Spring 5-6-2022

The Development of an Evidenced-Based Guideline for the Anesthetic Management of Surgical Cases Utilizing Evoked Potential Monitoring

Brent Hitchens

Darrell Risinger

Executive Summary

Introduction of the Problem

The use of intraoperative evoked potential (EP) neuromonitoring has increased from 31,762 cases in 2008 to 125,835 cases in 2014 (Laratta et al., 2018). This increase is predominantly attributed to the overall efficacy of EP monitoring and early identification of neurological morbidity. Surgeons utilize EP monitoring in a variety of surgical cases to assess the effect of anesthesia and surgery on central and peripheral nervous system electrical conductance (Laratta et al., 2018). This alerts the surgeon, anesthesia provider, and neuromonitoring technician of any changes that could potentially result in permanent neurological injury. The anesthesia staff at a tertiary care facility in central Illinois noted an increase in cases that utilized EP monitoring and expressed the need for a guideline that highlighted best practice for the anesthetic management of neuromonitoring cases. In addition, the anesthesia staff expressed particular interest in the effects of dexmedetomidine administration on EPs. Due to these important circumstances, a guideline was created to focus on best practice recommendations that supported the use of intraoperative neuromonitoring.

Literature Review

Total Intravenous Anesthesia

Total intravenous anesthesia (TIVA) is the use of intravenous agents for induction and maintenance of anesthesia. The most frequently used TIVA medications include propofol, remifentanil, alfentanil, sufentanil, ketamine, midazolam, lidocaine, and dexmedetomidine (Anderson & Bagshaw, 2019). TIVA has become increasingly more popular in recent years because of the pharmacokinetic and pharmacodynamic properties of intravenous anesthetics and the availability of short-acting synthetic opioids (Anderson & Bagshaw, 2019). Overall, the

research indicates the use of TIVA yields a more balanced anesthetic with greater hemodynamic stability which results in a more predictable and reliable general anesthetic.

Evoked Potentials

Spinal surgery places the patient at high risk of spinal cord injury due to distraction, ischemia, or compression of the nerves (Acharya et al., 2017). As a result, EP monitoring is used to assess the neural integrity of sensory and motor pathways during surgeries near the spinal cord. The monitoring of EPs is designed to prevent postoperative sensory and motor deficits in surgeries including, but not limited to, herniated or ruptured disks, spinal stenosis, spondylolisthesis, vertebral fractures, or degenerative disk disease. The two main monitoring techniques for EPs are somatosensory evoked potentials (SSEPs) and motor evoked potentials (MEPs).

Anesthesia and Evoked Potentials

Evoked potentials, including SSEPs and MEPs, can provide potential benefit in surgical procedures involving manipulation of the spinal cord. These procedures require patients to be placed under general anesthesia using a TIVA technique, as volatile anesthetic agents and neuromuscular blockers negatively affect EP readings. Volatile anesthetics are potent suppressants of EPs, particularly SSEPs. Despite their suppressant effects, studies have shown when combined with intravenous medications, low doses of inhalational agents such as 0.5 MAC (minimum alveolar concentration) have been successfully used during surgical cases without compromising the quality of EP signals (Soghomonyan et al., 2014). Conversely, neuromuscular blockers have been proven to significantly suppress MEPs and their use during EP monitoring of surgical cases is not recommended (Sachdev et al., 2020). Collectively, medications should be administered in accordance with general dosing parameters and titrated based on individualized

patient needs. Dexmedetomidine has been widely studied as an adjunct to TIVA and overall results have indicated that there is no statistically relevant change in EP amplitude or latency at therapeutic dosages (Li et al., 2016). Ultimately, the goal is to administer a drug regimen with the least adverse effect possible on EP monitoring and patient hemodynamics, which is typically accomplished by utilizing a multimodal anesthetic approach.

Project Methods

Purpose and Goals

The purpose of this project was to highlight current anesthetic best practice recommendations and create an updated guideline for EP monitoring surgical cases. The main goals of this project were to increase provider acceptance and buy-in of the updated TIVA guideline, and to increase knowledge regarding appropriate medications for TIVA for EP monitoring cases. This included recommended medication combinations, common medication dosing, and drug effects on neuromonitoring.

Project Setting

This project was implemented in the main conference room at a tertiary care facility in central Illinois. The project design was a non-experimental single-group design that consisted of a convenience sample of certified registered nurse anesthetists (CRNAs) who were available for participation at the time of project implementation.

IRB Information

The Institutional Review Board (IRB) at Southern Illinois University Edwardsville reviewed and approved this project on June 28, 2021.

Evaluation

Tools and Measures

A guideline was created for the use of TIVA for EP monitoring surgical cases at the host facility. This guideline was presented on September 24th, 2021, to all available staff on a voluntary basis. Staff members that attended the project presentation were asked to answer a thirteen-question survey to determine current knowledge and knowledge gained from the project. Survey questions targeted understanding of EP monitoring, TIVA pharmacology, and current anesthetic best practice recommendations for EP monitoring. Participants completed the survey in Qualtrics, a web-based software that allows users to create surveys and generate reports. Results were recorded and analyzed, and the data was incorporated into the final project.

Results

Demographic data showed that all participants in attendance were CRNAs. Participants had a wide variety of experience levels, ranging from 1 year to over 10 years. Although physician anesthesiologists were invited to the presentation there were no Medical Doctors of Anesthesia (MDAs) in attendance.

Questions 3-11 were formatted using a Likert style scale with 1 representing “not at all” and 10 representing “very much.” These questions assessed current knowledge and knowledge gained regarding TIVA for EP cases, as well as the utility of the guideline in the operating room (OR). Mean scores ranged from 7.5/10 to 10/10, indicating an overall positive response to the survey questions and project itself.

Participants reported a relatively high level of baseline knowledge regarding TIVA for EP monitoring (mean score of 7.5). However, this was the lowest mean score calculated, indicating a potential need for further education on the subject. Participants reported increased knowledge of TIVA pharmacology and ability to administer current best practice TIVA protocols (mean score of 9), signifying confidence in the knowledge gained from the

presentation. Participants also agreed that the guideline represented current best practice standards for anesthesia management of EP monitoring cases (mean score of 9.75), indicating a high confidence level in the data presented. When the participants were asked about new knowledge gained from the presentation a mean score of 8.75 was calculated, indicating that there was some information that participants were previously unaware of. Additionally, results indicated that providers were likely to incorporate this information into everyday practice (mean score of 9.25), that it was appropriate for the OR setting (mean score of 9.75), and that the guideline was user friendly (mean score of 10). These results indicate that that the guideline could be understood and used by all providers that it was intended for.

The survey concluded with a series of open-ended questions that addressed the effectiveness of the presentation and information provided. Participants reported that the medication dosing guideline for EP monitoring was the most important part of the presentation. This finding highlighted the efficacy of the updated guideline since a laminated copy could be added to every OR for easy access. One participant stated that caution should be used with dexmedetomidine since some of the surgeons prefer a higher dose propofol infusion instead. This statement shows that for a project of this nature to be completely successful surgeon participation and buy-in is essential, and surgeons need to be involved in future projects.

Limitations

The most significant limitation to this project was the sample size, with only four providers being present during the initial presentation. This was mainly attributed to scheduling difficulties and the inability for working providers to attend, as this presentation took place during normal working hours. Future projects may benefit from presenting on a late-start day in the OR where more providers would be available for a morning meeting. Lack of MDA and

surgeon presence was also a significant limitation, as their buy-in is essential to the success of this project.

Impact on Practice

The results of the project revealed a strong desire to adopt the updated evidence-based guideline into everyday practice. The adoption of this guideline has the potential to positively affect patient safety and improve outcomes. This guideline gives providers the tools to provide optimal anesthetic conditions for EP monitoring while also promoting rapid emergence from anesthesia.

Conclusion

Proper dosing and administration of anesthetic agents during TIVA for EP monitoring surgical cases is imperative to ensuring positive patient outcomes. Despite performing many neuromonitoring cases per year, the host facility's current TIVA guideline required updating with the current best practice standards. The goals of this project were to update the current TIVA guideline and educate the anesthesia staff regarding pertinent pharmacology and anesthetic considerations for EP cases. A post-implementation survey assessed the participants' current knowledge regarding TIVA for EP cases, knowledge gained, utility of the guideline, and the probability of incorporating the guideline into daily practice. Overall results were positive and demonstrated that presentation and guideline were effective tools that could aid in the facility's ability to administer optimal anesthesia for EP surgical cases. Adoption and incorporation of this guideline in clinical practice has the potential to both improve patient outcomes and increase provider confidence in administering anesthetic agents for these important procedures.

Author Contact Information

Brent Hitchens, MSN, SRNA
bhitche@siue.edu
618-318-6900

Darrell Risinger, BSN, SRNA
drising@siue.edu
636-375-8947