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Perspective: Superiority of Regional or General Anesthesia for Hip Replacements

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Abstract

There are different institutional practices regarding use of regional or general anesthesia during total hip arthroplasties. This Perspective reviews our current understanding of the literature surrounding the efficacy and utility of both anesthesia techniques, as well as the gaps in research and future directions of the field.

Keywords

Spinal anesthesia, Regional anesthesia, Hip arthroplasty, Perioperative outcomes, Neuraxial anesthesia

Abbreviations

AMS: Altered Mental Status; aOR: adjusted Odds Ratio; CI: Confidence Interval; CVA: Cerebrovascular Accident; DVT: Deep Vein Thrombosis; ICU: Intensive Care Unit; LMWH: Low Molecular Weight Heparin; LOS: Length Of Stay; MI: Myocardial Infarction; OA: Osteoarthritis; RCT: Randomized Control Trial; SSI: Surgical Site Infection; THA: Total Hip Arthroplasty; TJA: Total Joint Arthroplasty; TKA: Total Knee Arthroplasty; UTI: Urinary Tract Infection; WMD: Weighted Mean Difference

Introduction

Between 1990 and 2019, the prevalence of hip osteoarthritis (OA) increased more than doubled, with an increase from over 247,000,000 to over 527,000,000 people worldwide [1]. While OA is by far the most common arthropathy, people suffer from other types of hip arthropathies such as rheumatoid and psoriatic arthritis, systemic lupus erythematosus, and ankylosing spondylitis. When conservative management doesn't work, the standard of care treatment for end-stage hip arthropathies is surgical intervention with total hip arthroplasty (THA), typically performed under either general or regional anesthesia. In 2010 it was estimated that 2.34% of US adults over the age of 50 had received a THA, with a retrospective sample between 2006 and 2015 finding over 3,200,000 people who received either a THA or a revision THA for failed THA [2]. As the national and global population continues to age, this number that is only expected to rise will lead to increased burdens and costs on our healthcare system.

Furthermore, while hip fractures are typically treated with hip hemiarthroplasty, THAs may sometimes be used for surgical treatment. Although the incidence of hip fractures is declining due to various factors, the number of hip fractures in the United States is still expected to increase 1.9-fold by the year 2050, potentially leading to an increase in THA procedures performed [3].

Discussion

Effects on post-operative complications

A multitude of data exists on the varying efficacy of either spinal or general anesthesia for THA operations, with a wide variation in study results reported. Such data often looks at a variety of factors including mortality, surgical site infections (SSI), deep vein thrombosis (DVT), myocardial infarction (MI), stroke, and hospital length of stay (LOS). In one 2016 meta-analysis of 13 studies comprising over 350,000 patients who underwent THA or total knee arthroplasties (TKA), neuraxial anesthesia was significantly associated with a reduction of postoperative surgical site infections compared to general anesthesia (OR = 0.84; 95% CI 0.76 to 0.92; P < 0.001) [4]. Another analysis of 21 randomized control trials found that regional anesthesia reduced operating time (aOR -0.19, 95% CI -0.33 to -0.05), the need for transfusion (OR 0.45, 95% CI 0.22 to 0.94), and thromboembolic disease (OR 0.45, 95% CI 0.24 to 0.84) [5]. While an investigation by Pu and Sun (2019) did not find a difference in blood loss and DVT occurrence in their analysis of 5 RCTs, they did note a significant reduction in nausea occurrence (RR 3.04, 95% CI 1.69 to 5.50) and LOS (WMD 1.00, 95% CI 0.59 to 1.41 days) in spinal compared to general anesthesia [6].

In addition, several studies have replicated similar findings in specific patient populations. Among a data analysis of 30,000 patients with sleep apnea, Memtsoudis, et al. (2013) found lower rates of complications postoperatively in neuraxial anesthesia, compared to combined neuraxial and general or general (16.0%, 17.2%, 18.1%) [7]. A study conducted

on US veterans showed a lower risk of cardiac, renal, and pulmonary complications (AOR 0.74, P < 0.001; AOR 0.75, P = 0.03; AOR 0.62, P = 0.01) with neuraxial as opposed to general anesthesia, in addition to reduced LOS [8].

Effects on mortality and morbidity

Evaluation of over 380,000 patients by Memtsoudis, et al. (2013) found significantly lower 30-day mortality in addition to decreased incidence of prolonged LOS, cost, and postoperative complications [9]. Similarly, a retrospective study of almost 97,000 patients for elective THA by Knio, et al. (2023) did not find a significant mortality difference and showed that spinal anesthesia was associated with lower unplanned resource utilization, systemic complications, bleeding events requiring transfusion, and LOS compared to general anesthesia (P < 0.001 for all) [10]. Decreased length of stay when using regional anesthesia compared to general anesthesia was found in other studies as well [8,11,12]. Analyses encompassing thousands of THA patients have corroborated findings of decreased post-operative morbidity [13] and pulmonary complications, such as ventilator dependence, pneumonia, and unplanned intubation [14].

Findings to support non-superiority of regional anesthesia

Despite the seemingly strong evidence pointing towards benefits of regional anesthesia, not all research is concordant with these findings. Several studies have suggested that there may not be a significant difference in outcomes between neuraxial and general anesthesia. One of the meta-analyses is a 2016 review of the Cochrane database, based on 31 individual studies with data examined on 2976 patients. While not every study included each measurable data point, those that were analyzed did not show a significant difference in regional vs. general anesthesia in mortality at one month or risk of pneumonia, MI, CVA, or AMS. The study did find a difference in the rate of DVT when no prophylactic anticoagulation was administered, however this distinction disappeared when LMWH was given after surgery [15]. Although the nature of the study was a meta-analysis, the authors did note that the sample size was insufficient to make robust conclusions. The 2021 REGAIN trial, an RCT conducted on 1600 patients 50 or older, did not find a significant difference in regional vs. general anesthesia in the death or the ability to walk 60 days after surgery or in the incidence of delirium [16]. Likewise, the Southeastern Chinese RAGA trial in 2022 similarly found no difference in delirium incidence when comparing general vs. regional anesthesia [17]. It is important to recognize that these two prospective studies were focused on patients with hip fractures, different from the typical OA population undergoing elective THA. The use of spinal anesthesia in hip fracture patients also offers unique technical challenges due to varying requirements in patient positioning as compared to OA patients.

While Yap, et al. (2022) found reduced pain, analgesia requirements, and incidence of PONV in neuraxial anesthesia, they did not find a significant difference in major (MI, DVT, PE, stroke, death, renal failure) or minor (SSI, pneumonia, UTI) complications with general anesthesia compared with neuraxial anesthesia [18].

Findings to support superiority of general anesthesia

In addition, a minority of publications found that use of regional anesthesia may be inferior to general in some respects. For example, a study of over 2,000 Japanese patients by Nakamura, et al. (2017) found the relative risk of postoperative venous thromboembolism in patients receiving spinal anesthesia to be 1.48 (95% CI 1.18 to 1.85) compared to those receiving combined epidural and general anesthesia [19]. However, it is worth noting that patients under the combined epidural and general anesthesia have the benefit of neuraxial anesthesia in addition to general anesthesia. The aforementioned 2022 study by Yap, et al. also found that general anesthesia was associated with a shorter mean recovery room LOS but a decrease in same-day discharge (33% vs. 23.4%; P < 0.01) [18].

Potential contribution of contemporary anesthesia techniques

One possible reason for this discordance in findings is the difference in the type of used anesthetics and anesthetic techniques over the years. The use of a contemporary general anesthesia protocol among 1527 patients receiving THA or TKA was found to lead to decreased LOS, ICU need, and postoperative readmission, suggesting an improved efficacy of GA in the modern setting in a 2019 publication [20]. A retrospective review of over 6000 Canadian patients found no difference in 90-day mortality among regional anesthesia patients compared to those with general anesthesia, but did note a decrease in blood transfusion need and an increase in LOS [21]. This is in contrast to a 2016 meta-analysis containing 10,448 patients, which found a decrease in LOS associated with neuraxial anesthesia, despite no differences in other major or minor complications [22].

Economic considerations

In addition to peri- and post-operative complications, there are a variety of other factors that should be taken into consideration by physicians when deciding whether to pursue general or regional anesthesia for a patient. Given that THA is no longer considered an inpatient-

only procedure by Medicare/Medicaid, the duration of LOS - a factor representing both clinical outcomes and significant cost to the healthcare system - is an important consideration [23]. Outpatient TJAs have been found to have both lower complication rates and increased cost savings when compared to inpatient TJAs [24]. An analysis of over 370,000 patients from 2006-2014 found a reduction in hospitalization cost of 15.6% (95% CI, 7.7 to 22.8) when neuraxial anesthesia was used compared to general in THA patients [25]. Furthermore, the overall decrease in complications associated with regional anesthesia use may provide a fiscal benefit, as shifting insurance practices that award increased reimbursement for improved patient outcomes becomes more commonplace.

Patient preferences

However, despite the economic considerations, the push towards outpatient THA procedures may be antithetical to patient wishes. An analysis of 725 TJA patients by Pagani, et al. (2022) found that while 59.9% of patients would feel comfortable with same-day discharge, 64.6% would prefer to stay in the hospital if possible. However, of the minority that desired same-day discharge TJA, 45% were willing to endure increased costs out of pocket and more than half were willing to travel farther and wait longer for a surgery date [26]. Understandably, certain patients may be concerned that changes in anesthesia use may be driven primarily by financial reasons. However, data obtained during the COVID pandemic showed that despite increases in outpatient facility usage for TJAs (21% versus 7%, $P < 0.001$), there was not a statistically significant difference in patient outcomes or incidence of readmissions [27].

Conclusion

While conclusions regarding superiority of regional or general anesthesia cannot be definitively made, the current aggregated body of literature suggests improved side effect profiles, complication risk, mortality risk, length of stay, and cost when regional anesthesia is used for THAs compared to general anesthesia. However, more randomized control trials evaluating general and regional anesthesia usage in THA are needed to fully evaluate the benefits of each of these techniques. While there are a few RCTs published in this field [16,17], the majority of data is retrospective and thus poses difficulties in establishing more causal relationships and introduces confounding factors. Furthermore, as has been noted, studies focused on the utilization of modern general anesthesia protocols may provide an updated view of the efficacy of GA in THAs. In addition, much of the current data available has a broad study population of TJAs as a whole, comprising of both THAs and TKAs, instead of solely THAs. Also, the study population may include elective THA vs. THA after hip fracture. There is also a dearth of evidence looking at select patient populations with specific comorbidities. By focusing research on THAs solely and looking at specific populations with conditions common across the country, it may be possible to generate data with greater generalization of the findings that can be more easily applied to the patients.

There are several interdisciplinary areas of further study within this debate. The psychological state of patients undergoing major surgery may have a large impact on their appraisal of the event and their subjective outcomes. A 2018 study of 499 patients by Celik and Edipoglu found that patients undergoing general anesthesia had higher anxiety scores on the Amsterdam Preoperative Anxiety and Information Scale (APAIS) than those who underwent regional anesthesia ($P = 0.029$). It is worth noting that this analysis was on participants who underwent various types of elective surgery. There is also evidence implicating potential disparities in access to care received for THAs among different racial groups. 2019 data from a NSQIP retrospective review showed decreased occurrence of outpatient THA in white patients compared to black patients (10.2% versus 5.9%) [28], implicating potential disparities in access to care among different racial groups. Given the potential relationship between anesthesia use and same-day discharge, it is possible that anesthesia use may have some role in the interpretation of this finding.

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Conflicts of Interest

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