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Problems of Improvement of the Complex Treatment of Mandible Fractures at the Present Stage

ADSTRACT

There is a review of literature on the themes of: epidemiology, clinic, pathogenesis of inflammatory complications and methods of complex treatment of jaw fractures. Pathogenic mechanisms of the inflammatory process in the area of injury, connected with impaired microcirculation, changes of blood rheology and processes of bone formation are observed. The characteristic of the basic principles of treatment is given. Despite the extensive studies of this problem, posttraumatic complications still remain high, so it is necessary to conduct further researches.

Keywords: mandible fractures, maxilla-facial traumas, concomitant injury, posttraumatic osteomyelitis, complex treatment, osteosynthesis, distraction-compression devices, bone joint, intraosseous drug administration, prevention of complications.

INTRODUCTION

Nowadays a number of traumas of maxillofacial area has a tendency to increase, and that's why it is considered an actual problem in medicine [7, 20]. Jaw fractures occupy a significant part in the structure of traumas of face bones [22]. At the same time from 11 to 36% of cases are defined as a complication of purulent processes of the soft tissues, suppuration of bone tissue, which lead to post-traumatic osteomyelitis. Untimely provision of specialized medical care, unsatisfactory immobilization of bone fragments, the presence of periapical foci of infection, reducing of the immunobiological reactivity of the organism, impaired lipid peroxidation cause complications of jaw fractures [7, 37].

Despite extensive studies of these problems, the frequency of complications is still on a high level. And that's why the health-care organisations of maxillofacial surgery focus on prevention, early diagnosis and treatment of inflammatory complications of traumatic injuries of the jaw.

Clinical and epidemiological characteristics. Nowadays it is established, that in the structure of pathological processes of maxillofacial region face bones fractures are up to 30% [6, 27]. And this is particularly connected with the peculiarities of social and economic development

of society in the last period [2]. Fractures of the skull and facial bones are concerned to difficult ways of traumas with prolonged temporary disability and further consequences for health [20]. Men of 20-30 years are more often exposed to jaw traumas, they are the most active part of population, and it is a significant social problem of nowadays [43].

The anatomical and physiological features of the facial bones increase the incidence of mandibular fractures in comparison with fractures of other areas [39]. In this case, the lack of protection of jaw other bones by the other facial bones and its extended position, as well as an arched shape, and also its mobility cause over than 50% of jaw fractures [17, 18]. In addition, the fracture areas are often localized in the most subtle and curved parts of jaw. These "weak" places are: cervix condyle, angle, chin area and the point of the trigeminal nerve area exit [27]. It is worth noted, that the most cases of fractures are compound, which in unfavorable dental status may lead to inflammatory posttraumatic complications [18].

Pathogenic mechanisms of reparative osteogenesis. It is well known that any injury causes a stress for organism. The outcome of treatment and possible complications for jaw fractures depends on microcirculation in maxillofacial area [8, 24], which has pathology regulation, connected with the state of autonomic nervous system [45]. Bone fracture nexus starts with the second (active endosteal and periosteal osteogenesis) and continues to the third month with formation of dense fibrous connective tissue [19,29]. Biologically active substances, which are produced in traumatic inflammation, have some peculiarities, such as an extension of small vessels, an acceleration of capillary blood flow, an increased permeability of the capillary endothelium [46]. While this, happens the migration of leukocytes and output in the intercellular space from the vascular transudate with high concentration of protein [9, 28]. Inflammatory response in the injured area is the trigger reparative of osteogenesis and is aimed to fight against infection, removal of necrotic cells and tissues [40]. Violation of rheological properties of blood occurs mainly by increasing of its viscosity, erythrocyte aggregation and decrease of their deformability [28].

Progenitor cells from bone marrow which can stimulate reparative process of bone and cartilage tissue, as well as tendons and other connective tissue in the fracture zone work in traumas [6, 9].

In scientific literature there are some data about the role of hypothalamic neurosecretion for the development of reparative potency of cellular elements and in correction processes of reparative regeneration in tissues, there is a decrease in the inflammatory process, stimulating effect on endothelial cells, fibroblasts and functional activity of macrophages [17].



There are two processes which occur simultaneously while forming a callus, but in different cell populations in a particular moment dominates a particular process and each one has its own epigenetic components, parts of which are to optimize every step of the regeneration process [40]. Wherein after the formation of thrombin fibrinogen transforms into fibrin, which is the first step to healing wounds. Fibrin degradation products cause migration of osteogenic cells which provides more rapid regeneration of the fracture line [9]. However, the reparative process proceeds as restitution in part formed by unformed dense fibrous connective tissue, where by the 35th day the formation of a dense fibrous connective tissue happens, and it is the best option [29].

It is well known that maxillofacial area has a highly developed blood vessels, and a violation of local blood circulation immediately affects on the metabolic processes in cells and tissues, increases hypoxia [2, 37]. Changes of gemomicrocirculation lead to imbalance and disorder of mineral balance of the internal environment of organism [42]. At the same time, a violation of the trophic bone caused not only by the damage of the vessels which supply the jaw bones, but also a violation of nerve conduction – the damage of the third branch of the trigeminal nerve [41].

It should be noticed, that under adverse conditions of the fracture, such as trophic disorders in fragments due to their damage of the lower alveolar nerve consolidation may be protracted [4, 16]. During prolonged hypoxia of tissues occurs anaerobic glycolysis, retardation of osteoblast differentiation, formation of collagen with lower content of hydroxyproline and hydroxylysine is formed, and that lead to ossification deceleration [38]. Endosteal osteogenesis is inhibited due to the lack of vascular growth in the area between the fragments of jaw within 2-3 weeks [43]. By the end of the third week the periosteal callus of cartilage is formed [12].

Pathogenetic mechanisms of posttraumatic complications. Disturbance of microcirculation in the damaged area plays a big role of inflammation of maxilla-facial bones fractures. Endothelial damage of the vessel walls causes a decrease in antithrombogenic properties. Wherein hemostatic system activates, rheological properties of blood changes [5, 28].

Local and common risk factors play a role in the occurrence of posttraumatic complications of mandible fractures. All kinds of metabolism are disturbed in a trauma of maxilla-facial area obtained in a state of alcoholic and narcotic intoxication. This reduces compensatory and adaptive reactions of organs and system [35].

Pathogenic microflora of the oral cavity plays an important role in development of posttraumatic complications. This microflora falls into the gaping wound often in the angle of

the mandible under the interposition of the masticatory muscles [30]. At the same time oral fluid with an abundance of different microflora constantly gets into torn mucosa, where "valve gear" of bone infection activates [13]. Such localization of the fractures in area of the dentition are considered primarily complicated. Meanwhile, the presence of oral fixation structures after immobilization of bone fragments contributes to a violation of periodontal tissue trophism and self-purification of the mouth, which have a negative impact in the development of inflammatory complications due to activation of pathogenic microflora [31].

Blood clotting and fibrinolysis of saliva factors play important role in the development of complications and significant changes in the first days after injury. Decrease of the antithrombogenic properties of the vessel wall leads to the increased deposition of platelets at the vessel wall, activation of hemostasis and thrombosis [28]. The platelets create preconditions thrombus formation due to activation of the coagulation system [9].

The high prevalence of major dental diseases are determined in population, which lives in severe climate of the North [33]. Chronic foci of infection in the mouth contributes to activation of pathogenic flora due to violation of metabolic processes and immune system in jaw fractures. Which often leads to development of osteomyelitis of the jaw. At the same time, odontogenic infection may spreads from the pathological periodontal pocket when the barrier properties of the boundary of periodontal are broken. Anaerobes, enterococci, staphylococci, *Pseudomonas aeruginosa*, etc. are causative agents of infectious-inflammatory process [31].

Complex treatment and prevention of complications. Jaw fractures treatment has always been a serious problem in maxillofacial surgery. Despite of their extensive studies, the complications development, such as infections in posttraumatic period remains, are still on a high level and their amount averages from 9 to 44% [23]. A multi-disciplinary approach has always been considered. Early reduction and fixation of bone fragments, restore of anatomical integrity, resume function, healthy food, the maintenance of oral hygiene are the main moments in treatment of jaw fractures [35, 39].

Today there are many different methods of treatment of mandibular fractures. For fixation of bone fragments different metal structures can be used: bone suture, bone metal mini-plates, bracket with the shape memory, Kirschner's needle, etc. [18, 44]. Extraoralosteosynthesis where not enough stable fixation of bone fragments affects on the frequency of postoperative inflammatory complications [1]. And that's why the oral method of osteosynthesis is recommended, which creates the optimal conditions for fracture healing [11]. Another advantage of this method of surgical treatment is the lack of scars on face and the probability of the facial

nerve branches damages. The stability of extrafocal osteosynthesis between the fragments of jaw is the important moment of extrafocal osteosynthesis and that helps to regulate bone formation processes in the fracture line, not interrupting its natural course. Its negative moments are the lack of serial production of compression-distraction devices, scientific basis and devices departments of maxillofacial surgery [18].

It must be emphasized that in open osteosynthesis excised the soft tissues, which disturbs microcirculation and in damages of branches of the facial nerve can lead to paresis of facial muscles, an exfoliation the periosteum, at the same time processes of formation and ossification of callus are broken [29]. Osteosynthesis with small plates have the advantage over the other constructions, because the periosteum is peeled from the vestibular side. Because of different shapes, forms and sizes using of small plates is possible in complex comminuted, oblique fractures, where there is a stable fixation of bone fragments [20, 44].

Nowadays there are different methods in jaw fractures treatment. For example, one of these methods is the use of bone calcium phosphate cements in oral and maxillofacial surgery, which are used as osteoplastic material [15]. Fibrin clot in injuries of jaw bone to stimulate the regeneration of the damaged area is also successfully applied in clinic [9].

One of the key methods in prevention of complications of jaw fractures is the use of antibacterial drugs [32]. Lymphotropic antibiotic therapy is more effective than intravenous, which is connected with the formation of interstitial fluid an optimal concentration of antibiotic [23]. But at the same time the efficacy of the intraosseous injection of drugs in treatment of jaw was determined, it in some extent helps to prevent the development of post-traumatic inflammatory complications [26].

It is well-known that the use of systemic action drugs is not expedient, because in fracture area a violation of blood circulation of local character can be observed [10]. In this case osteotropic drugs such as lincomycin, morfocyclin, vibramycin and others are recommended to be appointed [3, 38]. But at the same time many antibiotics, which are appointed in jaw fractures possess are highly hepatotoxic. And their cumulative properties in combination with other drugs are not well learned [23].

There is information about efficiency of hyperbaric oxygenation in acute posttraumatic period of severe maxillofacial injury in literature [25]. Also contains information about efficiency of topical application of ozonated distilled water, where antioxidant systems activate [36]. Using percutaneous electroneurostimulation has a significant positive effect on the recovery of sensory-paresthetic disorders in patients with jaw fractures [16]. Patients need to take

high-calorie foods rich in calcium and minerals to restore bone structure of mandible and organism. Use of immunomodulators increases number of immunocompetent cells and its functional activity [14].

Despite of extensive studies in complex treatment and prevention of post-traumatic complications of jaw fractures this problem is not solved completely. New methods and ways which can increase the effectiveness of treatment and prevent complications are searched.

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