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## **Introduction**

Local anesthetic techniques were popularized early in the history of surgery with the advent of injectable nerve blocking agents. Until their discovery, patients were either held down or knocked unconscious to perform procedures. In the early days of general anesthesia, local anesthesia was preferred in all cases that it was applicable due to the significant risks associated with general anesthesia. Many procedures performed today under general anesthesia, such as tonsillectomy, rhinoplasty, and even bronchoscopy, were performed under local anesthesia to avoid the perils of general anesthetics. With the introduction of pulse oximetry, safer inhaled anesthetics, and combined intravenous and inhaled general anesthesia techniques, general anesthesia has become much safer, resulting in many surgeons being unfamiliar with regional nerve blocks to perform surgery.

There are many advantages of regional anesthesia. First, the patient is conscious during surgery. Therefore, the patient can maintain his own airway, contain his own gastric secretions, and warn the surgeon of impending complications, for example vertigo in stapes surgery. Next, unlike general anesthesia, patients are awake and usually have a smooth postoperative course. This allows for less nursing care after procedures, and shorter recovery times facilitating outpatient surgery. Another advantage is the elimination of painful afferent stimuli for the operative site plus the blockade of efferent sympathetic nerves to endocrine glands eliminates or greatly reduces the metabolic endocrine changes seen after surgical operations. Finally, local anesthesia is much less expensive.

Disadvantages of local anesthesia are significant as well. First, the patient may prefer to be asleep. Also, operating on an awake patient may take more patients and skill from the entire surgical team. Next, some blocks require up to 30 minutes or more to be fully effective. Another disadvantage is that analgesia may not always be totally effective, and general anesthesia may be required secondarily. Next, generalized toxicity may occur if local anesthetic drugs are given intravenously by mistake or an overdose is given. Also, widespread sympathetic blockade can result in hypotension. Finally, there is a small but definite incidence of prolonged nerve damage.

Differing properties of local anesthetics should be known in detail by the operative surgeon. Toxic doses, duration of action, and side effects should be reviewed before using local anesthetics. The following is an overview of commonly and uncommonly performed nerve blocks of the head and neck. A review of intravenous sedation or properties of local anesthetics is not included. The reader is referred to appropriate texts for discussion of their properties.

## **Scalp**

### Anatomy

The skin overlying the skull which is innervated by the supratrochlear and supraorbital nerves, the zygomaticotemporal and zygomaticofacial nerves, and the ariculotemporal nerve, all of which are divisions of the trigeminal nerve and the lesser and greater occipital nerves arising from C-2 and C-3.

### Technique

To block the entire scalp, a circumferential infiltration of local anesthesia is necessary, making a wheal above the ears extending to the occiput and above the gabella. Because the infiltration is extensive, a diluted infiltration of local with 1:200,000 epinephrine should be used. Extra anesthetic should be used in the area of the supratrochlear, supraorbital, occipital, and ariculotemporal nerves. If limited scalp dissection is needed, an alternative is local infiltration locally in a circular or triangular pattern around the lesion to be excised. Infiltration of the periosteum may be necessary.

## **Gasserian Ganglion Blocks**

### Anatomy

The gasserian ganglion (trigeminal ganglion, Semilunar ganglion) sits in Meckel's cave, an invagination of the dura mater of the posterior cranial fossa.

### Indications

Blocks of this nerve are used for trigeminal neuralgia after failure of conservative therapy and for cancer pain involving the face where cancer precludes the direct block of the affected divisions. Its use for procedures of the head and neck is limited.

### Technique

A needle is inserted just medial to the ramus of the mandible at the corner of the mouth and directed toward the pupil. Direction of the needle is aimed at the skull base and when the skull base is encountered, verification with CT is performed. The needle is directed posteriorly until the foramen oval is reached. Because injection is into the dura, CSF should be encountered upon withdrawal of the syringe. Even small amounts of local in this area can cause unconsciousness and respiratory arrest. Because of the danger of this technique and the risk associated with it, only very experienced physicians should perform this block under controlled circumstances.

## **Nasociliary Nerve Block**

### Anatomy

The ophthalmic nerve runs from the trigeminal ganglion to the eye via the cavernous sinus and the superior orbital fissure. The nasociliary nerve gives off the anterior ethmoid, the infratrochlear and the long ciliary nerve. Block of this nerve gives anesthesia of the anterior lateral portions of the nose.

#### Technique

Injection is performed 1.5 cm above the medial canthus at the medial orbital wall with the needle advanced 2-3 cm posteriorly. Two ccs of local is injected at this sight with injection of additional local with withdrawal of the needle.

## **Supraorbital and Supratrochlear Nerve Block**

#### Anatomy

The frontal nerve enters the orbit at the superior orbital fissure and divides into the supraorbital and supratrochlear nerves. This block is used for forehead anesthesia during surgical procedures or to block nerve pain caused by tic douloureux.

#### Technique

Palpitation is performed to find the supraorbital notch and the needle is advanced until parasthesia is felt in the distribution of the nerve, then injection of 3ml of 2% lidocaine with epinephrine is given. Then another 2 ml is injected at the point where the bridge of the nose meets the supraorbital ridge, i.e. the superior medial corner of the orbit.

## **Maxillary Nerve block**

#### Anatomy

The maxillary nerve starts from the trigeminal ganglion, travels through the cavernous sinus exiting the skull at the foramen rotundum to enter the pterygopalatine fossa where it gives off several branches to the mid face.

#### Technique

A needle is inserted just below the zygomatic arch midway between the coronoid and condyle of the mandible. It is inserted perpendicular to the skin until the pterygoid plate is felt. The needle is then withdrawn and guided anteriorly towards the eye to enter the pterygopalatine fossa. Five ccs of local are injected when paresthesia of the upper jaw is illicited. It should be noted that hemorrhage of the maxillary artery can cause hematoma in the hard and soft palate.

## **Infraorbital Nerve Block**

#### Anatomy

This is the largest terminal branch of the maxillary nerve. It enters though the inferior orbital fissure and travels in the infraorbital foramen to innervate the incisors and canines and anterior gingival mucosa along with the skin and soft tissues of the cheek. It should be noted that blocking the infraorbital nerve does not provide anesthesia to all the upper dentition. Maxillary nerve block would be used for this purpose.

#### Technique

The infraorbital foramen is located in a line between the pupil and the corner of the mouth just below the infraorbital rim. Three ccs of injection at the sight of exit of the nerve is usually sufficient for adequate anesthesia. The foramen can be approached from the skin or sublabially.

## **Sphenopalatine Ganglion Block**

### Anatomy

The sphenopalatine ganglion sits in the pterygopalatine fossa. Its main innervation is from the maxillary nerve, the greater superficial petrosal nerve, and sympathetics from the deep petrosal nerve. It supplies the periosteum of the orbit and lacrimal gland, and gives off the posterior superior nasal nerve and the nasal palatine nerves that supply the gums, hard palate, soft palate, uvula, and part of the tonsils.

### Technique

The greater palatine foramen is located at the posterior portion of the hard palate just medial to the gum line opposite the third molar. A needle is advanced 2 inches through the foramen and 3 cc is injected.

## **Mandibular Nerve Block**

### Anatomy

The mandibular nerve exits the foramen oval and divides into an anterior motor branch and a posterior branch. The anterior motor branch supplies the medial pterygoid, tensor tympani, and tensor palatine muscles. The posterior branch supplies sensation for the lower third of the face and the preauricular area.

### Technique

The patient is asked to open his mouth and the needle is advanced just below the zygomatic arch at the midpoint of the notch of the mandible until the pterygoid plate is felt. The needle is then withdrawn, and redirected posteriorly in the direction of the ear. 4-5 ccs of local are injected here and upon withdrawal of the needle.

## **Inferior Alveolar and Lingual Nerve Blocks**

### Anatomy

The inferior alveolar nerve is the largest branch of the mandibular nerve and enters the mandibular canal giving off several branches in the canal to give sensation to the teeth before exiting the mental foramen to supply sensation to the chin. The lingual nerve travels anteriorly just medial to the mandible on the floor of the mouth where it is joined by the corda tympani nerve before traveling to the tongue. It also gives off supply to the submandibular and sublingual glands.

### Technique

The inner surface of the mandible is infiltrated with 5 ccs of local injection after advancing the needle 2 inches deep, 1 inch superior and just medial to the 3<sup>rd</sup> mandibular molar.

## **Auriculotemporal Nerve Block**

### Anatomy

The auriculotemporal nerve is the posterior branch of the mandibular branch of the trigeminal nerve. It passes between the EAC and the TMJ and passes through the parotid gland to ascend with the superficial temporal artery over the zygomatic arch. It gives sensation to the external auditory meatus, tympanic membrane, portions of the pinna, and the TMJ, as well as the skin of the temporal region and lateral part of the scalp.

### Technique

Palpation of the temporal artery as it crosses the zygomatic arch near the root of the zygoma is given for the approximate location of the nerve. Infiltration with 3 ccs of local anesthetic in this area is given for anesthesia to the nerve and to its smaller peripheral branches.

## **Mental Nerve Block**

### Anatomy

The mental nerve is one of two terminal branches of the inferior alveolar nerve. It emerges from the mental canal to innervate the lower lip and gingival surface from the corner of the mouth to the midline. It is located just below or slightly posterior to the second premolar midway between the inferior and superior borders of the mandible.

### Technique

The foramen is approached intraorally or through the skin with a 25 gauge needle and 2 to 3 ccs of local anesthetic. It should be noted that entrance into the foramen poses risk of permanent nerve damage.

## **Nasal Surgery Blocks**

### Anatomy

The nose is supplied by the anterior and posterior ethmoidal nerves, multiple branches of the olfactory nerves, terminal branches from the sphenopalatine ganglion, and branches of the supratrochlear, nasociliary, and infraorbital nerves.

### Technique

The nose is first sprayed with 4% topical lidocaine or ponticane. Infiltration of the infraorbital, supratrochlear, and supraorbital nerves is next done with 5-10 ccs of local anesthetic, with 1 in 100,000 epinephrine. Pledgets of 4% cocaine are next used to further provide topical anesthesia. Additional anesthesia can be performed with injection of the sphenopalatine ganglion by endoscopic technique just posterior to the medial attachment of the middle turbinate or via the greater palatine foramen.

## **Ear Surgery Blocks**

### Anatomy

The ear is innervated by branches of the greater auricular nerve and the auriculotemporal nerve. The external auditory canal is innervated by branches of the seventh, ninth, and tenth

cranial nerves.

### Technique

If surgery is to be done on the auricle, injection completely around the ear, with additional injection of the greater auricular nerve and the auriculotemporal nerve as described above is adequate. If surgery of the EAC and middle ear is contemplated, an additional 4 quadrant injection of  $\frac{1}{4}$  -  $\frac{1}{2}$  cc of local is necessary.

## **Cervical Plexus Blocks**

### Anatomy

The cervical plexus is formed by the ventral primary rami of the first four cervical nerves. Each rami gives a superior and inferior branch that forms the nervous bundle of the cervical plexus. The deep nerves give off more superficial cutaneous branches that are the lesser occipital nerve, the greater auricular nerve, the suprascapular nerves, and smaller cutaneous branches. The deep cervical plexus gives motor supply to the deep musculature of the neck. The superficial branches merge from behind the midpoint of the sternocleidomastoid muscle, or Erb's point, to supply the overlying skin of the neck from the base of the skull to the clavicle.

### Technique

*Deep block* – the patient is positioned with head turned away. A line drawn between the mastoid tip and the insertion of the SCM on the clavicle approximates the transverse processes of the cervical spine. Approximately 2 inches below the mastoid tip is the level of C3. A needle is inserted until the level of the transverse process of the spine is reached, then 5-10 ccs of local anesthetic is injected. This is done both above and below this mark by about 1 cm to achieve blocks of C2-C4. Care is taken to withdraw on the needle prior to injection to assure that CSF or blood is not aspirated. The deep block will produce some paralysis of the musculature of the neck. Bilateral deep nerve blocks can result in bilateral phrenic nerve paralysis with subsequent respiratory insult.

*Superficial Block* – Erb's point is found midway between the origin and insertion of the SCM. 10 cc of local anesthetic is injected at the posterior border of the SCM and 1 inch superior and inferior to this point. This block will give only sensory blocks, and muscular relaxation will not be achieved.

## **Greater and Lesser Occipital Nerve Blocks**

### Anatomy

The greater occipital nerve arises from the dorsal primary ramus of the second and third cervical nerve. It gives sensation to the medial portion of the posterior scalp. The lesser occipital nerve arises from the ventral primary rami of the second and third cervical roots and give supply to the cranial surface of the pinna and adjacent scalp.

### Technique

The greater occipital nerve runs with the occipital artery and can be blocked by injecting 5-10 ccs of local anesthetic at the level of the superior nuchal line midway between the midline of the neck and the posterior border of the mastoid process. The lesser occipital nerve can be

blocked by injecting 1 inch inferior and medial to this area. The occipital artery can often be palpated and used as a landmark for injection of both areas.

## **Greater Auricular Nerve Block**

### Anatomy

The greater auricular nerve arises from the ventral rami of C2 and C3. It passes Erb's point to supply the skin in the region of the ear, angle of the jaw, and over the parotid gland.

### Technique

See Superficial cervical plexus blocks.

## **Glossopharyngeal Nerve Block**

### Anatomy

The glossopharyngeal nerve exits the jugular foramen and passes between the internal jugular and internal carotid staying lateral to the vagus and spinal accessory to pass anteriorly in the neck. It gives off the tympanic nerve to the middle ear, the carotid nerve to the baroreceptors of the carotid body, the pharyngeal nerve which gives sensation to the pharynx, and the tonsillar nerve and sensory branches to the posterior 1/3 of the tongue.

### Technique

This block can be used to treat glossopharyngeal neuralgia. The nerve is blocked just after leaving the jugular foramen. 1cm anterior and 1cm inferior to the mastoid tip, a needle is inserted 2-3 cm until the styloid process is contacted. At this point, the needle is directed posteriorly and advanced another 1-2 cm. Aspiration is advised before injection of 3-5 cc of local. Blockage of the spinal accessory and hypoglossal nerves are usually achieved at the same time.

## **Spinal Accessory Nerve Block**

### Anatomy

Spinal nerve XI leaves the jugular foramen in the same dural sheath as the vagus nerve to pass through the SCM at the upper to middle third of the muscle. It travels subdermally to innervate the trapezius muscle in the posterior triangle of the neck.

### Technique

This block is used for muscle spasms of the SCM and trapezius muscle. The junction of the upper and middle thirds of the SCM is used as a landmark. The posterior border of the SCM is identified at this point and infiltrated with 5 – 10 ccs of local anesthetic.

## **Laryngeal Blocks**

### Anatomy

Nerve supply to the larynx is largely via the superior laryngeal nerve with a small contribution from the recurrent laryngeal nerves. The superior laryngeal nerve is a branch of the vagus nerve. It passes lateral to the pharynx and behind the internal carotid to divide into

internal and external branches at the level of the hyoid. The internal branch gives sensation to the mucus membranes of the supraglottis and glottis, and the external branch supplies motor innervation to the cricothyroid muscle.

### Technique

The larynx is best blocked by a combined transtracheal and superior laryngeal nerve block. The cricothyroid membrane is palpated and 2 cc of 4% lidocaine is injected with a large bore needle. The patient will cough after the injection, so the needle should be withdrawn immediately after injection. Then with 2% lidocaine, the hyoid bone and thyroid cartilage are palpated, and midway between these two structures 2 ccs is injected bilaterally. It is possible to feel a popping sensation if the thyrohyoid ligament is pierced.

### **Conclusion**

Regional anesthesia can be used alone or in combination with general anesthesia as a safe and effective way to relieve pain in operations of the head and neck. Otolaryngologist should be equipped in its use. The acquisition of this skill is easy for the Otolaryngologist because of his intimate knowledge of the anatomy of the area.



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