

Anesthesia for Penile Procedures

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An 18-month-old boy with phimosis presents for circumcision. He is otherwise healthy. In your pre-operative discussion with the parents, you describe performing general anesthesia with a caudal block. The parents seem concerned about “sticking a needle near the spine” as the patient’s mother reports a bad experience with her labor epidural. They ask you to explain the benefits and risks of a caudal block and how it is placed.

What Are the Indications for a Circumcision?

Circumcision is the most common surgical procedure performed in males. This can be performed for medical reasons (e.g., phimosis, balanitis, chronic urinary tract infection), religious practice, societal norms, and/or aesthetic reasons. Commonly, circumcision is performed in the neonatal period; however, it can be delayed for a variety of reasons including prematurity, genitourinary anomalies (e.g., hypospadias) or religious practice.

Medical indications for circumcision include phimosis due to balanitis xerotica obliterans (with a reported incidence of 1.5%) and recurrent balano-posthitis, which is inflammation of the glans and foreskin (1.0% incidence). Other relative indications for circumcision are based on retrospective data that suggests the prevention of sexually transmitted diseases, and a reduced incidence of penile cancer and urinary tract infections, especially in patients with urologic abnormalities who are prone to infections.

Risks of circumcision are rare and include inadequate foreskin removal, inadequate cosmetic appearance, retained plastic ring when using the Plastibell device, infection, and glans or urethral injury.

What Is the Sensory Innervation of the Penis?

The sensory innervation of the penis is supplied by the dorsal nerve of the penis, a branch of the pudendal nerve. The pudendal nerve supplies the entire perineum and originates from the ventral rami of the sacral nerve roots S2, S3, and S4. The pudendal nerve appears in the pudendal canal where it travels anteriorly into the deep perineal pouch. It continues along the dorsum of the penis terminating in two dorsal nerves, located at 10- and 2-o’clock, which are targeted during a dorsal penile nerve block.

Describe the Anatomy of the Caudal Epidural Space and the Sacral Hiatus

The caudal epidural space is the most distal portion of the epidural space at the level of the sacrum. The sacrum is made up of five fused vertebrae (S1–S5) that join the lumbar vertebrae with the coccyx. All of the sacral laminae are fused in the midline with the exception of the S5 lamina, which form the sacral cornua. This defines the sacral hiatus, which is a midline opening in the sacral vertebrae S4 and S5. The sacral hiatus is covered by a membranous layer that extends downward to the coccyx (the sacrococcygeal ligament). It is through this ligament that the caudal space can be entered during a caudal block.

Is a Caudal Block a Good Adjunct to General Anesthesia for Postcircumcision Pain?

Circumcision can cause significant postoperative pain and discomfort. Therefore, it is important to provide postoperative analgesia, the most efficacious of which is a nerve block to provide total anesthesia. Caudal blocks are the most common regional anesthetic performed in infants and children. They consistently

demonstrate effectiveness as an adjunct to general anesthesia for surgeries below the umbilicus in children, including circumcision, by lowering the perioperative narcotic requirement.

How Is a Caudal Block Performed?

A caudal block is placed during general anesthesia while the child is in a flexed lateral decubitus position. The sacral cornu can be palpated at the midline just above the gluteal cleft. Once the sacral hiatus is found, a needle (butterfly, straight, or angiocatheter) can be inserted into the hiatus. The needle will pierce skin, a subcutaneous fatty layer, and the sacrococcygeal ligament/membrane. Many experienced practitioners will describe feeling a loss of resistance into the epidural space and the needle should then be advanced several millimeters further into the space. Aspiration of the catheter should occur to decrease the risk of intravascular injection.

What Is a Test Dose in Relation to a Caudal Block?

A test dose is performed to assess if a block is intravascular prior to injection of the local anesthetic. Epinephrine (0.5 mcg/kg) may be used to identify intravascular injection. Most providers use lidocaine 1.5% with 1:200,000 epinephrine for this purpose.

A positive test dose is evidenced as shown in Table 43.1.

What Are Indications for a Caudal Block?

- Lower abdominal surgery – e.g., inguinal hernia repair
- Testicular procedures – e.g., hydrocele

Table 43.1 Signs and sensitivity for positive test dose using epinephrine for caudal block

Sign	Sensitivity for intravascular injection (%)
T-wave amplitude increase >25% from baseline	100
Systolic blood pressure increase > 15 mmHg	95
Heart rate increase > 10 beats per minute	71

- Penile surgery – e.g., hypospadias/circumcisions
- Hip – e.g., manipulations/pinning
- Lower limb – various orthopedic procedures

What Are Contraindications to a Caudal Block?

Contraindications to caudal anesthesia are similar to that of epidurals and/or spinals and include:

- Patient or legal guardian refusal
- Sepsis or infection at the site of injection (diaper rash)
- Coagulopathy
- Congenital anomaly of the lower spine

What Is the Significance of a Sacral Dimple and How Does It Affect Your Decision to Place a Caudal Block?

Sacral dimples and other skin abnormalities of the lower back are seen in 2–3% of newborns. Most dimples are harmless, but some may indicate underlying spinal or bony pathology. Dimples that are associated with skin tags, hair tufts, discolored skin patches or that are located distant from the gluteal fold are more likely to indicate pathology, and imaging with ultrasound and MRI is usually done during infancy. A sacral dimple may indicate the presence of spina bifida occulta – a relatively common condition in which there may be downward displacement of the spinal cord or dural sac, tethering of the cord structures, or the presence of a mass (Figure 43.1). While most cases are asymptomatic, neurologic problems involving the lower extremities and bladder may be present and progress with age. In

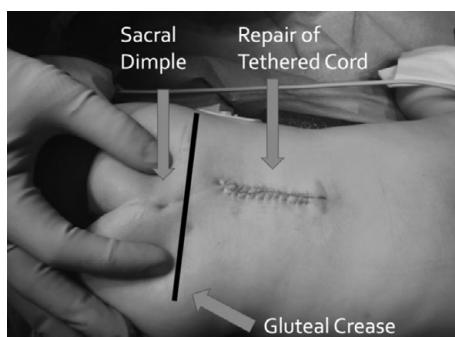


Figure 43.1 Anatomic view of sacral dimple in the presence of a repaired tethered cord. Courtesy of Adam C. Adler, MD

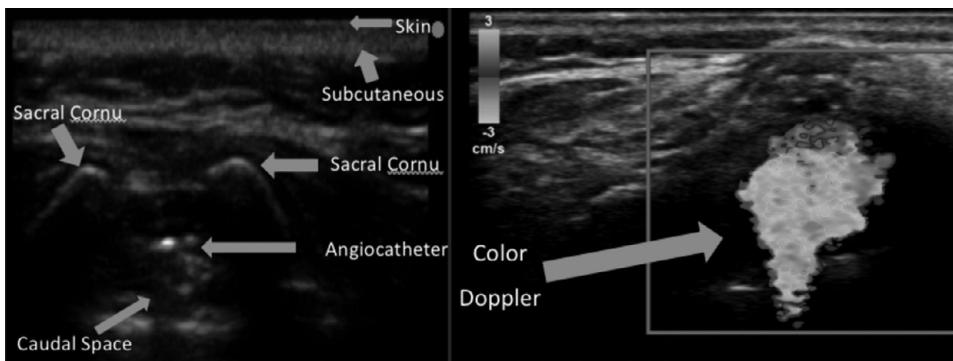


Figure 43.2 Left: Ultrasound guidance for visualization of caudal block placement. Right: Use of Doppler ultrasound to identify location of injection. Courtesy of Adam C. Adler, MD

the absence of an MRI or ultrasound that demonstrates normal underlying anatomy, it is prudent to avoid placing a caudal block.

What Confirmatory Tests Are Available for Caudal Blocks?

Methods to confirm correct placement of the caudal epidural injection include a “whoosh” test, which involves auscultation over the sacrum during injection of air, or nerve stimulation tests. Several groups have described using real-time ultrasound to confirm dural displacement, placing the probe either in the sagittal or transverse axis. Subcutaneous infiltration or ECG changes during the test dose suggest improper needle placement.

What Role Can Ultrasound Play in Performing a Caudal Block?

The availability of portable ultrasonography is proving to be useful for the placement of caudal blocks, including real time assessment of injection in addition to identification of the sacral hiatus when palpation is difficult (Figure 43.2).

How Would You Dose the Local Anesthetic in a Caudal Block and How Does the Dose Affect the Level of Analgesia?

Ropivacaine and bupivacaine are frequently used as the local anesthetics for caudal blocks in the pediatric population. Ropivacaine 0.2% provides similar

Table 43.2 Dose of local anesthetic for caudal block based on surgical procedure

Surgery	Dose (ropivacaine 0.2% or bupivacaine 0.25%)
Lower extremity	1 mL/kg
Penile/anal surgery	0.7–1 mL/kg
Abdominal incision	1–1.25 mL/kg

analgesia to bupivacaine with less motor blockade. Bupivacaine 0.125% does not cause a significant motor blockade. Suggested doses are provided in Table 43.2.

- A 0.5 mL/kg dose of 0.25% bupivacaine typically produces analgesia at the lumbo-sacral level;
- A 1.0 mL/kg dose of 0.25% bupivacaine typically produces analgesia to the thoraco-lumbar level;
- A 1.25 mL/kg dose of 0.25% bupivacaine typically produces analgesia to the midthoracic level.

What Adjunct Medication Can You Use to Prolong a Caudal Block?

Clonidine (1 mcg/kg) can prolong caudal blocks with minimal side effects. Higher doses may result in sedation, hypotension, and bradycardia. Clonidine has been avoided in neonates and premature infants due to concerns of postoperative apnea and given careful consideration for those with congenital heart disease.

Opioids can be used to prolong a caudal block, but their use is limited by opioid-related side effects, including sedation, urinary retention, itching, and nausea. Morphine (preservative-free) provides long-lasting analgesia, but the risk of respiratory depression necessitates prolonged monitoring in an inpatient setting. Fentanyl and other lipophilic opioids have not been shown to prolong a caudal block in a clinically significant way.

Ketamine can triple the duration of a caudal block at doses of 0.5 mg/kg without concerns for motor blockade or sedation. However, animal studies have shown that ketamine can cause apoptotic degeneration in the developing brain, thus concerns for neurotoxicity have limited its use.

Intravenous dexamethasone 0.5 mg/kg when given with a caudal block results in longer block duration and reduced requirement for additional analgesics.

What Is the Safety Record for Caudal Blocks?

As a single shot block, a caudal block is a highly reliable and safer alternative compared with other neuraxial techniques in children with no reports of epidural hematoma, abscess, or paraplegia. The reported issues based on the pediatric regional anesthesia network database include:

- Block failure or patchy block (most common at 1%)
- Blood aspiration (0.6%) or positive test dose (0.1%)
- Accidental dural puncture or “wet tap”: 0.1%
- Severe local anesthetic toxicity (seizures or cardiac arrest): 0.008%

Caudal blocks can produce a dense motor block which depending on the surgical setting (outpatient/ambulatory) may be highly undesirable. Use of ropivacaine 0.2% or dilute bupivacaine 0.125% helps to minimize motor block occurrence.

What Are the Options for Postoperative Analgesia Using a Peripheral Penile Nerve Block?

The dorsal penile nerves can be anesthetized by injecting 1–2 mL of local anesthetic solution below the deep fascia at the base of the penis at the 2- and

10-o’clock positions. This is commonly referred to as a dorsal penile nerve block (DPNB). Complications of DPNB include subcutaneous hematoma at the site of injection (fairly common), and rarely, arterial injection.

Alternatively, a penile block can be accomplished with one injection into the subpubic space, which contains the pudendal nerve as it exits from beneath the pubic bone. The base of the penis is gently stretched downward with one hand while the block needle is advanced along the caudal edge of the pubic bone in the midline. Initially, a “give” is felt as the needle pierces the superficial fascial layer. The needle is further advanced until another more marked give is felt as the needle pierces Scarpa’s fascia to enter the subpubic space. After gentle aspiration to rule out an intravascular injection, 3–5 mL of 0.25–0.5% plain bupivacaine is injected. Occasionally a small subcutaneous hematoma will develop, but no other complications from this block have been reported. As this is an end-arterial system, epinephrine is never used in the local anesthetic solution.

Risks of the dorsal penile block include local hematoma formation, local anesthetic toxicity, and potentially ischemia of the penis if epinephrine is used. Ischemia has also been reported at the glans penis when a hematoma at the injection site caused decreased perfusion.

Local infiltration of the penis is distinguished from a specific nerve block and is traditionally referred to as a ring block. Between 2 and 3 mL of local anesthetic solution are injected below the deep fascial level at the base of the penis in a circumferential fashion. Practitioners who prefer the ring block to the DPNB cite the inconsistent anatomical location of the dorsal penile nerves.

Is There a Difference between Penile and Caudal Blocks with Respect to Efficacy?

Multiple studies comparing caudal blocks and penile nerve blocks have found that they have similar efficacy with regard to perioperative analgesia. One study reported that caudal blocks are “more successful” for postoperative analgesia, increasing the duration of time to supplemental “rescue” analgesic agents. Another study demonstrated that caudal blocks are superior in children under six years old (or <25 kg)

for hypospadias repair when compared to a penile block. The most recent meta-analysis comparing caudal blocks and penile nerve blocks suggests that both offer similar analgesic success rates for pediatric patients undergoing circumcision with caudal blocks providing a longer duration of analgesia.

Aside from Caudal or Penile Blocks, What Other Means of Analgesia Is Available?

Topical anesthesia with local anesthetic creams is another option for pain management and has been described more commonly in the neonatal population for circumcisions. One common product used is eutectic mixture of local anesthetics (EMLA) cream,

a water-based mixture containing 2.5% lidocaine and 2.5% prilocaine. For adequate absorption and efficacy, sixty minutes is required. In studies that looked at EMLA cream application compared to placebo, infants had lower heart rates and less crying. Risks of using EMLA cream include local skin reactions and methemoglobinemia due to the metabolism of prilocaine. Methemoglobinemia has been found to be low risk in infants. A randomized, blinded trial compared EMLA cream applied one hour prior to surgery to penile blocks placed intraoperatively on children 2–12 years of age. This study showed no difference in pain scale between the two groups although no studies have compared the use of EMLA cream to caudal blocks.

Suggested Reading

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