Complications of Local Anesthesia

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Abstract

This chapter is presenting the local and systemic complications associated with the local anesthetics used in oral and maxillofacial surgery. The prevention of complications and management method are also given importance. Dental procedures are frequently performed under local anesthesia; thus, drug-related complications often come across. It is mandatory to have a preoperative evaluation of the patient and choosing the proper local anesthetic agents.

Keywords: *Local anesthesia, complication, systemic complication, local complication, treatment*

Introduction

Local anesthesia is defined as a loss of sensation in a circumscribed area of the body caused by depression of excitation in nerve endings. Local anesthetic agents have been used in clinical dentistry to eradicate pain associated with invasive operations. It is also used in oral and maxillofacial surgery. [1]

Composition:

- Local anesthetic agent: lignocaine hydrochloride (2%)
- Reducing agent: sodium meta-bisulfite
- Preventive agent: methylparaben
- Diluting agent: distilled water
- Fungicide: thymol
- Isotonic solution or ringer's solution: sodium chloride
- Vasoconstrictor agent: adrenaline

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Complications: Various complications of local anesthetics can be evaluated systemically and locally. Common systemic reactions due to local anesthesia are reported as psychogenic reactions, systemic toxicity, allergy, and methemoglobinemia. Common local complications associated with local anesthesia are given as pain at injection, needle fracture, prolongation of anesthesia and various sensory disorders, lack of effects, trismus, infection, edema, hematoma, gingival lesions, soft tissue injury, and ophthalmologic complications.[2]

Local Complications:

Trismus: Also called lockjaw, is reduced opening of the jaw. May be caused by spasm of the muscles of the mastication. Several factors cause trismus such as multiple injections in a short period in the same area, intramuscular injections inside the muscle which cause hematoma formation and fibrosis, needle fracture in the muscles inserting to styloid process, inaccurate positioning of the needle when giving the inferior nerve block and other masticatory muscles, a low-grade infection. Excessive volumes of local anesthetic solution deposited into a bounded region which causes expansion of tissues.

Cause:

Intraarticular: Ankylosis, Arthritis synovitis

Extra-articular: Infection (Odontogenic & Non-Odontogenic)

Odontogenic: Pulpal, Periodontal, Pericoronal

Non-odontogenic: Tonsillitis, Tetanus, Meningitis, Brain abscess, Parotid abscess

Trauma: Fractured mandible, Fractured zygomatic arch

Infection: Infection may extend to tissues by penetration of the needle through a contaminated tissue, because of the needle being contaminated before an operation. A latent viral infection may be reactivated due to the trauma of the procedure which may be responsible for neural sheath inflammation. Antiseptic mouthwash solutions such as chlorhexidine gluconate should be taken for all regional techniques. The local anesthesia should not be injected through the infected area.[3]

Edema: Swelling of tissues can be due to trauma during injection, infection, allergy, hemorrhage, and injection of irritating solutions. The management of edema is dependent on the cause. Allergy-induced edema treatment consists of intramuscular epinephrine injection as mentioned above and, additionally, antihistamine and corticosteroid administration and consultation with an allergist to determine the precise cause of the edema. Trauma-induced edema should be managed as a hematoma. For the treatment of edema produced by infection, antibiotics should be prescribed.[3-6]

Hematoma: Hematoma formation as a complication of local anesthesia. It is an abnormal collection of blood outside of a blood vessel. It occurs because the wall of a blood vessel, artery, vein, or capillary has been damaged. And blood has leaked into tissues where it does not belong.

Symptoms: Pain, Swelling, Redness

Gingival lesions: Gingival lesions consist of recurrent aphthous stomatitis. Isolated lesions of gingival arise in succession to the hyperinflammatory reaction. No management is necessary until there is severe pain. To relieve pain, topical anesthetic solutions (e.g., viscouslidocaine) may be used on affected areas. Triamcinolone acetonide without corticosteroid can remedy pain.

Soft tissue injury: Soft tissues which include the tongue, lips, gums, and lips are injured when they are accidentally be bitten while eating or in an accident, or when hot food is kept inside the mouth. Chewing on hard objects also damage soft tissues. And the main symptoms are persistent, throbbing pain.[3-6]

Treatment of gum trauma:

- Rinsing the mouth out with salt water, helps to keep the woundsclean.
- If the bleeding in the mouth is particularly heavy some gauze is applied to stem the flow of blood.
- An ice pack or cold compress is also used to reduce swelling in the mouth.

Wounds in the oral cavity heal faster still being less cared than the wounds in the other parts of the body. Saliva creates a humid environment which improves the survival and functioning of inflammatory cells that are crucial for wound healing. Saltwater has a disinfectant quality which in turn helps in healing the wounds at a faster rate.

Pain on injection: Pain on injection can be due to specific circumstances such a temperate of the solution, velocity of injection, dull needles, damaging soft tissues, blood vessels, nerves, or the periosteum and causing more pain and other complications. It can be very distressing to the patient. The rate of injection and the acidity of the solution are the main factors on which burning depends. Lidocaine causes an intense burning sensation when injected locally. When the needle penetrates a nerve, the patient may also feel a sudden "electric" shock, suddenly moving the head, with the risk of self-inflicted damage. Local anesthetic administration with intradermal or subcutaneous lignocaine infiltration is associated with discomfort.[4]

Factors contributing to the pain during local anesthesia:

- Number of injections
- Size of the needle
- Amount and type of anesthetic
- Level of anxiety of the patient

Sodium bicarbonate was added to the local anesthetic solution which reduces the stinging sensation caused by adrenalin. Bupivacaine was used local anesthesia is used for a longer time. Topical anesthetic is applied to prevent the discomfort of the patient during injection. Switching to a fresh needle is the utmost important work when injection is applied multiple times to the same lesion.[5]

Needle fracture: Needle breakage in the oral cavity after local anesthesia is a rare complication, since the use of non-reusable, stainless steel dental local anesthetic

needles. In most cases, needle fracture happened with 30-gauge needles and during inferior alveolar nerve block, as a result of either wrong injection technique, improper choice of hypodermic needle magnitude, or unexpected motion of the patient or assistants. The needle may damage the intraneural blood supply, resulting in a hematoma or the needle may traumatize the medial pterygoid muscle which results in trismus. When seen in a case of a broken needle, the foremost duty is to remove the broken needle with a hemostat. In case, it is not accessible, a CT scan can be the method for accessing the broken needle by operating the patient under general anesthesia. If a nerve is damaged due to dental local anesthesia, the first treatment should be managing the pain. Only the use of high concentration agents' infiltrations is the source to decrease nerve injury caused due to local anesthesia and to avoid inferior alveolar nerve blocks which in turn prevents frequentative injections.[6]

Systemic Complications:

Systemic Toxicity: Systemic toxicity means toxicity at a cellular level that causes failure of organ leading to the possible death of the organism.

It can be of three types: Acute, Subacute, Subchronic

Local anesthetic systemic toxicity develops when a toxic concentration of anesthetic drugs in the blood level reaches to the central nervous system and cardiovascular systems. Initial symptoms are characterized by central nervous system signs such as excitation, convulsions, followed by loss of consciousness and respiratory arrest. These symptoms are often accompanied by cardiovascular signs such as hypertension, tachycardia, and premature ventricular contractions. Predisposing factors are associated with age, weight, other drugs, gender, the presence of disease, genetics, vasoactivity, concentration, dose, route of administration, the rate of injection, vascularity of the injection site, and the presence of vasoconstrictors.[7]

To prevent systemic toxicity, these should be followed:

- The patient should be evaluated.
- The volume of local anesthesia should be decreased,
- Accurate and slow injection technique,
- Adjustment of dosage divided administration
- Aspirating technique, using agents with low toxicity such as ropivacaine and levobupivacaine.

Allergy: Allergy is also known as hypersensitive reactions. Two types of reactions are involved in allergic reactions to local anesthetics: Immunoglobulin E mediated type I & Tcell-mediated type IV reactions. Allergic reactions may include mild symptoms, such as urticarial, erythema, and intense itching, as well as severe reactions in the form of angioedema and/or respiratory distress. Before the LA is injected in a person's body, first a skin prick test is done to observe if any kind of reaction is taking place in the person's body. If the test result is seen negative intradermal testing is performed. Intradermal tests are performed by beginning with a lower concentration of the potential allergen and gradually increasing its concentration. Although rare, adverse effects from local anesthetic may be encountered at any time in clinical settings. In these cases, it is important to determine whether the patient is having an allergy. And if a local anesthetic that does not cause adverse effects can be identified, then that drug should be used for local anesthesia in performing dental treatments. If no such drug is available, then the use of general anesthesia might be unavoidable.[8]

Anaphylaxis is an acute potentially life-threatening hypersensitivity reaction. The clinical symptoms of anaphylaxis are depending on the organ systems involved. Uncontrolled co-existing asthma, mast cell disorders, and patients with specific allergens such as peanut and tree nut allergy are the risk factors for anaphylaxis.

Methemoglobinemia: It is a blood disorder in which an abnormal amount of methemoglobin is produced. Hemoglobin is the protein in the red blood cell that carries and distributes oxygen to the body. When methemoglobinemia, the hemoglobin can carry oxygen, but it is not able to release it effectively to body tissues. Methemoglobinemia is a unique dose-dependent reaction where the iron in hemoglobin is stabilized in the ferric (Fe^{3+}) form, unable to attach oxygen.[9]

Causes: Congenital & Acquired

There are two forms of inherited MetHb:

- **Type I:** erythrocyte reductase deficiency, occurs when RBCs lack the enzyme
- **Type II:** generalized reductase deficiency, occurs when the enzyme does not work in the body.

Symptoms of cyanosis will be observed in nail beds and mucous membranes. In more severe cases, headache, dizziness, fatigue, dyspnea, and tachycardia are seen. Management of methemoglobinemia begins with supplemental oxygen (100%) immediately. As a guideline, methylene blue, which is a heterocyclic aromatic chemical compound increasing the rate of conversion of methemoglobin to hemoglobin.

Psychogenic reactions: The patient's body counterbalance to an anxiety-inducing situation or adrenaline secreted by the vasoconstrictor agent are the main factors associated with the psychogenic reactions. Due to psychogenic reactions mood change, respiratory rate, heart rate, blood pressure is also affected. Relaxation of the patient before administering local anesthetic injections is important for the prevention of psychogenic reactions. Using oral sedatives is an effective method to manage dental fears. Patient's physic such as health, age, weight and duration of operation are the main factors for the initial dosage of local anesthesia.[10]

Conclusion

Complications from local anesthesia are often due to overdosage. Predisposing factors, such as the patient's age, weight, state of health, and other medications that the patient may be taking may cause increased free local anesthetic blood levels due to a lack of plasma proteins available for binding. During administration, both the rate of injection and the route of administration can also have an impact on the dosage effect, as rapid injection can lead to increased plasma levels of local anesthetic. Drug factors may also be related to overdosage. While administrating anesthesia, the painless injection should be performed, avoiding intravascular or intramuscular or direct trauma to the nerve. The best way to avoid nearly complications relating to the administration of local anesthetics is to use the right technique and to have a good knowledge of the anatomy of the trigeminal nerve and the adjacent anatomical structure. Concluding the article by the statement that "**New developments should be followed by the practitioners to reduce possible complications associated with the local anesthesia**".

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References

1. Ogle OE, Mahjoubi G. Local anesthesia: agents, techniques, and complications. Dent Clin North Am. 2012;56(1):133–ix.
2. Cummings DR, Yamashita DD, McAndrews JP. Complications of local anesthesia used in oral and maxillofacial surgery. Oral Maxillofac Surg Clin North Am. 2011;23(3):369–377.
3. Daubländer M, Müller R, Lipp MD. The incidence of complications associated with local anesthesia in dentistry. Anesth Prog. 1997;44(4):132–141.
4. Boynes SG, Riley AE, Milbee S, Bastin MR, Price ME, Ladson A. Evaluating complications of local anesthesia administration and reversal with phentolamine mesylate in a portable pediatric dental clinic. Gen Dent. 2013;61(5):70–76.
5. Blanton PL, Jeske AH; ADA Council on Scientific Affairs; ADA Division of Science. Avoiding complications in local anesthesia induction: anatomical considerations. J Am Dent Assoc. 2003;134(7):888–893.
6. Lu DP. Managing patients with local anesthetic complications using alternative method. Pa Dent J (Harrisb). 2002;69(3):22–29.
7. Meyer FU. Complications of local dental anesthesia and anatomical causes. Ann Anat. 1999;181(1):105–106.
8. Becker DE, Reed KL. Local anesthetics: review of pharmacological considerations. Anesth Prog. 2012;59(2):90–103. doi:10.2344/0003-3006-59.2.90
9. Singh P. An emphasis on the wide usage and important role of local anesthesia in dentistry: A strategic review. Dent Res J (Isfahan). 2012;9(2):127–132.
10. Sekimoto K, Tobe M, Saito S. Local anesthetic toxicity: acute and chronic management. Acute Med Surg. 2017;4(2):152–160.