

The Decline of Thoracic Epidural Placements and Future Directions

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Abstract

There is some evidence that thoracic epidural analgesia (TEA) has been declining worldwide. This decrease, likely due to a multifactorial cause, may lead to less trainee exposure to TEA. While thoracic epidurals are still the gold standard for pain control in certain surgeries, recent studies and alternative analgesic strategies may replace the usage of TEA in these procedures, reducing the number of epidurals placed. Existing literature does not conclusively support substitution of TEA with newer analgesic methods and further research is needed. In this article, we discuss these developments and also advocate for its continued teaching as a vital anesthetic technique.

Neuraxial anesthesia procedures were first described and performed over 100 years ago. Going back as early as the 1880s, neurologist Leonard Corning first proposed injecting local anesthetic into the epidural space. Neuraxial descriptions and techniques were then further refined by physicians from all over the world. In 1901, the first caudal blocks were completed by two Frenchmen, Jean-Anthanase Sicard and Fernand Cathelin. They independently performed single injection caudal blocks with cocaine for neurologic and genitourinary procedures, respectively [1]. Twenty years later, Spanish surgeon Fidel Pages Mirave successfully performed the first single injection lumbar epidural [2]. Further refinement occurred in the 1930s, when the Italian surgeon Achille Dogliotti first described the popular loss-of-resistance technique to identify the epidural space. Through these improvements in technique, the first successful continuous lumbar epidural was described by Cuban Manuel Martinez Curbelo in 1949 [2].

Since these initial advancements in neuraxial techniques, epidural indications and uses have expanded over the decades to provide both anesthesia and analgesia for a variety of procedures including obstetric, thoracic, abdominal, and lower extremity surgeries. Epidurals can be utilized in preoperative, postoperative, as well as diagnostic and chronic pain settings. In the perioperative setting, its many benefits include decreased mortality,

reduced perioperative opioid requirements, superior analgesia compared to intravenous medications, reduced ileus, decreased pulmonary complications, and improved patient satisfaction [3,4]. In addition to local anesthetic, opioids and other adjuncts, such as clonidine or dexmedetomidine, can be added to the epidural solution to further optimize analgesia in the perioperative period [5].

While neuraxial anesthesia and analgesia remain standard of care in parturients, there is some evidence that thoracic epidural placement in the perioperative setting appears to be declining [6,7]. In a survey of trainees at major academic centers in Australia, less than half of the respondents used neuraxial analgesia in open surgery [6]. Reasons for decreased use of epidurals seem to be multifactorial. Minimally invasive surgical techniques and emergence of alternative analgesic techniques, such as fascial plane blocks, intravenous lidocaine infusion, and liposomal bupivacaine, have likely contributed to decline of thoracic epidural use. Additionally, inadequate or failed epidural analgesia may occur in up to 30% in clinical practice and may contribute to decreased use [8]. Furthermore, from a systems standpoint, many centers have limited resources to deal with the monitoring requirements and potential adverse effects of epidurals in the perioperative period, such as systemic hypotension, nerve injury, one-sided or failed blocks, and inadvertent spinal puncture headache. Contraindications such as patient anticoagulation status may also limit epidural candidacy. While alternative analgesic modalities and medications are being used, thoracic epidural analgesia (TEA) still remains the most effective analgesic technique in open laparotomies and thoracotomies, thus necessitating resident training in placement and management of TEA.

TEA remains the gold standard in open abdominal surgery and a key analgesic modality in Enhanced Recovery after Surgery (ERAS) protocols [9-11]. In addition to providing superior analgesia compared

to systemic opioids, epidurals have been shown to minimize insulin resistance and reduce protein catabolism, which is particularly useful in the immediate postoperative period of colorectal surgery during which patients resume a diet [10]. In reviewing the evidence for interfascial plane blocks, the transversus abdominis plane (TAP) may provide similar analgesia to TEA; however, the TAP block provides only somatic analgesia and only covers lower thoracic and upper lumbar dermatomes, thus missing the upper abdomen and visceral pain [12,13]. As of now, there are no known randomized control studies comparing quadratus lumborum blocks or erector spinae plane blocks, two other popular fascial plane blocks, to TEAs. Recently, the external oblique intercostal block has emerged as an alternative fascial plane block for upper abdominal surgery; however, only case studies have been published describing this block and larger studies are needed to determine its efficacy compared to TEA [14]. Regarding other systemic multimodal analgesia, intravenous lidocaine has been shown to reduce opioid consumption and possibly reduce rates of nausea and ileus compared to placebo in colorectal surgery. Whether it produces similar benefits compared to TEA in open abdominal surgery remains unclear, and the available published studies are of very low-quality evidence [11].

TEA has also been the gold standard for analgesia in open thoracic surgery. In addition to risk of postoperative pulmonary complications, patients undergoing thoracotomy can experience severe acute postoperative pain and are also at high risk of developing chronic pain [15]. While TEA efficacy has been demonstrated for decades, its potential adverse effects such as hypotension, inadvertent dural puncture, and nerve injury, have led clinicians to investigate other less invasive regional anesthesia techniques in open thoracic surgery. The ultrasound-guided erector spinae plane block (ESP), which was first described in 2016, has become a popular analgesic technique due to relative safety profile and ease of placement under ultrasound guidance. There are few published studies comparing ESP to TEA in thoracotomies, and results are inconclusive. In a pediatric thoracotomy study, patients with an ESP block were found to have similar postoperative opioid requirements as TEA [16]. However, this is in contrast with an adult study which showed that patients with TEA had significantly lower pain scores and opioid consumption compared to patients with an ESP or serratus anterior block, another fascial plane block of the chest wall [17]. More studies comparing ESP to TEA are needed to determine the utility of this popular fascial plane block as well as the role of TEA in open thoracic surgeries.

Liposomal bupivacaine is an encapsulated extended release bupivacaine that can be injected as surgical site

infiltration and has been another analgesic of interest. While it has been purported to extend analgesia for up to three days postoperatively, studies have not shown liposomal bupivacaine to be superior to standard local anesthetics in surgical site infiltration or as a perineural injection [18]. Furthermore, the cost of a liposomal bupivacaine vial is about \$365, which far exceeds that of standard bupivacaine and may be a limitation to increased usage compared to TEA [19].

Given the analgesic and mortality benefits of TEA discussed above, training programs should continue teaching and training residents on this valuable technique. While ACGME does not specify the context of the required 40 epidurals placed and managed in residency [20], residents would certainly benefit from encountering epidurals outside of labor analgesia. Although TEA have been reported to provide inadequate analgesia in up to 30% of cases, optimizing the technical aspects of the procedure and postoperative management will mostly likely increase success rates. To improve accuracy of block placement, ultrasound can be utilized to mark precise dermatome levels, locate interspinous or interlaminar space, and estimate depth at loss of resistance [8,21]. Fluoroscopic guidance has also been shown to increase incidence of proper thoracic epidural placement [22]. Pharmacologic strategies to improve TEA include adding neuraxial fentanyl to improve quality of the analgesia and decrease dose of local anesthetic needed [8]. A dedicated acute pain service can also help facilitate management of TEA postoperatively and improve efficacy. In summary, TEA is still a gold standard analgesic strategy for certain patient populations and surgeries; thus, training programs should continue to teach residents this valuable technique.

Authors Contribution

All authors have made significant contributions to this article warranting authorship. All authors participated in at least one of the following areas: Literature search, manuscript preparation, and/or manuscript review.

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