Adult caudal anesthesia: A reexamination of the technique

Capt STEVEN J. ZITO, CRNA, BS, USAF, NC
LaPlata, Maryland

Adult caudal blockade has fallen from favor in the anesthesia community. The majority of anesthesia providers now use lumbar epidurals and spinals for surgeries that can be done with caudals. Many claim the procedure is difficult to perform and the outcome of the block is unpredictable.

Caudal anesthesia has distinct advantages over lumbar epidurals and spinals and can be done with confidence by anesthetists who are willing to learn the anatomy, basic skills, and limitations entailed in this lost technique.

Key words: Caudal anesthesia, regional anesthesia.

Introduction

Caudal anesthesia was introduced in 1901 by Sicard and Cathelin, who injected local anesthetic solutions into the epidural space through the sacrococcygeal hiatus. It was used as the only means of administering epidural anesthesia until the lumbar approach was described by Page in 1921 and Dogliotti in 1927. Since then, caudal anesthesia has fallen from favor compared with the lumbar epidural technique.¹

This distortion of anatomy is more common in adults than in children. One study has found that 7.7% of the population does not possess a sacral hiatus.² Another anatomic reason for the drop in the caudal's popularity relates to the dermatomal distribution of the nerve roots.

In the lumbar region, the spread of anesthetic solution can occur both cephalad and caudad, giving rise to a wide dermatomal distribution of anesthesia. A caudal can only be cephalad and may be limited by minor bony obstructions so that the total number of segments blocked is bound to be less.

To achieve a wide distribution of anesthesia, large doses of local anesthetic solutions must be used, increasing the risk of drug toxicity and an occasional excessively high level of block. Approximately twice the dosage of local anesthetic drug is needed for caudal anesthesia as for lumbar epidural anesthesia, because of the relatively large sacral canal and the free leakage of solution from the large sacral foramina.³

The key to the success of any regional anesthetic technique is an understanding of the normal anatomy of the area to be blocked and knowledge of the range of normalcy that may occur. This has never been more true than with caudal anesthesia. The wide range of normalcy in this region has led to a 5-10% failure rate, which has caused many anesthesia providers to shy away from caudal block. But this failure rate decreases more significantly with greater experience than it does with any regional technique.

This article is intended to inform anesthetists...
that caudal anesthesia in adults can be done safely and successfully if the practitioner is willing to learn the anatomy and the technique of this forgotten and seldom-used regional block.

**Anatomy**

The sacrum is a triangular bone that is composed of five fused sacral vertebrae. It articulates with the lumbar spine superiorly, the iliac bones laterally, and the coccyx inferiorly. The posterior midline crest represents the vertebral spines. The remnants of the S5 inferior articular processes are free, prominent, and flank the sacral hiatus. They constitute the sacral cornua and, together with the adjacent coccygeal cornua, are important landmarks for the identification of the sacral hiatus and successful caudal block.

While these landmarks are very prevalent in children, they can be extremely difficult to locate in adults because of the increase in tissue and fat in the sacral area that occurs with aging. Often, palpation of these landmarks or identifying them when the patient is in a prone position with a pillow under his or her pelvis can be very difficult.

The lack of fusion or the absence of the S4 and S5 laminae gives rise to the sacral hiatus between the sacral cornua. This area is covered posteriorly by the dense sarcococcygeal ligament that is formed from the supraspinous and interspinous ligament, as well as the ligamentum flavum. Penetration of this inverted V-shaped ligament by a needle provides direct access to the caudal limit of the epidural space in the sacral canal. It is in this area where there is considerable variation in the normal anatomy of adult patients (Figure 1).

The sacral canal contains the dorsal sac, which ends at approximately the level of S2, the anterior and posterior divisions, and the dorsal root ganglia of the sacral nerves which are enveloped by the dura until they exit at the anterior and posterior foramina, as well as a rich network of epidural veins and some loose fat and areolar tissue.

Because of the variations in anatomy in the adult population, the caudal technique may be easy, difficult, or impossible to perform. It is for this reason that the sacrum must be examined during the preoperative visit to determine the feasibility of achieving this procedure.

**Technique of caudal blockade**

In preparing for any regional technique, all resuscitation and suction equipment should be checked and readily available. Intravenous access must be obtained and secured.

The patient can be positioned in one of three ways:

1. In the lateral Sims' position, with the lower leg only slightly flexed at the hip and the upper leg more flexed so that it lies over and above the lower leg.
2. In the prone position, with or without a
pillow under the pelvis, and both legs rotated so that the toes face medially.

3. In the knee-chest position, which may be particularly useful in the pregnant patient (Figure 2A).4

The prone position is most often chosen by anesthetists, and the knee-chest least often.

Conformation of the bony landmarks is the key to success in a caudal blockage. In a young, slender adult, successful needle placement is extremely easy, but the vast majority of adults, as mentioned previously, have less obvious surface anatomies and require very careful palpation of all bony landmarks.

Once the sacral hiatus has been located, the anesthetist dons sterile gloves, and the sacral area is thoroughly prepared with antiseptic solution and draped. Local anesthetic solution is then infiltrated into the skin above and below the sacrococcygeal ligament with a hypodermic needle (Figure 2B).

An 18- through 20-gauge Tuohy needle with a stylet is inserted almost perpendicular to the skin (approximately 120 degrees) until a distinct pop indicates that the sacrococcygeal ligament has been penetrated. The needle is then advanced a centimeter or two parallel to the sacrum, with the bevel downward (Figure 2C). The stylet is removed and, with a dry syringe, aspiration is gently done to detect the appearance of cerebrospinal fluid or blood. The presence of either necessitates repositioning of the needle. Five milliliters of air are then injected, while the anesthetist holds his or her fingers over the side of the needle tip.

If crepitus is felt, it indicates that the needle lies on the dorsum of the sacrum and must be reinserted. If the needle is well positioned, no air will be felt under the skin, and there will be no tissue resistance to injection.

Once accurate needle placement has been made, a test dose of 3 mL of an anesthetic solution containing 1:200,000 epinephrine is injected to determine the presence of cerebrospinal fluid or an intravenous injection of medication that may have not been detected by needle aspiration alone.

After achieving a negative test dose, the anesthetist injects the remainder of the anesthetic solution. About 10-20 mL 1.5-2.0% lidocaine or mepivacaine or 3% 2-chloroprocaine with 1:200,000 epinephrine are usually required for sacral anesthesia.

The onset of lidocaine or mepivacaine is apparent within 2-5 minutes and 2-chloroprocaine within 1-3 minutes; complete anesthesia can be obtained in about 15-20 minutes with any of the drugs. Therefore, patience is required on the part of the anesthetist for the block to take effect.

If a catheter is to be used, it should be inserted at this time. The epidural catheter should enter the canal freely with the same or greater ease than it entered the lumbar epidural space. It can be secured by spraying the area lightly with an adhesive, such as tincture of benzoin and applying a sterile adhesive plastic dressing over the insertion site.

Despite the limited extent of the block anticipated with caudal anesthesia, patient monitoring is still mandatory. Intravenous or intraosseous misplacement of the needle or excessive spread of the block may give rise to unwanted effects. Maintaining verbal communication with the patient is the simplest and in some ways the most reliable method.

Figure 2
Caudal block technique
A. Positioning for caudal block. B. Palpation of landmarks and needle insertion. C. Needle insertion through sacrococcygeal (sacral) membrane.

of monitoring; however, blood pressure and pulse should be measured frequently and the progress of the block plotted on the anesthesia record.

**Indications**

Caudal blockade can be used whenever the surgical area is primarily innervated by the sacral and lower lumbar nerve roots. When it is innervated from a higher level, the use of lumbar epidural and spinal blocks is preferable. The following procedures are appropriate for caudal blockade:

1. Anal surgery, especially hemorrhoidectomy and anal dilation.
2. Surgery on the vulva and vagina.
3. Surgery on the scrotal skin and penis.
4. Surgery on a lower limb.

If the tip of a caudal catheter is positioned near the lumbosacral junction, a higher level of anesthesia can be assured and more extensive surgery accommodated. Such procedures could include vaginal hysterectomies and inguinal herniorrhaphies. The use of a caudal blockade for relief of postoperative pain following hemorrhoidectomy is well documented.

Caudal anesthesia that is administered just before vaginal delivery has advantages over lumbar epidural anesthesia, because the onset of perineal anesthesia and muscle relaxation is more rapid. It is also the ideal anesthetic for surgeries that involve the ankle and foot, because the dermatomal level of the ankle is S1 and the level of the foot is L5, making the sacrum the best area to inject medication to anesthetize both. By comparison, a lumbar epidural would require a great deal more medication and a higher cephalad spread than a caudal, resulting in too high a level and inadequate sacral analgesia.

Several studies have shown that lumbar epidurals do not produce satisfactory caudal analgesia and anesthesia. One study showed that as high as 21% and as few as 6.7% of lumbar epidurals fail to reach S1. This is a significant percentage of failures when using lumbar epidurals to provide anesthesia in the sacral area. The incidence of postdural puncture headache is also decreased significantly using a caudal rather than a spinal or lumbar epidural, especially in younger patients.

The caudal block can be used effectively in situations where a spinal or lumbar epidural is simply not feasible, such as in the case of a patient who has had a Harrington rod placement. A caudal block would provide greater anesthesia and analgesia for patients who are undergoing surgical procedures below the level of the diaphragm. It would also be extremely effective in controlling labor pains in mothers with Harrington rods, when epidurals for labor could be difficult to perform.

**Comparisons**

Caudal anesthesia has a couple of distinct advantages over lumbar epidurals. Unlike an epidural, a caudal block provides more reliable perineal anesthesia. As mentioned earlier, the number of instances in which a lumbar epidural is unable to block the S1 dermatome level is extremely high (6.7-21%). In addition, the likelihood of a dural puncture is less with a caudal than with an epidural.

There are really only two disadvantages to a caudal compared with an epidural.

1. The caudal block is technically more difficult than an epidural. But this difficulty can be decreased by greater experience and knowledge of the anatomy, a factor that is true for any regional technique.
2. A caudal requires approximately twice as much local anesthetic drug as a lumbar epidural. However, if the catheter is threaded to the S1 level, the dosage can be decreased by one-third.

When compared to a spinal block, the advantages of a caudal are many. The duration of a single-dose caudal is longer than a single-dose spinal. In addition, the incidence of postdural puncture headache is extremely low with a caudal. Patient resistance to the technique is also less with a caudal, as is the incidence of arachnoiditis.

The advantages of spinal anesthesia over a caudal blockade are really twofold:

1. A spinal will deliver anesthesia more rapidly, resulting in a quicker onset than a caudal.
2. Like an epidural, a spinal is technically easier than a caudal, making the failure rate lower.

**Complications**

Complications associated with caudal anesthesia are the same as those seen with most other regional anesthesia procedures. They can be decreased with experience, meticulous attention to technique, and use of a test dose.

Claims of a high incidence of local anesthesia toxic reactions during caudal anesthesia have not been substantiated by studies. Nevertheless, the potential exists for the early onset of high blood levels by either intravenous or intraosseous injection.

With the dural sac ending at S2, or approximately on a line joining the posterior-superior iliac spines, the incidence of dural puncture should be exceedingly rare. At 0.1%, the rate of resultant accidental spinal block was much lower with a caudal anesthetic. While knowledge of the distance from the tip of the dural sac to the apex of the sacral hiatus should help prevent a dural puncture, ad-
vancement of the needle more than 1 to 2 cm into the sacral canal should be avoided.4

Problems arising from the use of caudal catheters are not different from those of lumbar epidural catheters. When the needle is correctly placed, catheter insertion is usually very easy. Early resistance to insertion is usually an indication that the needle has been incorrectly placed. The catheter should never be withdrawn through the needle, because of the risk of shearing off the tip. Dural puncture by the catheter is also a possibility, particularly with older, more rigid catheters with sharp tips.9

Postoperative complications with caudal block include pain, infection, urinary retention, and neurologic complications.

Pain at the injection site is the most common postoperative complaint. Ligament penetration without periosteal trauma will give rise to only minimal pain both during insertion and postoperatively. On the other hand, a periosteal hematoma may cause pain that lasts several weeks.4

Because of the insertion site's proximity to the perineum, infection is a concern in caudal anesthesia. However, it is exceedingly rare. The bacteriostatic or bacteriocidal actions of local anesthetics probably contribute to the low incidence of infection with these agents. In a bacteriologic comparison of epidural and caudal techniques, Abouleish and associates found no difference in skin cultures or subsequent cultures of the catheter in either epidural or caudal techniques.10

There seems to be little doubt that some increased risk of urinary retention occurs after epidural block of the sacral segments, especially when a long-acting local anesthetic drug is used.11 Such urinary retention may be greater in the elderly, puerperal women, and after perineal surgery.

Like lumbar epidural and subarachnoid anesthesia, caudal epidural anesthesia is inevitably associated with some slight risk of neurological damage. In his analysis of complications, Dawkins mentioned one permanent lesion in nearly 23,000 cases, but the details are not specified.12 Whatever the true incidence, it appears to be very small. Of greater significance is the likelihood that a worsening of a preexisting neurologic deficit will be blamed on the block.

Contraindications

There are relatively few absolute contraindications to caudal anesthesia. They include:
1. Patient refusal.
2. Infection at the site of the needle injection.
3. Hypovolemic shock.
4. Coagulopathies.
5. Preexisting neurologic disease of the spinal cord or peripheral nerves is a relative contraindication, but at times the use of regional anesthesia may be in the best interest of the patient. Each case should be evaluated individually.5

Conclusion

The adult caudal block has specific indications and distinct advantages compared to other regional techniques. It can be performed with great success when there is a knowledge of the pertinent anatomy and the practical experience to go along with it. Once these two factors have been mastered, the use of a caudal block in adult patients can become a welcome addition to the anesthetist's repertoire of anesthesia techniques.

REFERENCES


AUTHOR

Capt Steven J. Zito, CRNA, BS, USAF, NC, received his associate of science degree in Nursing from Mohagen Community College, Norwich, Connecticut, and a bachelor of science degree in Nursing from Salvation Regina College, Newport, Rhode Island. He is a graduate of the Navy Nurse Corps Anesthesia Program and George Washington University, Washington, DC, and received a bachelor of science degree in Nurse Anesthesia. At the time this paper was written, Capt Zito was on active duty in the U.S. Air Force, assigned to Eglin Air Force Base, Florida, as a staff CRNA. He is currently a staff anesthetist at Physician's Memorial Hospital in La Plata, Maryland.

ACKNOWLEDGEMENTS

The author wishes to express his great appreciation to Dr. John Dekrey, "the Master of the Needle," for teaching him the technique of caudal anesthesia during his training.

The opinions or assertions in this article are the private views of the author and are not to be construed as official or as reflecting the views of the U.S. Department of the Air Force or the U.S. Department of Defense.