Regional Anesthesia in Children; Beyond the Caudal Block

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Introduction:

Regional anesthesia is becoming more popular in children because of its benefits for the patient in the postoperative period.(1) As we increase our understanding of local anesthetic pharmacology and toxicity, we have expanded our capability of safely providing a new level of postanesthesia pain and comfort. The two main types of regional anesthesia used in children are central neuraxial blocks and peripheral nerve blocks.

Local Anesthetics: Choice and Dosage

Bupivacaine and ropivacaine are two commonly used amide local anesthetics in pediatric patients. Dosing is based on weight and age of the patient. Potential toxicity from single doses of local anesthetics should be avoided by calculating doses on a mg/kg basis and should not be extrapolated from adult experiences using predetermined volumes of local anesthetic for regional blocks. We use a concentration of 0.25% bupivacaine for peripheral nerve blocks and 0.1% bupivacaine for continuous central neuraxial infusions. When a continuous infusion is utilized, care has to be taken not to exceed toxic doses for children. For instance, bupivacaine infusion should not exceed 0.2 mg/kg/hr in neonates and 0.4 mg/kg/hr in older children.(2) Care has to be taken to avoid intravascular injections since cardiac toxicity from longer acting drugs like bupivacaine can be fatal. Newer isomers including levobupivacine may potentially reduce the potential toxicity to the cardiac and central nervous system.(3) Ropivacaine is a newer amide local anesthetic that has a higher threshold for cardiac and neurological toxicity than bupivacaine.(4) A 0.2% solution is commonly used and the volume of drug injected is 1 mL/kg to a maximum dose of 20 mL. A more comprehensive detail of local anesthetics and their complications can be found in standard pediatric anesthesia textbooks.(5) It is imperative that a test dose of the local anesthetic is first utilized prior to infusion of larger doses in children.

There are certain subtle differences between central neuraxial blockade and peripheral nerve blocks that have to be understood before choosing either modality for perioperative and postoperative pain relief (Table 1).

Table 1. Difference between central neuraxial and peripheral nerve blocks

Central Neuraxial	Peripheral Nerve Blocks
Epidural or intrathecal	Directed to the area requiring analgesia
Cannot be used for head and neck surgery	Applicable for any area
Systemic effects include hypotension	Rare-systemic effects
Lower extremity (LE) weakness	Unlikely unless LE motor nerve block
Duration of analgesia is limited to about 4 to 6 hrs	Analgesia may last greater than 12 hrs
Parental acceptance is still difficult	Parental acceptance is greater

Central Neuraxial Blockade

(i) **Caudal blocks**: This is an easy block to perform and provides predictable postoperative pain relief. "Single shot" caudals are often performed after induction of general anesthesia in children for surgery below the diaphragm.

Dose: One mL/kg to a maximum of 20 mL of 0.125% or 0.25% bupivacaine with 1:200,000 epinephrine is utilized in our institution. The advantage of using a more dilute solution is less motor block, allowing the child to meet discharge criterion in an ambulatory surgery setting. When a urinary catheter will be left in the postoperative period, 1 – 2 mcg/mL of an opioid (fentanyl) is added to the caudal solution to provide additional analgesia. More recently, the addition of clonidine to the caudal solution has been reported in children.(6) This may prolong the duration of the block for several hours compared to a local anesthetic solution alone.

Technique: With the patient in the lateral or prone position, the sacral cornu is palpated and the sacral hiatus identified. A 22-G-styletted needle is advanced into the sacral hiatus. A "pop" is felt as the needle enters the caudal space. After careful aspiration to rule out intravascular placement, a test dose of 2 mL of 0.125% bupivacaine with epinephrine is injected. Any increase in heart rate or increase in size of the 'T- wave' on an electrocardiograph (ECG) recording(7) indicates intravascular placement. Since the heart rate may not always increase, it is important to view the monitor at the time the block is performed. If the test dose is negative, the rest of the volume is administered in slow incremental doses.

Complications: Intravascular injection, intrathecal injection

(ii) Continuous caudal analgesia: In surgical procedures lasting longer than 2 hours we prefer using a caudal catheter for intraoperative and postoperative analgesia. This is especially useful in infants and neonates since access to the caudal space is relatively easy and passing a catheter to the desired dermatome is easily achieved. An 18-G intravenous Angiocath® or Crawford needle is introduced into the caudal space. A 21-G catheter is passed into through the catheter into the caudal space. In infants undergoing procedures in the thorax or upper abdomen, it is desirable to place the catheter at the appropriate dermatomal level. A new technique using a nerve stimulator for placement of the catheter has been described.(8) Postoperative pain relief can be carried out either with intermittent boluses or a continuous infusion of local anesthetic solution. This technique can be safely used for neonates undergoing laparotomy or tracheo-esophageal repair.(9) It can also be used in infants and toddlers undergoing lower extremity orthopedic procedures.

(iii) Epidural Analgesia: As the experience with continuous central neuraxial techniques grows, there are more centers offering this technique to pediatric patients. Use in pediatric patients differ in many aspects from adults:

(a) The patient is most likely to be under general anesthesia; eliciting paresthesias are not possible.

(b) Sole use of a regional technique for surgical anesthesia may not be feasible for most surgical procedures.

(c) Substantial data are not available for the risk/benefit ratio of indwelling epidural catheters in children.

Which patients qualify for a continuous epidural analgesia?

(a) Patients undergoing extensive abdominal procedures

(b) Extensive lower extremity surgeries

(c) Thoracic procedures

Where and how should the catheter be placed?

The best location for the catheter tip is at the exact dermatomal level of the nerve roots for the surgical site. A thoracic catheter is preferred to a lumbar catheter in a patient undergoing a thoracotomy or pectus excavatum repair. In older patients and in teenagers, we prefer placing the catheter with mild sedation. However, there are conflicting views as to whether a thoracic catheter can be placed in a patient who is awake.(10) A small volume of a hypoallergenic dye can be injected through the catheter to determine correct placement. The nerve stimulation technique, once perfected, may offer an advantage to correct placement of the catheter in patients under general anesthesia.(8)

Technique: An 18-G Tuohy needle is placed using loss of resistance with saline (particularly in small children)(9) or air. Once the epidural space has been identified, a 21-G catheter is inserted into the space. The epidural space is more superficial in children than adults. Several guidelines for determining epidural depth have been published. Although none is consistently accurate, a rough estimate of the depth of the epidural space below the skin in children between 6 months and 10 years of age is approximately 1 mm/kg of body weight below the skin surface. Other formulas are depth (cm) = 1 + 0.15 x age (years) and depth (cm) = 0.8 + 0.05 x weight (kg). The mean depth of epidural space in neonates has been reported as 1 cm (SD 0.2, range 0.4-1.5 cm). The best protection against excessive depth and resultant dural puncture is to use appropriately short needles and to use extreme care during advancement of the needle.(9) Once the needle is in the epidural space the absence of blood or cerebrospinal fluid reflux is verified before insertion of the catheter. A test dose of local anesthetic with epinephrine (1:200,000) is injected to ascertain intravascular placement. If there are no adverse effects, the catheter is injected with the appropriate local anesthetic.

Management in the postoperative period:

Attention to details such as temperature, site infection, coagulation profile and the need for adjuvant medication in the epidural solution is essential in the care of these patients.

Peripheral Nerve Blocks:

Peripheral nerve blocks are useful adjuvants to general anesthesia in the pediatric patient for intraoperative as well as postoperative pain control. There are advantages to peripheral blocks

(a) The target nerves can be blocked

(b) Associated motor blockade is minimized

(c) A lower amount of local anesthetic is utilized

(d) Potential for urinary retention is minimal

(e) It can be used in areas where a central neuraxial block cannot always be used eg., head and neck

***Selecting the local anesthetic for peripheral blocks*:**

Lidocaine, mepivacaine and bupivacaine are commonly used for peripheral blocks. The longer acting local anesthetics are usually preferred since they provide longer duration of postoperative pain relief. Adding a small amount of bicarbonate (1 mL /20 mL of local anesthetic) reduces the pain on injection and can enhance the speed of onset of the local anesthetic block. The addition of epinephrine may decrease vascular absorption and extend the duration of the block.

Nerve Stimulator:

Most peripheral nerve blocks are performed in children who are either moderately sedated or under general anesthesia. A peripheral nerve stimulator may be useful for locating the nerve to be blocked. It is clearly not a substitute for anatomic knowledge but an adjunct for locating the nerve in an unconscious or heavily sedated patient. Based on anatomical regions, it will be useful to discuss peripheral nerve blocks in children.

(1) Head & Neck Blocks

The scalp is innervated by two groups of nerves (i) the first division of the trigeminal nerve that divides into the supraorbital and supratrochlear nerves supplying the anterior part of the scalp, and (ii) the cervical root C_2 supplying the posterior part of the scalp (Figure 1).

(a) Supraorbital & supratrochlear blocks

Indications*:* Pain relief for scalp excisions(11), frontal craniotomies, frontal ventriculo-peritoneal shunts.

Technique*:* With the patient supine, the supraorbital notch is palpated. After careful preparation of the skin, a 27-G needle is inserted subcutaneously above the supraorbital notch; 1 to 2 mL of bupivacaine (0.25% with 1:200,000 epinephrine) is injected after careful aspiration. The needle is directed medially towards the tip of the nose; 1mL of bupivacaine (0.25% with 1:200,000 epinephrine) is injected to block the supratrochlear nerve.

Complications*:* Due to the loose adventitious tissue of the eyelid, gentle pressure should be applied to the supraorbital area, which prevents the dissection of local anesthetic and the formation of ecchymosis.

(b) Greater Occipital Nerve Block

Indications*:* Treatment of occipital pain following posterior fossa surgery and posterior shunt revisions. It is also useful for treating chronic pain secondary to occipital neuralgia.

Anatomy: The posterior neck and head is innervated by the cervical spinal nerves. The dorsal rami of C2 end in the greater occipital nerve, which provides cutaneous innervation to the major portion of the posterior scalp (Figure 2).

Technique: With the patient's head turned to one side, or with the patient prone, the occipital artery is palpated at the level of the superior nuchal line (Figure 2). The occipital nerve is located medial to the occipital artery. Two mL of bupivacaine (0.25% with 1:200,000 epinephrine) is injected to form a skin wheal.

Complications: Rare. Caution has to be exercised to prevent intravascular placement.

(c) Infraorbital Block

Anatomy: The infraorbital nerve is the termination of the second division of the trigeminal nerve and is entirely sensory. The nerve emerges in front of the maxilla through the infraorbital foramen and divides into four branches; the inferior palpebral, the external nasal, the internal nasal and the superior labial. These branches innervate the lower eyelid, the lateral inferior portion of the nose and its vestibule, the upper lip and the mucosa along the upper lip and the vermilion.

Indications: Postoperative pain relief in cleft lip repair(12; 13); reconstructive procedures of the nose including septal reconstruction(14) and rhinoplasty and in patients undergoing endoscopic sinus surgery.(15)

Technique: Either an intraoral approach or an extraoral approach can be used. I prefer the intraoral approach (Figure 3). After palpating the infraorbital foramen, the upper lip is folded back. A 27-G needle is inserted through the buccal mucosa approximately parallel to the maxillary second molar. With the tip of the needle at the level of the infraorbital foramen, and, after careful aspiration, 0.5 to 1 mL of local anesthetic (0.25% bupivacaine with epinephrine 1:200,000) is injected into the space.

Complications: Pressure has to be applied to the area since there is loose adventitious tissue that can lead to ecchymosis and swelling. Care has to be taken to prevent direct injection into the orbit or eye.

(d) Great Auricular nerve block:

Indications: Provides postoperative pain relief in patients undergoing mastoidectomy(1; 16) and otoplasty. A significant advantage is a reduction in postoperative nausea and vomiting in patients undergoing this block compared to those receiving analgesia only from intravenous opioids.(1)

Anatomy: The great auricular nerve provides the sensory innervation to the mastoid and the external ear. It is a branch of the superficial cervical plexus (C3). The landmark for the identification of the great auricular nerve has been described by McKinney, a plastic surgeon, and is often described as McKinney's point.(17) The great auricular nerve wraps around the belly of the sternocleidomastoid at the level of the cricoid cartilage and emerges to supply the area of the mastoid and the external ear.

Technique: The cricoid cartilage is identified. A line is drawn from the superior margin of the cricoid laterally to the posterior border of the sternocleidomastoid muscle. Two to 3 mL of bupivacaine (0.25% with 1:200,000 epinephrine) is injected superficially at this point (Figure 4).

Complications: If the needle is placed deep there is a chance that a deep cervical plexus block can ensue with added complications including Horner's syndrome, phrenic nerve block, or unintended subarachnoid block. A small erythematous area can be seen at the site of injection.

(2) Intercostal Nerve Block:

Anatomy: The intercostal nerves are derived from the ventral rami of the 1st thoracic through 12th thoracic nerve roots. There are four branches; the gray rami communicans; posterior cutaneous branch; a lateral cutaneous branch; and a cutaneous branch that supplies the midline of the chest.

Technique: The nerve can be blocked either at the paravertebral or in the midaxillary line. After the low margin of the rib is located, the skin is retracted cephalad and a needle is inserted perpendicular to the skin over the rib and advanced until the rib is encountered. A distinct pop may be felt as the needle enters the neurovascular sheath. After negative aspiration, local anesthetic is injected into the space.

Complications: Pneumothorax has been reported with intercostal blocks. Toxicity from local anesthetic absorption from the site is higher from intercostal nerve blocks than in any other regional anesthesia technique.(18) A third complication is a high subarachnoid block associated with the posterior paravertebral approach.

(3) Inguinal Block: (ilioinguinal & iliohypogastric block):

Indications: This block is used for procedures in the inguinal area including hernia repair and orchidopexy.

Anatomy: The inguinal area is innervated by the subcostal nerve (T12), iliohypogastric and ilioinguinal nerves (derived from L1). After piercing the internal oblique approximately 2 – 3 cm medial to the anterior superior iliac spine, the nerve then travels between the internal oblique and external oblique aponeurosis where it accompanies the spermatic cord to the genital area.

Technique: A 27-G needle is inserted at a 45-degree angle at a point one quarter of the way from the anterior superior iliac spine and the umbilicus at the level of the inguinal ligament. Two distinct 'pops' are felt as the needle enters the external and internal oblique muscles. About 10 mL of bupivacaine (0.25% with 1:200,000 epinephrine) is injected into the space. Care must be taken not to enter the peritoneum.

Complications: Intraperitoneal injection; intravascular placement.

(4) Penile Block:

Indications: A penile block is useful for procedures on the external genitalia, including circumcision(19), urethral dilatation, and hypospadias repair. Even though a caudal block is ideally suited for these procedures, there are certain contraindications like spinal dysraphism and lack of parental consent that may prohibit the use of caudal analgesia.

Anatomy: The pudendal nerve and the pelvic plexus supply the penis. There are two dorsal nerves that run along side the dorsal artery that separate at the level of the symphysis pubis to innervate the penis.

Technique: Two common techniques are used (i) Ring Block: A ring of *local anesthetic without epinephrine* is injected at the base of the shaft of the penis. (ii) Dorsal nerve block: A point 1-cm above the symphysis pubis is identified. A 27-G needle is inserted at a 30-degree angle. After aspiration, 4 mL of local anesthetic without epinephrine is injected.

Complications: Hematoma formation, compromised blood flow to the penis and intravascular injection.

(5) Lower Extremity Blocks

The major use of nerve blocks of the lower extremity in pediatric patients is for managing postoperative pain and as an adjunct to general anesthesia.

(a) Sciatic Nerve Block

Anatomy: The sciatic nerve arises from the L_4 through S_3 roots of the sacral plexus, passes through the pelvis, and becomes superficial at the lower margin of the gluteus maximus muscle. It then descends into the lower extremity in the posterior aspect of the thigh, supplying sensory innervation to the posterior thigh as well as to the entire leg and foot below the level of the knee except for the medial aspect, which is supplied by the femoral nerve. All blocks are performed with the aid of a nerve stimulator to elicit a motor response in the foot. A newer approach to the sciatic nerve using a lateral approach to the popliteal fossa has been described.(20) This offers the additional advantage of being able to provide the block in a supine patient and is particularly helpful in the pediatric patient.

(i) Approach of Labat (Posterior Approach).

Technique**.** The patient is placed in the lateral decubitus position lying on the non-operative leg. The leg to be blocked is flexed and the lower leg is extended. A line is drawn from the posterior superior iliac spine to the greater trochanter of the femur. Another line is drawn from the greater trochanter to the coccyx. The first line is bisected, and a perpendicular line is drawn from that point to the second line; the point at which it intersects the second line is the site of needle insertion. A 22-gauge insulated needle is advanced in the perpendicular plane until it strikes bone. It is possible for the needle to pass through the sciatic notch without either encountering bone or causing a paresthesia. In that case, the needle is redirected in a cephalad direction until bone is encountered. A motor paresthesia is then sought using a grid-like approach, fanning medially to laterally. Under general anesthesia, dorsiflexion or plantar flexion of the foot is desired to locate the nerve. A dose of 0.5 mL/kg of bupivacaine (0.25% with epinephrine 1:200,000) is recommended for children older than 6 months of age. If the sciatic nerve block is used in conjunction with a femoral nerve block, consideration should be given to diluting the local anesthetic concentration further to limit the injected dose to 2-3 mg/kg of bupivacaine.

(ii) Lateral Popliteal Sciatic Nerve Block:

This approach to the sciatic nerve can be performed with the patient in the supine position provides postoperative analgesia in patients undergoing surgery to the foot and knee.(21) It has the advantage of preserving hamstring function and allows early ambulation with crutches.

Anatomy: The popliteal fossa is a diamond shaped area located behind the knee. It is bordered by the biceps femoris laterally, medially by the tendons of the semitendinosus and semimembranosus muscles, and inferiorly by the heads of the gastrocnemius muscle. The sciatic nerve, after its formation from the L_4 through S_5, innervates all areas of the leg and foot below the knee except the antero-medial cutaneous area of the leg and foot, which are supplied by the femoral nerve. The sciatic nerve divides into two branches, the larger tibial nerve located medially and the common peroneal nerve located laterally. At the apex of the popliteal fossa, the nerves are in close proximity to each other and are enclosed in a connective tissue sheath for a few more centimeters before dividing into the component nerves.

Technique: After induction of general anesthesia, the lower leg is elevated on a pillow. The biceps femoris tendon is palpated. The tendon is then traced upwards for about 3 to 5 cm. A 22 G insulated needle is inserted anterior to the tendon in a horizontal plane with a cephalad angulation (Figure 5). A nerve stimulator is attached to the sheathed needle and with low voltage stimulation (0.2 to 0.5 mV), the foot is observed for plantar flexion (tibial nerve) or dorsiflexion (common peroneal nerve). On injection of a test dose of 1 mL bupivacaine (0.25 % with epinephrine 1:200,000), the twitching is abolished. This confirms correct placement of the needle; 5-10 mL of additional local anesthetic are then injected. In adult studies, it has been shown that the duration of a sciatic nerve block is longer than an ankle block or subcutaneous infiltration and provides excellent postoperative analgesia.(22) We have similar experience in pediatric patients.

Complications: Intraneural injection must be avoided. Using a low voltage nerve stimulator ensures proper placement of the needle. It is rare to see intravascular placement of the needle with this approach.

(b) Femoral Nerve Block

A femoral nerve block is particularly useful in patients with a fractured femoral shaft so that transport, x-ray, and other minor surgical manipulations are not painful.

Anatomy: The femoral nerve is located immediately lateral to the femoral artery and deep to both the fascia lata and fascia iliaca. (22-24)

Technique: A blunt 22-gauge B-bevel needle, or alternatively, a caudal needle is advanced lateral to the pulsation of the femoral artery. Two fascial planes can be located by a distinct “pop” that is felt as the needle traverses the fascial planes. Femoral nerve block can be achieved by depositing an appropriate volume (5-10 mL) of local anesthetic lateral to the femoral pulse and deep to the fascia iliaca Repeated aspiration and incremental injection should be used to avoid injection into the femoral artery.

Complications: Due to the close proximity of the nerve to the femoral artery, it may be preferable to avoid this technique in patients who are on anticoagulants or bleeding diathesis. Intravascular injection is avoided with incremental injection and frequent aspiration.

(c) Lateral Femoral Cutaneous Nerve

Anatomy: The lateral femoral cutaneous nerve arises from the L_2 and L_3 roots of the lumbar plexus. It emerges from the lateral border of the psoas muscle and passes obliquely under the fascia iliaca to enter the thigh 1 to 2 cm medial to the anterior superior iliac spine. The nerve innervates the lateral aspect of the thigh. It is suitable for anesthetizing the lateral aspect of the thigh as a donor site for small skin grafts, fascia iliaca grafts, or muscle biopsy for muscular disorders.(22)

Technique**:** A point approximately 2-cm caudal and 2 cm medial to the anterior superior iliac spine is located. A B-bevel needle or a caudal needle is then advanced through the skin and then through the fascia lata. A distinct pop is felt at this point. Two to 10 mL of local anesthetic, depending on the size of the child, are deposited in a fan-like fashion.

Complications: It is rare to see any complications associated with a lateral femoral cutaneous nerve block. However, care has to be taken to avoid an intraneural placement of the local anesthetic solution. Intravascular injection may be avoided with incremental injection with frequent withdrawal.

(d) Fascia Iliaca Block

This block is particularly useful in children to provide unilateral anesthesia or analgesia of the lower extremity. It produces blockade of the femoral, lateral femoral cutaneous and obturator nerves with a single injection of local anesthetic.

Anatomy: The fascia iliaca and iliacus muscle bind this compartment superficially. Superiorly it is bound by the iliac crest, and posteriorly by the psoas muscle. This block has the advantage of producing excellent peripheral nerve blockade without the needle in the close proximity to any major nerves or blood vessels.

Technique. The injection is made approximately 1 cm inferior to the junction of the outer and middle thirds of the inguinal ligament. As the needle is inserted in a perpendicular angle of about 75° to the skin, two characteristic "pops" are felt as the needle pierces the fascia lata and then the fascia iliaca. Digital pressure is exerted distally to the site during the injection and for a short time afterwards, and the swelling produced in the groin by the volume of local anesthetic is massaged to promote proximal flow of the drug. A volume of 0.3-0.5 mL/kg is sufficient in most cases.

Complications: Due to the larger volume that is required to provide an adequate block, care has to be taken to not exceed the maximum dosage of the local anesthetic. Intravascular injection may be avoided with incremental injection with frequent withdrawal.

(e) Ankle block.

Blockade of the nerves of the foot at the ankle is a technique that is valuable to produce both surgical anesthesia and postoperative analgesia for procedures on the foot. If a tourniquet is being used, one can use an Esmarch® bandage at the level of the ankle rather than the standard thigh or calf tourniquet

Anatomy & technique: There are five nerves that have to be blocked to provide an adequate ankle block. (i) Deep peroneal nerve (L_4, L_5, S_1, S_2) innervates the web space between the great and second toes. It is blocked at the level of the ankle crease in the lower part of the leg by inserting a 25-gauge needle through the skin until it contacts the tibia; 5 mL of local anesthetic are injected and then an additional amount as the needle is being withdrawn. (ii) Superficial peroneal nerve (L_4, L_5, S_1, S_2) innervates the medial and lateral aspects of the dorsum of the foot. It is blocked immediately above the talocrural joint. It can be blocked by subcutaneous infiltration of local anesthetic from the anterior border of the tibia to the lateral malleolus. (iii) Saphenous nerve, which innervates the skin over the medial malleolus. It is blocked by subcutaneous infiltration around the great saphenous vein at the level of the medial malleolus. (iv) Tibial nerve (L_4, L_5, S_1, S_2, S_3) lies posterior to the posterior tibial artery and divides into the medial and lateral plantar branches, which innervate their respective aspects of the sole of the foot. It is blocked at the level of the medial malleolus. (v) Sural nerve is blocked at the lateral aspect below the lateral malleolus

Complications: It is very rare to see complications from an ankle block. However, the use of vasoconstrictors in the block solution can cause necrosis of the toes. Care should be taken to avoid the use of an ankle block in patients who may have compromised blood flow to the lower extremity.

Conclusion: Regional anesthesia can be used for most pediatric surgical procedures and expands our capability for providing safe and effective pain relief. Caution has to be exerted since most patients are under general anesthesia and paresthesias cannot be obtained. When appropriate, a nerve stimulator may be useful. Dosing of local anesthetic, with limits set for maximum doses, should be part of the routine when a choice of regional technique is considered. Lastly, the use of regional anesthesia can provide a predictable and consistent level of prolonged pain relief that will allow for easy discharge of the child with a reduction in side effects such as nausea and vomiting, somnolence, or ventilatory depression. Regional anesthesia has an important role in improving the overall anesthetic care provided to children of all ages.

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Figure 1

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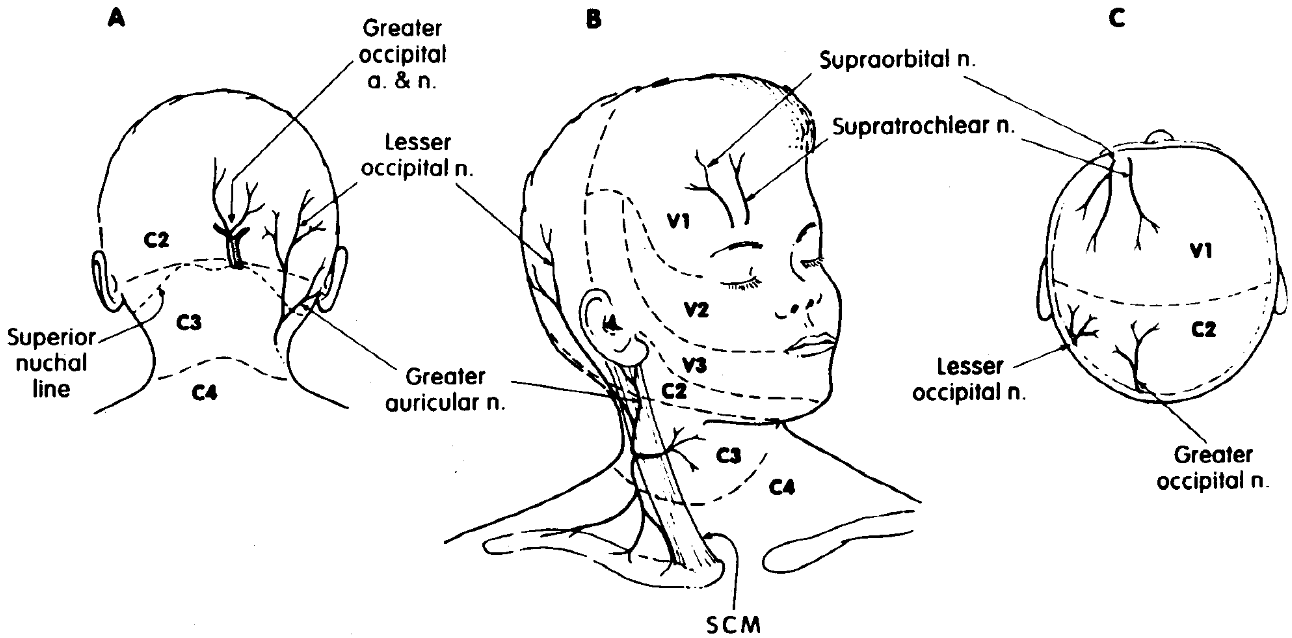

Figure 2: Greater occipital nerve block

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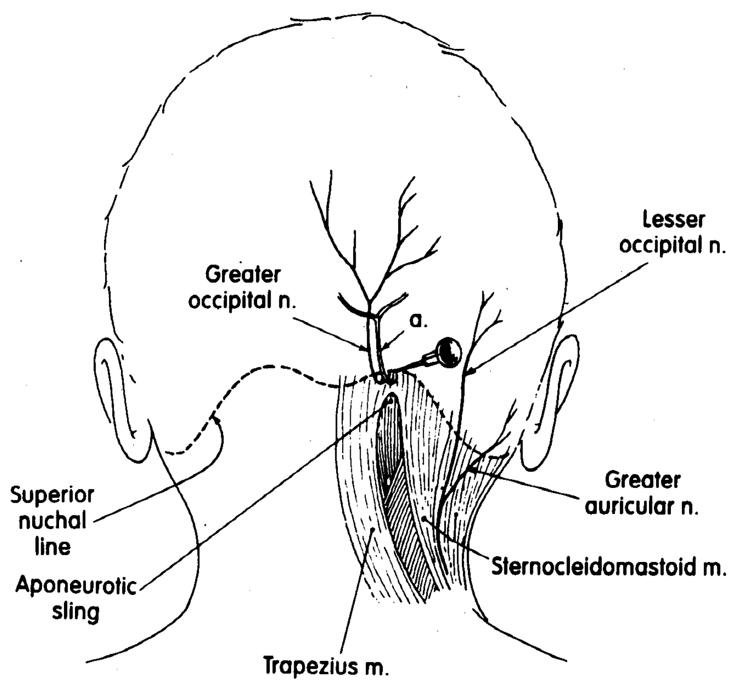

Figure 3: Infraorbital nerve block

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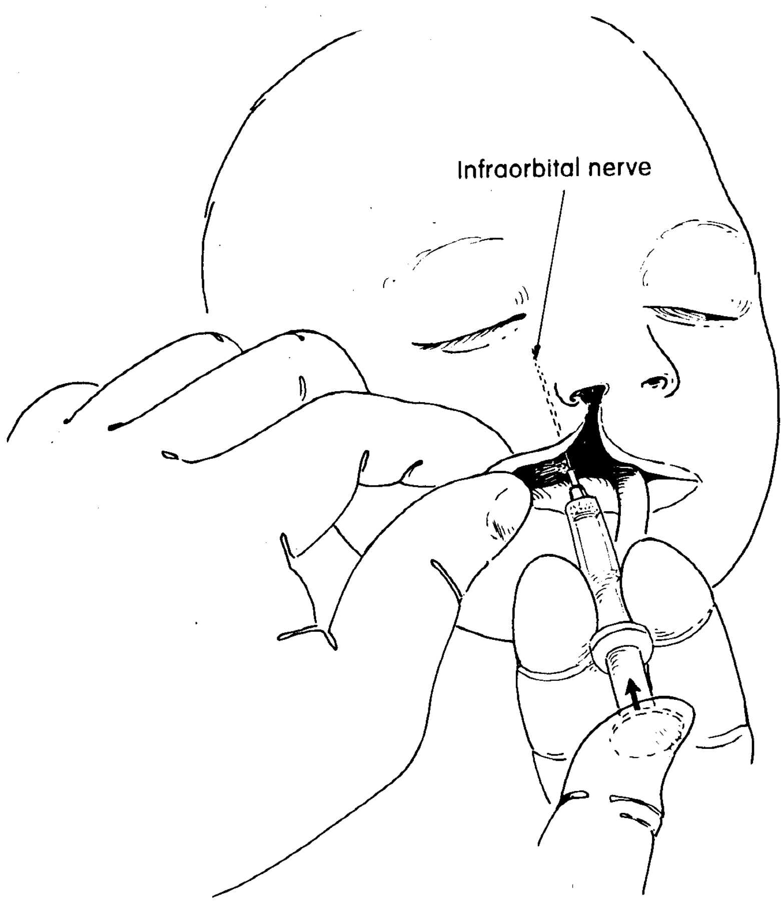

Figure 4: Great auricular nerve block

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