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Katherine Pozzo

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Neuraxial Anesthesia for Total Joint Arthroplasty

Katherine Pozzo

Southern Illinois University Edwardsville

Executive Summary

Introduction

Total joint arthroplasty is one of the most common surgical procedures performed in the United States. Exponential future growth is expected due to our aging patient population, the obesity epidemic, and continued improvements in surgical techniques. Despite advances, orthopedic surgeries continue to be taxing on the body and can produce significant complications. Furthermore, the patient population that undergoes these procedures can suffer from a wide range of comorbidities and requires careful anesthetic administration and titration to ensure optimal recovery. General anesthesia for these procedures has been associated with increased postoperative complications, including enhanced risk for deep vein thrombosis, blood loss, and postoperative nausea and vomiting (Pellegrini, 2018). In direct comparison, neuraxial anesthesia has demonstrated superior outcomes, including reduced blood loss, DVT, and PONV risk (Pellegrini, 2018). Most notably is a proposed reduction in postoperative opioid consumption due to enhanced pain control via the neuraxial modality. Neuraxial anesthesia has become regarded as the superior anesthetic technique for total joint arthroplasty.

Despite solid evidence, not every institution or provider readily promotes neuraxial anesthesia for total joint arthroplasty. A critical access hospital in Illinois required a more uniform approach and practice methodology for total joint arthroplasty. This quality improvement doctoral nursing project sought to provide a sustainable and data-driven change process for the institution. The main objective of this project was an improvement in postoperative pain scores and the implementation of best practice guidelines regarding total joint arthroplasty.

Literature Review

A multitude of articles with similar themes was identified via a comprehensive literature review on total joint arthroplasty. These themes revolve around outcome measures such as complication rates, pain control, postoperative cognitive dysfunction, length of stay, cost, timing, ERAS protocols, and the sympathetic stress response.

A study by Warren et al. (2020) revealed statistically significant ($p < 0.05$) enhanced risk for overall complications and a non-home discharge in the general anesthetic group versus neuraxial anesthetic group. An overview of nine Cochrane systematic reviews suggested reduced zero to 30-day mortality for neuraxial anesthesia compared to general anesthesia in patients with intermediate to high cardiac risk (Guay et al., 2016). Decreased length of stay ($p = 0.0001$) was identified by Van Waeberghe et al. (2017), which was a consistent element found in multiple studies. A study by Fergoso et al. (2019) stated that the combination of regional and neuraxial anesthesia could be used in a multimodal approach to prevent chronic postsurgical pain development, a concern specifically tied to joint arthroplasty since the development centers around chronic pain and acute untreated surgical pain. Mason et al. (2010), in a systematic review with a meta-analysis, revealed that general anesthesia compared to neuraxial anesthesia does marginally enhance the risk of developing postoperative cognitive dysfunction, a growing concern among our aging patient population. Cost and timing did not appear to be pertinent factors for choosing one modality over the other. As such, it was noted that a neuraxial technique did not create operating room time constraints or enhanced cost to the patient or institution. Furthermore, ERAS protocols, which are becoming standard of care, consistently embraced neuraxial anesthesia for joint arthroplasty in the literature. The reduced sympathetic stress

response that neuraxial anesthesia is proposed to provide continues to find scientific pertinence in recovery and healing.

Project Methods

The design of this doctoral nursing project had the main focus on quality improvement and was non-experimental. The main goal of this project was an improvement in postoperative pain scores. Stakeholders included the institution, all anesthesia personnel, and orthopedic surgeons. A human subjects protection approval was obtained from the Institutional Review Board at Southern Illinois University of Edwardsville. Additionally, the project complied with all policies set forth by the stakeholder institution.

The sample population was a sample of convenience and included eligible adult patients undergoing total joint arthroplasty. Any individuals with contraindications to neuraxial anesthesia or those who refused were exempt from the process change. Collected data figures included patient age, patient sex, type of surgery, anesthetic, postoperative pain score, postanesthesia care unit (PACU) time, and length of stay. All data figures were kept secured and locked to protect personal patient information.

The initial retrospective chart review sought to determine the difference in pain scores, length of stay, and postoperative care unit time between individuals receiving neuraxial anesthesia for total joint arthroplasty versus those that underwent a general anesthetic. After this initial data gathering, anesthesia providers at the facility were encouraged to provide neuraxial anesthesia as the primary anesthetic choice for total joint procedures over the Summer of 2021.

After several weeks, a prospective chart review was conducted to compare and contrast the obtained data. A final presentation was created using evidence obtained from the extensive literature review and was conducted for all anesthesia and surgical staff in the Summer of 2021.

The goal of the presentation was to identify if the process change was successful and determine if the primary outcome measure of reduced postoperative pain scores was met. In addition, disseminated surveys sought the presentation's relevance, applicability, and if the information promoted adherence to the proposed practice change.

Evaluation

The retrospective chart review demonstrated significantly higher postoperative pain scores in those patients who underwent a general anesthetic, with a mean postoperative acute care unit (PACU) pain score of 4.8 out of 10. In comparison, those who underwent a neuraxial technique consistently yielded PACU pain scores of 0 out of 10. Additionally, required PACU time proved to be roughly 12.44 minutes longer in the general anesthetic group. The general anesthetic group required an average of 44.44 minutes in PACU versus 38 minutes in the neuraxial group. Also of interest was the requirement for a rescue drug in PACU. This additional medication occurs when a patient typically requires opiate intervention due to severe postoperative pain. The general anesthetic group required rescue in 5 out of 9 cases, whereas the neuraxial anesthetic group required no further intervention. In this project, the length of stay did not demonstrably favor the neuraxial technique over general anesthesia.

The final meeting was presented to five surgical staff employees, three Certified Registered Nurse Anesthetists (CRNA), and two registered nurses. The facility has five CRNA's in employment; therefore, approximately 60% of the anesthesia staff was in attendance for this meeting. Five surveys were disseminated and included a series of yes or no questions. In addition, evaluations were made regarding the presentation's relevance, whether the evidence provided was deemed applicable to practice, and if the information promoted further adherence

to the proposed practice change. Of the five surveys disseminated, 100% of attendees stated that the process change was deemed relevant and valuable for the institution.

Buy-in was a particular barrier that was crucial for full project implementation. Despite an initial plan to pursue total neuraxial anesthesia where applicable, reluctance towards the change process was evident concerning surgeon buy-in. Another implementation barrier was due to the small sample size and lack of a larger pool for verifiable data. The critical access hospital involved in the change process does not perform total joint arthroplasty daily, which limited the size and power of the study.

Impact on Practice

Despite the limited sample size (n=13), the change process revealed applicable and real-time data to the anesthesia providers. It helped cement the stance that neuraxial anesthesia is superior for total joint arthroplasty. Despite the need for further buy-in from the participating surgeons, the data consistently revealed better outcomes for those patients who received a neuraxial anesthetic. Ideally, the anesthesia providers can utilize these results to convince the surgeons to change their practice at this facility.

Reduced postoperative pain scores, PACU time, and total narcotic consumption for the patients who received a neuraxial anesthetic were evident. In our current healthcare industry, reduced complication rates benefit both the patient and the healthcare system. These benefits can reduce costs, reduce morbidity and mortality, and improve patient satisfaction. Creating a positive experience for the patient, with reduced postoperative pain and the need for opiate consumption, promotes positive well-being and holistic care for our patient populations.

Conclusion

Principally, this project demonstrated superior results concerning reduced postoperative pain scores when neuraxial anesthesia was provided for total joint arthroplasty procedures. Despite barriers to implementing this project, both the survey results and the chart review figures demonstrated the relevance and applicability of continuing this process change at the facility at hand. Additionally, multimodal analgesia, anticipatory antiemetics, local infiltration analgesia, and peripheral nerve blockade combined with a short-acting spinal technique demonstrated excellent success rates for total joint arthroplasty.

Author Contact Information

Katherine Pozzo, RN, BSN, NA-DNP student

SIUE email address: kpozzo@siue.edu

Personal email address: kmdobihal@gmail.com