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## A Comparison of Erector Spinae Plane Block and Epidural Analgesia for Major Abdominal Surgery

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## **Executive Summary**

### **Introduction of the Problem**

Peripheral nerve blocks have grown in popularity for perioperative pain management as they are associated with a reduction in post-operative pain scores, physiological stress response, postoperative opioid consumption, general anesthesia requirements, and postoperative nausea and vomiting (Madison & Ilfeld, 2013; Thompson, 2018; Tsui & Rosenquist, 2017). General anesthesia with thoracic epidural analgesia has historically been the gold standard for patients undergoing major abdominal surgery (Du et al., 2020). However, the erector spinae plane (ESP) block is a novel regional nerve block that is a viable alternative to epidural analgesia for abdominal surgeries (Forero et al., 2016; Kot et al., 2019). With the convivence of ultrasound and long-lasting amide local anesthetics, the ESP block can play a key role in enhanced recovery pathways. Still, the safety of either treatment depends on vigilant monitoring and management. A large tertiary care center in central Illinois saw an increase in ESP block administration for patients who underwent abdominal surgery, but many anesthesia providers were not thoroughly informed about the ESP block. This project aimed to use current literature to develop a comprehensive educational program to teach anesthesia providers about the erector spinae plane block and the thoracic epidural to strengthen their understanding and ultimately improve patient care.

### **Literature Review**

The ESP block first appeared in the literature in 2016 and hundreds of related studies have since been published. More than 90% of ESP block studies were case reports or case series while only 2% were randomized control trials. Still, most researchers found the ESP block provided excellent pain control for abdominal procedures such as exploratory laparotomy, open and laparoscopic nephrectomy, percutaneous nephrolithostripsy, hysterectomy, gastric bypass,

gastrectomy, cesarean delivery, renal transplant, and laparoscopic cholecystectomy (Chin et al., 2017; Ciftci & Ekinici, 2019; Jain et al., 2018; Kot et al., 2019; Luis-Navarro et al., 2018; Tulgar et al., 2018). Researchers postulated that the only absolute contraindications to the ESP block are patient refusal, infection at the site of injection, and coagulopathy. Furthermore, complications of the ESP block are limited to incomplete analgesia, slight motor blockade, pneumothorax, or infection. Cadaveric studies suggested the extent and quality of the ESP block rely on the cephalocaudal spread of local anesthetic below the erector spinae fascial plane allowing the drug to reach the target nerves within the paravertebral and epidural spaces thus providing visceral and parietal pain relief (Adhikary et al., 2018a; Chin et al., 2017). The cephalocaudal spread seen with the ESP block is volume dependent, so most researchers used 20-30 ml of 0.25-0.5% bupivacaine or 20-30 ml of 0.2-0.5% ropivacaine and noted a spread of up to nine vertebral levels. Adding 4-10 mg of Decadron to the block extended the duration of the ESP block by 50-75%. Additionally, researchers suggested 0.2% ropivacaine at a rate of 7 ml/hr for continuous catheter infusions (Navarro et al., 2018). For abdominal procedures, most researchers performed the block at the sixth, seventh, eighth, or ninth thoracic vertebral level as it provided consistent spread to cover the T4-L3 dermatomes (Chin et al., 2017; Ciftci & Ekinici, 2019; Jain et al., 2018; Kot et al., 2019; Luis-Navarro et al., 2018; Tulgar et al., 2018). However, if the incision crossed the midline, the block needed to be performed bilaterally.

Compared to the ESP block, the epidural has a long-standing track record of providing effective analgesia for abdominal procedures (Toledano & Van de Velde, 2016). The randomized control trials included in this study found that the epidural displayed superior analgesic qualities compared to the ESP block (Adhikary et al., 2018b; Kukreja et al., 2021; Sakae et al., 2020). Additionally, adjunctive epidural therapy was associated with less PONV, postoperative ileus,

and opioid consumption while offering exceptional postoperative pain control. Researchers suggested performing a thoracic epidural for abdominal procedures to reduce the total amount of local anesthetic that is needed to block neural transmission, but the height of the block must extend to the T4 dermatome. Researchers suggested dosing the epidural with 5-20 ml of 0.2-0.5% ropivacaine or 5-20 ml of 0.25% bupivacaine. The local anesthetic can be expected to spread about one vertebral level for every milliliter injected. Most researchers speculated the epidural provides visceral and somatic analgesia through the action of local anesthetic on the nerve roots in the epidural space before they exit the intervertebral foramina on both sides of the vertebral canal (Toledano & Van de Velde, 2016). Moreover, some of the well-established complications of epidural therapy include epidural hematoma, nerve damage, significant sympathectomy, post-dural puncture headache, urinary retention, persistent immobility, postponed discharge, infection, incomplete analgesia, a total spinal requiring resuscitation and intubation, longer hospital stay, and higher healthcare costs.

According to the Centers for Medicare and Medicaid Services (2019), the total reimbursement for the ESP block is \$717 while the patient pays \$142 out of pocket if they don't have secondary insurance. Similarly, the epidural reimbursement is \$912 while the patient pays \$182. Furthermore, patients with an indwelling catheter must be assessed by an anesthesia provider daily and there is a surcharge for this service. Private insurance companies can be expected to pay significantly more than Medicare, but their billing policies are not publicly available.

## **Project Methods**

A robust educational program was presented to anesthesia providers at a tertiary regional care center in central Illinois focusing on evidence-based research concerning the analgesic efficacy of erector spinae plane block compared to epidural for patients undergoing major

abdominal surgery. This project was proposed to the Institutional Review Board at Southern Illinois University Edwardsville and received an exempt status owing to its quality improvement nature and exclusion of human test subjects. Constructivism was the pedagogical approach used for this project as it required anesthesia providers to create relationships between the concepts they already understood and the information that was presented. Each participant in attendance was given a QR code to permit access to an anonymous online pretest to assess their existing knowledge of the erector spinae plane block and epidural before the presentation. The questionnaire consisted of twenty multiple-choice questions that were derived from the material that was to be presented. The program introduced the relevant anatomy, indications, technique, advantages, and disadvantages of ESP block and epidural. Anesthesia providers were informed of the current supporting and opposing literature concerning the effectiveness of ESP block compared to epidural analgesia for abdominal surgeries as well as the risks, benefits, and costs of both adjunctive therapies. Following the presentation, participants were provided with a second QR code to allow access to the posttest consisting of the same questions as the pretest. Seven anesthesia providers in attendance participated in the data collection process.

## **Evaluation**

Using third-party survey software, the pretest and posttest results submitted by the participants were evaluated and scored for correctness. A paired-samples t-test was performed using a statistical software application to determine if the arithmetic average of the posttest was reliably higher than the mean of the pretest. Compared to the pretest results, a greater percentage of participants scored correctly on 14 of the 20 questions on the posttest. Participants demonstrated an enhancement of knowledge concerning the ESP block and epidural following the presentation. Additionally, all the participants responded correctly to 4 of the questions on both the pretest and the posttest while only one question yielded the same percentage of correct

responses, and one question yielded a lower score on the posttest compared to the pretest. Furthermore, the paired-samples t-test revealed the two-tailed P value equaled 0.0002 meaning that the posttest scores showed an extremely statistically significant improvement compared to the pretest scores. The mean for the pretest was 65% while the mean for the posttest was 86%. The inferential statistics from performing a paired-samples t-test analysis indicated that the educational program was an effective teaching method for the anesthesia providers in attendance and it would also be an effective training strategy for a different group of participants. However, the statistical power of the analysis was limited because only seven anesthesia providers in attendance participated in the data collection.

### **Impact on Practice**

The main objective of this project was to encourage anesthesia personnel at the host facility to integrate ESP block into their clinical decision-making as adjuvant analgesic therapy for abdominal surgeries. Abdominal surgeries are common procedures thus giving anesthesia providers many opportunities to integrate the knowledge they gained during the educational seminar into their clinical practice. Considering the wide dynamic range of the ESP block and epidural, this project served to improve patient care and satisfaction while reducing surgical complications and opioid consumption. A potential limitation of this project was that not all anesthesia providers at the facility performed peripheral nerve blocks, but the anesthesia group recently changed its policy and now allows all anesthesia providers who are interested to perform nerve blocks.

### **Conclusions**

An exhaustive literature review of the current evidence for the erector spinae plane block and the thoracic epidural was performed to determine their efficacy when used as adjunctive

therapy for patients undergoing major abdominal surgery. The information gathered was used to develop a comprehensive didactic curriculum that was disseminated to anesthesia providers at a large level-1-trauma-center to encourage them to integrate the ESP block into their clinical decision-making repertoire. The literature shows that the epidural remains the gold standard for pain control following major abdominal surgery, but the ESP block can be an effective alternative for patients where an epidural is contraindicated or undesirable (Adhikary et al., 2018b; Kukreja et al., 2021; Sakae et al., 2020). The ESP block appears to have far fewer complications compared to an epidural, but the safety profile of both therapies depends on vigilant monitoring and management. This project gave anesthesia providers the information necessary for them to make clinical judgments that are in the best interest of their patients thus improving patient care, safety, and satisfaction.

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