Section 3

ANESTHESIA IN DENTISTRY

Scanned with CamScanner

Scanned with CamScanner

8 CHAPTER

Local Anesthesia

DEFINITION

Local anesthesia may be defined as the reversible regional loss of sensation to a painful stimulus as well as loss of sensation of touch, temperature and pressure. This is brought about by an inhibition in excitation of the nerve endings or a reversible block of conduction in the peripheral nerves. This does not produce a loss of consciousness of the individual.

Cocaine was the first of the local anesthetics to be discovered and it is also the only naturally occurring LA. All others such as lignocaine, procaine are synthetically derived.

Discussion of the actions of local anesthetics should be preceeded by a brief idea of the physiology of nerve conduction.

Propagation of electrical impulses is brought about by the alteration in the ion gradient across the nerve cell wall (also called axolemma). This process helps in transmitting sensation along a nerve.

- When the nerve is in the resting state, there is a negative membrane potential of -70 mV.
- This is because, in this resting state, the sodium/potassium adenosine triphosphate pump acts by transporting the sodium ions (Na^+) out of the cell and potassium ions (K^+) into the cell.
- This is an active transport pump which in this way creates a concentration gradient by which it favors the transport of K^+ out of the cell.
- The nerve membrane, however, allows K^+ ions to pass through it easily but does not allow the passage of Na^+ ions through it.
- Therefore, negatively charged ions accumulate within the cell (axoplasm). This explains the negative resting membrane potential.

Depolarization

- When the nerve is stimulated, it gets depolarized. Depolarization causes impulse propagation.
- During depolarization, the nerve membrane becomes permeable to Na^+ also and thus initially there is a gradual entry of Na^+ into the cell through the nerve cell membrane.
- Once the Na^+ ions enter the cell, the transmembrane electric potential increases. Once the potential reaches a threshold level or the threshold potential is achieved (approx -55 mV) the permeability to Na^+ increa[illegible] due to the activation of sodium channels. This causes [illegible]pid influx of Na^+.
- At the end of the depolarization, the potential is [illegible]und +35 mV.
- These alterations in nerve membrane potenti[illegible] are termed as action potential.

Repolarization

- The last phase of action potential is repolarization.
- During this phase, the nerve membrane permeability to Na^+ decreases again.
- The K^+ ions move along the concentration gradient and come into the cell while the sodium ions go extracellularly.
- The activation of the sodium/potassium pump restores the resting membrane potential of -70 mV.

MECHANISM OF ACTION

- The local anesthetics basically block the influx of sodium ions. This inhibits the depolarization process itself and thus since the threshold potential is not achieved, there is no propagation of the action potential.
- Local anesthetics are weak bases. To make them injectable, they should be water soluble and, therefore, a hydrochloride salt is added to the local anesthetic.
- In aqueous solution, this salt dissociates into ionised and nonionised forms and equilibriates between the two.
- For LA to be effective, it has to first diffuse into the nerve cell membrane. The nonionized base has lipophilic properties and is responsible for the diffusion into the nerve cell membrane.
- Once the base diffuses into the nerve cell, due to the pH of the axoplasm, the local anesthetic reequilibrates into ionised and nonionised forms. Now the ionised form is responsible for binding to the sodium channel receptor and thus blocking the sodium channel to prevent depolarization.
- Therefore, the lipid solubility of the local anesthetic solution is essential. Since more than 90% of the nerve membrane is made of lipids, for LA to diffuse into the nerve membrane, lipid solubility is important.

Scanned with CamScanner

Scanned with CamScanner

- The more lipid soluble the solution, the faster it penetrates through the nerve membrane to block the sodium channels. The faster it diffuses, the faster is the onset of action of LA.
- Since LA exists as ionised and nonionised form, the proportion of these forms depends on the pH of the surrounding tissue. The nonionised part helps in diffusion through the cell membrane and a decrease in the pH of the surrounding tissues shifts the equilibrium towards the ionised form (not useful for diffusion through the membrane). Therefore, the onset of action is delayed.
- For example, in case of an infection or an inflammation, the acidic environment increases the ionised form of the solution, thus making LA less effective.

THEORIES

Various theories have been proposed regarding how exactly the local anesthetic blocks the influx of sodium ions.

1. *Acetylcholine theory*
2. *Calcium displacement theory:* It was believed that calcium which is present at the sodium channel was responsible for the transport of sodium through the channel. The local anesthetic was said to displace the calcium, thus preventing the influx of sodium. This theory was, however, disputed by clinical experiments which showed that even in the presence of excessive calcium around the nerve trunk, it did not alter the effect of the local anesthetic.
3. *Surface charge repulsion theory:* It was believed that the charged local anesthetic molecules bind to the nerve membrane surface and alter the electrical potential. This theory also has been disputed.
4. *Membrane expansion theory:* This theory proposes that local anesthetic is absorbed into the cell membrane and causes an expansion of the membrane itself. This causes a narrowing of the sodium channels, thus preventing its influx.
5. *Specific receptor theory:* This theory states that there are specific receptors present at the opening of the sodium channels. Local anesthesia diffuses across the nerve membrane and binds to these specific receptors. This binding probably leads to an alteration in the structure and functioning of the sodium channel and thus prevents the influx of Na^+.

CLASSIFICATION OF LOCAL ANESTHETICS

The chemical structure of local anesthetics basically consists of three components.

1. Aromatic group: This is lipophilic and is made of a benzene ring.
2. Amine group: hydrophilic part.
3. Intermediate chain:
   - This connects the aromatic and the amine group.
   - Can be either an ester or an amide.
   - Local anesthetics can be classified based on whether the intermediate chain is an ester or an amide.
   - This structural difference affects the metabolism of the drug.

Local anesthetics may be classified into:

1. **Amino esters**
   - These local anesthetics are metabolised by hydrolysis by plasma pseudocholinesterase.
   - In some patients there may be genetically a structural defect of this enzyme. In such cases the local anesthetic cannot be metabolised and the blood levels may be toxic.
   - One of the products of hydrolysis of this drug is PABA. This is a known allergen. Therefore, if a patient is allergic to this type of local anesthetic, use of all other local anesthetics of this group should be avoided.
   - Examples of ester local anesthetics are: cocaine, procaine, chlorprocaine, tetracaine etc.
2. **Amino amides**
   - Metabolised in the liver by microsomal enzymes.
   - Use with caution in patients with liver disease.
   - Lidocaine is metabolised by a specific microsomal enzyme P-450 3A4.
   - Examples of amides are: lidocaine, prilocaine, mepivacaine, bupivacaine, etidocaine etc.

CONTENTS OF LOCAL ANESTHETIC SOLUTION

Usually contains the following:

1. Local anesthetic
2. Vasoconstrictor
3. Antioxidant
4. Preservative
5. Fungicide
6. Salt
7. Vehicle

1. *Local anesthetic:* This may be an amide or an ester.
2. *Vasoconstrictor:* Epinephrine is used as the vasoconstrictor.
   - Local anesthetics are vasodilators; they cause vasodilation of the peripheral arterioles in the region of the injection. This causes the LA to be rapidly absorbed into the blood stream from the operative field.
   - Epinephrine added to the local anesthetic causes vasoconstriction and prevents rapid absorption into the blood stream.

Scanned with CamScanner

Scanned with CamScanner

- Therefore, a lower dose of local anaesthetic is required to produce the desired effect.
- Also reduces systemic toxicity by decreasing systemic absorption from site of administration.
- Since it delays the absorption from the local site, the local anesthetic lasts for a longer time locally, increasing the duration of action.
- Increases the safe dose of local anesthetic that may be administered.
- Epinephrine also causes hemostasis in the local area into which it is injected and therefore helps in creating a blood-free field for operation.
- Usually used in the concentration of 1:100,000.
- Epinephrine has its own toxic effects.
  i) May produce cardiac arrhythmias in patients with previous heart disease.
  ii) May induce hypertension in an already hypertensive patient or a patient with hyperthyroidism.
  iii) May induce arrhythmias when used along with halothane.
  iv) May hamper the healing of a flap if injected in the region.
  v) Local anesthetics with epinephrine should not be injected in the ala of the nose or in the helix of the ear since it may cause necrosis.

3. *Antioxidant:* Sodium metabisulphite. Vasoconstrictors in the local anesthetic solution tend to get oxidised if left for a while or on exposure to sunlight. Addition of an antioxidant delays the rapid oxidation of vasoconstrictor and prolongs the shelf life of the solution.
4. *Preservative:* Methyl paraben or capryl hydro cuprinotoxin. The addition of a preservative is essential in the use of multi-dose vials. It is not added in case of single-use cartridges.
5. *Fungicide:* Thymol
6. *Salt:* Bicarbonate may be added to local anesthetics to make the solution isotonic. Local anesthetic solution with a vasoconstrictor is usually of a pH of 4–5 to prolong shelf life. This causes burning on injection in a patient. Addition of bicarbonate makes the solution isotonic and comfortable for the patient.
7. *Vehicle:* Distilled water or Ringer's lactate solution may be used as the vehicle for dissolving all the contents of the local anesthetic to make it injectable. Addition of solution may also be done to reduce the concentration of the drug. This provides additional volume for injection over a larger operative field without increasing the total dose administered.

PHARMACOLOGY OF LOCAL ANESTHETICS

Once a local anesthetic is injected into the tissues, it is distributed to all the body tissues. Organs which have a greater perfusion such as brain, kidney, liver etc., receive more of the drug than lesser perfused organs. The skeletal muscles have the highest concentration of the drug.

Metabolism of Local Anesthetics

Esters: These local anesthetics are metabolised by hydrolysis by plasma pseudocholinesterase.
Amides: Metabolised in the liver by microsomal enzyme
Excretion: The kidneys help in excretion of the drug. Patients with renal disorders may not be able to excrete the drug which may result in elevated blood levels.

Systemic Effects of Local Anesthetics

Effects on CNS

- The local anaesthetic has basically a depressive effect on the CNS.
- Within therapeutic levels, there is no significant change on the CNS.
- With mildly increased blood levels, local anesthetics have anticonvulsant effect. This is because LA acts by depressing the hyperexcitable cortical neurons of the CNS.
- With further increase in blood levels, it is manifested as convulsions or an excitatory effect on the CNS. This is because the inhibitory pathway of the cerebral cortex is blocked. This inhibitory pathway actually prevents a seizure and by the effect of local anesthetics which inhibit this pathway, there is a precipitation of a seizure.
- Even further increase in blood levels produces a generalised CNS depression.

Effect on the CVS

- Local anesthetics have a depressive action on the myocardium.
- Thus the heart rate and the force of contraction of the heart are reduced.
- Also as it produces peripheral vasodilatation, it can produce hypotension.

The administration of the local anesthetic solution into the tissues may be done by a variety of techniques. The point to be remembered, however, is that around 8–10 mm of the nerve should be bathed in the solution for the anesthesia to be effective.

This can be done by a variety of methods:

1. *Nerve block:* The local anesthetic solution is injected such that it is close to the main trunk of the nerve. Since the main nerve trunk itself is blocked, sensation is not conducted along the nerve centrally beyond the point where the nerve is blocked. E.g.: inferior alveolar nerve block

Scanned with CamScanner
Scanned with CamScanner

2. *Field block:* The local anesthetic solution is injected to block the large terminal branches of a nerve trunk. This causes a smaller localized area of anesthesia. The field block may be given by a variety of techniques depending on in which region the anesthesia is required.
   i) *Submucosal injection:* As the name suggests, the solution is deposited just below the mucosa. This produces effective anesthesia to the mucous membrane in the region where it is injected.
   ii) *Paraperiosteal injection:* In this technique, the solution is deposited in close proximity to the periosteum. The local anesthetic solution in this technique can anaesthetise the periosteum and the underlying cortical bone as the solution diffuses into it. This is one of the ways of anesthetising the cortical bone of the maxilla. Subperiosteal injections are usually not possible as the periosteum is tightly adherent to the bone and depositing solution in this region is very painful.
   iii) *Intraosseous injection:* Injection of local anesthetic solution into the bone itself. Cannot be done using the traditional needles.
   iv) *Interseptal injection:* The local anesthetic is forced into the interseptal bone on either side of the tooth to be anesthetized. This is a variant of the intraosseous technique.
   v) *Periodontal ligament injection:* A narrower gauge needle is used to force the local anesthetic solution into the periodontal ligament space. This can be used to anesthetise a single tooth.
3. *Local infiltration:* This is an injection given to block the smaller terminal nerve endings in a localised region. E.g.: along the margins of a wound to be sutured or along the region of a planned incision.
4. *Topical anesthesia:* This is a method of application of a local anesthetic to the surface of the skin or mucous membrane where the superficial nerve endings are anesthetised. Not all local anesthetics can be used by the topical route.

See **Table 8.1** for nerve supply of the teeth.

TECHNIQUES

MAXILLARY NERVE BLOCKS

Infraorbital Nerve Block

Anatomy

- This is a branch of the maxillary division of the trigeminal nerve.
- Innervates the lower eyelid, lateral aspect of the nose, upper-lip and medial aspect of the cheek on the same side. It also innervates the labial mucosa and the labial gingiva in relation to the anterior teeth.
- It exits the skull through the infraorbital foramen which is present 1 cm inferior to the infraorbital ridge and approximately 2.5 cm lateral to the midfacial line.
- The nerve exits the foramen and divides into three main branches, the inferior palpebral, lateral nasal and the superior labial branches.

***Technique* (Fig. 8.1–8.4)**

- This nerve block will be required for the extraction of the maxillary anterior teeth along with the nasopalatine nerve block.
- Two methods, intraoral and extraoral.
- The infraorbital ridge is palpated and 1 cm inferior to it, the infraorbital depression containing the infraorbital foramen is palpated with the middle finger. The thumb and index finger of the same hand are used to elevate the upper lip to visualise the superior labial sulcus.
- The needle is inserted at the depth of the labial sulcus with the bevel of the needle facing the teeth. The needle is inserted at the apex of the canine fossa or along the long axis of the first premolar with the finger still in the infraorbital foramen region.
- Approximately 1 cc of solution is injected in the vicinity of the infraorbital nerve. The solution is felt under the palpating finger. Apply mild pressure in the region to allow the solution to diffuse.

***Extraoral Technique* (Fig. 8.5)**

- The infraorbital region is prepared with antiseptic solution. The infraorbital rim is palpated and the infraorbital depression is felt 1 cm inferior to it.
- A needle is inserted cutaneously and approximately 1 cc of solution is deposited near the foramen.

Symptoms

- The patient experiences a feeling of numbness in the infraorbital region, lateral aspect of the nose and the upper lip.
- This nerve block also anesthetises the anterior superior and the middle superior alveolar nerves which are given out within the infraorbital canal.
- On instrumentation of the upper labial mucosa, the maxillary anterior teeth with the related gingiva on the buccal side are also numb.

Complications

- Rarely, a hematoma may develop. This can be managed by applying pressure locally for a few minutes.

Scanned with CamScanner

Scanned with CamScanner

Table 8.1 Nerves to be anesthetised for extraction

Maxillary teeth	Buccal	Palatal
Central incisor	- Anterior superior alveolar nerve - Infraorbital nerve	Nasopalatine nerve
Lateral incisor	- Anterior superior alveolar nerve - Infraorbital nerve	Nasopalatine nerve
Canine	- Anterior superior alveolar nerve - Infraorbital nerve	Nasopalatine nerve
First premolar	- Middle superior alveolar nerve	Greater palatine nerve
Second premolar	- Middle superior alveolar nerve	Greater palatine nerve
First molar	- Posterior superior alveolar nerve - Middle superior alveolar nerve	Greater palatine nerve
Second molar	- Posterior superior alveolar nerve	Greater palatine nerve
Third molar	- Posterior superior alveolar nerve	Greater palatine nerve
Mandibular teeth	**Buccal**	**Lingual**
Central incisor	- Incisive nerve (branch of inferior alveolar) - Mental nerve (soft tissues)	Lingual nerve
Lateral incisor	- Incisive nerve (branch of inferior alveolar) - Mental nerve (soft tissues)	Lingual nerve
Canine	- Incisive nerve (branch of inferior alveolar) - Mental nerve (soft tissues)	Lingual nerve
First premolar	- Inferior alveolar nerve - Mental nerve	Lingual nerve
Second premolar	- Inferior alveolar nerve - Plexus of long buccal and mental nerve	Lingual nerve
First molar	- Inferior alveolar nerve - Long buccal nerve	Lingual nerve
Second molar	- Inferior alveolar nerve - Long buccal nerve	Lingual nerve
Third molar	- Inferior alveolar nerve - Long buccal nerve	Lingual nerve

- If the needle is positioned superior to the infraorbital foramen and the solution enters the orbit there are chances of diplopia, exophthalmos and very rarely blindness.

Posterior Superior Alveolar Nerve Block

Anatomy

- This is a branch of the maxillary division of the trigeminal nerve.
- It innervates the maxillary first, second and third molars with an exception of the mesiobuccal root of the first molar in a large number of patients.
- The buccal periodontium and buccal gingiva in relation to these teeth are supplied by this nerve.
- The nerve is located on the posterior surface of the maxilla.

Technique (Fig. 8.6–8.8)

- A short needle is to be used for this block.
- The aim is to position the needle on the posterior surface of the maxilla.

Scanned with CamScanner

Scanned with CamScanner

Fig. 8.1 Palpation of infraorbital depression

Fig. 8.2 Infraorbital nerve block premolar approach

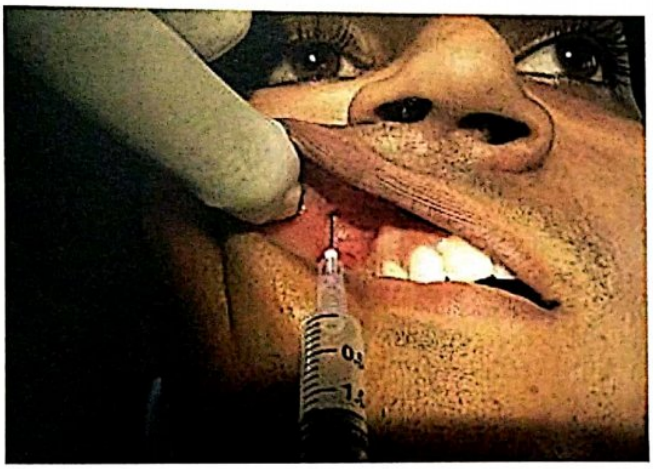

Fig. 8.3 Infraorbital block

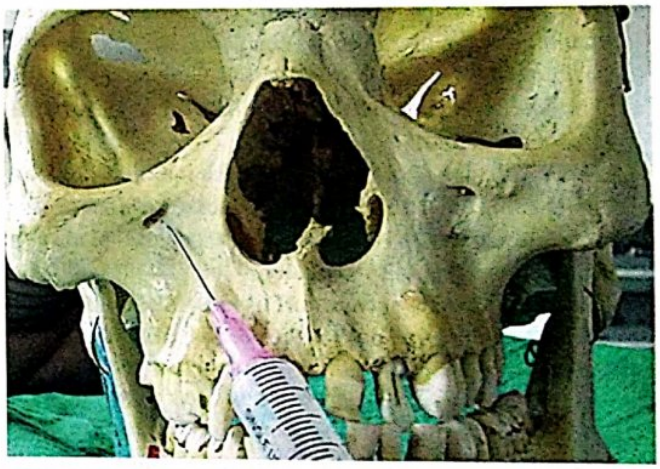

Fig. 8.4 Infraorbital nerve block central incisor approach

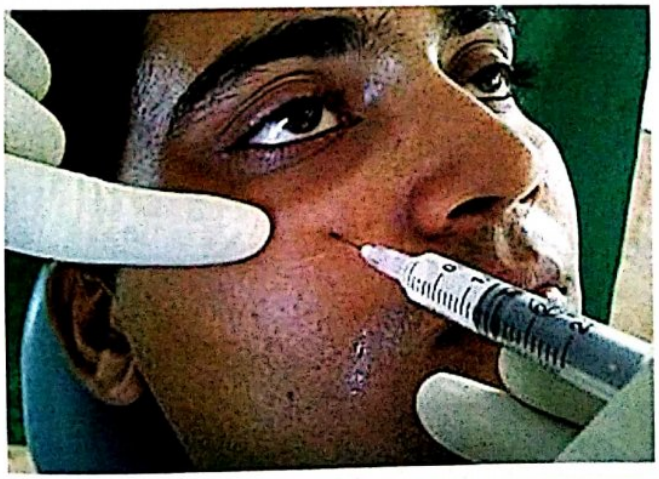

Fig. 8.5 Extraoral infraorbital

Fig. 8.6 Palpation of zygomatic butters for posterior superior alveolar nerve block

Scanned with CamScanner

Scanned with CamScanner

Fig. 8.7 Posterior superior alveolar nerve block

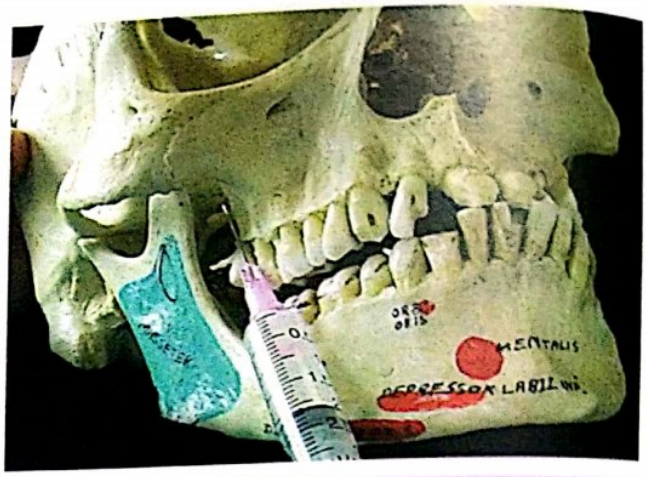

Fig. 8.8 Posterior superior alveolar nerve block

- The patient is asked to partially open the mouth. The mandible may be moved to the same side to improve visibility.
- The cheek is retracted to visualize the depth of the mucobuccal fold.
- The needle is then inserted above the maxillary second molar going upwards, inwards and backwards. The needle is to be angulated at 45 degrees to the occlusal plane and 45 degrees to the sagittal plane.
- The needle is advanced in soft tissues only, no bony resistance is felt. Once 3/4th of the needle is inside, aspirate and inject around 2 cc of the solution slowly.

Symptoms

- The patient may not be able to appreciate the numbness unless it is checked with an instrument. Loss of sensation is felt over the buccal gingiva of the first, second and third molars.

Complications

- Hematoma: If the needle is penetrated very deep to injure the pterygoid venous plexus or accidentally the maxillary artery is injured.
- A swelling will be seen immediately in the cheek. Pressure may be applied posterior to the maxillary tuberosity or ice packs may be given immediately.
- The hematoma usually resolves by itself. There may be chances of infection of a large hematoma.
- Chances of anesthesia of the mandibular nerve as it is present lateral to the PSA.

Middle Superior Alveolar Nerve Block (Fig. 8.9)

- This nerve is a branch of the maxillary division of the trigeminal nerve.
- It supplies the premolars and the mesiobuccal root of the maxillary first molar and the buccal gingiva in relation to these teeth.
- This nerve is usually anesthetised along with an infraorbital block but in cases where adequate anesthesia is not achieved it may be given separately.

Technique

- This is similar to an infiltration, only the needle is positioned deeper.
- The cheek is retracted and the needle is positioned with the bevel facing the bone.
- The needle is inserted parallel to the long axis of the second premolar till it reaches approximately till the apex of the tooth.
- Around 1 cc of the solution is injected after aspiration.

Symptoms

- Patient may not be able to experience any symptoms unless an instrument is used to probe on the buccal gingiva in relation to the premolars.

Complications

- Rare.

Greater Palatine Nerve Block (Fig. 8.10, 8.11)

Anatomy

- The greater palatine nerve exits the greater palatine foramen which is present in between the second and third molars on the palate.
- The nerve then travels between the bone and soft tissues of the palate in a groove to supply the palatal gingiva and roots of the premolars and molars.

Scanned with CamScanner

Scanned with CamScanner

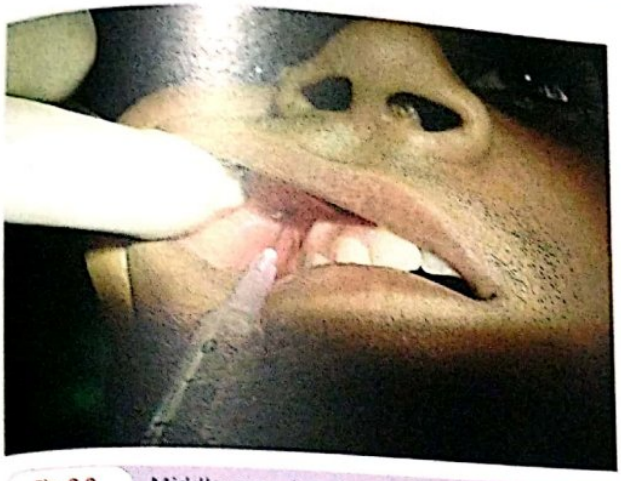

Fig. 8.9 Middle superior alveolar nerve block

Fig. 8.10 Greater palatine nerve block

Fig. 8.11 Greater palatine nerve block

Technique

- The greater palatine foramen may be located 1 cm medial to the free gingival margin of the second molar and around 1 cm lateral to the mid palatine raphae.
- The index finger is run from the alveolar process on the palatal side towards the midline. It will encounter a depression at the junction of the alveolar and palatine aspect of the hard palate. This will be the region of the greater palatine foramen.
- The injection is given just anterior to the foramen.
- The needle is to be positioned with the bevel facing the bone. The patient is asked to open the mouth wide and the needle is entered from the opposite direction to contact the mucosa at right angles to it.
- The needle will not be able to penetrate very deep as it will encounter resistance from the palatal bone.
- A small amount of solution is deposited in the region after aspiration till blanching is seen on the palatal tissues surrounding the needle.
- Once blanching is seen, the needle is withdrawn.

Symptoms

- The patient will not be able to appreciate the anesthesia till the palatal tissues are probed.
- The palatal gingiva from the premolar region to the third molar region will be anesthetised.

Complications

- Ischemia of the palate in the region of the injection—this may occur when high concentration of vasoconstrictors is used in the solution or when excessive solution is forced into the palate.
- Anesthesia of the soft palate—this can lead to gagging.

Nasopalatine Nerve Block

Anatomy

- This is a branch of the pterygopalatine branch of the maxillary division.
- It enters the oral cavity from the nasal cavity through the incisive foramen and supplies the palatal gingiva of the maxillary anterior teeth.
- The incisive foramen is located behind the incisive papilla between the palatal aspect of the central incisors.

Technique (Fig. 8.12–8.14)

- Since it is usually a painful injection, the incisive papilla should be anesthetised initially.
- The patient is asked to open the mouth wide and the needle is inserted into the incisive papilla at an angle of 45 degrees. Deposit a small amount of solution till blanching is seen on the incisive papilla.

Scanned with CamScanner

Scanned with CamScanner

Fig. 8.12 Nasopalatine nerve block

Fig. 8.13 Nasopalatine nerve block

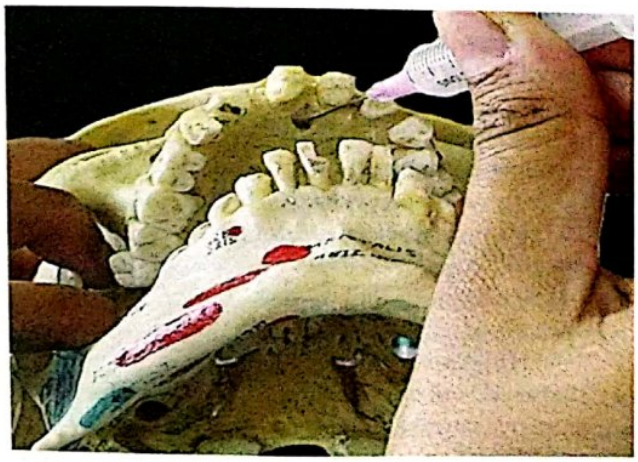

Fig. 8.14 Nasopalatine nerve block

- Advance the needle along the same angulation till a loss of resistance is felt and the needle enters the foramen. It will go in around 4–6 mm. Deposit a small amount of solution after aspiration.
- Alternatively, the labial frenum, and interdental papilla on the buccal side may be anaesthetised prior to the palatal injection.

Symptoms

- The patient will not be able to appreciate the anesthesia till the palatal tissues are probed.
- The palatal gingiva in relation to the maxillary anterior teeth will be numb.

Complications

- Ischemia and necrosis of the palatal tissue in the region of the injection.
- Inability to deposit enough solution due to excessive density of the palatal gingiva.

MANDIBULAR NERVE BLOCKS

Inferior Alveolar Nerve Block

Anatomy

- This is branch of the posterior division of the mandibular branch of the trigeminal nerve.
- It has 2 terminal branches—incisive and mental nerves—which also get anesthetised along with the main trunk of the nerve.
- The aim is to inject into the pterygomandibular space in the vicinity of the inferior alveolar nerve just before it enters the mandibular foramen.
- The inferior alveolar nerve supplies all the teeth from the central incisor to the third molar on the same side. It also supplies the labial gingiva anterior to the first premolar, labial mucosa, lower lip and chin on that side.

Technique (Fig. 8.15–8.17)

- A long needle is used for this block.
- The anterior border of the ramus is palpated as a sharp edge lateral to the molars. The finger is run up and down the anterior border of the ramus till the deepest part is located. This is the coronoid notch. It is important to locate the coronoid notch because the mandibular foramen lies at the same level of the coronoid notch.
- The pterygomandibular raphae is a soft tissue landmark which runs from the maxillary tuberosity to the retromolar fossa in an S-shaped curve.
- The patient is asked to open the mouth wide; the cheek is retracted with the thumb still placed at the coronoid notch. The needle is placed from the opposite side premolar in such a way that it bisects the nail of the thumb placed

Scanned with CamScanner

Scanned with CamScanner

Fig.8.15 Palpation of coronoid notch

on the coronoid notch. The needle is inserted around 3/4th till bony resistance is encountered.

- Bony resistance should be present prior to injection.
- Aspirate and then deposit around 1.5 cc of solution.

Symptoms

- Tingling and numbness over the lower lip on the injected side.
- On probing with a blunt instrument, there will be no sensation over the labial gingiva anterior to the first premolar.

Complications

- Transient facial nerve paralysis: If the needle is inserted too deep it enters the parotid gland and thus the facial nerve gets anesthetised.
- Trismus: Repeated injections may cause injury and spasm of the medial pterygoid muscle, causing trismus.
- Hematoma due to injury to the inferior alveolar vessels.

Lingual Nerve Block

Anatomy

- This is also a branch of the posterior division of the mandibular branch of the trigeminal nerve.
- This nerve is situated anteromedial to the inferior alveolar nerve.
- This nerve supplies the lingual gingiva of all the mandibular teeth of that side. Also supplies the floor of the mouth and the anterior 2/3rd of the tongue on the same side.

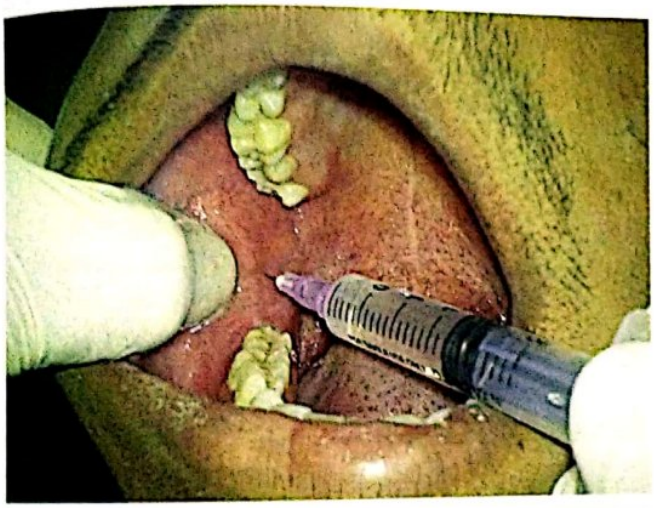

Fig.8.16 Inferior alveolar nerve block

Technique

- The technique is similar to an inferior alveolar nerve block. After the inferior alveolar nerve block is given, the needle is withdrawn less than 1 cm. The remaining solution, around 1 cc, is deposited here after aspiration.

Symptoms

- Tingling and numbness in the anterior 2/3rd of the tongue.
- On probing with a blunt instrument on the lingual gingiva, there is no sensation.

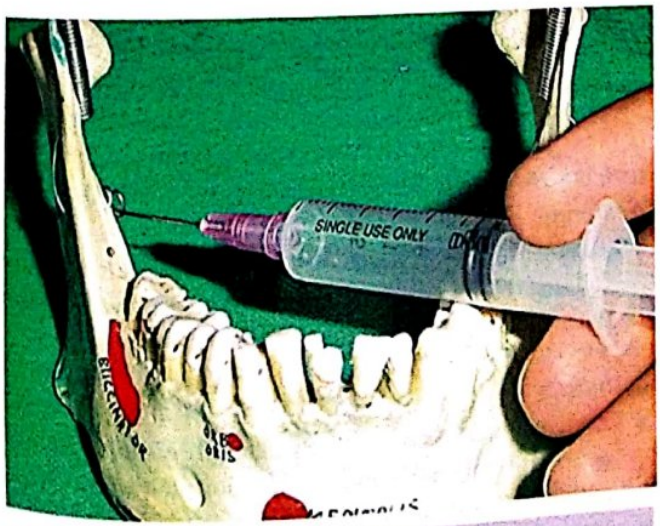

Fig.8.17 Inferior alveolar nerve block

Long Buccal Nerve Block

Anatomy

- This is a branch of the anterior division of the mandibular branch of the trigeminal nerve.
- It supplies the buccal mucosa and buccal gingiva in relation to the second premolar and molars.

Technique (Fig. 8.18)

- The aim is to anesthetise the nerve when it crosses the anterior border of the ramus.
- The cheek is retracted and the needle is inserted distal and buccal to the last molar.

Scanned with CamScanner

Scanned with CamScanner

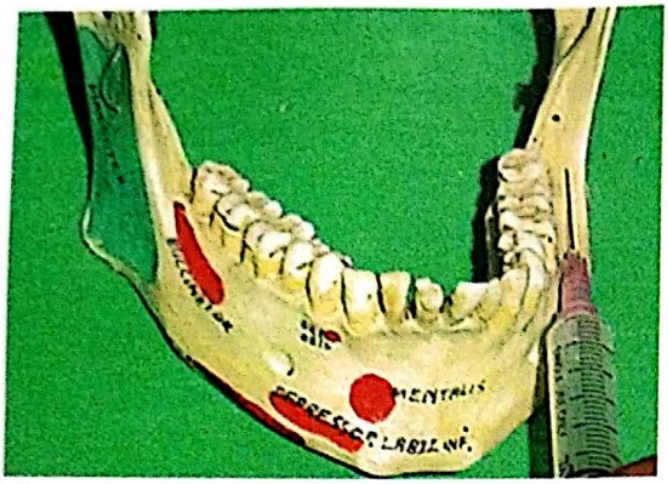

Fig. 8.18 Long buccal nerve block

Fig. 8.19 Mental nerve block

- Bone may not be contacted during the injection. The needle is inserted less than 1 cm and after aspiration, 1 cc of solution is injected.

Symtoms

- The patient may not have any subjective symptoms.
- On probing on the buccal gingiva in relation to the molars and second premolar no sensation is felt.

Complications

- Superficial mucosal injection may produce a swelling in the region.

Mental Nerve Block

Anatomy

- This is one of the terminal branches of the inferior alveolar nerve.
- It exits the mental foramen and branches out to supply the soft tissues of the lower lip and chin. It also supplies the labial gingiva in relation to the anterior teeth and first premolar.
- The mental nerve does not supply the hard tissues, i.e., the teeth and bone.

Technique (Fig. 8.19, 8.20)

- The aim is to anesthetise the mental nerve after it exits from the mental foramen which is located between the two premolars.
- The lip is retracted outwards till it makes the depth of the mucobuccal fold visible.
- The needle is placed with the bevel facing the bone between the two premolars for less than 1 cm.
- Around 1 cc of solution is deposited after aspiration.

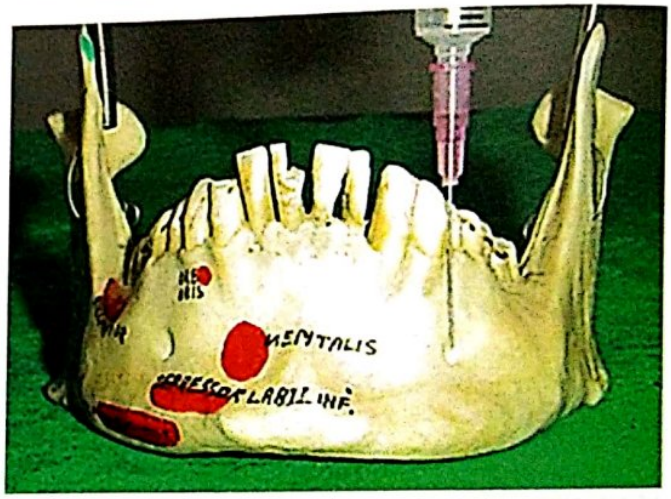

Fig. 8.20 Mental nerve block

Symptoms

- Numbness of the lower lip and labial mucosa on the injected side.
- On instrumentation with a blunt instrument on the labial gingiva in relation to the anterior teeth, there is no sensation.

Incisive Nerve Block

Anatomy

- The incisive nerve is the other terminal branch of the inferior alveolar nerve. It does not exit from the foramen but supplies all the anterior teeth on the same side.

Technique

- The technique is similar to a mental nerve block. It is not necessary to actually enter the needle into the mental foramen for an incisive nerve block.
- The needle is positioned similar to a mental nerve block and after injection, the region is held under mild pres-

Scanned with CamScanner

Scanned with CamScanner

sure for the solution to diffuse into the foramen to anesthetise the incisive nerve.

Symptoms

- The lower anterior teeth will have no pain on percussion.

Mandibular Nerve Block (Gow Gate's technique)

- This is an intraoral technique which uses extraoral landmarks for guidance.
- It anesthetises the entire mandibular nerve—inferior alveolar nerve, mental, incisive, lingual, mylohyoid, buccal and auriculotemporal nerves.

Techniques

- An imaginary line is drawn from the corner of the mouth to the intertragic notch.
- The patient is made to open his mouth as wide as possible. The aim is to anesthetise the nerve in the region of the condylar neck.
- Intraorally the needle is penetrated just below the mesiopalatal cusp of the maxillary second molar along the extraoral imaginary line.
- The needle is advanced till bone is contacted. The depth of insertion of the needle will be at least 3/4th.
- After aspiration, 2 cc of the solution is deposited.

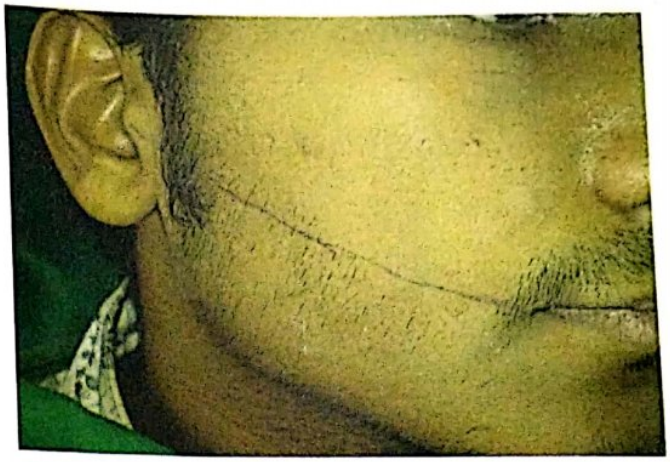

Fig. 8.21 Extraoral landmarks for Gow Gates technique

Fig. 8.22 Insertion of needle based on extraoral landmarks

Symptoms

- Tingling and numbness is felt all along the distribution of the mandibular division of the trigeminal nerve.

Akinosi Vazirani's Closed Mouth Technique

- This technique is done when the patient is unable to open his mouth completely for a classical inferior alveolar nerve block.

Technique (Fig. 8.24–8.26)

- The aim is to reach the inferior alveolar nerve which is present on the medial side of the ramus just before it enters the mandibular foramen. It also anesthetises the lingual and mylohyoid nerves.
- The patient is asked to close the mouth till the teeth occlude.
- The cheek is retracted and the needle is inserted parallel to the occlusal plane at the level of the mucogingival junction of the maxillary arch.
- The needle is inserted such that it goes medial to the ramus of the mandible.
- No bony resistance is encountered in this block. 3/4th of the needle is inserted and after aspiration, 2 cc of the solution is deposited.

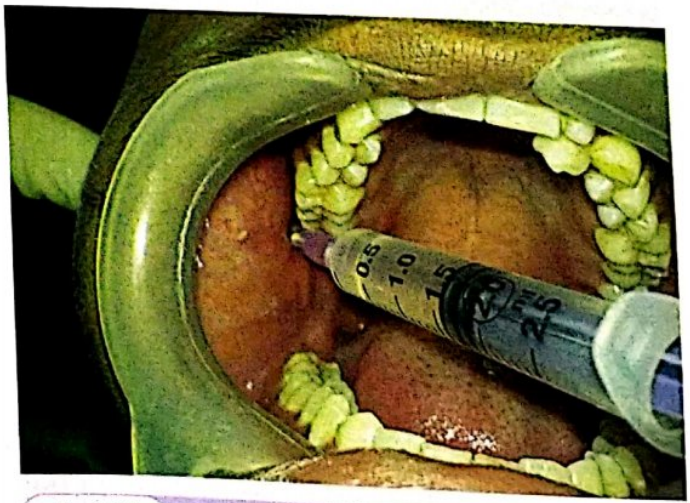

Fig. 8.23 Gow Gates technique

Scanned with CamScanner

Scanned with CamScanner

Fig. 8.24 Vazirari Akirosi technique – closed mouth technique

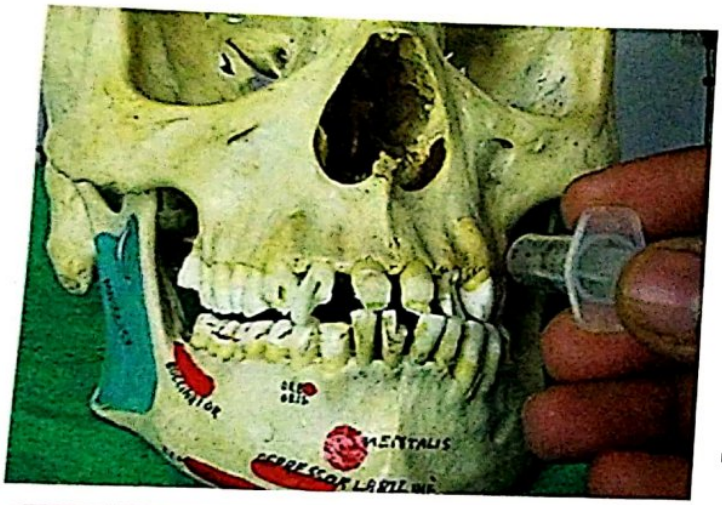

Fig. 8.25 Closed mouth technique front view

Fig. 8.26 Closed mouth technique - inferior alveolar nerve block

Symptoms

- Tingling and numbness of the lower lip, anterior 2/3rd of the tongue.
- On instrumentation, no sensation is felt on the labial gingiva.

Complications

- Transient facial nerve paralysis
- Trismus.

EXTRAORAL NERVE BLOCKS

Inferior Alveolar Nerve Block: Curty Thomas' Technique

- In cases where the inferior alveolar nerve block cannot be given intraorally, an extraoral technique is used.
- The mandibular foramen is located midway in the ramus both anteroposteriorly and superoinferiorly. This point is located approximately by extraoral landmarks.
- The width of the masseter muscle approximately gives the anteroposterior width of the mandibular ramus.
- A point is marked just anterior to the tragus (Point A). Another point is marked at the lower border of the mandible coinciding with the anterior border of the masseter (Point B). This can easily be palpated by asking the patient to clench his teeth while palpating the mandible a little anterior to the angle.
- An imaginary line is drawn connecting these two points.
- The midpoint is located. This is approximately the point of the "ante lingula" which is the identification point for the mandibular foramen located on the medial aspect of the ramus of the mandible.
- A long needle is marked with a stopper to this mid point. After preparing the skin in the region the needle is inserted medial to the ramus of the mandible from the submandibular region till the measured midpoint.
- After careful aspiration, 2 cc of solution is deposited.

Maxillary/Mandibular Nerve Blocks

- The nerves are blocked as they exit the skull from the foramen ovale and foramen rotundum.
- The landmarks are: the lower border of the zygomatic arch, coronoid process of the mandible, sigmoid notch, and lateral pterygoid plate.
- The lower border of the zygomatic arch is palpated and a depression is felt. The sigmoid notch is felt just below it. It may be confirmed by locating the coronoid process.
- A long spinal needle is used and a rubber stopper placed at 45 mm.
- The extraoral region is prepared and the needle is inserted in the region between the sigmoid notch and the depression in the zygomatic arch.
- The needle is penetrated till it encounters the lateral pterygoid plate.

Scanned with CamScanner

Scanned with CamScanner

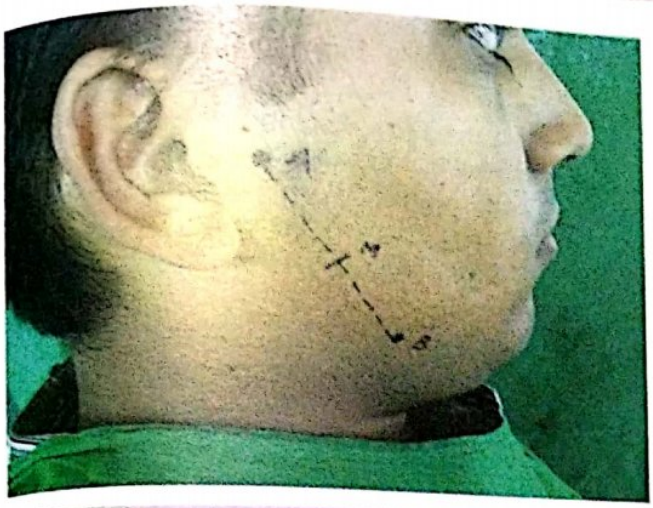

Fig. 8.27 Extraoral landmarks for inferior alveolar nerve block

Fig. 8.28 Inferior alveolar nerve block

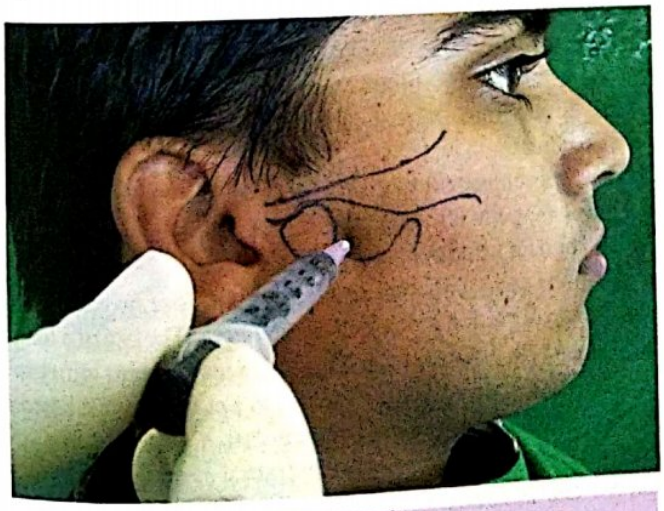

Fig. 8.29 Mandibular nerve block

- The foramen ovale is located posterior to the lateral pterygoid plate while the foramen rotundum is present anterior to it.
- Thus, for a maxillary nerve block, the needle is withdrawn till 1 cm remains within the tissues and the needle is re-inserted anteriorly till the 45 mm mark.
- After aspiration, 2 cc of the solution is deposited.
- For a mandibular nerve block, the needle is withdrawn till 1 cm remains in the tissues and then reinserted posteriorly and upwards till the 45 mm mark and after careful aspiration 2 cc solution is deposited.

A point to be remembered prior to giving local anesthesia to any patient who is undergoing a dental procedure under LA for the first time is that a test dose must be deposited to ensure that the patient is not allergic to the local anesthetic or to any of the other ingredients in the LA vial.

This can be given intradermally as shown in the figure (Fig. 8.30). The skin on the forearm is pinched and 0.5 cc of the solution is deposited just beneath the skin till a small elevation is seen on the skin. The area is circled for identification (Fig 8.31). The patient is made to wait for 15–20 minutes after which the marked region is examined for wheal or flare reactions.

COMPLICATIONS OF LOCAL ANESTHESIA

Box. 8.1 Local complications

- Pain or burning sensation
- Failure to achieve anesthesia
- Local necrosis
- Trismus
- Hematoma
- Prolonged anesthesia
- Needle breakage
- Facial nerve paralysis
- Soft tissue injury
- Infection

Immediate Local Complications

1. ***Failure to anesthetise the nerve***
   - This is usually due to improper technique of injection.
   - Failure to follow proper anatomical landmarks during injection.
   - In case of injection into inflamed or infected tissue, LA may not be effective.
   - Reinjection by following accurate landmarks may help in achieving anesthesia.
2. ***Pain or burning sensation on injection***
   - This may be due to the use of a blunt needle or a needle with a barbed end.
   - Use of broader gauge needles may also cause pain.

Scanned with CamScanner

Scanned with CamScanner

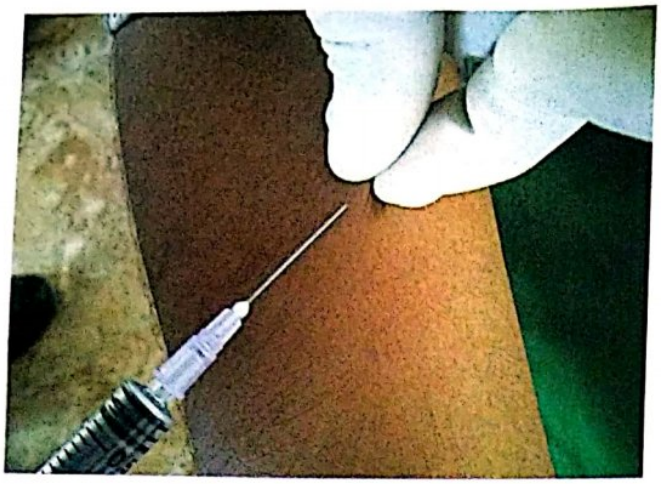

Fig. 8.30 Test dose before giving local anesthesia

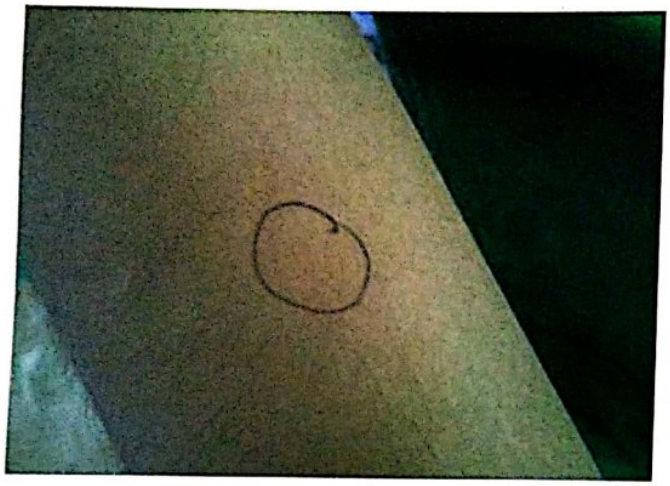

Fig. 8.31 Looking for reaction to test dose

- Rapid injection.
- Local anaesthetic solution which is acidic may cause burning sensation on injection.
- The problem can be prevented by the use of sharp, narrow gauge disposable needles.
- Local anaesthetic solutions are made isotonic by the addition of bicarbonate. This prevents burning sensation.

3. ***Needle breakage***
   - This may be due to a sudden movement by the patient when the needle is within the tissues.
   - Use of a very narrow gauge needle may also lead to its breakage.
   - The needles generally break at the hub which is the weakest part of the needle. It may also break at a point where it has been bent previously.
   - If the broken end of the needle is visible it should be grasped with a hemostat and removed immediately.
   - Radiographs may be taken to help locate a needle within the tissues. These radiographs are taken in two planes perpendicular to each other. Also to locate the needle an additional needle (guide needle) may be inserted in the same region and a radiograph taken. Since the position of the guide needle is known, it helps in approximately localising the broken needle.
   - The broken needle should be exposed carefully and removed.

Delayed Complications

1. ***Trismus***
   - This complication is usually associated with an inferior alveolar nerve block.
   - It may be due to trauma to the muscle due to repeated puncture by the needle in an attempt to accurately locate the region of injection.
   - Injury to the inferior alveolar vessels during the injection may cause a hematoma close to the muscle. A large hematoma compresses on the muscle causing spasm and trismus.
   - Use of contaminated needle or an infection in the local region can also cause trismus.
   - The patient usually returns the next day with inability to open the mouth.
   - Trismus may be treated by giving the patient an analgesic with muscle relaxants.
   - Only if the trismus is due to an infection, antibiotics are indicated.
   - In the absence of an infection, hot fomentation in addition to muscle relaxants may relieve the muscle spasm.
   - Physiotherapy is essential with gentle mouth opening and lateral excursions. If physiotherapy is not successful in overcoming the trismus, forceful mouth opening may be done with a mouth gag.
2. ***Hematoma***
   - Injury to any blood vessel may result in escape of blood into the extravascular spaces resulting in a hematoma.
   - This can occur with any nerve block but is usually associated with a posterior superior alveolar nerve block and an inferior alveolar nerve block.
   - The pterygoid venous plexus is in close proximity to the posterior superior alveolar nerve. The use of a long needle in this region may cause inadvertent injury to this plexus of veins resulting in a slow massive bleed. Since the space can accumulate a large volume of blood, it is seen as a big extraoral swelling.
   - Inferior alveolar nerve block may result in the injury to the inferior alveolar vessels manifested as an intraoral swelling and trismus.

Scanned with CamScanner

Scanned with CamScanner

Table 8.2 Local anesthetic—duration of action, maximum dosages

Anesthetic	Duration without Epinephrine (min)	Duration with Epinephrine (min)	Maximum dose without Epinephrine (mg/kg)	Maximum dose with Epinephrine (mg/kg)
Esters				
Cocaine	45	—	2.8	—
Procaine	15–30	30–90	7.1	8.5
Chloroprocaine	30–60	—	11.4	14.2
Tetracaine	120–240	240–480	1.4	—
Amides				
Lidocaine	30–120	60–400	4.5	7.0
Mepivacaine	30–120	30–120	4.5	7.0
Bupivacaine	120–240	240–480	2.5	3.2
Etidocaine	200	240–360	4.2	5.7
Prilocaine	30–120	60–400	5.7	8.5

Table 8.3 Dosage of local anesthetics

Drug	Onset	Maximum Dose (with Epinephrine)	Duration (with Epinephrine)
Lidocaine	Rapid	4.5 mg/kg (7 mg/kg)	120 min (240 min)
Mepivacaine	Rapid	5 mg/kg (7 mg/kg)	180 min (360 min)
Bupivacaine	Slow	2.5 mg/kg (3 mg/kg)	4 hours (8 h)
Procaine	Slow	8 mg/kg (10 mg/kg)	45 min (90 min)
Chloroprocaine	Rapid	10 mg/kg (15 mg/kg)	30 min (90 min)
Etidocaine	Rapid	2.5 mg/kg (4 mg/kg)	4 hours (8 h)
Prilocaine	Medium	5 mg/kg (7.5 mg/kg)	90 min (360 min)
Tetracaine	Slow	1.5 mg/kg (2.5 mg/kg)	3 hours (10 h)

- Immediate management includes pressure application in the region posterior to the maxillary tuberosity for a PSA block. Ice packs may be placed extraorally.
- A hematoma usually resolves by itself within 7–14 days. A large hematoma may get infected and the patient may be placed on antibiotics. After 1–2 days the patient may be advised hot fomentation which will relieve the pain and soreness.

3. ***Local necrosis***
   - May be seen as a complication of a palatal injection.
   - The mucoperiosteum is tightly adherent to the bone in the region of the palate with very little space for the injection of local anesthetic solution. When LA is injected into the tissues in this region, there is blanching of the tissues due to the pressure. This is an indication of stopping the injection of any further solution.

Scanned with CamScanner

Scanned with CamScanner

- Forcing excessive LA with adrenaline into the palatal region may result in vasoconstriction and localised necrosis of the palate in the region of the injection.

4. ***Transient facial nerve paralysis***
   - A complication associated with an inferior alveolar nerve block.
   - The parotid gland forms the posterior boundary of the pterygomandibular space into which the inferior alveolar nerve block is given.
   - If the anatomical landmarks are not followed carefully and the needle is injected too far posteriorly, the solution may be injected into the parotid gland.
   - The facial nerve divides into its terminal branches within the substance of the parotid gland and is thus anatomically in close relation to it.
   - The solution causes transient facial nerve paralysis. All the signs and symptoms of facial nerve paralysis may be seen including loss of wrinkling of the forehead, inability to close the eye, inability to blow or whistle, inability to show the teeth due to absence of movement of the lips on the affected side.
   - The patient should be reassured that it is a transient problem and will come back to normal once the effect of the local anesthetic subsides.
   - Since the patient will be unable to close the eye on the affected side, there may be injury to the eye. An eye pad may be given temporarily.
5. ***Prolonged anesthesia***
   - This may be a complication due to a direct injury to the nerve during the injection.
   - Also may be due to pressure on the nerve from an expanding hematoma.
   - The patient may complain of anesthesia even after the effect of the LA solution has worn off.
   - This usually recovers by itself but may take a few months.
   - The patient should be reassured and the problem explained to them clearly.
   - The patient should be periodically recalled and the improvement in the nerve regeneration should be noted by checking if the area of sensation is improving.
6. ***Soft tissue injury***
   - Numbness of the lip and chin is seen with an inferior alveolar nerve block.
   - In children there may be inadvertent lip biting and injury to the lip as the child is unaware of the numbness. The parents should be informed to take care that the child is prevented from lip biting or chewing.
   - In adults also there may be inadvertent injury from intake of hot fluids which may injure the lower lip.
7. ***Infection***
   - Use of a contaminated needle for injection may cause infection in the region.
   - Injection in the inferior alveolar nerve region or a posterior superior alveolar nerve may even result in trismus and spread of infection into the surrounding tissue spaces.
   - Use of disposable needles can prevent this complication.
   - Antibiotics and drainage of the space involved along with physiotherapy for trismus will improve the symptoms.

Systemic Complications

1. Overdose

   Toxicity to local anesthetic or an overdose reaction may occur due to:

i) Administration of excessive dose of local anesthetic.
ii) Inadvertent IV injection of the drug.
iii) It can also take place in patients with a diminished activity of plasma pseudocholinesterase.

Lidocaine, which is the most common local anesthetic administered, has a maximum dose of 4.5 mg/kg body weight without vasoconstrictor and 7 mg/kg body weight with vasoconstrictor. The systemic effects of toxicity are manifested effects on the CNS and CVS. This is because these tissues are highly vascular and their tissues are made of hyperexcitable membranes which is the target for activity of local anesthetics.

Signs and Symptoms of CNS Toxicity

At blood levels of 1–5 micrograms/mL:
- Tinnitus
- Lightheadedness
- Circumoral numbness
- Diplopia
- Metallic taste
- Nausea/vomiting
- Patient may even become very talkative.

At blood levels of 5–8 micrograms/mL:
- Slurred speech
- Nystagmus
- Tremors
- Muscle twitching
- May even have hallucinations.

At 8–12 micrograms/mL:
- Focal seizures
- Generalized tonic-clonic seizures

Scanned with CamScanner

Scanned with CamScanner

Levels higher than 20–25 micrograms/mL:
- Hypoxia
- Acidosis
- Respiratory depression
- Coma.

Toxic Effects on CVS

Toxic doses of LA cause myocardial depression or cardiac arrhythmias. Decreased heart rate and force of contraction may lead to hypotension. The patient manifests with:
- Chest pain
- Shortness of breath
- Palpitations
- Lightheadedness
- Hypotension and syncope
- Bradycardia
- Ventricular fibrillation.

Prilocaine has been seen to produce methemoglobinemia at toxic doses. Lidocaine and benzocaine may also cause similar effects. The patient manifests with:
- Cyanosis
- Grayish discolouration of skin
- Dyspnoea
- Fatigue, exercise intolerance
- Dizziness and syncope.

Management of a Toxic Reaction
- The first step is to stabilise the patient before any definitive management.
- Rule out any other etiological factors.

Management of CNS Manifestations
- Maintain the patient's airway.
- Provide supplementary oxygen.
- Control seizures with benzodiazepines or barbiturates.
- Propofol or thiopental are also effective in controlling seizures.
- Phenytoin should not be used as its pharmacological actions are similar to that of lignocaine and may potentiate toxicity.
- Patient may be intubated and succinylcholine may be given to stop tremors.

Management of CVS Manifestations
- Cardiac life support may be required which may be prolonged as the drug takes a long time to be eliminated.
- IV fluids and vasopressors such as ephedrine to counter hypotension.

2. Hypersensitivity or Allergic Reaction to Local Anesthetics

Although this is a very rare phenomenon, allergy to local anesthetics may occur in some patients. Allergic reaction may be due to:
- Local anesthetic agent itself
- Preservatives in the local anesthetic solution.

As discussed earlier, the ester group of anesthetics is metabolized by plasma pseudocholinesterase. One of the breakdown products is PABA. Para amino benzoic acid is known to be antigenic and is capable of inducing a humoral immune response.

Amide local anesthetics contain methyl paraben as a preservative. This is chemically similar to PABA and is capable of initiating a similar response systemically.

If a patient is allergic to the ester group of anesthetics, he probably is allergeic to all other local anesthetics of that group and the amide group of LA may be used.

If any doubt exists regarding the precipitation of an allergic reaction, a test dose may be administered prior to actual LA for therapeutic purposes.

The reactions to local anesthetics may be of the type I (anaphylaxis) or type IV (delayed hypersensitivity) type of reactions. These reactions are not dose related and even a small exposure to this drug may lead to extreme manifestations.

Clinical Signs of Type I Reactions
- Pruritus
- Urticaria
- Facial swelling
- Wheezing, laryngeal edema
- Dyspnea
- Cyanosis
- Nausea/vomiting, abdominal cramps

Clinical Signs of Type IV Reactions
- Erythema
- Plaques
- Pruritus.

Management of an Allergic Reaction
- Stop the procedure immediately.
- Mild allergy may be managed with antihistamines or corticosteroids.
- Severe reactions: epinephrine 1:1000 SC, 0.3–0.5 mL. Repeat every 20–30 minutes. Not more than 3 doses.
- If anaphylaxis still continues, 5 mL of 1:10,000 epinephrine can be given IV.

Scanned with CamScanner

Scanned with CamScanner

ALTERNATIVES TO LOCAL ANESTHETICS

If a patient is allergic to both esters and amide LA, alternatives to LA should be given.

1. 0.9% sodium chloride solution may be injected intradermally. This produces short-term anesthesia probably due to local pressure on the nerve endings.
2. Injectable antihistamines such as diphenhydramine provide short-term anesthesia when injected locally.

Scanned with CamScanner

Scanned with CamScanner

CHAPTER 9

General Anesthesia

INTRODUCTION

The surgical specialty is indebted to the field of dentistry for the discovery of general anesthesia. It was Dr Horace Wells, in 1844, a dentist at Hartford, Connecticut, who first used nitrous oxide as anesthesia for a tooth extraction procedure.

Dr William TG Morton, also a dentist, is credited with first public demonstration of general anesthesia for surgery in 1866. He was also the first teacher of anesthesiology.

Definition

The term anesthesia was first coined by Oliver Wendell Holmes in 1847 and it implies the absence of all sensations.

Analgesia refers to the absence of pain. To know what is anesthesia it is important to know what consciousness is.

The ADA definition of consciousness is: A conscious patient is one who has intact protective reflexes, including the ability to maintain an airway and is capable of rational response to question or command.

General anesthesia is a state of unrousable unconsciousness to which analgesia and muscle relaxation is added to produce a balanced anesthesia. It implies the absence of all sensations including consciousness.

General anesthesia can also be explained as a controlled state of unconsciousness accompanied by a partial or complete loss of protective reflexes, including inability to maintain an airway independently and respond purposefully to a physical stimulation or verbal command.

PREANESTHETIC ASSESSMENT

The patient who is to undergo any procedure under general anesthesia should be assessed thoroughly by the anesthetist one day prior to the surgery. Proper examination and details should be recorded of the following:

1. Thorough medical history
2. Previous exposure to anesthesia, how long back, any side effects of that procedure
3. Current physical status; medications, if any
4. Presence of loose teeth, dentures, crown and bridge on anterior teeth etc.
5. An informed consent form should be signed by the patient.
6. The patient should be explained about the endotracheal tube, masks, IV lines etc. The patient should also be told that these may be present when he recovers from anesthesia. It should not be new and frightening to the patient. Any questions and doubts should be answered in detail. A well-prepared patient is usually very cooperative.
7. Appropriate laboratory findings should be checked and also the availability of cross matched blood if required.

Assessment of the Physical Status of the Patient

In 1962 The American Society of Anesthesiologists adopted what is now referred to as the ASA physical status classification. This is useful in determining the surgical and anesthetic risk prior to the procedure.

ASA I

- The patient has no organic, physiological, biochemical or psychiatric disturbance.
- The pathological process for which the operation is being conducted is localised and does not entail any systemic disturbance.

ASA II

- Mild to moderate systemic disturbances caused either by the condition to be treated surgically or by other pathophysiological process.
- Mild organic heart disease, diabetes, hypertension, anemia, old age etc.

ASA III

- Limitation of lifestyle due to disease
- Severe systemic disturbances or disease, e.g.: angina, history of MI, diabetes etc.

ASA IV

Life-threatening severe systemic disorder.

ASA V

A moribund patient not expected to survive more than 24 hours with or without operation.

Scanned with CamScanner

Scanned with CamScanner

ASA E
- Emergency operation of any variety.

Preoperative Assessment for a Patient Undergoing Maxillofacial Surgery
- Similar procedure is followed for these patients as well. Additional important points to be noted are the assessment of the airway and problems that may be encountered during intubation. Conditions such as ankylosis of the jaws, jaw deformities, tumors, previous surgery, radiotherapy, infections, and oral submucous fibrosis may complicate securing an airway due to trismus.

Premedication
The purpose of premedication:
1. Reduction of anxiety in the patient.
2. It provides a synergistic effect and helps in smooth and rapid induction of GA. It also allows the reduced use of GA drugs.
3. For the reduction of salivary and bronchial secretions.
4. To prevent vagal reflexes caused by surgical stimulation or associated with medication.
5. For control of preoperative and postoperative pain.
6. For suppression of vomiting and coughing.
7. To produce amnesia.

Drugs Used for Premedication
A variety of drugs are used for different effects of premedication. These drugs are often used in combination to achieve the desired effect.

1. **Opioids**
   Drugs such as morphine or pethidine are used basically for:
   - Reducing anxiety prior to surgical procedure.
   - Analgesic effect after the surgery.
   - They help to create a smooth induction of anesthesia.
   - They reduce the dosage of the anesthetic used.
   - The patient is usually more cooperative postoperatively due to reduced restlessness.
     Since they produce respiratory depression and may also mask the pupillary signs of anesthesia, opioids are now only used for postoperative pain in some cases.
2. **Benzodiazepines**
   - Drugs such as diazepam, midazolam are used for premedication.
   - They also help to create a smooth induction of anesthesia.
   - They are also antianxiety drugs and help to reduce preoperative apprehension. They are given on the night before the surgery.
   - They also create some amount of postoperative amnesia which means that the patient does not usually remember the perioperative events.
   - It does not create respiratory depression and does not induce vomiting postoperatively.
3. **Anticholinergics**
   - Drugs such as atropine are used for premedication.
   - These help in reducing the secretions—both salivary and bronchial.
   - They also help in reducing bradycardia and hypotension which may be induced during certain surgical procedures.
   - The use of these drugs may produce dryness of mouth which is uncomfortable during the immediate postoperative period.
   - Nowadays glycopyrrolate is used as a substitute for atropine. It also has the same effects as atropine which includes reduced secretions and antibradycardic effect.
4. **Histamine receptor blockers**
   Cimetidine, ranitidine etc., can be used to raise gastric pH secretions. This is given on the night before the surgery. This reduces the chances of gastric regurgitation and aspiration pneumonia. This is always given before a prolonged surgery. It also has the advantage of reducing stress ulcers prior to surgery. Omeprazole which is a proton pump inhibitor may be given as an alternative.

   On the day of the surgery, food and fluids are completely withheld for 6 hours prior to induction of general anesthesia. The bladder also should be emptied before proceeding into the operation theatre.

GENERAL ANESTHESIA IN A HOSPITAL SETTING
Based on the route of administration of the drug, induction of general anesthesia may be by two means:
1. Inhalation induction
2. Intravenous induction.

Inhalational Induction (Fig. 9.1)
Gaseous agents such as nitrous oxide or anesthetic vapours such as halothane or isoflurane, may be used for induction. Induction by this method is a slow process and is usually used for maintenance of anesthesia.

Intravenous Induction
Drugs such as thiopentone sodium are injected intravenously for induction of GA. This produces smooth and easier induction. The process is much faster and the classical stages of anesthesia as described by Guedel are not seen as the patient is taken into the stage III rapidly.

Scanned with CamScanner
Scanned with CamScanner

Induction of anesthesia is usually done using intravenous drugs.

Endotracheal Intubation

This procedure secures the airway by placing a tube into the trachea either via the nose, mouth or a tracheostomy (Fig. 9.2). This tube has an inflatable cuff. Once the tube is placed into the trachea, the cuff is inflated. This prevents aspiration of debris. This tube is connected to the anesthetic machine to allow the delivery of oxygen, nitrous oxide and an inhalational anesthetic. A throat pack is used as a supplement to the cuff to prevent aspiration of blood, saliva and debris.

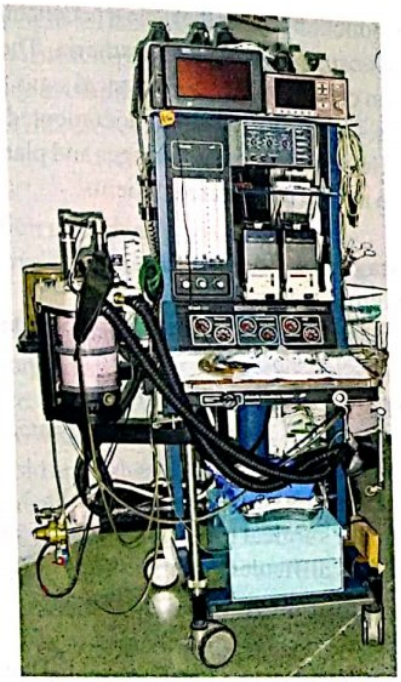

Fig. 9.1 Boyle's apparatus

Fig. 9.2 Endotracheal intubation

Airway Management

In maxillofacial surgery, an oral endotracheal intubation is very rarely used. A nasal tube is indicated for most of our procedures. This is because:

1. With a nasal tube, the oral cavity is free for good access and visibility as the endotracheal tube is away from the surgical field.
2. Many oral surgical procedures may require intermaxillary fixation. This becomes easy with a nasal tube instead of an oral tube.

In maxillofacial patients intubation may be difficult in the following cases:

1. Patients with TMJ ankylosis, masticatory space infections, oral submucous fibrosis, and tumors involving certain areas in the oral cavity may be associated with trismus. Inadequate mouth opening complicates the intubation procedure.
2. A patient with pan facial trauma including Le Fort II, III fractures with CSF leak or an anterior cranial fossa fracture, a nasal tube for intubation is contraindicated. Oral tube makes intraoperative checking of occlusion and intermaxillary fixation impossible. In such cases a tracheostomy is considered. With the recent introduction of the transmylohyoid or submental technique of intubation, however, a tracheostomy can be avoided in such cases. In a transmylohyoid intubation, an oral tube is placed but the tube does not come out of the oral cavity. It is brought out by an opening made in the submental region or slightly lateral to it through the mylohyoid muscle to the exterior. This way the tube does not cross the occlusal surfaces of the teeth and allows for checking of occlusion and IMF.

Other methods of securing an airway in case of a difficult airway include:

- Blind nasal intubation
- Fibreoptic guided intubation
- Retrograde intubation
- Transtracheal ventilation
- Laryngeal mask airway.

Commonly used Agents for General Anesthesia

Inhalational Anesthetics

1. **Nitrous oxide**
   - This is an inert gas which does not enter the body's metabolic pathways.
   - It gets distributed rapidly and peak saturation is achieved within 5 minutes. It is also eliminated rapidly by the lungs within 10 minutes.

Scanned with CamScanner

Scanned with CamScanner

- It has both sedative and analgesic properties but is used more for sedative purposes as the dose required for analgesia is very high.
- It is given as a mixture of 70% nitrous oxide and 30% oxygen.
- Though the onset for induction is quick and smooth, thiopentone is used usually for induction of GA.

2. **Halothane**
   - This is a commonly employed anesthetic which is a weak analgesic.
   - Induction with halothane is reasonably rapid and smooth.
   - It may, however, cause hypotension and dysrhythmias.
   - Use of injected adrenaline should be avoided in patients inhaling halothane as it may cause ventricular fibrillation.
   - It may be hepatotoxic after repeated exposure in adults.
3. **Enflurane**
   - This is a weaker anesthetic than halothane.
   - It is less likely to cause dysrhythmias and hepatitis.
   - The muscle relaxation property is better than that of halothane.
4. **Isoflurane**
   - This drug is similar to enflurane and is more recently developed.
   - It is more potent and produces rapid induction and recovery.
   - It has less cardiac effects and good muscle relaxation properties.
   - Its use is limited due to its cost.

Intravenous Anesthetics

1. **Thiopentone sodium**
   - This is an ultra short acting barbiturate with a half-life of 6–8 hours.
   - It acts rapidly and can produce unconsciousness within 20 seconds.
   - It is given in a dose of 4–8 mg/kg.
   - Extravasation of the intravenous injection is highly irritant and may produce severe pain.
   - It is a weak muscle relaxant, poor analgesic.
   - This is the most common inducing agent.

Muscle Relaxants

These drugs are given to create laryngeal relaxation. This enables intubation. Muscle relaxation, however, stops spontaneous breathing of the patient and the patient has to be ventilated till the effect of this drug wears off or is reversed. Muscle relaxants used include:

1. **Suxamethonium**
   - This is a short acting depolarizing muscle relaxant.
   - This drug has a fast recovery but the effect cannot be reversed.
   - Patient may complain of severe muscle pains a day or two after the procedure.
2. **Pancuronium, vecuronium, atracuronium**
   - These are non-depolarizing muscle relaxants.
   - The onset of action is slow but the effect lasts longer.
   - The effect of these drugs is reversible with neostigmine.

Stages of GA

During the induction of anesthesia in a patient, it is important to know the onset and depth of anesthesia. The anesthetist depends upon certain invaluable physical signs to determine these factors. Guedel in 1951 first documented the signs of anesthesia. He divided them into stages and planes and used open ether in non-premedicated patients.

Guedel's Stages of Anesthesia

Stage I: Analgesia

- This stage extends from the beginning of induction to the loss of consciousness.
- There is progressive abolition of pain.
- Patient is conscious but in a dream-like state. The patient can hear and see.
- Reflexes and respiration remain normal.
- Though minor surgical procedures can be carried out in this stage, it is difficult to maintain.

Stage II: Stage of Delirium

- Extends from the loss of consciousness till the beginning of regular respiration.
- Excitement in the form of violent movements of limbs, vomiting, and muscle contractions, patient may hold his breath or have irregular respiration, incoherent speech etc.
- Raised BP and tachycardia.
- Dilated pupils.
- Surgeries should not be performed at this stage.
- With newer drugs used for anesthesia, this stage is bypassed nowadays.

Stage III: Stage of Surgical Anesthesia

- This stage extends from the beginning of regular spontaneous respiration until complete cessation of spontaneous respiration. This can be divided into four planes:

Plane 1

- Regular spontaneous respiration

Scanned with CamScanner

Scanned with CamScanner

- Eyelid reflex is lost
- Vigorous uncoordinated eyeball movements
- Loss of pharyngeal reflex
- Loss of conjunctival reflex at the end of plane 1

Plane 2
- Centrally fixed eyes
- Pupil size decreases
- Loss of muscle tone
- Loss of laryngeal reflex
- Loss of corneal reflex

Plane 3
- Pupillary light reflex is lost
- Intercostal muscle paralysis
- Respiration is diaphragmatic
- Complete muscle relaxation

Plane 4
- Respiration is gradually depressed
- Progressive diaphragmatic paralysis.

Stage IV: Stage of Medullary Paralysis
- In this stage respiratory arrest and vasomotor collapse take place.
- Pupils are widely dilated.
- Skin is cold and ashen.
- Pulse is feeble, BP is low.
- Respiration finally ceases.

These stages are well defined with the use of ether or chloroform. Nowadays with induction with thiopental sodium, these stages are bypassed and the patient goes directly into stage III plane 2 or deeper depending upon the dose given.

Monitoring of a Patient under GA

Increasingly sophisticated non-invasive methods are now available for monitoring a patient. These include:

1. Pulse oximeter—this measures the percutaneous saturation of hemoglobin with oxygen
2. Capnograph—to measure end tidal $Paco_2$
3. ECG
4. Automatic machines for checking BP.

   Also the anesthetist must check the patient's pulse, colour, skin changes, ventilatory pattern etc.

Reversal from Anesthesia

Towards the end of the surgical procedure under general anesthesia, drugs for reversal are given. The drug given is basically for the reversal of the muscle relaxant effects. It must be remembered that the repeated dose of muscle relaxation should not be given very close to the end of the procedure as reversal will take longer.

The effect of the non-depolarizing muscle relaxant may be reversed by giving neostigmine sulphate 0.05–0.07 mg/kg. This drug is administered along with atropine sulphate to prevent the muscarinic effects of neostigmine. These include profuse secretions, bradycardia and bronchospasm.

Recovery and Postoperative Care of the Patient

The patient is kept in the ICU till complete recovery from GA. The patient is to be monitored during this time:

1. Careful monitoring of the airway, respiration and vital signs
2. Postoperative management of fluid and electrolyte balance
3. Postoperative management of pain
4. In case of maxillofacial procedures, special care should be taken of:
   - Patients with intermaxillary fixation
   - Use of antiemetics in patients with IMF to prevent vomiting and aspiration
   - A wire cutter should be placed at the bedside and the nurse should be aware of how to release an IMF if vomiting or regurgitation occurs.

General anesthesia in dental Practice setting

In the dental clinic, simple and short procedures such as extractions, restorations, abscess drainage etc., may be done under general anesthesia. The procedure is not very different from the anesthesia given in a hospital setting. A team of a dentist, nurse and an anesthetist is required for this procedure.

Selection of the patient is important in these cases; the patient should be healthy, i.e., ASA I or II.

Indications for GA in a Dental Setting

- In uncooperative patients if multiple procedures are required, extractions, root canal treatment, filling etc., may be done in one sitting.
- Apprehensive patients.
- Patients allergic to the contents of a local anesthetic solution.

General Anesthesia on an Outpatient Basis in the Clinic

- Intravenous induction is done.
- Sufficient anesthesia is achieved to keep the mouth open for the procedure.
- A throat pack is placed to prevent aspiration of secretions and irrigating fluids.
- The patient is placed on a nasopharyngeal airway.

Scanned with CamScanner

Scanned with CamScanner

- Dental procedures not lasting more than 40–45 minutes are performed.
- Adequate hemostasis is achieved and pack placed before the patient is handed back to the anesthetist for recovery.
- The recovery from anesthesia should be rapid and adequate equipment should be present to manage any emergency.
- Once the patient recovers, he should be accompanied home by a responsible adult.

Position of the Patient During the Procedure

Earlier procedures under GA in the dental clinic were done with the patient in upright position. This position, however, was found to be potentially dangerous for the patient, because if the patient had a fainting episode before or during the procedure, the neurological damage was serious. This led to the positioning of the patient in a supine position for the procedure. This, however, compromises the airway significantly. The patient is thus placed in a semi-reclining position to strike a balance between these two complications.

Whenever possible, general anesthesia should be avoided and an alternative procedure of conscious sedation may be used in the dental setting.

Conscious Sedation

Most minor dental surgical procedures may be performed under local anesthesia. In some conditions however regional anesthesia alone may not be sufficient to perform the procedure efficiently with maximum comfort both to the patient and the doctor. In these cases, it may be required to conduct these procedures under general anesthesia. General anesthesia may be given to the patient only by an experienced and trained professional and definitely involves more risk to the patient.

It is then possible to have an intermediary path where the patient is both comfortable and conscious. These procedures may be safely conducted in the dental clinic under the efficient care of an experienced dentist.

A patient is said to be conscious when he is capable of a rational response to command and has intact protective reflexes including the ability to maintain a patent airway and also has the capability to clear his airway. It is important to note that the patient remains conscious throughout the procedure. Pain control is to be supplemented by the use of regional anesthesia and also with the use of analgesics.

Definition: A minimally depressed level of consciousness that retains the patient's ability to maintain an airway independently and continuously and respond appropriately to physical stimulation and verbal command.

Deep Sedation

Definition: A controlled state of depressed consciousness which is accompanied by a partial loss of protective reflexes, including an inability to respond purposefully to verbal command. Conscious sedation may be achieved by employing different routes of administration including oral, inhalation, intramuscular, intravenous, sublingual, rectal or submucosal.

Indications for Conscious Sedation

- Uncooperative children and adults
- Patients with phobia for dental treatments
- Small children requiring multiple dental procedures
- Some medically compromised patients who cannot tolerate stress in the dental procedure

Objectives of Conscious Sedation

- Mood alteration: patients who are generally psychologically apprehensive about dental treatment should be able to accept the procedure without any fear. The patient is made comfortable and relaxed.
- To improve the patient's cooperation: by using sedation the patient is more tolerant towards the procedure and tends to cooperate better. This decreases the operative time taken and decreases the discomfort both to the dentist and to the patient.
- Elevation of pain threshold: the patient's pain threshold is elevated by the use of certain drugs. However regional anesthesia is a must with sedation as it does not eliminate the pain from the local site. It makes the patient more tolerant to pain.
- Although the patient is sedated he should be able to maintain a patent airway and also be able to clear his airway of secretions.
- The vital signs should be within normal limits. The patient should be monitored constantly with a pulse oximeter.
- Some drugs used for conscious sedation cause some amount of amnesia.

Routes of Administration

- Inhalation
- Oral
- Parenteral:
  Intravenous
  Intramuscular
  Subcutaneous

Inhalational Sedation

- This is one of the safest methods of sedation
- It is easy to administer and dependable
- The time of onset is rapid and the recovery from the drug is safe and fast
- The effects of this drug can be reversed very fast by just stopping the administration and allowing the patient to breathe oxygen or normal room air.

Scanned with CamScanner

Scanned with CamScanner

The most commonly used drug in inhalation sedation is nitrous oxide.

Nitrous Oxide

- This is the most commonly used inhalational anesthetic.
- It is an inert, colourless inorganic gas.
- It has an acceptably pleasant odour.
- The concentration of exposure of the gas can be titrated. It produces different levels of effects depending on the percentage of exposure.
- 10–15% causes numbness and tingling of extremities, some sedation.
- 35–40% causes increased sedation and mild analgesia. Patient has the sensation of floating and noises around him may appear dull and distant. There is significant numbness and tingling felt in the hands, feet and circumoral areas. The patient may have a feeling of warmth.
- 50% causes increased intensity of all these subjective symptoms except for analgesia which remains the same.
- Breathing more than 50% nitrous oxide will lead to the patient moving from the realm of conscious sedation into general anesthesia where the patient is no longer conscious and requires support for maintaining an airway.
- The maximum effect of nitrous oxide is between 3–5 minutes with the first signs appearing in less than a minute.
- Nitrous oxide does not undergo biotransformation in the body and is eliminated unexchanged by the lungs. Once the exposure to the drug is removed, it is eliminated within 5 minutes.

Indications

- Mildly apprehensive and uncooperative adult patients who are afraid to undergo procedures under local anesthesia
- Uncooperative children
- Patients who have a severe gag reflex
- Medically compromised patients such as cardiovascular disorders, asthmatics etc., who cannot undergo stressful procedures.

Contraindications

- Patients with upper respiratory tract infection.
- Pregnant patients, especially first trimester of pregnancy.
- Mentally retarded patients and patients who are extremely anxious. Such patients are more suitable for procedures under GA.

Technique of Administration

- Administration of nitrous oxide and oxygen to the patient requires the dose of the drug to be adequately metered and given with great care. This requires the use of gas flow regulators, flow meters and other equipment for administering nitrous oxide mixed with oxygen.
- Patient preparation is important. The patient should be told about the use of masks, tubes etc so that he is not anxious on the day of the procedure.
- He should be asked to take a light meal 2–3 hours before the procedure.
- The procedure is conducted as an outpatient procedure but the patient must be accompanied by a responsible adult to escort the patient home after the procedure is completed.
- Although the inhalational anesthetic effect wears off within 5–10 minutes after the gas is stopped, the effect of other drugs used may take a while and it is advisable to keep the patient under constant monitoring till he recovers completely prior to discharge.
- The patient is made to sit on the dental chair.
- First 100% oxygen is administered via a face mask. The flow of nitrous oxide is started with a low dose and slowly increased to about 35% and maintained at this level. A pulse oximeter is connected and monitored constantly.
- Once the patient is sedated, regional anesthesia is given and the procedure completed.
- At the end of the procedure, nitrous oxide is cut off followed by the breathing of 100% oxygen.
- The patient usually recovers within 3–5 minutes.
- The vital signs are checked to be normal prior to discharge of the patient.

Advantages of Inhalational Anesthesia

- Rapid onset of action.
- Rapid recovery from sedation.
- Ease of administration.
- Acceptance to the drug is easy because nitrous oxide is inert, nonirritating and has a pleasant odour.
- It does not undergo biotransformation within the body, so can be safely administered to patients with hepatic disorders.
- It is a relatively safe drug if administered correctly.
- Procedures can be done on an OPD basis.

Disadvantages

- The administration requires the use of expensive equipment and trained personnel.
- There should be no leaks in the tubing system as it is harmful to the dental clinic personnel.
- Levels of nitous oxide should be strictly measured and administered to prevent deep sedation.

Oral Route of Administration

Oral Sedation

Indications

- Management of patient anxiety

Scanned with CamScanner

Scanned with CamScanner

- May be used to sedate the patient for venepuncture before GA
- Manage patient anxiety by giving it on the night before the surgery.

Contraindications

- A medical history or if physical assessment prevents the use of sedatives
- Pregnancy may be a relative contraindication.

Advantages

- Easy to administer
- Patient acceptance is good.

Disadvantages

Drug dose cannot be titrated.

- This is the least effective route of drug administration.
- The dosage is measured based on the patient's age, weight etc.
- The time of onset, duration of effect and recovery from the drug are not predictable.

Parenteral Route of Administration

- The intravenous route is the most commonly used for sedation.
- It is the most reliable route of administration after the inhalational technique.
- The onset of action of the drug is rapid.
- The drug dose also can be titrated and controlled. It can be started with a small dose and subsequently increased in increments.
- A large number of drugs are available for IV sedation.

Barbiturates

- E.g.: thiopental sodium, methohexital sodium—ultra short acting barbiturates.
- Pentobarbital, secobarbital—short acting barbiturates.
- These drugs are derivatives of barbituric acid.
- These group of drugs are basically CNS depressants and at different doses can be used as sedatives or general anesthetics.
- IV route of administration is most commonly done.
- The site of action of these drugs is on the cerebral cortex and the depression of the cortex causes drowsiness and amnesia.
- Within therapeutic limits the drug is safe to use but beyond this dose it may cause respiratory depression, decreased blood pressure, decreased cardiac output and may also affect the liver and kidneys.
- These drugs are lipid soluble and their effect is first on the lipid-rich cells of the CNS. Once the drug is stopped, it gets redistributed to other lipid-rich cells in the body.

Benzodiazepines

E.g.: diazepam, midazolam etc

Advantages

- Relatively safe to use
- Highly lipid soluble and well absorbed orally
- They induce sedation, anxiolysis and amnesia.

i) *Diazepam*

- It is absorbed almost entirely and enters the brain, quickly leading to a rapid onset of action.
- Wide distribution in the adipose tissues which may lead to recurrence of sedation when redistribution takes place.
- Active metabolites are produced which may prolong the sedation period.
- Elimination is slow and variable.
- Dose 5–20 mg.

ii) *Midazolam*

- This is a water-soluble benzodiazepine which is double the strength of diazepam.
- Shorter half-life, no significant active metabolites, therefore, quicker and smoother recovery.
- Creates more amnesia than diazepam.
- Oral dose of 0.5 mg/kg is used for premedication.
- It has significant interaction with erythromycin.

Antihistamines

These drugs reverse the action of histamine and produce sedation, antiemetic effect, anticholinergic and local anesthetic actions.

Promethazine

- This drug has a rapid onset of action and the duration lasts from 2–8 hours.
- It potentiates the action of CNS depressants such as opioids and doses must be reduced if they are given in combination. May even result in convulsive seizures.
- Dose of 25–50 mg in adults.

Non-barbiturates: Eg: propofol, ketamine
Narcotic agents: eg: morphine, pethidine, fentanyl

Ketamine

This drug characteristically induces what is described as:dissociative anesthesia. This is deeper than conscious sedation and the patient has amnesia and profound analgesia.

- It is a derivative of phencyclidine which is a hallucinogen.
- It mainly acts on the cerebral cortex and subcortical areas.
- It produces profound analgesia, amnesia, sedation and the feeling of being dissociated from one's body.

Scanned with CamScanner
Scanned with CamScanner

- It is a relatively safe drug with no known irritation to the tissues.
- It does not produce respiratory depression and also the muscle tone increases with the use of ketamine.
- The patient is able to maintain a patent airway under ketamine.
- Dose: 1–2 mg/kg when given IV or 6.5–13 mg/kg IM. Onset of action is within 1 minute and recovery starts after 10–15 minutes. Amnesia lasts for 1–2 hours after procedure.
- Although the laryngeal reflexes are maintained, some cases of aspiration have been reported with the use of ketamine.
- Should be used with caution in patients with hypertension and with IHD.
- It is known to cause raised intraocular pressure and raised intracranial pressure.
- One major disadvantage with ketamine is that it causes rigidity or spasm of the muscles of the jaw making it difficult for the patient to open the mouth. Intraoral procedures are thus difficult to perform unless the mouth is opened with a mouth gag.
- Nausea, vomiting and hallucinations are known to occur with the use of ketamine. This may be reduced to some extent by premedicating the patient with benzodiazepines.

Propofol

- This is a recently introduced oily emulsion for IV induction and also for short duration anesthesia.
- In the dental clinic, propofol can be adequately titrated to produce sedation. This is achieved by a slow continuous infusion of the drug.
- Once the drug is terminated the patient recovers rapidly from the sedative effect.
- It produces sedation and mild amnesia along with good control over the airway.
- It causes some amount of muscle relaxation making dental procedures safer to do.
- Dose: 10–50 mg/kg /min generally produces adequate sedation. The patient recovers within 5–10 minutes of stopping the drug.

Fentanyl

- It is an opioid analgesic related to pethidine and is short acting.
- Dose: 1–2 microgram /kg used in combination with a sedative hypnotic such as midazolam or propofol.
- It does not cause hypotension but may cause respiratory depression, nausea, vomiting and muscle rigidity.

Pethidine + Promethazine Used as a Combination

- This narcotic and antihistamine can be given in combination to produce adequate sedation which lasts for almost one and a half hour.
- The patient is usually drowsy for a few hours after the procedure.
- Both these drugs are drawn into the same syringe and diluted with saline to obtain 5 mg/mL of pethdine and 2.5 mg/mL of promethazine (phenargan).
- This is injected slowly IV till adequate sedation is achieved. Usually 1–2 cc is sufficient to produce about 60–90 min utes of sedation.
- The sedative effect lasts for a long time after the procedure is completed and therefore difficult to discharge the patient on the same day.

Technique for IV Sedation

- Patient preparation is essential. He must be accompanied by a responsible adult.
- The patient must be advised to take a light snack 2–3 hours before the procedure. Drugs given on an empty stomach may cause nausea and vomiting.
- Venipuncture site is identified. Usually the preferred veins are the dorsal metacarpal and the basilic vein, median cubital vein.
- The site is prepared with antiseptic solution.
- A tourniquet is tied above the site of the venipuncture and the patient is asked to close the fist tightly. The vein is visualized prominently.
- The needle is then used in a two-step procedure. The skin on the site is stretched and the needle is used to puncture the skin at a 45 degree angulation. The needle is then lowered till it is parallel to the skin surface and then slowly inserted into the vein. The cannula remains in place while the needle is withdrawn. The drug is administered after securing the tubing in place.

It is important to choose the pharmacological agent and the route of administration with great care prior to starting a procedure. Based on the patient's requirement and his medical condition this choice is varied. Although each of the agents described above may be used individually, it is possible to combine them also for the desired effect.

Scanned with CamScanner

Scanned with CamScanner