCD manifests primarily as reduced memory, attention, language fluency, orientation, and social skills after surgery . Since its inception, substantial research has been conducted on POCD; however, a universally acknowledged specific pathogenesis remains elusive. Currently, it is widely accepted that POCD arises from the confluence of various factors, including patient age, surgical type, anaesthesia modality, and pain intensity. Moreover, studies indicate that POCD may persist for weeks to years, impacting patient recovery, prolonging hospitalization, and potentially leading to additional physical and mental ailments, heightened mortality, and significant burdens on patients and their families. The ongoing trend of population aging, coupled with economic development, poses a challenge for anaesthesia surgery, with an increasingly aged patient population. As patients undergoing surgery grow older, the likelihood of developing postoperative cognitive dysfunction rises. Consequently, addressing the identification and prevention of POCD has become a paramount concern. This article reviews POCD, risk factors, and potential prevention strategies, while offering insights into future prospects for POCD prevention and treatment.

DISCUSSION

Short-term postoperative cognitive impairment typically affects attention, memory, and psychomotor speed. POCD has substantial implications on quality of life and socioeconomic functioning, especially in older adults. Although not officially recognized in the DSM-5-TR, POCD is diagnosed based on changes in neuropsychological test scores before and after surgery. These tests evaluate a wide range of cognitive domains. Interestingly, patient-reported symptoms are not always consistent with test outcomes. Age remains the strongest risk factor. Initial studies on CABG patients showed a 36% incidence of POCD at 6 weeks and 42% at 5 years. In non-cardiac surgeries, POCD occurred in 26% of patients over 65 within 1 week, and in 10% by 3 months. However, newer studies question the correlation between cardiovascular risk factors and POCD, suggesting that outcomes may be influenced by a wider array of perioperative variables. Chronic POCD—though affecting a small proportion (about 1%)—is associated with increased 1-year mortality. Risk factors include:

- Age (Odds Ratio [OR]: 2.58)
- Postoperative infections within 3 months (OR: 2.61)
- POCD presence at 1 week post-surgery (OR: 2.84)

Symptoms of POCD includes; Memory loss (difficulty recalling events, conversations, or appointments) , Attention deficits (trouble concentration), Executive dysfunction (difficulty with planning, decision- making, or organizing), Slowed processing speed(sluggish mental activity, delayed reaction times)

DIAGNOSIS

Diagnosing POCD is challenging due to its subtle onset. Comprehensive neuropsychological testing remains the gold standard, although it is resource-intensive.

Prevention

1. Optimizing Anaesthetic Protocols – Using minimal effective dosages and avoiding agents like benzodiazepines or anticholinergics
2. Reducing Surgical Stress – Minimally invasive surgeries and improved perioperative pain management
3. Preoperative Cognitive Training – Cognitive exercises to boost reserve capacity

Anaesthesia and POCD: General vs Regional

The impact of anaesthesia on POCD is not fully understood. While general anaesthesia has been associated with a higher risk, studies comparing procedures under general vs regional anaesthesia have not consistently shown a significant difference. For instance, POCD incidence at 3 months was similar in patients undergoing coronary angiography under general anaesthesia and total hip replacement under spinal anaesthesia.

CONCLUSION

POCD predominantly occurs in the early postoperative period, especially among the elderly. While most cases are reversible, a minority may suffer persistent cognitive impairment. No specific anaesthetic practice has yet been proven to prevent POCD, and no effective treatment is currently available. More research is needed to identify modifiable risk factors and develop targeted interventions. By prioritizing patient- centred care and multidisciplinary collaboration, healthcare professional can work towards minimizing the risk of POCD and improving outcomes for patients undergoing surgery.

REFERENCES

[1] Newman, S., et al. (2014). Postoperative cognitive dysfunction after noncardiac surgery: a systematic review. *Anaesthesiology*, 120(3), 633–644.

[2] Steinmetz, J., et al. (2011). Long-term consequences of postoperative cognitive dysfunction. *Anesthesiology*, 114(5), 941–950.

[3] Crosby, G., Culley, D. J., & Hyman, B. T. (2011). Preclinical studies of postoperative cognitive dysfunction: what is needed? *Anesthesiology*, 114(5), 951–953.

[4] Evered, L., et al. (2018). Recommendations for the nomenclature of cognitive change associated with anaesthesia and surgery. *Journal of Alzheimer's Disease*, 61(2), 533–546.

[5] Rasmussen, L. S., et al. (2003). Does anaesthesia cause postoperative cognitive dysfunction? A randomised study of regional versus general anaesthesia in 438 elderly patients. *Aesthesia & Analgesia*, 96(4), 1105–1111.

[6] Whitlock, E. L., et al. (2014). Postoperative cognitive dysfunction in older adults: a systematic review. *Aesthesia & Analgesia*, 119(3), 631–643.

[7] Monk, T. G., et al. (2008). Predictors of cognitive dysfunction after major noncardiac surgery. *Anesthesiology*, 108(1), 18–30.

[8] Deiner, S., & Silverstein, J. H. (2009). Postoperative delirium and cognitive dysfunction. *British Journal of Anaesthesia*, 103(Suppl 1), i52–i61.

[9] Moller, J. T., et al. (1998). Long-term postoperative cognitive dysfunction in the elderly: ISPOCD1 study. *The Lancet*, 351(9106), 857–861.

[10] Funder, K. S., et al. (2009). The postoperative cognitive dysfunction phenomenon: is it a real syndrome? *Aesthesia & Analgesia*, 109(4), 1162–1169.

[11] Radtke, F. M., et al. (2010). Risk factors for inadequate emergence after aesthesia: emergence delirium and hypoactive emergence. *Deutsches Ärzteblatt International*, 107(36), 591–597.

[12] Silverstein, J. H., et al. (2007). Central nervous system effects of aesthetics in the elderly. *Aesthesia & Analgesia*, 104(2), 438–442.

[13] Culley, D. J., et al. (2017). Postoperative cognitive dysfunction: the current state and future directions. *Current Opinion in Anaesthesiology*, 30(5), 568–573.

[14] Berger, M., et al. (2015). Perioperative neurocognitive disorder: a new nomenclature for perioperative cognitive impairments. *British Journal of Anaesthesia*, 115(Suppl 1), i32–i39.

[15] Wang, N. Y., et al. (2007). Long-term cognitive decline after coronary-artery bypass surgery. *Anesthesiology*, 107(3), 401–411.