

EPIDURAL ANESTHESIA IN CONTEMPORARY MEDICINE

(A LITERATURE REVIEW)

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Abstract:

Epidural anesthesia is a fundamental technique in contemporary medicine with a significant role in perioperative pain management and anesthesiology. This literature review provides a comprehensive examination of epidural anesthesia, covering its anatomy and physiology, indications, contraindications, equipment, personnel involved, preparation, techniques, potential complications, clinical significance, and the importance of an interprofessional healthcare team approach. The review underscores its versatility as both a primary anesthetic and adjunct for pain control, emphasizing its ability to reduce the need for other anesthetic agents and analgesics, thereby minimizing potential side effects. Furthermore, epidural anesthesia is shown to have physiological benefits, including cortisol level reduction, expedited postoperative recovery, decreased risk of complications, and shorter hospital stays. The literature review highlights the need for a collaborative approach among healthcare professionals to optimize patient outcomes, making epidural anesthesia an indispensable tool in modern medical practice.

Objectives:

1. Describe the significance and advantages linked to the utilization of epidural anesthesia in the context of postoperative pain control.
2. Examine the criteria for implementing epidural anesthesia or analgesia, including indications, contraindications, the underlying anatomy, and the procedural technique.
3. Recognize the prevalent adverse effects connected with the application of epidural anesthesia or analgesia.

4. Highlight the value of teamwork and effective communication among healthcare professionals caring for patients receiving epidural anesthesia or analgesia to enhance patient outcomes.

Introduction:

Epidural anesthesia stands as a pivotal technique in modern medical practice, playing an essential role in perioperative pain management and anesthesiology. While it can be employed as the primary anesthetic, its most frequent application is as an adjunct for pain control. This versatile method can be administered either as a single dose or via continuous infusion to ensure long-term pain relief. Its significance is underscored by the fact that it not only provides effective analgesia but also minimizes the need for other anesthetic agents and analgesics, thus reducing the potential for side effects. Beyond these benefits, epidural anesthesia has been shown to lower cortisol levels, expedite the recovery of bowel function, decrease the incidence of postoperative pulmonary embolism and deep vein thrombosis, and significantly shorten hospital stays [1][2][3].

Anatomy and Physiology:

In the intricate landscape of the human body, the spinal cord and the spinal canal are key actors. While the spinal cord in adults is usually shorter than the spinal canal, terminating at L1 or L2 in most cases, it extends to L2-L3 in neonates. Below these levels, the lumbar and sacral nerves converge to form the cauda equina. Surrounding the spinal cord is cerebrospinal fluid, enveloped by the arachnoid membrane. This membrane extends caudally to varying degrees, reaching S2 in adults, S3 in children, and S4 in newborns. The spinal epidural space, where the magic of epidural anesthesia takes place, houses fatty and connective tissues, vessels, and lymph channels. Importantly, the distance between the skin and the epidural space varies based on factors such as age and weight, ranging from 4 cm in

normal-weight adults to 8 cm or more in obese patients. Within this space, the ligamentum flavum forms the dorsal boundary, and more superficially, one encounters the ligamentum interspinale (between the spinous processes), the ligamentum supraspinale (on the surface of the spinous processes), subcutaneous tissue, and skin [4].

Indications:

Epidural anesthesia finds its niche in various surgical contexts, including thoracic, major intra-abdominal, and spine surgeries, especially when muscle relaxation isn't necessary. Furthermore, it serves as an invaluable tool for intraoperative or postoperative pain management. Its application has been linked to a reduction in surgical risks and morbidity, especially in patient populations with ischemic cardiac disease. The advantages also extend to postoperative outcomes, with a noticeable decrease in lung complications and an expedited return to normal bowel function following abdominal surgery [4][3].

Contraindications:

Epidural anesthesia is not without its limits. Absolute contraindications include a patient's refusal, bacteremia, local infection at the puncture site, hemorrhagic diathesis, therapeutic anticoagulation, and increased intracranial pressure. Relative contraindications encompass significant aortic stenosis, right-to-left shunt and pulmonary hypertension, and anatomical spine deformities [4].

Equipment:

Cyberlininka.ru

In the hands of medical professionals, epidural procedures necessitate specific equipment. Epidural needles come in various designs, with the Tuohy needle being the most widely used. These needles usually have a gauge of 17 or 18 and range from 3.5 to 6 inches in length, with longer needles being suitable for obese patients. A loss of resistance syringe, made of glass or plastic, is used to detect changes in resistance within the epidural space. Epidural catheters, which can be flexible or stiff, with single or multiple openings, are employed for continuous epidural anesthesia/analgesia [5].

Personnel:

Epidural procedures are a collaborative effort, involving both anesthesiologists and nurse anesthetists [6].

Preparation:

Before commencing the procedure, a set of essential preparations are in order. This includes ensuring that emergency equipment and medications are readily available. Establishing intravenous access is crucial for fluid and medication administration if needed. Standard ASA monitors should be applied before moving forward. Depending on the situation, the patient may be positioned either in a sitting or lateral decubitus position, with back arching to optimize exposure of the intervertebral interspaces. Maintaining aseptic techniques while managing the disposable epidural kit and field preparation is imperative [4].

Technique:

Medial (Midline) and Paramedian Approaches:

In the medial approach, the needle is inserted between the vertebral spinous processes. After injecting lidocaine 1% into the skin and underlying tissues to achieve local anesthesia, the epidural needle is advanced with its bevel pointed cephalad to ensure proper placement of the epidural catheter. The needle traverses through the skin, subcutaneous tissue, supraspinous, and interspinous ligaments. Once the needle pierces the ligamentum flavum, a noticeable loss of resistance signals the epidural space, at which point 5 to 10 cc of saline may be injected to expand the epidural space, reducing the risk of vascular injury.

In the paramedian approach, the needle is inserted 1 cm lateral to the vertebral interspace. Local anesthesia is administered in a manner similar to the medial approach. The epidural needle is advanced through paraspinal tissues without traversing the supraspinous or interspinous ligaments. The needle stops when it engages the ligamentum flavum, and the loss of resistance syringe is then attached to locate the epidural space, mirroring the medial approach.

In both the midline and paramedian approaches, the epidural catheter is advanced inside the needle after removing the loss of resistance syringe. The catheter is positioned to the 20 cm mark on the epidural needle. Once the epidural needle is removed, the catheter is withdrawn, aiming to leave its tip 5 to 6 cm within the epidural space. This measurement is calculated by adding 5 to 6 cm to the depth of the epidural space. A 3 cm syringe can be used to gently aspirate and confirm the absence of cerebrospinal fluid leakage. If cerebrospinal fluid is detected, the catheter may be intrathecal and must be repositioned. To rule out intravascular placement, a test dose of 3 mL of 1.5% lidocaine with epinephrine can be administered. Specific hemodynamic criteria indicate intravascular injection [4].

Caudal Anesthesia:

Caudal anesthesia, a variation of epidural anesthesia, is commonly employed in pediatric patients for procedures below the umbilicus line. The indications and contraindications align with those described above. The patient is positioned in a lateral decubitus fetal posture, and the sacrococcygeal membrane is pierced with a 22 to 25 G venous catheter at a 45-degree angle to the body's longitudinal axis. The catheter is advanced until a loss of resistance is felt. Further advancement should be avoided since the distance between the sacrococcygeal membrane and the caudal end of the dural sac can be less than 10 mm. If CSF or blood is encountered, repositioning of the catheter is necessary. Once properly placed, a test dose with Epinephrine 0.5 mcg/kg can be administered to rule out an intravascular injection [4][7][8].

Complications:

Epidural anesthesia, while effective, is not without potential complications. These include hypotension, nausea, vomiting, bronchoconstriction, post-puncture headache following dural perforation, transient neurological syndrome, nerve injury with possible neuropathy (though paresis is extremely rare), epidural hematoma, epidural abscess, meningitis, accidental intrathecal injection with total spinal anesthesia, and osteomyelitis [4].

Clinical Significance:

The role of epidural anesthesia in contemporary medicine is multifaceted and crucial. Properly administered, it offers numerous benefits. It can serve as the primary anesthetic for surgical procedures, reducing the need for general anesthesia and the complexities of airway management. Furthermore, it diminishes exposure to volatile anesthetics and has the potential to reduce the requirement for opioids during or after a procedure, thereby lowering the incidence of associated side effects. This is particularly significant in pediatric anesthesia, where concerns exist regarding the

impact of certain anesthetics on neurodevelopment. Epidural anesthesia is also invaluable for postoperative pain management as part of a multimodal approach.

Enhancing Healthcare Team Outcomes:

The adoption of epidural anesthesia and analgesia techniques has been supported by a growing body of evidence that highlights their positive effects. These include faster recovery of bowel function, a decrease in the hormonal stress response to pain, reduced postoperative pulmonary complications, shorter hospital stays, and increased patient satisfaction. It is essential for healthcare professionals, especially nurses in the postoperative period, to closely monitor patients to ensure their safety. Adequate consideration of risks and benefits is required on a case-by-case basis, reinforcing the importance of an interprofessional team approach. Physicians, specialists, specialty-trained nurses, and pharmacists must collaborate across disciplines to achieve optimal patient outcomes [4].

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