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**LOCAL COMPLICATIONS
OF INJURIES
OF MAXILLOFACIAL AREA**

Minsk BSMU 2021

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ЧЕЛЮСТНО-ЛИЦЕВОЙ ХИРУРГИИ

Н. Н. ЧЕРЧЕНКО, Е. А. ЛАБОНАРСКАЯ

**МЕСТНЫЕ ОСЛОЖНЕНИЯ ТРАВМ
ЧЕЛЮСТНО-ЛИЦЕВОЙ ОБЛАСТИ**

**LOCAL COMPLICATIONS OF INJURIES
OF MAXILLOFACIAL AREA**

Учебно-методическое пособие



Минск БГМУ 2021

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LOCAL COMPLICATIONS OF MAXILLOFACIAL INJURIES

The total lessons' time: 225 min.

The content of the lesson. Clinical manifestations of local complications of injuries of the maxillofacial area. Peculiarities and methods of treatment of patients with complications of traumas of the maxillofacial region.

In recent years, due to the growth of large cities and countryside and deterioration of the psycho-emotional climate of the population, there has been a significant increase in injuries and complications of injuries of the maxillofacial region among the population. Surgeon-dentists and maxillofacial surgeons have to render help to patients with traumas of the maxillofacial area and their complications, therefore they should know the reasons of development of complications, clinical manifestations, diagnostics, treatment and prevention of diseases which have arisen as a result of complications of the received traumas.

Purpose of the lesson. To study local complications of maxillofacial injuries, to understand their clinical manifestations, diagnosis, treatment.

Objectives of the lesson:

1. To study the classification of local complications of maxillofacial injuries, to analyze the causes of complications of injuries.
2. Study the clinical picture of local complications of maxillofacial injuries.
3. To study modern methods of diagnostics of complications of maxillofacial injuries.
4. Give a comparative description of the methods of treatment of complications of injuries.

Requirements for the initial level of knowledge. In order to fully master the topic of practical lesson, the student should repeat the material from the following sections:

– human anatomy: topographic-anatomical structure of bones, soft tissues of the maxillofacial area, blood supply to the head and neck, innervation of the facial area of the skull;

– maxillofacial surgery: examination of patients with pathology of the maxillofacial region; classification of trauma of the maxillofacial region, classification of inflammatory diseases, peculiarities of the course of inflammatory processes of the maxillofacial region, principles of their complex treatment, anesthesia in dentistry.

Control questions from related disciplines:

1. Anatomy of the upper jaw, lower jaw, cheekbones.
2. Muscles attached to the lower jaw, their role in displacement of fragments in fractures of the lower jaw.
3. Blood supply and tissue innervation of the head and neck.
4. Classification of soft tissue injuries in the maxillofacial area.

5. Classification of lower jaw fractures. Mechanism of fractures and causes of fracture displacement.
6. Inflammatory processes of the maxillofacial area.
7. Methods of examination of patients with trauma of the maxillofacial area.
8. Methods of X-ray examination of patients with maxillofacial trauma.

Control questions on the topic of the class:

1. Types of bleedings, which occur at the source of blood from the vessel and at the time of bleeding.
2. Immediate and early bleeding, causes, features of patient examination.
3. Late bleeding, causes of late bleeding, harbingers of possible late bleeding.
4. What methods do you know to determine the amount of blood that has been lost.
5. Name the methods to stop the bleeding temporarily.
6. Name the methods to stop the bleeding permanently.
7. Name the cause of traumatic osteomyelitis.
8. Describe the clinical picture of an acute stage of traumatic osteomyelitis.
9. Describe the clinical picture of chronic traumatic osteomyelitis.
10. Treatment of patients with traumatic lower jaw osteomyelitis.
11. Causes of development, clinical manifestations and treatment of delayed consolidation of bone fragments.
12. Causes of development, clinical manifestations and false joint treatment.
13. Treatment of incorrect jaw splinters.
14. Traumatic upper jaw sinusitis. Clinical manifestations, diagnosis and treatment.

Prevention, diagnosis and treatment of injuries of the maxillofacial region, their complications and consequences, are one of the most pressing modern medical and social problems, the importance of which is increasing from year to year in all countries. This is determined by a constant increase in the level of maxillofacial trauma and an increase in the severity of maxillofacial injuries and associated injuries (D. A. Trunin, 1996; V. A. Petrenko et al., 1999; M. Muraoka, Y. Nakai, 1998; B. Plaisier et al., 2000; K. Fischer et al., 2001). Patients with facial fractures make up from 3 to 8 % of patients with skeletal fractures and up to 30 % of inpatient dental patients (Yu. I. Bernadsky, 1999; V. M. Bezrukov, T. G. Robustova, 2000; A. J. Shapiro et al., 2001).

The main etiological factors of injuries of the MFA are road traffic, criminal household and sport trauma (V. A. Malyshev, B. D. Kabakov, 2005; W. L. Adeyemo, 2005). Multiple injuries of the maxillofacial area are important

place among injuries to the human skeleton, causing severe functional and cosmetic changes. The trauma of this area is characterized by a number of distinctive properties:

1. Disfigurement. The face, first of all, expresses the individual physical appearance of a person, the features of his intellect. Therefore, it is natural that any damage affects the emotional and mental status of the patient. After the trauma forms gross cosmetic defects and deformities of the face resulting from displacement of bone fragments and improper consolidation fractures of the bones of the facial skeleton. In addition, there are functional disorders with injuries to the face (in eating, chewing, speaking), which often lead to disability. Therefore, it is necessary for the medical staff to create conditions for maintaining the belief in recovery.

2. Inconsistency between the type and the severity of the injury. It is caused by the presence of facial muscles and their contraction, which causes dilution of the edges of the wound. This must be remembered, since wounded in the maxillofacial area often give the impression of hopelessness and even death. However, after stopping the bleeding, combating shock and asphyxia, and treating the wound, the appearance of the wounded is significantly improved.

Besides, the trauma of maxillo-facial area causes disturbances in the function of external respiration, maintaining hypoxia for a long time; playing the role of a focus of enzymatic aggression is a source of development of purulent-infectious complications

3. Presence of teeth:

a) teeth located in the fracture line often support the inflammatory process. Therefore, all fractures in the line of the dentition are considered open, infected;

b) teeth can be secondary shells. If the teeth are damaged during trauma, they are accelerated and embedded in deep tissue.

4. The proximity of vital organs (brain, eyes, hearing organs, upper respiratory tract) often leads to severe complications and outcomes.

5. Increased regenerative capacity of facial tissues, which is due to:

a) good innervation and blood supply;

b) a large amount of connective tissue with poorly differentiated cellular elements, which are the potential for tissue regeneration. Therefore, during the surgical treatment of wounds, there is no need for prophylactic tissue excision. Only obviously non-viable tissues are cut off.

6. Special care and nutrition.

Malnutrition with fractures of the facial skeleton leads to a slowdown processes of restoration of body functions.

Despite significant progress, the treatment of patients with fractures of the bones of the facial skeleton and the prevention of complications is the most difficult and far from being solved problem. The severity of the problem is due to a significant proportion of elderly and senile patients with chronic

concomitant diseases. Therefore, the percentage of victims with complications and unsatisfactory results of treatment remains so high, which makes it necessary to look for new ways to increase the effectiveness of treatment of patients with injuries of the maxillofacial region.

Like any other disease, traumatic diseases are easier to prevent than to cure later. For this, injury prevention is used, which prevents the development of the disease.

As with other areas of medical disease prevention, the prevention of injuries may be primary, secondary, or tertiary.

Primary prevention is the prevention of circumstances that lead to injury.

Doctors can advocate for maxillo-facial injury-preventive, remind, that during sports and other activities, where there is a risk of falling or being hit by an object, wearing a faceguard and/or mouthguard still seems to be the only way to prevent or at least significantly reduce the seriousness of injuries. Another common mechanism of injury is traffic accidents. Wearing seatbelts in a car, and when riding a motorcycle using a helmet with a chin arch, is in many places mandatory. The most commonly used bicycling helmets do provide very good protection against head injuries.

Secondary prevention is the prevention or reduction of injury severity in incidents which do happen. This is achieved by early diagnosis of the injured area, the provision of quick and complete qualified assistance and the appointment of antibiotic therapy to prevent complications early diagnosis of the disease in individuals who have already been exposed or have risk factors.

Tertiary prevention is the optimal treatment and rehabilitation of the injured person to minimize the impact of the injury. The goal of rehabilitation is aimed at preventing complications, relapses of already developed diseases, the transition of the disease into a chronic form.

An important direction in the system of increasing the efficiency of treatment of patients with trauma of the maxillofacial region is the development of measures for the prevention of traumatic complications, among which the most important in terms of frequency and severity are inflammatory complications.

Improving the provision of medical care to victims with trauma to the maxillofacial area currently remains one of the leading tasks of modern medicine. This circumstance is associated with an increase in the number of victims with this pathology, a high percentage of complications and unfavorable outcomes.

LOCAL COMPLICATIONS OF MAXILLOFACIAL INJURIES:

- Secondary bleeding
- Infectious inflammatory complications
- Traumatic osteomyelitis
- Ankylosis
- Persistent contracture of the masticatory muscles
- Traumatic sinusitis
- Fistula of the salivary glands
- Paresthesia, hyposthesia and hyperesthesia of the skin of the face and mucosa

Bleeding is the flow of blood from a blood vessel when the integrity of its walls is violated. Depending on the place where blood is spilled after the injury:

a) Intra-tissue bleeding, where blood is coming out of the vessels, soaks up the surrounding damaged tissue vessel, causing the formation of petechias, ecchymoses and bruises;

b) external bleeding is manifested by the flow of blood on the body surface;

c) Internal bleeding is characterized by the flow of blood into organs cavities. Internal bleeding may be open (hemosinus) and closed (hemarthrosis).

Depending on the time of occurs bleeding may be:

- primary (immediately after injury);
- secondary (early and late).

SECONDARY BLEEDING

Early secondary bleeding occurs when a blood clot separates during transportation of the victim or due to rupture of blood vessels in the absence of reliable transport immobilization of jaw fragments, can occur in the first 24–48 hours after the injury. The variety of post-operative bleeding includes the ligature penetration of the vessel, slipping of the ligature from the vessel and so-called reactionary haemorrhage which occurs as the blood pressure of a mildly shocked patient is restored, or if a local analgesic with a vasoconstrictor has been used a resumption of bleeding may occur as effect of adrenaline wear off.

Late secondary bleeding is usually due to purulent fusion of a blood clot and the vessel wall of a partially damaged vessel after 7–14 days or due to erosion of the vessel 3–4 weeks or later, DIC-syndrome with subsequent hypocoagulation of blood. If the has been carried out under antiseptic or aseptic conditions and every customary surgical precaution taken both pre- and post-operatively, then this type of haemorrhage should be exceedingly rare. All surgical patients must be kept under careful review and adequate antibiotic therapy until such time as their wound have healed, and the development of any

sing of post-operative infection should be the signal for serious and energetic remedial treatment. Secondary haemorrhage on the classical tenth day should be a thing of the past for those engage in the practice of oral surgery.

HAEMATOMA FORMATION

Haematoma formation post-operatively is usually due to a combination of inadequate post-operative haemostasis combined with overtight suturing. Its occurrence leads to the development of considerable swelling of the face and neck adjacent to the operation site, and the firm swelling is painful and tender on palpation. The condition is usually present on the day following operation and the immediate action should be remove some of the sutures and to instruct the patient to use frequent saline mouth-baths to facilitate absorption of the blood. Evacuation by aspiration using a wide-bore needle is occasionally valuable, but the application of pressure dressing is less beneficial. These effusions of blood may easily become infected, and if there is evidence of this, e.g. pyrexia, then antibiotic therapy should be instituted forthwith. Unfortunately antibacterial medications may not be as effective as the dental surgeon might expect, since there is no appreciable circulation to the haematoma until it becomes organized. An infected haematoma almost invariably leads to a breakdown of the suture line and protracted healing of the wound. Soft tissue haematomas are slowly absorbed, but occasionally incompletely so that an area of fibrous thickening remains.

Clinical manifestations of secondary bleeding:

- increased wound pain;
- appearance of bloody discharge from the wound;
- expectoration and spitting of sputum and saliva mixed with blood;
- intensification of the inflammatory process near large vessels in the floor of the mouth and neck.

MEDICAL ASSISTANCE

Temporary control bleeding. Spontaneous stopping of bleeding is possible when the integrity of small diameter vessels is broken, when the rate of blood out of the vessel is low. The bleeding is temporarily stopped by applying a pressure bandage, finger pressing the vessel, applying a temporary braid, and applying a styptic clamp to the damaged vessel in the wound. The pressure bandage in the face and neck area is a multi-layer sterile gauze applied to the wound, which is fixed by a tight bandage. Finger pressure is applied to stop the bleeding from the floor of the mouth cavity. In this case, the gauze tampon is placed on the bleeding surface and clamped the tissues of the floor of the mouth cavity with fingers of the right hand towards each other through the skin and mucous membrane.

If it is impossible to stop the bleeding from the floor of the mouth, yawn and throat, to temporarily stop the bleeding it is necessary to perform a tracheotomy followed by a tight tamponade of the mouth cavity.

The temporal artery is pressed 1 cm higher and in front of the ear tragus to the temporal bone.

The facial artery is pressed at the edge of the mandible along the front edge of the masseter muscle. Carotid artery is pressed to the transverse process of the cervical vertebrae in the middle of the front edge of the sternocleidomastoideus muscle. Applying a tourniquet or pressure bandage on the neck area to temporarily press the external carotid artery by Kaplan as follows: the neck on the side of the bleed is covered with a sterile cloth. The hand on the healthy side is placed on the head, in the area of the common carotid artery, a dense roller of gauze or cotton wool is placed and tightly pin on the side of the injury in bandage rounds. The fixed hand prevents the compression of the common carotid artery on the healthy side, and protects the larynx and trachea. Instead of the hand, you can use a rigid Mikulic resistance device on the healthy side. In this way, the artery is pressed against the cross sections of the cervical vertebrae and the bleeding stops.

Final control bleeding. The final bleeding arrest is done at the stage of qualified and specialized assistance. The methods of its implementation are subdivided into: a) surgical or mechanical; b) physical; c) biological.

The choice of method depends on the intensity of the bleeding and the cause (vessel involved).

With minor bleeding from small vessels, you can resort to the following.

Local hemostatic agents are injected into the wound:

- a) specific preparations — thrombin, thromboplastin, fibrinogen, fibrin-isogenous film, collagen hemostatic sponge;
- b) non-specific preparations — gelatin sponge, oxycellodex;
- c) combined preparations — biological antiseptic tampon, autofabricated with autoplasm.

Physical methods include local wound hypothermia, overlaying wipes with hot (70 °C) isotonic sodium chloride solution, electrocoagulation — tissue coagulation under the influence of electric current (frequency 1–2 MHz, voltage 150–220 V, current strength 1–2 A) for 2–3 seconds.

The chemical and biological method to stop bleeding is when the victim is injected with general staunching agents such as:

- a) specific preparations — fibrinogen, prothrombin complex;
- b) non-specific preparations — vicasol, pamba, calcium gluconate, 10 % calcium chloride, Σ -aminocapron acid, vitamins K, P, androxone, dicinone (sodium ethamzylate 12,5 %), serotonin, preparations of ergotonium, sodium thiosulphate.

Sometimes it is difficult to stop bleeding from bone, in such cases you could burnish the area with a blunt instrument such as a wide-ended haemostat. Care, however, must be taken to avoid thrusting the end of the haemostat into the mandibular canal in the lower jaw, and similarly through the floor of the maxillary sinus in the upper jaw. You could use of bone wax to plug the orifice of a bleeding nutrient vessel.

More profuse bleeding from larger vessels requires surgical techniques.

Surgical methods include pressure dressing, ligation of a vessel in a wound, suturing a wound, tampon a wound, tamponade of bone channels, ligation of vessels, vascular suture.

The main and most frequent surgical method of stopping bleeding is dressing a vessel in the wound. In this case, the end of the vessel is captured with a hemostatic clamp and bandaged with a surgical suture. It is advisable to bandage large vessels with two ligatures with stitching. If it is not possible to put the ligature on the vessel, it is tied together with the surrounding tissues with Z-stitches. If it is impossible to bandage the vessel in the wound, a ligation of the vessel is applied throughout. For patient with a tamponade of mouth cavity and superimposed tracheostoma, it is necessary to make a temporary dressing of the external carotid artery at the final stop of bleeding, after that, make a revision of the wound and, if the issue of permanent ligation of the external carotid artery is solved, Moreover, if in the zone of the neurovascular bundle of the neck there are inflammatory changes, then the artery should not only be bandaged, but also crossed between the ligatures. This is due to the fact that the intersection of the artery allows you to turn off the sympathetic innervation of the vessel and limited the pain associated with irritation of sympathetic paraarterial nerve trunks.

Ligation of the common carotid artery may only be performed in exceptional cases where it is damaged or there are no conditions for dressing the external carotid artery. Despite the threat of brain blood circulation complications, there are known cases of a successful outcome after a common carotid artery ligation.

Outcrop and ligation of the external carotid artery:

1. Position of the patient — a roller is placed under the back, under the shoulders, the head is pulled back and turns in the opposite direction.

2. The cut of the skin is made along the front edge of the sternocleidomastoideus muscle from the level of the lower jaw angle to 5–6 cm. The skin, subcutaneous fat and subcutaneous muscles are dissected. The branches of the inner jugular vein are revealed, which are moved aside by a unsharpened hook tool.

3. The anterior compartment wall of the sternocleidomastoideus muscle is opened along the gutter probe and the sternocleidomastoideus muscle is moved to the outside with a unsharpened Farabeth hook tool; then the posterior compartment wall of the sternocleidomastoideus muscle is opened.

4. The common facial vein, which crosses the operating field obliquely and closes the approach to the artery, is highlighted and pulled upward by a unsharpened hook tool.

5. In the lower corner of the wound, the place of division of the common carotid artery is detected and, going down and medially, the upper thyroid artery, which serves as an internal guideline for the detection of the external carotid artery. The internal carotid artery at the neck has no branches!

6. The external carotid artery must be bandaged distally from the upper thyroid artery.

The ideal method to stop the bleeding if large arteries and veins are damaged is the vascular suture, which not only stops the bleeding, but also restore normal circulation in the appropriate area. The superimposed vascular suture shall conform to the following requirements: it shall provide a vascular sealantion; it shall not cause narrowing of the lumen of the vessel or of the vascular anastomosis; the suture material shall not be in the contact with extravascular area and with blood; the superimposed vascular suture shall be performed without traumatizing the intima of blood vessel. The suture material used for vascular surgery is atraumatic, monofilament, non-borne, 8/0–10/0.

Whenever bleeding is prolonged and unresponsive to standart measures, a full haematological examination should be instituted without delay.

INFECTIOUS AND INFLAMMATORY COMPLICATIONS

SUPPURATION OF SOFT TISSUES

The presence of a rich network of blood vessels and nerves in the area of the jaws and the perimandibular muscle compartment predetermines their frequent damage in case of maxillo-facial injuries. Therefore, traumatic injuries and fractures of the jaw are accompanied by contusions, ruptures of soft tissues, which cause hemorrhages. Sometimes soft tissue suppuration occurs as a result of infection with hematoma. In case of late treatment of victims and inadequate treatment, abscesses and phlegmons of perimandibular tissue develop.

The clinical manifestations of soft tissue suppuration. Acute onset and manifestation of local and general symptoms of inflammation:

- intense pain;
- peritoneal tissue infiltration and swelling;
- hyperemia of the skin;
- frank fluctuation of the swelling;
- visible discharge of pus;
- fever;
- leukocytosis;
- increase in ESR, etc.

Soft tissue festering during untimely treatment may be a factor predisposing to the development of abscesses and phlegmons and traumatic osteomyelitis.

Treatment. In case of inflammatory phenomena growth in the area of injury, it is necessary to perform initial surgical treatment of the purulent foci by intraoral or external access, making an incision of a sufficient length to the periosteum.

A bacteriological examination of any pus withdrawn from the abscess must be carried out in order to elicit the nature of the infecting organisms and its susceptibility to various antibiotics, but since most oral infections respond to broad spectrum antibiotics, the adequate antibiotic therapy should be instituted empirically while awaiting the report of the laboratory investigation.

Wounds should be provided with adequate drainage, and the wound dialysis must be conducted as well.

Ligation should be done 2 times a day until purulent discharge is stopped.

The whole complex of measures aimed at accelerating the regeneration of bone tissue (physiotherapy, balanced nutrition, vitamin therapy, early functional load, immunotherapy) is carried out.

The patient is recommended to take careful care of the oral cavity (oral hygiene). To this end, after each meal you should use a toothpick and then rinse or irrigate the mouth with antiseptic solutions.

These measures are usually sufficient to treat inflammation and ensure healing of a traumatic injuries in most patients who are not burdened with related diseases.

SUPPURATION OF A BONE WOUND

Suppuration of a bone wound is an inflammatory process, localized only in the area of the primary lesion of the bone, easily eliminated by draining the purulent focus. In case of bone wound suppuration, the main sign of traumatic osteomyelitis is absent — there is no bone necrosis or sequestration. The duration of this period is 7–10 days.

The clinical picture. Suppuration a bone wound usually leads to limited inflammation in the fracture area. The mucous membrane of the alveolar process is often damaged, infiltrated, swollen, and a subcortical abscess is formed. Often there is swelling of perimandibular tissues.

Treatment. Removal of the tooth from the fracture, the incision at the place of the greatest tissue infiltration, ensuring good drainage of the bone wound, usually leads to an abortion of the inflammatory process.

Bone wound suppuration may transform into traumatic osteomyelitis if the therapy is untimely and not sufficiently active.

TRAUMATIC OSTEOMYELITIS

This is a purulent-necrotic process in the area of jaw damage, which is accompanied by bone necrosis with the formation of sequestrs and bone regeneration.

Osteomyelitis must be differentiated from suppuration of the bone wound and the presence of free bone fragments in the area of damage to the jaw. After removal of these fragments, the inflammation is completed and the fracture consolidates.

Factors contributing to traumatic osteomyelitis:

- delay presentation of the patient and late specialized care;
- the presence of teeth or roots in the fracture line, which are the source of infection;
- lack of adequate oral care and, as a result, infection of the jaw damage area;
- poor immobilization; this causes microtrauma of the surface layers of the bone at the ends of the fragments and suppuration of the wound substrate in the fracture zone, which prevents the formation of the primary bone adhesion due to a violation of the biosynthesis of the collagen matrix.

Due to these reasons, the wound substrate could be festered in the area of the jaw injury. No-nourished bone fragments, as well as fragments that received a molecular shock at the moment of bone destruction, are the primary sequestres, and can form secondary and tertiary sequestres. When the inflammatory process spreads to the deeper layers of the bone, the areas adjacent to the roots of the teeth in the fracture line are involved. A demarcation furrow between necrotized and healthy bone layers is formed approximately from the 3rd week after the injury and ends by the fourth week.

A distinction is made between acute, subacute and chronic traumatic osteomyelitis.

ACUTE TRAUMATIC OSTEOMYELITIS

The acute course lasts 7–8 days.

Clinical manifestations:

- high fever;
- leukocytosis in the blood;
- pain and inflammation in the wound;
- increasing swelling of the soft tissues in the fracture zone;
- general weakness;
- malaise.

By the 9–12th day, abscesses and phlegmon are formed in the projection of the fracture line, after opening which fistulas form and the process goes into the subacute stage.

The obvious signs of the beginning suppuration of the wound are the intensification of fetid odor from the mouth and the appearance of an alternate discharge from the fracture line of the jaw and in the interdental spaces. In some cases, abscesses are opened spontaneously.

SUBACUTE AND CHRONIC TRAUMATIC OSTEOMYELITIS

In the subacute and chronic phases, the general condition of patients is satisfactory, may be:

- leukocytosis;
- increase in ESR;
- low-grade fever.

The process is sluggish, regeneration and healing slowed down. Sluggish granulation with purulent discharge forms in the wound. Often purulent discharge persists for many months after jaw damage.

Diagnosics. Radiography is of great importance in the diagnosis of traumatic osteomyelitis of the jaw.

Already on the 3rd week after a fracture of the jaw, limited foci of destruction of bone tissue, small sequestras are formed. Repeated radiography can detect an increase in not only purulent-necrotic, but also reparative processes in the bone.

Based on clinical and radiological data, three forms of chronic traumatic lower jaw osteomyelitis are distinguished:

- focal purulent-destructive process in the bone during the consolidation of fragments;
- focal purulent-destructive process of wound surfaces of the bone without consolidation of fragments;
- diffuse purulent-destructive process in the bone with the formation of large sequestrators without signs of fragment fusion.

Treatment. If the inflammatory process has developed as a true traumatic osteomyelitis or the patient has reduced immunity for some reason, these measures may not be sufficient to eliminate the inflammatory process in the fractured jaw area. Then it is necessary to perform a radical revision of the fracture area — a sequestration. It is performed 3–4 weeks after the subsidence of acute inflammatory events, when the discharge of pus from the wound does not stop.

A sign of the completion of the demarcation furrow between necrotized and healthy bone layers at the ends of the fractures is the formation of fistula with granules inside.

The area of fracture of the jaw is inspected in various ways: in the upper jaw, mainly intraoral, and in the lower jaw, mainly external. The incisions have to be adequate to allow a thorough examination of the fracture line.

From the line of fracture to be removed: all teeth with complicated caries and with marginal periodontitis; dislocated and broken teeth; teeth and tooth rudiments.

All teeth remaining in the fracture line (intact teeth) are checked for pulp viability. If necessary, they are trepanned and sealed (usually single-root) or removed.

All splinting errors must be corrected.

During the operation, granulation, foreign bodies, free-lying bone fragments and sequestres are removed. Sequestrectomy carry out to separate a fragment of dead bone separated from healthy bone for stop migration of a detached piece of necrotic bone to a wound or abscess and the regression of inflammation.

The ends of the fragments are refreshed to healthy bone layers. Particular attention is paid to bone areas adjacent to the roots of teeth, located near the fracture line. After the revision of the fracture line, the jaws are assessed for the mobility of jaw fragments. Miniplates are applied to firmly fix the fragments in the correct anatomical position.

The wound is irrigated with a 0.05 % chlorhexidine solution, then sutured and drained. If the result of the sequestrectomy is a bone defect of more than 0.5 cm and there is no contact of the cortical layer between the jaw fragments — bone grafting is performed with replacement of the resulting bone defect by an autograft. Depending on the size of the jaw defect, the autograft is taken from the ridge of the iliac bone or from the donor area of the lower jaw — chin and retromolar area. Rigid fixation of the autograft to fragments of the jaw is also done by a system of miniplates. Particular attention in layer-by-layer suturing of the wound is paid to isolating the bone wound from the oral cavity. When traumatic osteomyelitis develops, the process of consolidation of the fragments slows down and the immobilization period increases. However, bone surgery significantly reduces the recovery time of patients after complications such as traumatic osteomyelitis.

ANKYLOSIS

This is a persistent reduction of the jaws, caused by the fusion of the articular surface of the head of the lower jaw with the articular cavity of the temporal bone.

By the type of forming tissue fibrous and bone ankylosis are distinguished. The disease often occurs in childhood. But due to gunshot wounds to the maxillofacial area may form fibrous ankylosis (joint contracture).

Causes of the process are inflammatory changes in the joint (arthrosis, arthritis, etc.) or severe intra-articular fractures associated with destruction of articular surfaces.

Clinical manifestations. The main complaint in fibrous ankylosis is joint pain. In this case, the residual rocking movements are preserved. Bone ankylosis is characterized by the absence of pain and any movement in the joint. The patient cannot open his mouth at all, i.e. the lower jaw is motionless.

Investigation. The diagnosis is confirmed by X-ray examination of the joint. On the X-ray the elements of the joint are practically absent, bone growths occupy the entire joint space, glenoid cavity, lunar notch, etc.

Treatment is surgical.

Several surgical techniques have been proposed to eliminate temporomandibular joint ankylosis in adults. There is a large number of bone incision modifications and suggestions materials for interposition between the incised surfaces. Restoration of the lower jaw mobility in bone ankylosis is reduced to the formation of a false joint. Osteotomies are performed either in place of the former normal joint (which is very rare due to the presence of extensive bone joints), or by horizontal dissection of a branch of the jaw below the place of bone growth, at the border of the upper and middle thirds. Osteotomies in the middle or lower third of the branch, as well as in the area of the angle and body of the jaw are not recommended, because the asymmetrical position of the joints adversely affects the function of the lower jaw and does not correct the shape of the face.

The most appropriate access to the ankylosed joint is an arched skin incision 6–8 cm long, which begins 1–1.5 cm below the earlobe, rounds the angle of the jaw and ends at the level of the middle of the jaw body. The tissues are cut in layers up to the bone of the lower jaw. The scalpel cuts the tendon of the masseter muscle from the external surface of the angle and branch of the jaw. Then the periosteum and muscles are dissected together with the parotid salivary gland and soft tissues up to the zygomatic arch with a scalpel. The inner pterygoid muscles are separated from the inner surface of the jaw branch by a dull separator and a spatula or a Buyalsky spatula is brought behind the branch. The upper edge of the wound is removed with a hook. Where the osteotomy is supposed to be performed, holes are drilled. The spatula brought from the inner side of the branch prevents the penetration of the dental bur into the soft tissues of the fossa pterygopalatinum. The deformed branch of the lower jaw is cut along the line of the holes made with a chisel. A rotor spreader is inserted into the resulting slot and the bone wound is gradually widened to 2.5–3.5 cm. Simultaneously, the lower jaw is moved down and forward as much as possible with sharp pincers fixed in the area of the lower jaw angle and a single-toothed hook behind the lower edge of the bone wound. In bilateral ankylosis, after osteotomy, the wound is tamponized on one side with gauze wipes wetted with antibiotic solution. Then a similar operation is performed in the area of the other joint. Only after a bilateral osteotomy with a rotor spreader is it quite easy to

lower the mandible as much as possible and to obtain at least 2–2.5 cm diastases between the osteotomized surfaces on each side.

Jaw opening exercises must be performed for several months to several years to maintain the surgical correction, however, forced opening of the jaws without surgery is generally not indicated and is generally ineffective due to bone fusion.

PERSISTENT CONTRACTURE OF THE MASTICATORY MUSCLES

This is a partial or complete restriction of the movements of the lower jaw as a result of changes (traumatic or inflammatory genesis) in tissues that occur outside the temporomandibular joint.

Clinical manifestations. Persistent contractures can be of varying degrees of severity: from a moderate limitation of opening the mouth to almost complete immobility of the lower jaw. However, in contrast to ankylosis of the temporomandibular joint, with cortical contracture, there is almost always a slight movement of the lower jaw in the vertical and lateral directions when trying to open the mouth. In advanced cases, ossification of scar tissue and fusion of the coronoid process of the lower jaw with the zygomatic arch can occur.

Treatment. The treatment of stable contracture of the chewing muscles is quite complicated.

Treatment is conservative in the early stages. Its aim is to prevent scarring or soften existing ones. Applications of paraffin, hyaluronidase injections, mechanotherapy are prescribed.

In severe cases, surgical intervention is shown, which consists in the dissection of scar tissue or bone contusions and replacement of the resulting tissue defects with a wide fascia of the thigh and fiber.

In case of contractures caused by scarred skin and subcutaneous tissue deformations, the resulting defect is closed after the scars have been dissected with triangular flaps moved from the surrounding tissue, or use other flaps techniques, taken from the adjacent tissues of the submandibular region, neck, cheek.

In the case of extensive soft tissue defects formed after the dissection of the scars, which require a large amount of plastic material, the tissues of the Philathaceous stem are used.

Superficial scars of the mucous membrane in the area of the mouth and cheeks angle are eliminated by longitudinal dissection and by displacement of counter, triangular mucous membrane flap and submucosa layer cut out on both sides of the defect.

In the postoperative period prescribed therapeutic gymnastics for the chin, jaw and neck muscles, mechanotherapy and physiotherapy for a long time.

A FALSE JOINT

A false joint should be understood as an overgrown fracture with persistent pathological mobility of fragments. It occurs with imperfect reposition and immobilization of fragments of the lower jaw in cases of interposition of soft tissues, the lower alveolar nerve, in the event of traumatic osteomyelitis with extensive sequestration of bone tissue. In this case, instead of rigid bone consolidation, a fibrous adhesion of fragments occurs, which does not provide adequate functioning.

Clinical manifestations of the false joint is characterized by:

- deformation of the mandibular bone and a violation of the closure of the teeth;
- cicatricial changes in soft tissues in the area of the false joint;
- the mobility of fragments, which is easily determined by bimanual examination of the lower jaw;
- chewing function is severely impaired, especially in the absence of teeth;
- conditions for eating and speaking are difficult.

Treatment. Accurate reposition, reliable fixation of fragments and measures to activate reparative regeneration in most cases are sufficient to prevent this complication.

With the formed false joint, the treatment is prompt: removal of fibrous tissue filling the space between the fragments, refreshment of the ends of the fragments, their stable fixation in the correct position using metal osteosynthesis.

If, after removal of the fibrous adhesion and refreshment of the ends of the fragments, a bone defect with violation of the continuity of the jaw with a length of more than 0.5 cm is detected, its bone graft repair is shown.

In case of incorrectly conjoined fractures, which cause bite disorder, osteotomies are performed in the area of the former fracture and osteosynthesis is performed after the repositioning of the fragments. In cases of large bone defects, bone plastics is used.

TRAUMATIC MAXILLARY SINUSITIS

Traumatic maxillary sinusitis as a complication of an upper jaw fracture is rare and usually associated with damage to the anterior or external wall of the maxillary sinus.

If the sinus wall is damaged, bone fragments (free or connected to the periosteum) enter the sinus together with blood, and chronic sinusitis of traumatic etiology may develop later. They are similar to chronic odontogenic maxillary sinusitis.

Clinical manifestations:

- headaches;
- stuffy nose;
- difficulty in nasal breathing;
- discharge from the nose, first serous-bloody, and then blood-purulent contents.

Getting into the sinus at the time of injury, bone fragments, foreign bodies can cause and support the inflammatory process in the sinus mucosa for a long time. Then, the sinus granulation tissue turns into fibrous tissue with fragments of bone immured in it, which periodically cause an exacerbation of the process — pain and swelling in the infraorbital region, discharge of pus from the nose.

Treatment. Treatment of chronic traumatic maxillary sinusitis is radical surgery. In this case, an incision is made in the oral mucosa along the transitional fold in the projection of the anterior sinus wall. After trepanation of the anterior sinus wall, granulations, fibro-altered tissues filling the sinus, bone fragments, foreign bodies are removed. An anastomosis is placed between the maxillary sinus and the lower nasal passage. The sinus cavity is filled with an iodine swab, the end of which is brought out through the anastomosis and placed in the lower nasal passage. The wound of the mucous membrane is sutured tightly. The swab is removed in 48 hours.

FISTULA OF THE SALIVARY GLANDS

Fistulas are formed as a result of damage to the parotid (much more often) or submandibular salivary glands. Persistent fistulas develop after damage to the main excretory duct of the gland, less persistent, incomplete — with damage to the salivary gland parenchyma.

Fistulas of the submandibular salivary gland are very rare and occur due to epithelialization of the wound channel by the epithelium of the salivary ducts. The elimination of these fistulas is not difficult.

Fistulas of the parotid salivary gland can form as a result of damage to the duct or as a result of an inflammatory process in the gland which developed as a result of trauma and suppuration of the wound.

Diagnosing fistulas of the parotid salivary gland is not difficult.

Clinical manifestations. A constant (or during a meal) outflow of saliva from the fistula. Sometimes around the fistula due to constant irritation of the saliva, maceration of the skin occurs. If during the revision of the mouth of the duct on the mucous membrane of the cheek is not observed at least a few drops of saliva, then this indicates the presence of complete damage to the duct.

Diagnostics. Radiography with contrasting fistulous passage (sialodochography) the main duct and lobes of the gland as a whole (sialography) is used. This allows us to detect the message of the fistulous

course not with the main duct, but only with the duct of the lobe of the gland, which is essential when choosing a treatment method.

Treatment. Of the methods of treating fistulas of salivary glands is the most acceptable surgical. To dissect incomplete salivary fistulas are used methods Sapozhkov and Limberg.

The Sapozhkov method consists in excising the fistula scar along the inserted probe to the maximum depth and then applying a pouch seam in the depth of the wound, after which the fistula is excised, and the pouch seam is tightened and tied. On soft tissues, stitches are applied in layers.

In the Limberg modification, after excision of the fistula, the wound on the skin is closed by moving the opposite triangular flaps. In case of complete parotid fistula, especially if the intraglandular part of the main duct is damaged, surgical intervention is performed, as a result of which the external fistula is moved to the internal one. In this case, the skin around the fistula opening is prepared by the fistula passage to the greatest possible depth, an incision is made of the cheek mucosa and the edge of the prepared fistula is sewn to the edges of the incision of the cheek mucosa. If the fistula is not eliminated in this way, carry out the plastic reconstruction of the peripheral duct.

PARESTHESIAS, HYPOSTHESIAS AND HYPERAESTHESIAS OF THE SKIN OF THE FACE AND SOPR

Paresthesias, hyposthesias and hyperaesthesias of the face skin and oral mucosa are one of the complications of trauma to the maxillofacial area due to the case of injuries of the branches of the trigeminal nerve.

Clinical manifestations:

- pains;
- paresthesia, hyperesthesia in the area of affected branches.

When the mandibular nerve (3rd branch of the trigeminal nerve) is damaged, the main symptoms are numbness and pain in the teeth of the lower jaw, in the area of the skin of the chin and lower lip.

In the case of damage to the lingual nerve, pain and paresthesia are noted in the anterior $\frac{2}{3}$ of the corresponding half of the tongue, tactile, pain and taste sensitivity may be reduced.

When the 2nd branch of the trigeminal nerve is affected, there is a loss or decrease in the sensitivity of the front teeth of the upper jaw of the corresponding side, the gums, the skin of the under-eye area, the wing of the nose.

Damage to the anterior Palatine nerve is characterized by burning and dryness in the area of one half of the palate.

Treatment:

- Conservative;
- Physical therapy;
- Psychotherapy.

If the sensitivity disorder is caused by a traumatic fracture and displacement of the fragments of the jaw or zygomatic bone, decompression of the nerve is performed, the fragments are repositioned to the correct anatomical position, followed by osteosynthesis with a system of mini-plates. The period of restoration of sensitivity lasts up to 6 months and sometimes more, depending on the degree of damage to nerve fibers.

Facial nerve lesions that manifest themselves as a paresis or paralysis of mimic muscles should be noted separately. In addition, there may be both sensitive and vegetative disorders on the face and neck, as the facial nerve widely anastomoses not only with the trigeminal nerve, but also with cervical plexus. Facial nerve cuts are usually treated in a conservative manner. Restoration of mimic muscle function usually takes place 4–6 months after the beginning of treatment.

ORAL HYGIENE

Intra-oral infection may occur following any oral surgery operation, but the risk can be minimised by meticulous attention to oral hygiene.

Patients who are conscious and co-operative should be advised to clean their teeth in the usual manner and to use a mouthwash after every meal. Those who, because of their wound or injury, are unable to conform with these simple hygienic instructions should have their mouth cleaned for them by a member of the nursing staff after each feed.

The essential action of any solution employed as a mouthwash is mechanical, and for cleansing purpose normal saline is an innocuous fluid. A sodium bicarbonate solution applied on cotton-wool swab held in forceps helps to dissolve the thin film of mucus which tends to form over the teeth.

It is inadvisable to employ hydrogen peroxide for oral irrigation purposes when an open wound such as a fracture site is present, for the effervescence of the oxygen-containing liquid is apt to carry infected debris down into the depths of the wound and so increase the risk of spread of infection. A hydrogen peroxide solution may, however, be applied on cotton-wool held in tweezers in order to remove blood clot from teeth or splints.

Patient who are not incapacitated should be advised to clean their splints or interdental wire fixation with a soft toothbrush and toothpaste.

CONCLUSION

The healing of traumatic injuries may be complicated by both movement and infection. These complications delay and even prevent repair by soft and bone tissues. Without a really adequate knowledge of the processes of repair of hard and soft tissues, the mechanism of development possible complications no intelligent treatment can be formulated. It is very important in modern medicine, because Improving the provision of medical care to victims with trauma to the maxillofacial area currently remains one of the leading tasks.

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