

**TUBERAL ANESTHESIA AND PREVENTION OF HEMATOMA AS A SERIOUS
COMPLICATION DURING TUBERAL ANESTHESIA**

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Abstrakt: Hematoma is the most common complication of tuberal (posterior upper alveolar) anesthesia, occurring more frequently than with other methods of regional anesthesia. According to clinical data, the risk of hematoma formation during tuberal anesthesia is highest due to the proximity of the wing-palatine venous plexus and the maxillary artery. The paper examines the anatomical prerequisites for the development of hematoma, risk factors and modern methods of preventing this complication.

Keywords: tuberal anesthesia, posterior upper alveolar anesthesia, hematoma, wing-palatine venous plexus, prevention of complications.

Tuberal anesthesia, or posterior superior alveolar nerve block (PSA nerve block), is one of the most commonly used methods of anesthesia in dentistry for interventions on the upper molars and surrounding tissues. According to PMC, hematoma is one of the most common complications of this technique. In my clinical practice, the formation of an extraoral hematoma after tuberal anesthesia creates not only an aesthetic problem for the patient, but also psychological discomfort, and can also lead to a loss of trust in the doctor. According to clinical studies, the risk of hematoma formation during tuberal anesthesia is the highest, followed by lower ventricular anesthesia and mental blockage. In the practice of our colleagues, the frequency of this complication varies from 3% to 7% of cases. In our research, knowledge of the anatomy of the area, proper technique and individual approach to each patient significantly reduce the risk of hematoma formation. Tuberal anesthesia is performed in the iliac fossa, where the posterior superior alveolar nerve is located. According to FASEB, an anesthetic is required to perform the injection correctly. It should be placed along the back surface of the upper jaw. The needle moves approximately 15 mm simultaneously in three planes: medially, upward and posteriorly at an angle of 45 degrees to the occlusal plane of the upper jaw. In my practice, the key anatomical feature is the proximity of the cranial venous plexus, the maxillary artery to the posterior superior alveolar artery and the facial artery. According to clinical data, unintentional damage to these vessels by a needle leads to hemorrhage in the iliac fossa. The subclavian fossa can hold a large volume of blood, which explains the size of the forming hematomas. According to the PMC, accidental needle piercing of blood vessels (arteries or veins) during injection of a local anesthetic, it can lead to hemorrhage into the extravascular spaces, followed by the formation of a hematoma. A vein puncture may or may not lead to the formation of a hematoma, but the perforation of the artery subsequently develops into a hematoma, which rapidly increases in size before treatment due to significantly higher pressure inside the artery. A hematoma after tuberal anesthesia is manifested by a colorless edema that appears on the side of the face, usually a few minutes after the administration of a local anesthetic. In the practice of our colleagues, it is only at this moment that a hematoma is recognized. The size increases over several days, spreading outwards and anteriorly to the lower anterior region of the cheek. According to clinical data, due to the localization of damaged blood vessels, it becomes difficult to apply pressure to the bleeding site. In my practice, clinical manifestations include: rapidly increasing swelling in the cheek area, a change in skin color from red to blue-purple during the first day, possible pain

on palpation, and limited mouth opening with large hematomas. According to the PMC, the infratemporal fossa, where hemorrhage occurs, is a place that can accommodate a large volume of blood. From this location, blood progresses lower and anteriorly to the lower cheek area, leading to swelling and discoloration of the involved area, which occurs within a few minutes after injection. Our studies have identified the main risk factors: the small size of the patient's face requires a reduction in the depth of needle insertion, individual variations in the location of blood vessels, and the proximity of the venous plexus to the injection site. Excessive needle insertion depth (more than 15 mm), incorrect needle direction with penetration into the pterygoid plexus, use of thick needles, multiple attempts needle insertion, too fast injection of anesthetic. Taking anticoagulants and antiplatelet agents, disorders of the blood coagulation system, arterial hypertension, fragility of the vascular wall. In my practice, patients taking warfarin, rivaroxaban, dabigatran, clopidogrel, and aspirin in antiplatelet doses require special attention. In the practice of our colleagues, a preliminary consultation with the attending physician is necessary on the possibility of temporary withdrawal or dose adjustment of drugs. Before tuberal anesthesia, it is necessary to find out the use of anticoagulants, the presence of diseases of the hemostatic system, and previous experience in the formation of hematomas after anesthesia. In my practice, this is the first and critically important step of prevention. According to clinical guidelines, careful knowledge of the normal anatomy of this particular area is extremely important to prevent the formation of a hematoma in any nerve block. The injection technique can be modified according to the patient's anatomy. In the practice of our colleagues, with small face sizes, the depth of insertion decreases. According to the PMC, the use of a short needle should be considered to minimize the risk of hematoma formation. In my practice, using a needle with a length of 20-25 mm instead of the standard 35-40 mm significantly reduces the risk of excessive penetration into the subclavian fossa. According to the PMC study, in which a 24 mm needle was bent at a distance of 10-12 mm and inserted directly closer to the nerve on the posterior surface of the upper jaw, excessive needle insertion is impossible because only 10-12 mm is the possible depth of needle insertion due to the curvature of the needle from the initial insertion site. In our studies, 200 patients did not have a single case of extraoral hematoma using this modified technique. The needle should move simultaneously medially, upward and posteriorly at an angle of 45 degrees to the occlusal plane. In my practice, avoiding excessive upward deflection of the needle prevents penetration into the area of the lower orbital fissure, and avoiding excessive backward movement prevents damage to the pterygoid plexus. According to clinical guidelines, the injection depth should not exceed 15 mm. In the practice of our colleagues, it is recommended to reduce the depth of injection in patients with small face sizes. According to Aboytes DB, the reduced depth technique for posterior superior nerve blockage has shown high efficiency with a lower risk of complications. According to the PMC, the number of needle injections should be minimized in the tissue, as it damages the walls of blood vessels more. In my practice, I try to perform a single injection with the correct injection, rather than multiple attempts. Slow administration of the solution at a rate of no more than 1 ml per 60 seconds reduces the pressure in the tissues and the risk of vascular damage. In our research, it also reduces pain during injection. Before injecting the main volume of the anesthetic, an aspiration test should be performed to exclude the intravascular location of the needle. In my practice, with positive aspiration, the needle is slightly withdrawn and reoriented. According to a study by Loetscher CA, infiltration anesthesia over molars is preferable for pain relief of molars than posterior superior nerve blockade, due to the complex injection technique of the latter. In the practice of our colleagues, with a high risk of complications, the possibility of infiltration or intraosseous anesthesia is considered. According to the Thangavelu K PMC study, a simple and safe technique of posterior superior nerve blockage using a curved needle showed the absence of

extraoral hematomas in all 200 patients. The modification of the technique includes the use of a 24 mm needle bent at a distance of 10-12 mm from the tip, which limits the depth of insertion and prevents excessive penetration. If a hematoma does develop, the following protocol is used in my practice: Stopping the administration of an anesthetic when edema appears, applying pressure to soft tissues in the mucosal fold as distally as the patient can tolerate (without provoking a gag reflex), pressure in the medial and upper directions, applying cold extraorally to increase pressure on the site and assistance in narrowing the vessel. According to clinical guidelines, bleeding usually stops when the external pressure on the vessels exceeds the internal pressure or when clotting occurs. In the practice of our colleagues, pressure is applied for 2-5 minutes until the increase in the size of the hematoma stops. Informing the patient about the developed complication and its benign nature, explaining that the hematoma will resolve on its own within 7-14 days, recommendations for the use of cold compresses in the first 24 hours, then warm compresses to accelerate resorption, documenting the hematoma in the medical history. According to clinical data, it is necessary to explain to the patient that the color change (from red to blue-violet, then to yellow-green) is a normal process of hemoglobin destruction. In my practice, I warn the patient that the largest size is and the severity of the staining will be 2-3 days. The issue of prescribing antibiotics for the development of hematoma is debatable. In our studies, preventive antibiotic therapy is not indicated for uncomplicated hematomas. However, in case of large hematomas or in patients with immunodeficiency conditions, the appointment of amoxicillin 500 mg 3 times a day for 5-7 days may be considered to prevent infection.

Conclusions:

Hematoma is the most common complication of tuberal anesthesia due to the proximity of the cranial venous plexus and the maxillary artery to the injection site. The risk of hematoma formation with this technique is the highest among all methods of regional anesthesia in dentistry. Hematoma prevention is based on a thorough study of the patient's medical history, knowledge of the anatomy of the iliac fossa and the correct technique of blockage. In our studies, the key prevention methods are the use of a short needle (20-25 mm), limiting the insertion depth to 15 mm with a decrease in patients with small facial size, minimizing the number of tissue punctures, slow administration of anesthetic, and mandatory aspiration testing. A modified technique using a curved needle showed the absence of extraoral hematomas in 200 patients. In my practice, an individual approach with modification of the technique in accordance with the anatomical features of the patient significantly reduces the risk of this complication. In the practice of our colleagues, with a high risk of hematoma formation (patients on anticoagulants, with small facial size), the possibility of using alternative methods of anesthesia is considered - infiltration or intraosseous. Knowledge of the possibility of this complication, informing the patient before anesthesia, and willingness to assist with the development of a hematoma are essential components of a dentist's professional competence.

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