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Educational Corner

Postoperative Cognitive Dysfunction after Total Hip Arthroplasty: Educational Corner

Amir Hossein Karimi[1], Yousef Fallah[2], Mohammad Soleimani[3], Amir Salar Nourbakhsh[3], Seyyed Hossein Shafiei[2,*]

[1] Medical Student, Case Western Reserve University School of Medicine, Cleveland, OH, USA
[2] Assistant Professor, Orthopedic Surgery Research Center (OSRC), Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
[3] Orthopedic Assistant, Orthopedic Surgery Research Center (OSRC), Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran

[*] Corresponding author: Seyyed Hossein Shafiei; Orthopedic Surgery Research Center (OSRC), Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98-21-63120000, Email: dr_hshafiei@yahoo.com

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Background

Total hip arthroplasty (THA) is one of the most widely performed surgical procedures and one of the most cost-effective and reliably successful orthopedic surgeries (1, 2). THA produces consistent results, including pain alleviation, functional restoration, and enhanced quality of life. Although the advantages exceed the disadvantages, these procedures are not without problems (3, 4). A rare complication that occurs is postoperative cognitive dysfunction (POCD).

POCD is a neurological impairment that can cause difficulties with memory, attention, focus, function, and learning after major surgery and anesthesia (5, 6). Poor functional recovery, extended hospital stays, hospital costs, the need for long-term rehabilitation, and mortality are all associated with POCD (7-9). In contrast to delirium, which often manifests as acute and variable disturbances of consciousness 24 to 72 hours following surgery, POCD is a more persistent issue linked to a change in cognitive function (10). The pathophysiology of POCD is unknown and can occur either within the first-week post-op (early) or within 3 months (late); there have also been incidences of POCD that have occurred within 12 months.

The reported incidence rate of POCD varies greatly with a median rate of 19.3% for early POCD, 10% for late POCD, and 2.8% for studies that reported the one-year incidence of POCD (11). One of the main reasons for this variability is that there is no one specific definition or test that is used to determine the diagnosis of POCD among studies. The most common used diagnostic tool is the Mini Mental State Examination (MMSE); however, because it was designed to detect patients with dementia, it is not a highly descriptive tool for measuring perioperative cognition or specific cognitive impairment (12).

With THA rates continuing to rise, it is critical to identify the characteristics that put patients at increased risk for POCD in order to risk stratify and implement tailored therapies to either avoid POCD or lessen its severity. In the present study, we aimed to review the literature and proffer the essential information about POCD in patients who have undergone THA.

Risk Factors

Demographics: Demographic factors can play an important part in determining patients that are prone to POCD. Multiple studies have reported that older patients (age range: 65-82 years) were more likely to develop POCD compared to younger patients (13-16). Krenk et al. reported that in patients above the age of 60 who had undergone fast-track THA and total knee arthroplasty (TKA), there was no relationship between sex and POCD (7).

Preoperative Cognitive Disorder: In the study by Krenk et al., it was also reported that in the research population (n = 225), those with higher MMSE score preoperatively were more likely to develop early POCD (7). Similarly, Yan et al. demonstrated in their prospective cohort study on 998 patients that patients with preexisting neurocognitive impairments based on the MMSE score had a higher risk of developing POCD three months post-surgery (15). However, it is important to note that the MMSE test is utilized to detect patients with dementia and as a result, may not accurately represent other neurocognitive impairments.

Frailty: Preoperative frailty is associated with poor postoperative outcomes for multiple surgeries. Evered et al. used the Reported Edmonton Frail Scale (REFS) and the comprehensive geriatric assessment-frailty index to classify their patients based on the degree of their frailty and determined that there was an association between baseline frailty and postoperative neurocognitive disorders at both 3 months and 1 year (17).

Opioid Usage: Awada et al. performed a prospective study with 104 patients undergoing fast-track hip and knee arthroplasty. Only 4 of their patients developed, all of whom consumed higher doses of opioids in both the acute postoperative period (0-3 days) and during the 2-3-week study period compared to the POCD-negative patients. Given the fact that there were only four patients, this association is not strong and more studies are required to confirm it (18).

Genetics: In a clinical trial, Li et al. extracted peripheral leukocyte deoxyribonucleic acid (DNA) and assessed DNA methylation using enzyme-linked immunosorbent assay (ELISA) in patients having hip arthroplasty. They reported that there was no association between baseline DNA methylation and the risk of developing POCD. However, they demonstrated that patients who acquired POCD had considerably lower 5-methylcytosine levels 7 days after surgery than those who did not (19).

Perioperative Factors: Ji et al. recognized several cerebrospinal fluid (CSF) biomarkers associated with higher risk of POCD. They revealed that high levels of interleukin-1β (IL-1β), tau/amyloid-β-42 (Aβ-42), phosphorylated tau (p-tau)/Aβ-42, and a lower level of Aβ-42 in CSF preoperatively was higher in patients with POCD compared to those without POCD. In addition, plasma malondialdehyde (MDA) levels at day 7 were higher in patients who developed POCD (20). In a study by Lin et al., it was found that a drop of greater than 11% in the maximum percentage drop or regional cerebral oxygen saturation at 7 days was a potential predictor for POCD (13).

Blood: A study by Li et al. reported that in elderly patients undergoing THA, those with A blood type were more likely to develop early POCD, while those with O blood type were at a lower risk of developing POCD (21). Those with AB or B blood type did not have higher or lower risk of developing POCD. Moreover, Zhu et al. demonstrated that in patients above the age of 65, perioperative blood transfusion of more than 3 units was an independent risk factor for POCD 7 days postoperatively following THA (16).

Sleep Quality: There is a limited amount of literature available that discusses the methods that could help prevent or mitigate the severity of POCD after THA. In a randomized control study, Fan et al. demonstrated that MMSE scores did not change in patients that received 1 mg oral melatonin daily 1 hour before sleep the day before operation and for another 5 postoperative days compared to those who received placebo. They believed that this was due to the restoration of the regular function of circadian rhythm with normal sleep state after surgery which suggests that poor sleep quality could be a risk factor for POCD (22).

Conclusion

POCD is thought to be a rare complication of THA, although studies have shown that POCD can occur at high rates and can develop 1 year after surgery. Multiple factors have been associated with POCD; however, the majority of these studies were conducted with small populations and have not been replicated. According to most research, older age appears to have a strong association with the risk of developing POCD. As the global prevalence of THA is expected to climb further (23), it is critical to conduct higher-quality research to discover not only the risk factors linked with POCD, but also prophylactic approaches that can avoid POCD.

Conflict of Interest

The authors declare no conflict of interest in this study.

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