Case Report

Diplopia with local anesthesia

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ABSTRACT

A variety of local and systemic complications can occur during the administration of local anesthesia (LA). Diplopia is one of the very rare complications that follow a posterior superior alveolar (PSA) nerve block. This article describes a very rare case report and the possible mechanisms are discussed in detail. Diplopia is defined as double vision. The patient was administered PSA nerve block for the extraction of the upper right third molar tooth. After the extraction, the patient complained of double vision and not being able to gaze laterally with the right eye. The patient recovered completely after the anesthetic effect. Local and systemic complications do occur during and after administration of local anesthesia. The clinician needs to be aware of the complications and management.

Key words: Diplopia, local anesthesia, posterior superior nerve, pterygoid plexus of veins

INTRODUCTION

Local anesthesia is defined as a loss of sensation in a circumscribed area of the body caused by a depression of excitations of nerve endings or an inhibition of the conduction process in the peripheral nerves. Local anesthetic drugs are routinely administered for oral and maxillofacial surgical procedures. Despite careful patient evaluation, proper tissue preparation, and a meticulous administration technique, local and systemic complications associated with local anesthesia occasionally develop. Millions of local anesthetic cartridges are administered in dentistry each year, yet neurologically related complications appear to be rarely reported in the literature. Oculomotor disturbances have been known to occur as rare complications to injections of local anesthetic agents. Nerve-related ophthalmic complications other than direct trauma can arise after anesthetic injection-like paralysis of the extraocular muscles, diplopia, amaurosis (temporary blindness), Horner’s syndrome, blurring of vision, and so on. These ocular complications would most likely follow the posterior superior alveolar nerve block.

Neurological complications can be very alarming and lead to medicolegal issues. Diplopia with transient nerve palsy occurs during the injection of a PSA nerve block, as a very rare complication, as reported in the following case.

CASE REPORT

A 50 year old female patient came to the Department of Oral and Maxillofacial Surgery with the chief complaint of bleeding from the gums and bad breath, since two months. On intraoral examination, six teeth were missing and tenderness was present in the right upper third molar and the other teeth present had mild mobility due to chronic generalized periodontitis. After examination by the periodontist, the patient was advised extraction of the right upper third molar tooth. After making sure that the anesthesia was effective, the tooth was extracted. Soon after the extraction, the patient complained of double vision. When she was asked to look laterally, the movement of the pupil of the eye was restricted laterally as shown in the Figure 1. It was confirmed that there was abducence nerve palsy, due to which diplopia was present. The patient exhibited limited abduction of the ipsilateral eye, as well as paresthesia of the lateral side of the upper and lower eyelids.
There was no dilatation of the pupil and all the vital signs were checked to be normal. The patient was assured of the temporary nature of the complication. The patient was kept under observation. As the effect of local anesthesia reduced, the patient recovered gradually. After two hours, the patient was checked for double vision and movement of the pupil of the eye, and was found to be almost normal, as shown in the Figure 2. The patient was absolutely fine after four hours, and was sent home with a responsible person. The patient was asked to report immediately if any other complications arose. There was no further complaint with regard to this.

**DISCUSSION**

Dentists administer local anesthetic injections every day, with a few reports of serious complications. However, misjudging the anatomy involved during local anesthetic administration can not only result in inadequate or incomplete anesthesia, but also other complications, such as, paresthesia, bleeding, and hematoma or lead to serious systemic complications. Visual disturbances are uncommon following the administration of local anesthesia and have been reported in a few publications. Ophthalmic complications such as temporary loss of vision and other signs like partial orbital palsies with diplopia have been reported. There is little doubt that local anesthetics used in dentistry are safe agents. Complications associated with LA can be divided into systemic and regional, as also those determined by the local anesthetic agents used and the technique of administration. Some of the systemic reactions include vasovagal syncope, anaphylactic shock, toxicity, tissue necrosis, and facial nerve palsy; and the ophthalmic complications include temporary blindness, diplopia, temporary paralysis of cranial nerves III, IV, and VI, oculomotor muscle paralysis, mydriasis, palpebral ptosis, and even permanent blindness.

Peripheral facial nerve palsies have been reported following the administration of Posterior superior alveolar nerve (PSA) block. Intra-arterial injections and intravenous absorption are two possible means of vascular transport of the anesthetic solution into the orbital region. Transportation of the retrograde injection of local anesthetic drugs into the posterior superior alveolar artery is via the middle menengial artery and the subsequent petrosal artery branches, to the facial nerve. As seen in our reported case, abducent nerve palsy can develop during PSA nerve block. The patient may complain of double vision and may exhibit limitation of abduction of the ipsilateral eye as well as paresthesia of the lateral side of the upper and lower eyelids. The possible explanations given by John Crean and Alison Powis are as follows: (1) The inadvertent deposition of local anesthetic solution passes through the inferior orbital fissure to cause direct anesthesia of the abducent nerve. (2) The local anesthetic solution reaches the inferior ophthalmic vein via the pterygoid plexus or its communicating branches. This vein contains no valves and connects directly with the extrinsic muscles of the eye via the infraorbital foramen. An intraluminal injection may easily reverse the flow within the vessel, thus predisposing the muscles to the effect of the anesthetic solution. (3) Deposition of the anesthetic solution within the PSA artery causes a back flow into the connecting maxillary artery and subsequently into the middle menengial artery. There exists a constant anastomosis between the orbital branch of the middle menengial and the recurrent menengial division of the lacrimal branch of the ophthalmic artery. This lacrimal artery supplies the lateral rectus muscle, the lacrimal gland, and the outer half of the eyelids, which due to these anatomical considerations may explain these symptoms. (4) The local anesthetic solution reaches the abducent nerve within the cavernous sinus through the infratemporal fossa and the pterygoid plexus and its connecting emissary veins passing through the

![Figure 1: Immediate postoperative image. Patient attempts to gaze to her right. Note the inability of the right eye to abduct past the midline](image1)

![Figure 2: Postoperative image four hours after extraction. Patient successfully gazes to her right on command](image2)
foramen ovale and lacerum. Different manifestations observed following the administration of local anesthetic agents may be explained in terms of either sympathetic or parasympathetic involvement.

Several bony anatomical features are often cited as responsible for allowing the unintended spread of the anesthetic agent and resultant abducent nerve palsy. Two key points must be kept in mind regarding local anatomy. First, the inferior orbital fissure and pterygopalatine fossa are in open communication with one another in the orbital region and the greater palatine canal is in communication with the inferior aspect of pterygopalatine fossa as shown in the Figures 3-6. Thus the anesthetic solution may diffuse widely among these bony openings, perhaps very easily in some individuals with unique anatomic variations. The recumbent position of the patient during anesthetic administration may also play a role. Second the abducent nerve is the most vulnerable in the region of the orbital apex, where it lies on the deep (intraconal) surface of the lateral rectus muscle. Investigators have described anesthetic delivery close to the pterygopalatine fossa via PSA injection, allowing diffusion into the region of the orbital surface or the inferior orbital fissure. As the greater palatine canal is on a straight line trajectory with the pterygopalatine fossa and orbital apex, injections at this location can introduce anesthesia into the orbital apex and induce paresis of the abducent nerve by direct contact of the solution with the nerve, at its most vulnerable location [Figure 7].

![Figure 3: Rectangle approximates the extent of the infratemporal fossa, where the pterygoid venous plexus would be found. Foramen ovale contains small emissary veins that drain into the cavernous sinus](image)

![Figure 4: Coronal section through the cavernous sinus to show its relation to the pterygoid plexus through the emissary veins](image)

![Figure 5: Coronal section through the cavernous sinus to show its relation to the abducent nerve](image)

![Figure 6: Local anesthetic injected posterior to the maxillary tuberosity or into the greater palatine foramen may reach the orbital apex (not in view) by entering the pterygopalatine fossa. The red wire shows the straight-line path from the greater palatine foramen (GPF) to the pterygopalatine fossa (PPF), and its continuation with the inferior orbital fissure (IOF)](image)

![Figure 7: Anterior view of the left orbit, showing the orbital apex and its relationship to the inferior orbital fissure (IOF). The red marker indicates the continuity from the pterygopalatine fossa to the orbital apex, where the abducens nerve normally lies on the deep (intraconal) surface of the lateral rectus muscle, but is not yet embedded within the muscle](image)
Chun Kei-Lee, while describing ocular complications after LA, explains that the local anesthetic solution reaches the orbit through a vascular, neurological, and lymphatic network that is responsible for ocular complications. Even while administering the inferior alveolar nerve block, ocular complications do occur. The author has suggested that the different clinical manifestations are due to different degrees of vascular anomaly. It has been suggested that the local anesthetic solution, after an inadvertent entry into the venous system, will drain into the pterygoid venous plexus, and thereby into the cavernous sinus through the emissary veins, to traverse the bony foramina. The abducent nerve may be more susceptible than other cranial nerves, as it travels through the cavernous sinus. Therefore, it has been suggested that the venous spread of the local anesthetic solution will explain the isolated ocular complications of diplopia resulting from the paralysis of the lateral rectus muscle, which is innervated by the abducens nerve.

Although it is rare to have ocular complications after local anesthetic injection, the occurrence is alarming to both the dentist and the patient. Various complications can also result from an improperly placed PSA nerve block. For the proper administration of the PSA nerve block, the patient is positioned such that the maxillary occlusal plane is at a 45-degree angle to the floor. After palpating all the anatomical landmarks, a 1½ inch, 25 gauze needle is inserted to the depth of 14 – 16 mm and the LA is injected. The following guidelines are to be followed for better management of the complications.

a. Reassure the patient regarding the usually transient nature of the complications.

b. Cover the affected eye with a gauze dressing to protect the cornea for the duration of anesthesia.

c. The patient should be escorted home by a responsible adult.

d. If ocular complications last longer than six hours, refer the patient to an ophthalmologist for evaluation.

The precautions one needs to take in order to prevent ocular complications are: injections into the vascular system must be avoided, aspiration prior to injection and slow injection are mandatory, as also the knowledge of the surgical anatomy with regard to the particular nerve block. The best method for preventing these complications is to follow the accepted techniques and to adhere to all the basic concepts of the accepted procedures.

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