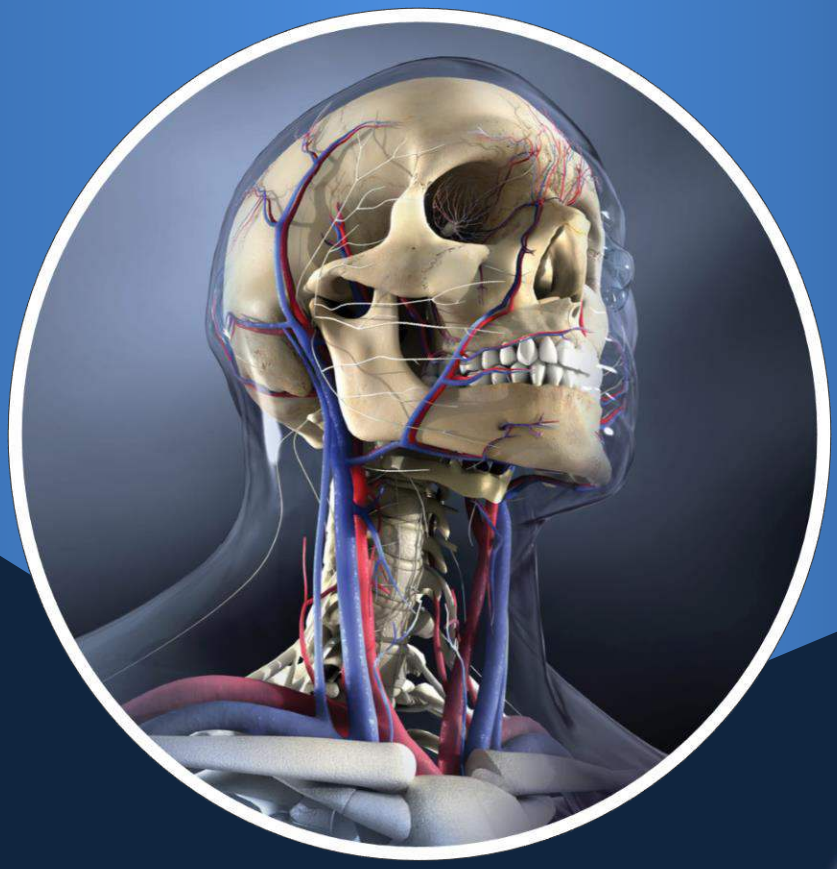
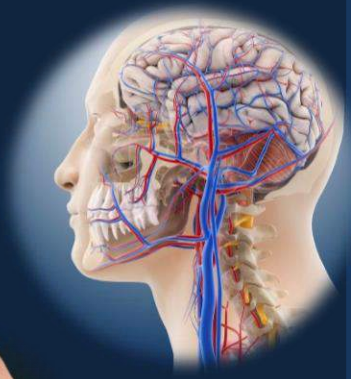


Oral Surgery

Third Stage







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Lecture 6

Complications of Dental Local Anesthesia

The widespread use of local anesthesia in dental practice is in itself attributed to both the effectiveness and safety of the method. Nevertheless, complications occasionally occur and it is essential that the dental surgeon should know how to minimize its incidence.

The complications associated with the administration of local anesthesia classified into local and systemic.

Local complications of the local anesthesia:

1. Pain on injection
2. Burning on injection
3. Failure to obtain anesthesia
4. Persistent anesthesia
5. Needle breakage
6. Facial nerve paralysis
7. Trismus
8. Soft tissue injury
9. Hematoma
10. Infection

1. Pain on injection:

Pain on injection increases patient anxiety and may lead to sudden unexpected movement, increasing the risk of needle breakage.

Causes:

1) Careless injection technique.

2) Rapid deposition of the solution may cause tissue damage and pain.

3) Low PH of the solution could irritate the tissue.

4) The temperature of the solution: a warmer solution is more comfortable for the patient than the cold one.

5) Aggressive insertion of the needle can tear the soft tissue, blood vessel, nerve and periosteum, causing more pain.

Prevention of the pain during injection could be achieved by avoiding the causes.

2. Burning on injection:

A burning sensation occurring during injection of local anesthesia is common.

Causes:

1) Low PH of the solution.

2) Rapid injection of local anesthesia, especially in the denser more adherent tissues of the palate.

3) Contamination of the local anesthetic cartridge that can result when they are stored in alcohol or other sterilizing solutions (diffusion of these solutions into the cartridge).

Management: Because most instances of burning on injection are transient and do not lead to prolonged tissue involvement no treatment is indicated.

3. Failure to obtain anesthesia:

Although the incidence of this difficulty tends to decrease as the experience of the operator increases it is still probably the most common problem seen during the use of local anesthesia. The problem is most common with block anesthesia, especially in the lower jaw.

Causes:

1) **Poor technique:**it is the most common cause of insufficient anesthesia in inferior alveolar nerve block and common mistakes are:

- Injection of anesthesia too soon on the anterior ascending ramus.
- Giving the solution inferior to the mandibular foramen.

2) Anatomical causes:

- Accessory nerve supply
- Abnormal course of the nerve
- Variation in the foramen location
- Sometimes the tooth is innervated by more than one nerve

3) Pathological causes:

- Trismus (limited mouth opening): in these cases, it is difficult to use the conventional technique of inferior nerve block.
- Infection and inflammation: if the pulp is inflamed the low PH may cause lack of effective anesthesia in that area. The inflammation makes the nerve more sensitive to pain; minimal stimulation can cause pain perception. In those patients, to obtain proper anesthesia more solution has to be injected, for example, by combining a block, infiltration and supplemental Intraligamentary injections.

4) Psychological causes: Fear and anxiety can cause failure in local anesthesia, to enable successful anesthesia relaxation of the patient is sometimes needed. The use of a sedative like benzodiazepine may be helpful.

4. Persistent anesthesia or Paraesthesia

Which can be defined as altered sensation beyond the expected duration of anesthesia or it is the prolonged loss of sensation. It is common in dental practice.

When anesthesia persists for days, weeks, or months, there is an increased potential for self-inflicted injury, biting, thermal or chemical trauma which can occur without the patient awareness.

Causes:

1) Trauma to any nerve during injection may lead to paresthesia. Patients report the sensation of an electric shock throughout the distribution of the involved nerve.

2) Injection of local anesthetic solution contaminated by a neurotoxic substance such as alcohol near a nerve.

3) Hemorrhage and infection in close proximity to a nerve may lead to transient paresthesia, due to pressure on the nerve, which resolves when the cause is removed.

Prevention: Strict adherence to injection protocol and proper care and handling of dental cartridges help to minimize the risk of paresthesia

Management: Most paresthesia resolves within approximately 8 weeks without treatment. Reassure the patient that the condition is transient with strict follow up. If the damage to the nerve is severe, the paresthesia will be permanent.

5. Needle breakage:

Breakage and retention of needles within the tissue have become an extremely rare occurrence because of the introduction of disposable needles. However, reports of needle breakage still appear.

Causes:

1) The primary cause of needle breakage is weakening of the dental needle by bending it before its insertion into the patient's mouth.

2) The sudden unexpected movement of the patient.

3) Smaller needles (such as gauge 30) are far more likely to break than larger needles (such as gauge 25).

4) Re-use of the needle (repeated injection cause fatigue of the needle structure and increases the risk of needle breakage).

5) Incorrect use of the needle:

 Aggressive insertion of the needle into the tissue.

 A sudden change in the direction inside the tissue.

 Too deep penetration as the needle goes up to its hub inside the tissue and might fracture at this point. The hub is considered the most common point of needle fracture.

6) Needles may be defective in manufacture.

Prevention:

 The dentist should check the needles before using them. If there is any suspicion of inadequate product quality a new one should be used.

 Use larger gauge and long needle for techniques needing penetration of significant depths of soft tissue, gauge 25 is appropriate for an inferior alveolar nerve block.

 Do not redirect a needle once it is inserted into the tissue.

Management:

 Stay calm and try to localize broken part in the tissue.

 Tell the patient what has happened and try to relax and comfort him.

 Stabilize the patient's jaws in order that the needle stays in place, if the patient moves his jaw the tension from the muscle of the masticatory system help the needle to penetrate the tissues.

 If a portion of the needle is visible, grasp it firmly with a hemostat and remove it.

 If you cannot remove the broken part by yourself, refer the patient to an oral and maxillofacial surgeon.

6. Facial nerve paralysis:

Paralysis of the facial muscles on one side is an uncommon complication of the inferior alveolar nerve block and may be either partial or complete depending upon which branches of the nerve are affected.

Cause: This complication arises if the tip of the needle is inserted too far back and behind the ascending ramus. The solution is then deposited in the substance of the parotid gland, where it anesthetizes the branches of facial nerve causing paralysis of the muscle they supply. Since a fascial sheath envelops the parotid gland there is also a failure in anesthesia of the inferior alveolar nerve.

Clinically the patient will immediately complain of transient paralysis of the muscles of the chin, lower lip, upper lip, eyelid (inability to close the eye) and inability to raise the eyebrow of the affected side.

Management:

 Reassure the patient of the transient nature of the event, it will last for a few hours and will resolve without residual effect.

 Advice the patient to use an eye patch until the motor function returns.

 If contact lenses are worn, they should be removed until the muscular movement retunes.

7. Trismus:

Trismus defined as a prolonged spasm of the jaw muscles by which the normal opening of the mouth is restricted (locked jaw).

Causes:

1) Trauma to the muscles due to the injection of local anesthetics which is the most common etiological factor in Trismus.

2) Muscles irritation by local anesthetic solution contaminated by alcohol.

3) Hematoma in or around the muscles, the blood is slowly resorbed over approximately 2 weeks.

4) Infection after injection can also cause trismus.

5) Excessive volume of local anesthetic solution deposited into a restricted area produce distention of tissues which may lead to post-injection trismus and this is more common after multiple missed inferior alveolar nerve block.

Prevention:

 Use sharp, sterile, disposable needle.

 Practice atraumatic insertion and injection technique.

 Avoid repeated injections and multiple insertions into the same area, by getting a good knowledge of anatomy and proper technique.

 Use the minimum effective volume of local anesthetic solution.

Management:

 Heat therapy, which consists of applying hot and moist towels to the affected area for approximately 20 min every hour or using warm saline rinse; a teaspoon of salt is added to a glass of warm water.

 Use analgesic and muscle relaxant.

 The patient is advised to initiate physiotherapy consisting of opening and closing the mouth as well as lateral excursions of the mandible, chewing gum is another means of providing lateral movement of the temporomandibular joint.

8. Soft tissue injury: The soft tissue anesthesia lasts longer than pulpal anesthesia. Trauma to the anesthetized soft tissue can lead to swelling, pain and even infection.

Causes: Self-inflicted trauma to the lips and tongue frequently occurs when the patient bites or chews these tissues while still anesthetized. Trauma occurs most frequently in younger children and in mentally retarded patients.

Prevention:

- The local anesthetic of appropriate duration should be selected.
- A cotton roll can be placed between the lip and the teeth if they are still anesthetized.
- Warn the patient against drinking hot fluid, and biting the lips or tongue.

Management: Management is symptomatic:

1) Analgesics for pain.

2) Antibiotic if necessary.

3) Warm saline rinses to aid in decreasing any swelling present.

4) Use any lubricant to cover the lip lesion and minimize the irritation.

9. Hematoma: Hematoma is a localized mass of extravasated blood that may become clinically noticeable following injection. It is caused by penetration of the blood vessel with the needle during injection. The patient will notice the development of swelling and discoloration (bruise). Intraorally the blood vessels most commonly associated with hematoma are:

- the pterygoid venous plexus
- the posterior superior alveolar vessels

 the inferior alveolar vessels in the pterygomandibular space

 the mental vessels

 the infraorbital vessels

Prevention:

1) Learn anatomical landmarks and injection technique.

2) Avoid relocating the needle to different sites inside the tissue.

Management:

 If it is visible immediately following injection, apply direct pressure if possible. Once bleeding has stopped, inform the patient of what was happened and reevaluate the possibilities of continuing the treatment. Instruct the patient to avoid application of heat over the area, prescribe analgesic and antibiotic if necessary.

 If it is invisible like in case of pterygomandibular space hematoma, the patient will come in the 2nd or 3rd day complaining of trismus, in this case, treat the case as trismus.

10. Infection:

Infection after local anesthesia has become rare since the introduction of sterile disposable needles.

Causes:

 Contamination of the needle by touching the mucous membrane in the oral cavity before the administration of local anesthesia.

 Improper technique in the handling of the local anesthetic equipment.

 Injecting the solution into an area of infection, which might transport bacteria into adjacent healthy tissues (spreading the infection).

Prevention:

1) Use sterile disposable needles.

2) Proper handling of the needle to avoid its contact with nonsterile surfaces.

3) Use cartridge only once and store it in their original container, covered at all times.

Management: If an infection does occur the patient will complain of pain and trismus, immediate treatment consists of those procedures used to manage trismus. A course of antibiotic should be prescribed to the patient for 7 days.

Summary: to give efficient local anesthesia, you should gather the following three elements:

- Thorough anatomical knowledge
- Mastering a good technique
- Sterile handling of the dental syringe assembly

Systemic Complications of Local Anesthesia

1. Fainting (vasovagal attack)

2. Hypersensitivity or allergy to local anesthesia

3. Overdosage and toxicity

4. Drug interaction

1.Fainting (Vasovagal Attack)

It is the most common systemic complication that occurs with local anesthesia in the dental office. It refers to a sudden transient loss of consciousness usually secondary to cerebral ischemia. The cerebral

ischemia is secondary to vasodilatation or an increase in peripheral vascular bed, with a corresponding drop in blood pressure.

The collapse in the dental chair may occur suddenly and may not be accompanied by loss of consciousness, in most instances, these episodes are vasovagal attack and spontaneous recovery is usual. The patient often complains of feeling dizzy, weak, and nauseated, the skin is pale, cold and slow pulse is noticed.

Predisposing Factors or Triggering Stimulus

The predisposing factors for this condition may be divided into two groups:

1) Psychogenic factors:

 Anxiety

 Emotional stress

 Pain of sudden and unexpected nature

 The sight of blood, surgical or other dental instrument such as a local anesthetic syringe, an injection needle, etc.

2) Non-psychogenic factors:

 Sitting in an upright position or standing for a prolonged period, it leads to pooling of the blood in the periphery, thereby decreasing cerebral blood flow.

 Hunger or starvation, which leads to a decrease in cerebral blood glucose level.

 Poor physical condition.

 Hot, humid and crowded environment.

Mechanism of Vasovagal Syncope

Regardless of the trigger, the mechanism of syncope is similar. The brainstem is activated directly or indirectly by the triggering stimulus, resulting in simultaneous enhancement of parasympathetic nervous system (vagal) tone and withdrawal of sympathetic nervous system tone.

This results in the following responses:

1) The cardioinhibitory response, characterized by a drop-in heart rate and in contractility leading to a decrease in cardiac output that is significant enough to result in a loss of consciousness.

2) Vasodepressor response: dilation of the blood vessels as a result of the withdrawal of sympathetic nervous system tone. The blood will pool in the dilated peripheral vessels, at the same time, the blood flow to the brain is reduced.

Prevention

The prevention is directed toward the elimination of the cause; good preoperative assessment, the patient should be asked to take a light meal prior to the dental appointment, proper injection technique, use of sedation for the relief of anxiety, etc.

Management

The first aid treatment should be started at once, the head of the patient should be lowered, the legs elevated, tight belt and collar should be loosened, and respiration is stimulated. Spontaneous recovery is usual and it is often possible to complete the treatment at the same visit.

If signs of recovery are not apparent within 30 – 40 seconds, the collapse probably is not a vasovagal attack, the airway must be maintained, oxygen administered and, in this case, a medical emergency team should be asked immediately for help.

Cardiopulmonary Resuscitation (CPR)

An emergency procedure that combines chest compressions with artificial ventilation in an effort to manually preserve intact brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest. It is recommended in those who are unresponsive with no breathing or abnormal breathing.

CPR involves chest compressions for adults of about 5 cm deep and at a rate of at least 100 per minute with a universal compression to ventilation ratio of 30:2 is recommended for adults. The rescuer may also provide artificial ventilation by either exhaling air into the subject's mouth (mouth-to-mouth resuscitation) or use a device that pushes air into the subject's lungs (mechanical ventilation).

2.Hypersensitivity or Allergy to Local Anesthesia

It is more commonly seen with ester type agent than amide type. Hypersensitivity reaction could be due to:

- local anesthetic agent
- vasoconstrictor
- additives like bisulfite which is used as a preservative

In general, hypersensitivity reaction to local anesthesia is very rare and represent less than 1 % of all complications of local anesthesia. True allergic response to local anesthesia may be localized or generalized and it may be immediate or delayed in onset, also the allergic reactions may vary from mild skin irritation or rashes to an anaphylactic reaction. Local reactions are seen more frequently than systemic and usually resolve without active treatment. If any degree of allergic reaction is observed, it is very important to determine the actual cause (allergen). Inadequate diagnosis and treatment can be life-threatening to the patient.

Clinical manifestations of allergy vary and include the following: fever, angioedema, urticaria, dermatitis, photosensitivity or anaphylaxis.

Prevention

Proper pre-anesthetic evaluation, which includes a proper personal history and the past dental history, particularly history of allergy to the local anesthetic agent, or history of allergy to any other drug.

Management

- Antihistamine injection
- Epinephrine 0.5 ml of 1:1000 IM (intramuscular)
- Administer O2 if necessary.

Substitution of the local anesthetic agent

The local anesthetic agent can be substituted with another type of agent. If the reaction is in response to ester-type then an amide type such as lidocaine could be used.

Anaphylactic Shock

It is a rare, life-threatening hypersensitivity reaction to an antigen. It develops fast causing death within a few minutes. It is characterized by:

1) profound fall in the blood pressure

2) dyspnea and respiratory embarrassment

3) facial and laryngeal edema

4) loss of consciousness

Management of anaphylaxis

If you suspect the anaphylactic reaction, immediately seek medical help.

- Epinephrine is the most important medication; it is given as intramuscular injection working rapidly to make the blood vessels

contract. it also relaxes the airway, helping the individual breathe easier and stop itching.

 Even if the patient responds to the epinephrine, it is vitally important to go to an emergency room immediately.

 Oxygen should be given to improve breathing.

 Intravascular (IV) fluid may be necessary to restore adequate blood pressure.

 Antihistamine should be given to contract the effect of histamine.

 If the patient stops breathing, start cardiopulmonary resuscitation (CPR) immediately until the patient begins to breathe again.

3.Overdosage and Toxicity

It is relatively rare; a toxicity reaction can occur when the concentration of local anesthesia in circulation increases too rapidly within a short period of time as in injecting too rapidly into the highly vascular area or when giving IV injection. The toxic effect is primarily directed to the central nervous system (CNS) and cardiovascular system (CVS). The dose necessary to induce toxicity varies among patients and is influenced by numerous factors which are:

 The patient general health, age and weight: in patients with dysfunction of the liver and kidneys, there is an increased level of local anesthetic in the bloodstream.

 Rapidity of injection.

 Rout of administration.

 Amount of local anesthesia administered.

Signs and symptoms: restlessness, agitation, convulsion along with increased blood pressure, heart rate and respiratory rate. There are two types of drugs that can exhibit toxic reactions in dental practice local anesthetic agent and the vasoconstrictor.

Prevention: The best method to avoid toxic reactions is by:

1) Use the smallest possible volume and lowest effective concentration.

2) The local anesthetic solution should be injected slowly.

3) Avoid intravascular administration by the use of aspirating syringe.

Management

- Stop the dental procedure.
- Position the patient supine with legs elevated.
- Reassurance of the patient.
- Administer O**2**, IV anticonvulsant and monitor vital signs.
- Allow the patient to recover and then discharge.
- If the patient fails to recover then transfer him to the hospital.

Factors adding to the increased risk of local anesthetic overdose in younger patients

1) Treatment plan where all four quadrants are treated with local anesthetic in one visit.

2) Use of plain local anesthetic.

3) Exceeding the maximum dosage based on patient's body weight.

4.Drug Interaction

In some patients, the administration of two drugs will counteract each other, while in others, potentiation occurs. In patients using a tricyclic antidepressant, variable degrees of potentiation of blood pressure response to adrenaline will occur even to small doses; therefore, precautions should be taken during the use of these vasoconstrictors with the patient taking a tricyclic antidepressant.

The practitioners can minimize the risk of interaction by using an aspirating syringe, which reduces the likelihood of the local anesthetic being administered directly into a blood vessel.