Regional Anesthesia Blocks in Head and Face

Resident Physician: Leon Martinez, MD
Faculty Mentor: Paul Brindley, MD, FACS
The University of Texas Medical Branch – UTMB Health
Department of Otolaryngology
Grand Rounds Presentation
December 15, 2014

Series Editor: Francis B. Quinn, Jr., MD, FACS -- Archivist: Melinda Stoner Quinn, MSICS
Outline

- Local anesthetic review
- Advantages and disadvantages
- Blocks
  - Trigeminal
    - Orbital
    - Maxillary
    - Mandibular
  - Scalp
  - Ear
Local Anesthetics

- Followed general anesthesia by 40 years
- Koller used cocaine for the eye in 1884
- Halsted used cocaine as nerve block
- First synthetic local—procaine in 1905
- Lidocaine synthesized in 1943

Speaker Notes:
Also sold Bayer heroin aid for cough, Morphine for teething children, Marijuana for nerves
Local Anesthetics

- Mechanism of action is by reversibly blocking sodium channels to prevent depolarization
- Anesthetic enters on axioplasmic side and attaches to receptor in middle of channel

Speaker Notes: Local anesthetics depolarize the nerve membranes and prevent achievement of a threshold potential. A propagated action potential fails to develop and a conduction blockade is achieved. This occurs by the interference of nerve transmission by blocking the influx of sodium through the excitable nerve membrane [12].
- Linear molecules that have a lipophilic and hydrophilic end (ionizable)
- Low pH-- more in ionized state and unable to cross membrane (abscess)
- Adding sodium bicarb-- more in non-ionized state
Local Anesthetics

- Two groups: esters and amides
- Esters metabolized by plasma cholinesterase
  Cocaine, Procaine, Chloroprocaine, Tetracaine
- Amides metabolized by cytochrome p-450
  Lidocaine, Mepivacaine, Bupivacaine, Etidocaine
## Local Anesthetics

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dose</th>
<th>Onset/Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine with epi (1 or 2%)</td>
<td>7mg/kg</td>
<td>Fast/medium</td>
</tr>
<tr>
<td>Lidocaine without epi</td>
<td>4.5mg/kg</td>
<td>Fast/short</td>
</tr>
<tr>
<td>Mepivacaine without epi (3%)</td>
<td>5.5mg/kg</td>
<td>Fast/short</td>
</tr>
<tr>
<td>Bupivacaine with epi (0.5%)</td>
<td>1.3mg/kg</td>
<td>Long/long</td>
</tr>
<tr>
<td>Articaine with epi (4.0%)</td>
<td>7mg/kg</td>
<td>Fast/medium</td>
</tr>
<tr>
<td>Bupivacaine with liposome suspension (1.3%)</td>
<td>266 mg (1 vial)</td>
<td>Long/long</td>
</tr>
</tbody>
</table>

**Speaker Notes:** Bupivacaine with liposome suspension (1.3%) toxic dose is 10mg/Kg animal studies
Central nervous system

Initially-- lightheadedness, circumoral numbness, dizziness, tinnitus, visual change

Later-- drowsiness, disorientation, slurred speech, loss of consciousness, convulsions

Finally-- respiratory depression
Local Anesthetic Toxicity

- Primarily from intravascular injection or excessive dose
  - aspirate often with slow injection
  - ask about CNS toxicity
  - have monitoring available
  - prepare with resuscitative equipment, CNS depressant, drugs, cardiovascular drugs
  - ABC’s
Local Anesthetic Toxicity

- Cardiovascular
  - myocardial depression and vasodilation--hypotension and circulatory collapse
- Allergic reactions-- rare (less than 1%)
  - preservatives or metabolites of esters, rare in amides
  - rash, bronchospasm
Local Anesthetic Toxicity

All cases:
assure adequate ventilation
administer supplemental oxygen

Seizures:
diazepam (Valium)

Hypotension
Trendelenburg position (head down, legs up)
IV fluid bolus (isotonic saline or LR)
vasopressors (dopamine) (if refractory to above)

Dysrhythmias
as per ACLS protocol (but do not administer further
lidocaine)
Advantages of Local Anesthesia

• The patient is conscious during surgery.
• Smooth postoperative course.
• Patient awake and maintains his own airway.
• Less pain needs less narcotics, lighter anesthesia in general cases.
• Less nursing care after procedures, less admissions.
• Less expensive
Disadvantages of Local Anesthesia

- The patient may prefer to be asleep
- Specialized skill necessary.
- Some blocks require up to 30 minutes to be fully effective.
- Analgesia may not always be totally effective, and general anesthesia may be required anyway.
Disadvantages of Local Anesthesia

• Generalized toxicity may occur if local anesthetic drugs are given intravenously by mistake or an overdose is given.
• Widespread sympathetic blockade can result in hypotension.
• There is a small but definite incidence of prolonged nerve damage.
BLOCKS
The main sensory innervation of the face is derived from cranial nerve V (trigeminal nerve) and the upper cervical nerves.
- Sensory divisions:
  - Ophthalmic division V1
  - Maxillary division V2
  - Mandibular division V3

- Motor division:
  - Masticatory- masseter, temporalis, medial and lateral
    - pterygoids
  - Mylohyoid
  - Anterior belly of the digastric
  - Tensor tympani
  - Tensor veli palatini
Speaker Notes: The trigeminal nerve is the fifth of the 12 cranial nerves. Its branches originate at the semilunar ganglion (Gasserian ganglion) located in a cavity (Meckel’s cave) near the apex of the petrous part of the temporal bone. Three large nerves, the ophthalmic, maxillary, and mandibular, proceed from the ganglion to supply sensory innervation to the face (Fig. 2.3).
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 ovale 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.
The V1 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. The supraorbital nerve (SO) exits about 27 mm from the glabellar midline and the supratrochlear nerve (ST) is located approximately 17 mm from the glabellar midline. The infratrochlear nerve (IT) exits below the trochlea, and provides sensation to the medial upper eyelid, canthus, medial nasal skin, conjunctiva, and lacrimal apparatus.
The forehead and scalp are blocked by a series of injections form the central to the medial brow.
To anesthetize this area, the supratrochlear nerve is measured 17 mm from the glabellar midline and 1–2 ml of 2% lidocaine with 1:100,000 epinephrine is injected (Fig. 2.5). The supraorbital nerve is blocked by palpating the notch (and or measuring 27 mm from the glabellar midline) and injecting 2 ml of local anesthetic solution (Fig. 2.6). The infratrochlear nerve is blocked by injecting 1–2 ml of local anesthetic solution at the junction of the orbit and the nasal bones (Fig. 2.6). In reality, one can block all three of these nerves by simply injecting 2–4 ml of local anesthetic solution from the central brow proceeding to the medial brow.
Nasociliary and Anterior Ethmoidal Nerve Blocks

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.
Maxillary Nerve Blocks

Speaker Notes: 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.
Maxillary Division (V2):

- Exits the cranium via foramen rotundum of the greater wing of the sphenoid
- Travels at the superior most aspect of the pterygopalatine fossa just posterior to the Maxilla

- Branches divided by location:
  - Inter-cranial
  - Pterygopalatine
  - Infraorbital
  - Facial
Maxillary nerve block (V2 block):

- Techniques for blockade of V2
  - External Approach
  - High tuberosity approach
  - Greater palatine canal approach
Maxillary Nerve Blocks

Speaker Notes: 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 elicited. It should be noted that hemorrhage of the maxillary artery can cause hematoma in the hard and soft palate.
Maxillary Nerve Blocks
High tuberosity approach technique:

- Area of injection is height of mucobuccal fold of maxillary 2nd molar
- Advance at 45° superior and medial
- Insert needle ~30mm
- Inject ~1.8cc of local anesthetic
Greater palatine canal technique:

- Area of insertion is greater palatine canal
- Target area is the maxillary nerve in the pterygopalatine fossa
- The foramen is usually found about 7 mm anterior to the junction of the hard and soft palates
- Insert to depth of ~30mm
- Inject 1.8cc of local anesthetic
Speaker Notes: The maxillary nerve block via the greater palatine canal was first described in 1917 by Mendel [15]. The greater palatine foramen is located anterior to the junction of the hard palate and the soft palate medial to the second molar tooth (Fig. 2.15). The foramen is usually found about 7 mm anterior to the junction of the hard and soft palates. This junction is seen as a color change such that the tissue overlying the soft palate is darker pink than the tissue overlying the hard palate. The key to this block is to place a 1.5-in. needle through the greater palatine foramen. It sometimes takes multiple needle sticks to localize the foramen. Owing to the need for multiple sticks, the palatal mucosa in this area is first infiltrated with 0.5 ml of lidocaine to facilitate painless location of the greater palatine foramen. A 1.5-in. 25-or 27-gauge needle is bent to 45° and will usually easily negotiate the pterygopalatine canal, thereby placing the local anesthetic solution into the pterygopalatine fossa.
The maxillary nerve block via the greater palatine canal was first described in 1917 by Mendel [15]. The greater palatine foramen is located anterior to the junction of the hard palate and the soft palate medial to the second molar tooth (Fig. 2.15). The foramen is usually found about 7 mm anterior to the junction of the hard and soft palates. This junction is seen as a color change such that the tissue overlying the soft palate is darker pink than the tissue overlying the hard palate. The key to this block is to place a 1.5-in. needle through the greater palatine foramen. It sometimes takes multiple needle sticks to localize the foramen. Owing to the need for multiple sticks, the palatal mucosa in this area is first infiltrated with 0.5 ml of lidocaine to facilitate painless location of the greater palatine foramen. A 1.5-in. 25-or 27-gauge needle is bent to 45° and will usually easily negotiate the pterygopalatine canal, thereby placing the local anesthetic solution into the pterygopalatine fossa.
To perform an infraorbital nerve block from an intraoral approach, topical anesthetic is placed on the oral mucosa at the vestibular sulcus just under the canine fossa (between the canine and first premolar tooth) and left for several minutes. The lip is then elevated and a 1.5-in. 27-gauge needle is inserted in the sulcus and directed superiorly toward the infraorbital foramen (Fig. 2.7). The needle does not need to enter the foramen for a successful block. The anesthetic solution needs only to contact the vast branching around the foramen to be effective. It is imperative to use the other hand to palpate the inferior orbital rim to avoid injecting the orbit. Between 2 and 4 ml of 2% lidocaine with 1:100,000 epinephrine is injected in this area for the infraorbital block aproach for local anesthetic block of the infraorbital nerve.
Speaker Notes: The facial approach for local anesthetic block of the infraorbital nerve.

The infraorbital nerve can also be very easily blocked by a facial approach and this is the preferred route of the author. This may also be the preferred route in dental phobic patients. A 0.5-in. 27-gauge needle is used and is placed through the skin and aimed at the foramen in a perpendicular direction. Between 2 and 4 ml of local anesthetic solution is injected at or close to the foramen (Fig. 2.8). Again, the other hand must constantly palpate the inferior orbital rim to prevent inadvertent injection into the orbit.
A successful infraorbital nerve block will anesthetize the infraorbital cheek, the lower palpebral area, the lateral nasal area, and superior labial regions (Fig. 2.9).
https://www.clinicalkey.com/#!/search/supraorbital%2520nerve%2520block/%7B%22facetquery%22:%5B%22%20contenttype:VD%22%5D%7D
Speaker Notes: The aforementioned techniques provide anesthesia to the lateral nasal skin but do not provide anesthesia to the central portion of the nose. A dorsal (external) nasal nerve block will supplement nasal anesthesia by providing anesthesia over the area of the cartilaginous nasal dorsum and tip. This supplementary nasal block is accomplished by palpating the inferior rim of the nasal bones at the osseous cartilaginous junction. The dorsal nerve (anterior ethmoid branch of the nasociliary nerve) emerges 5–10 mm from the nasal midline at the osseous junction of the inferior portion of the nasal bones (the distal edge of the nasal bones) (Fig. 2.10). The dotted line in Fig. 2.10 shows the course of this nerve under the nasal bones before emerging.
Speaker Notes: Too often overlooked nerves in facial local anesthetic blocks are the zygomaticotemporal and zygomaticofacial nerves. These nerves represent terminal branches of the zygomatic nerve. The gomaticotemporal nerve emerges through a foramen located on the anterior wall of the temporal fossa. This foramen is actually behind the lateral orbital rim posterior to the zygoma at the approximate level of the lateral canthus.
Injection technique involves sliding a 1.5-in. needle behind the concave portion of the lateral orbital rim. It is suggested that one closely examine this area on a model skull prior to attempting this injection as it will make the technique simpler. To orient for this injection, the physician needs to palpate the lateral orbital rim at the level of the frontozygomatic suture (which is frequently palpable). With the index finger in the depression of the posterior lateral aspect of the lateral orbital rim (inferior and posterior to the frontozygomatic suture), the operator places the needle just behind the palpating finger (which is about 1 cm posterior to the frontozygomatic suture) (Fig. 2.12). The needle is then “walked” down the concave posterior wall of the lateral orbital rim to the approximate level of the lateral canthus. After aspirating, 1–2 ml of 2% lidocaine with 1:100,000 epinephrine is injected in this area with a slight pumping action to ensure deposition of the local anesthetic solution at or about the foramen. Again, it is important to hug the back concave wall of the lateral orbital rim with the needle when injecting.
Speaker Notes: The zygomaticofacial nerve exits through a foramen (or foramina in some patients) in the inferior lateral portion of the orbital rim at the zygoma. If the surgeon palpates the junction of the inferior lateral (the most southwest portion of the right orbit, if you will) portion of the lateral orbital rim, the nerve emerges several millimeters lateral to this point. By palpating this area and injecting just lateral to the finger, one successfully blocks this nerve with 1–2 ml of local anesthetic (Fig. 2.14). Blocking this nerve will result in anesthesia of a triangular area from the lateral canthus and the malar region along the zygomatic arch and some skin inferior to this area (Fig. 2.13) [14].
The anesthetized areas from the zygomaticotemporal nerve (ZT) and the zygomaticofacial nerve (ZF)
Lower Branch blocks

- Posterior superior alveolar
- Middle superior alveolar
- Anterior superior alveolar
- Nasopalatine
- Greater palatine
Posterior superior alveolar nerve block:

- Used to anesthetize the pulpal tissue, corresponding alveolar bone, and buccal gingival tissue to the maxillary 1st, 2nd, and 3rd molars.
Posterior superior alveolar nerve block:

- Technique
  - Area of insertion - height of mucobuccal fold between 1st and 2nd molar
  - Angle at 45° superiorly and medially
  - No resistance should be felt (if bony contact angle is to medial, reposition laterally)
  - Insert about 15-20mm
  - Aspirate then inject if negative
Middle superior alveolar nerve block:
- Used to anesthetize the maxillary premolars, corresponding alveolus, and buccal gingival tissue
- Present in about 28% of the population
- Used if the infraorbital block fails to anesthetize premolars
Middle superior alveolar nerve block:

– Technique:

• Area of insertion is height of mucobuccal fold in area of 1st/2nd premolars

• Insert around 10-15mm

• Inject around 0.9-1.2cc
Anterior superior alveolar nerve block:
- Used to anesthetize the maxillary canine, lateral incisor, central incisor, alveolus, and buccal gingiva
Anterior superior alveolar nerve block:
- Technique:
  • Area of insertion is height of mucobuccal fold in area of lateral incisor and canine
  • Insert around 10-15mm
  • Inject around 0.9-1.2cc
- Greater palatine nerve block:
  - Can be used to anesthetize the palatal soft tissue of the teeth posterior to the maxillary canine and corresponding alveolus/hard palate
Greater palatine nerve block:

- Technique:
  - Area of insertion is ~1cm medial from 1st/2nd maxillary molar on the hard palate
  - Palpate with needle to find greater palatine foramen
  - Depth is usually less than 10mm
  - Utilize pressure with elevator/mirror handle to desensitize region at time of injection
  - Inject 0.3-0.5cc of local anesthetic
Nasopalatine nerve block:
- Can be used to anesthetize the soft and hard tissue of the maxillary anterior palate from canine to canine
Nasopalatine nerve block:
- Technique:
  - Area of insertion is incisive papilla into incisive foramen
  - Depth of penetration is less than 10mm
  - Inject 0.3-0.5cc of local anesthetic
  - Can use pressure over area at time of injection to decrease pain
Mandibular Nerve Blocks
Mandibular Nerve Blocks
Mandibular Nerve Blocks
Mandibular Nerve Blocks

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 prearicular area.
Mandibular Nerve Blocks

**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 Nerve Block
Inferior alveolar nerve block (IAN):
- Technique involves blocking the inferior alveolar nerve prior to entry into the mandibular lingula on the medial aspect of the mandibular ramus
- Multiple techniques can be used for the IAN nerve block
  - IAN
  - Akinosi
  - Gow-Gates
Inferior alveolar nerve block (IAN):

- Technique:
  - Area of insertion is the mucous membrane on the medial border of the mandibular ramus
  - Height of injection- 6-10 mm above the occlusal table of the mandibular teeth
  - Anteroposterior plane- just lateral to the pterygomandibular raphe
pterygomandibular raphe
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 3rd mandibular molar.
https://www.youtube.com/watch?v=whqcPLf7Y3E
- Akinosi closed-mouth mandibular block:
  - Useful technique for infected patients with trismus, fractured mandibles, mentally handicapped individuals, children
  - Provides same areas of anesthesia as the IAN nerve block
Akinosi closed-mouth mandibular block:

- Area of insertion: soft tissue overlying the medial border of the mandibular ramus directly adjacent to maxillary tuberosity
- Inject to depth of 25mm
- Inject ~1.0-1.5cc of local anesthetic as in the IAN
- Inject remaining anesthetic in area of long buccal nerve
Mental Nerve Block
Mental nerve block:

- Mental and incisive nerves are the terminal branches for the inferior alveolar nerve
- Provides sensory input for the lower lip skin, mucous membrane, pulpal/alveolar tissue for the premolars, canine, and incisors on side
- blocked
Mental nerve block:

- Technique:
  - Area of injection mucobuccal fold at or anterior to the mental foramen. This lies between the mandibular premolars
  - Depth of injection ~5-6mm
  - Inject 0.5-1.0cc of local anesthesia
  - Message local anesthesia into tissue to manipulate into mental foramen to anesthetize the incisive branch
Mental Nerve Block
Scalp Blocks

Greater and lessor occipital nerve
Scalp Blocks
Scalp Blocks

The greater occipital nerve is in close approximation to the artery of the same name (1). The nerve can be located by palpating the artery and injecting just medial to it (2). Another landmark is injecting on the nuchal line, one third to half the distance between the mastoid prominence and occipital protuberance (3, 5). 4 the lesser occipital nerve.
Scalp Blocks

1. supratrochlear
2. supraorbital
3. zygomatico temporal
4. greater auricular
5. lesser occipital
6. greater occipital
Blocking the entire ear (with the exception of the area supplied by the vagus nerve) can be performed by inserting the needle at the black dots and infiltrating along the dotted lines. This will anesthetize the terminal branches of the auriculotemporal nerve, the lesser occipital nerve, and the anterior and posterior branches of the greater auricular nerve. The main trunks of these nerves could be blocked as detailed in the text, but this terminal infiltration technique may be more convenient.
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.
References

Atlas of Regional Anesthesia, Katz et. al, Multiple pages, Appleton and Lange 1994

Techniques of Regional Anaesthesia, Scott et. al, Appleton and Lange, 1989

Regional Anesthesia of the oral cavity, Jastak and yagiela, The Mosby Company 1981

Illustrated Handbook in Local Anaesthesia, Eriksson, W.B. Saunders Company 1979
