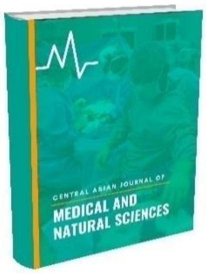
CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES



Volume: 04 Issue: 06 | Nov-Dec 2023 ISSN: 2660-4159

http://cajmns.centralasianstudies.org

Diagnostic Methods and Complex Treatment of Trigeminal Nerve Branch Injuries in Fractures of Bones of The Maxillofacial Region (Literature Review)

1. **Khatamov E.B.**
2. **Shomurodov K.E.**

Received 20th Sep 2023,
Accepted 21st Oct 2023,
Online 13th Nov 2023

[1] Samarkand State Medical University
[2] Tashkent State Dental Institute

Abstract: At present, there is a continuous growth in the incidence of maxillofacial traumas - annually their share averages 6-8% of the total number of traumas.

Key words: maxillofacial traumas, fractures of bones of the facial skull, trigeminal nerve.

Introduction

According to statistical data, the specific weight of maxillofacial trauma (MFT) with fractures of the bones of the facial skull has increased significantly in large cities and makes up to 42% of hospitalised patients. The proximity of important anatomical structures (brain, large nerves and ganglia, upper respiratory tract, sinuses, eyeball, etc.) causes difficulties in the process of diagnosis and treatment, as well as frequent cases of lethal outcome, loss of ability to work for a long period of time and subsequently lead to the development of disability. According to WHO data, every year fractures of bones of the maxillofacial region and their complications cause the death of up to 350 thousand people of working age and disability of more than 7.3 million injured people, which determines the relevance of this problem [1, 3].

Maxillofacial fractures can involve nerves and lead to complications such as paresthesias, neuropathy and sensorineural dysfunction (NSD). NSD may be persistent for a long time due to various manipulations, surgical interventions and other factors [5, 7, 12].

In the treatment of maxillofacial traumas, most doctors focus on restoring the shape of the damaged part of the face, while the issues of rehabilitation and solving the problems of loss of sensation and motor functions are relegated to the background, which leads to the loss of that valuable period of time during which competently selected methods of treatment could give the most positive result. This shows the necessity of multidisciplinary approach to the process of treatment of traumas of the NFC and joint work of specialists of different fields of medicine.

Thus, the lesion of nerves and their further rehabilitation in case of injuries of bone structures of maxillofacial skeleton is one of the topical issues of modern traumatology of maxillofacial region and requires new approaches, diagnostic methods, treatment and prevention of complications.

The aim of this work was to analyse the literature data and statistical indicators of traumatism of the maxillofacial region accompanied by damage to the branches of the trigeminal nerve, as well as pathophysiological features, modern methods and trends of diagnostics and treatment of nerve fibre injuries in traumas of the maxillofacial region.

According to various statistical data, fractures of the mandible account for an average of 70.3% to 83.5% of cases, less common are fractures of the zygomatic bone - about 15.5%, nasal bones - 3.5-4.1%, multiple fractures of the bones of the facial skeleton - 1.6-1.9% of cases, upper jaw - 1.3-1.5% of cases [7, 12, 17].

When analysing the etiology of fractures of the bones of the maxillofacial region, there is a significant preponderance of road traffic accidents, followed by traumatisation from falls and sports injuries [2, 6].

Complex anatomo-topographical relationships of facial bones cause combined lesions of several structures, high frequency of complications, and complicate diagnosis and the treatment process itself. Often fractures of facial bones are accompanied by damage of peripheral branches of large nerve trunks and blood vessels. According to Karpov S.M. (2015), fractures of the bones of the facial skeleton involving branches of the trigeminal nerve disrupt the processes of adaptive activity of the nervous system with changes in the bioelectrical activity of the brain. Thus damage of its peripheral parts in patients with fractures of bones of the facial skeleton can have a significant influence on the course and prognosis of the main disease. Traumatic injuries of the trigeminal nerve are one of the most common causes of persistent pain syndrome and other neurosensory disorders in the facial region. Injuries of the peripheral branches of the n.trigeminus can occur both immediately at the moment of direct exposure to the damaging factor due to contusion, stretching, rupture of the nerve fibre, and after some time due to inflammatory complications (posttraumatic osteomyelitis), infections, secondary displacement of the fragments, etc. [3, 4, 5].

According to statistical data, 84.5% of patients in maxillofacial surgery and traumatology departments are diagnosed with traumatic injuries of the III branch (inferior alveolar nerve); 82.3% of cases of injuries of the middle facial zone are accompanied by posttraumatic neuropathy of the II branch (maxillary nerve) [11, 13, 16].

According to Politoun A.M. et al. (2013), damage to the inferior alveolar nerve occurs due to contusion, stretching, compression by bone fragments of the mandible, resulting in an average of 71.2% of cases of stretching, contusion - 15.7%, incomplete nerve rupture - 11.8% or complete rupture - 0.6% of cases according to various authors. Sirak S.V. et al. (2013) in trauma of the inferior alveolar nerve distinguish 5 degrees of injury: subclinical, mild, medium, moderate and severe. Neurotrophic changes in innervated tissues are observed: disturbance of osteoreparation processes in the fracture zone, disturbance of sensation or motor function depending on the affected branch of the trigeminal nerve in the innervation zone. From the above, it should be noted that an important aspect is that trophic disorders in bone tissue and slowing of repair processes are inextricably linked with innervation disorders in the fracture area [12, 13, 14, 15, 16].

According to the data of Bakhteeva G.R. (2012), the zone of sensitivity reduction in mandibular fractures with the lesion of the inferior alveolar nerve was localised in most cases on the skin of the lower lip and in the chin area. In the oral cavity, the decrease in sensitivity was observed on the mucous membrane in the fracture area and distally from it. Statistically, the phenomenon of hypoesthesia accompanied fractures in the region of the mandibular angle in 57% of cases, and fractures in the region of the mandibular body and chin - 21.5% each [8, 20].

In posttraumatic neuropathy of the maxillary nerve, there is a violation of all types of superficial sensitivity of the lower eyelid and the outer corner of the eye, the upper lip, as well as the mucous membranes of the lower part of the nasal cavity and maxillary sinus. It should be noted that the electroexcitability of the pulp of the teeth of the upper jaw, trophic processes in the corresponding innervation of the n.maxillaris is disturbed, which slows down the processes of osteoreparation - healing of the fracture area.

Injury of the palatine nerve is less common, which is manifested by unpleasant sensations of burning, tingling and dryness in the area of the corresponding half of the hard or soft palate. The low rate of traumatisation of the palatine nerve is due to its deeper anatomical location.

Various diagnostic methods and pain intensity scales are used in the detection of nerve fibre injuries. Sensory-paresthetic disorders are determined by the examination of superficial (pain, temperature and tactile) and deep sensitivity of the facial skin.

Lepilin A.V. et al. (2012) suggest assessing the degree of impairment of the motor portion of the third branch of the trigeminal nerve by palpation of temporal and masseter muscles, analysing electroneuromyography data, and in the long term by the degree of atrophy of the masseter muscles on the affected side and the presence of displacement of the lower jaw movement trajectory. Electroneuromyography (ENMG) is used for topical diagnosis and assessment of the degree of damage to various parts of the peripheral neuro-motor apparatus, as well as for determining the effectiveness of therapy and predicting the outcome of treatment by recording and analysing the bioelectric activity of muscles and peripheral nerves. The analysis of ENMG data makes it possible to detect nerve damage in the absence of clinical picture, when objective methods have not identified signs of any neurological disorders in the area of trauma [7, 8, 10, 22].

According to Timofeev A.A. (2020), posttraumatic damage of most nerves does not require special treatment and often passes independently as bone fractures heal. Spontaneous recovery of trigeminal nerve branch functions after facial fractures depends on the following factors: sex, age and general medical status of the victim; displacement, location and method of treatment of the fracture, as well as the interval between trauma and fracture healing. But statistical data of the majority of studies show that in the absence of drug treatment in case of peripheral nerve injury in the face, there is preservation of sensory loss, motor disorders for a long time (several months, sometimes years), as well as marked inhibition of bone tissue repair processes in the area of the fracture.

Correction of the above complications by pharmacological, physiotherapeutic and surgical treatment methods is effective only in 60% of cases. According to the scientific literature, it is possible to achieve complete recovery of the damaged nerve of the peripheral nervous system and reinnervation of muscles and skin with a properly selected set of therapeutic measures and medications [15, 17, 19].

The key factor affecting the effectiveness of the treatment is time, which is due to the speed of development of irreversible changes at the tissue and cellular levels and pathomorphology of the lesion of the peripheral branches of the trigeminal nerve. Thus, according to a number of authors, the ability to regenerate peripheral nerves is preserved for a year or more, but after four months there is a decrease in the number of regenerating fibres, slowing down of their maturation, and after six months there are signs of atrophic processes in schwann cells. It should be noted that it is possible both direct, due to violation of the integrity, stretching or rupture of the nerve fibre, and indirect nerve damage caused by ischemia due to compression of the feeding artery. Popelyansky J.Y. (2005) highlighted the following relationship: the longer and more severe the damage, the more pronounced the demyelination. There were also attempts to assess the severity of nerve damage by measuring the level of decayed myelin content in the blood removed from the fibre [10, 18, 19].

Untimely or insufficient diagnosis, late immobilisation or surgical intervention, ineffective drug therapy, patient's non-compliance with recommendations lead to the development of irreversible changes in nerve fibres, which leads to impaired reparative processes in bone tissue and consolidation of bone fragments, inflammation, gross functional disorders of sensitivity, vision, motor functions (paresis or paralysis of masticatory muscles) and other physiological processes. Complications occurring in more distant periods include facial deformities due to disorders of tissue trophism and atrophy of muscles innervated by the affected branches of the trigeminal nerve [8, 9].

Nazarov V.M. et al. (2008) noted that modern approaches to complex treatment of traumatic injuries of peripheral branches of the trigeminal nerve are based on the fact that patients with the first neuron damage in the bone canal of the jaw are treated by dental surgeons and maxillofacial surgeons. Persons with lesions localised above the level of the first neuron, as well as patients suffering from trigeminal neuralgia of central genesis, should receive specialised care from neurologists and neurosurgeons [23].

Timofeev A.A. (2020) believes that if the nerve is pinched by a bone fragment, repositioning and, if necessary, osteosynthesis should be performed to release it. It should be remembered that careless and rough manipulation of instruments can lead to additional significant traumatisation of the peripheral branches of the trigeminal nerve. It is also necessary to avoid secondary displacement of the fragments, which occurs during conservative treatment and osteosynthesis. The main causes of dislocation of fragments are insufficient fixation of bone fragments with each other, early functional loads, as well as independent removal of intermaxillary traction by patients, additional trauma, etc. In some cases (in neuritis of only large branches of the trigeminal nerve), neurolysis is resorted to - isolation of the nerve from the scars to improve the conditions for its regeneration and functioning [2].

According to Kraut R. (2002), the development of microsurgical techniques has partially resolved the issue of restoring the integrity of the damaged nerve before irreversible changes develop (Waller degeneration - fatty degeneration of the damaged nerve fibre, which develops inside the nerve sheath distal to the nerve injury). Microsurgical nerve fusion is usually recommended in the absence of full recovery of nerve function after the absence of positive effect of all existing conservative methods of treatment within 4-6 months after the injury. According to various studies, the efficiency of restoration of the integrity of large branches of the trigeminal nerve by methods of direct nerve stitching, autogenous vein grafting, autogenous nerve, and tubular implant averages 45-52% [10, 24].

Pokhodenko-Chudakova I.O. et al. (2015) believe that conservative methods of treatment (drug therapy, physiotherapy, electroneurostimulation, etc.) of injuries of peripheral branches of the trigeminal nerve are the most common. For a long time the classical scheme of drug therapy in the treatment of traumatic trigeminal neuritis has been used, which includes analgesics, vasoconstrictors and dehydrating agents, as well as stimulators of reparative processes - antioxidants, B vitamins, anticholinesterase drugs. According to the authors the efficiency of the above described scheme according to different data varies within 55-62%. In the course of research by Kudinova M.P. (2005) it was determined that the inclusion of non-steroidal anti-inflammatory drugs, angioneurotic, immunocorregulating, antihistaminic drugs, antidepressants increased the effectiveness of treatment to an average of 88-90%. It should be noted that the use of the above groups of drugs is limited by the presence of comorbidities, generalised pathology and drug allergy in patients [25, 26].

Gurlenya A.M. et al. (2008) in their studies determined that physiotherapy methods (UHF, diadynamic currents, electrophoresis, Bernard currents, etc.) also to a certain extent increase the effectiveness of complex treatment, but in some cases their use is inadmissible due to the presence of such contraindications as cardiovascular, renal and hepatic insufficiency, systemic connective tissue diseases, the presence of neoplasms, etc.

According to Kudinova I.P. (2005) reflexotherapy gives good results of treatment. Application of reflexotherapy in the acute period of the disease is aimed at pain relief, elimination of nerve trunk compression by reducing perineural tissue edema, improvement of microcirculation, elimination of hypoxia, normalisation of impulse conduction [2,6].

Bakhteeva G.R. (2010) proposed a method of treating injuries of the inferior alveolar nerve (third branch of n.trigeminus) in mandibular fractures using an electrostimulator-analgesic device, which allows simultaneous stimulation of the nerve fibre both in the area of injury and in the area of the mental foramen. According to the author's data, electroneurostimulation aimed at the correction of neurotrophic disorders has a pronounced analgesic effect, normalises electrophysiological parameters, accelerates consolidation of mandibular fragments, and reduces the risk of complications [7].

Avdeeva V.A. (2008) proposed to use dynamic electroneurostimulation (DENS) in case of decreased or absent tactile, temperature, pain sensitivity of the skin of the chin area and lower lip, mucous membrane of the lower lip and alveolar process in the frontal region of the mandible, as well as in case of increased electroodontometry on the side of traumatic injury of the inferior alveolar nerve. According to Pokhodenko-Chudakova I.O. (2010), the method has no side effects, and the main advantage is non-invasiveness. The disadvantage is the gradual development of somatosensory receptor tolerance to electric currents [10, 17].

A.V. Lepilin et al. (2014) proposed a method of applying electroneurostimulation and laser therapy using a laser device with continuous radiation in the violet region of the spectrum (wavelength 405 nm) with a power of 100 mW developed by them. Exposure to laser was used after tooth extraction from the fracture gap, as well as in case of bone wound suppuration (on the first day of hospitalisation), the course consisted of 5 procedures. The authors applied the transmitter to the tooth socket or the wound of the oral mucosa from a distance of 5-7 mm. As a result of the above-described course of treatment, the severity of pain syndrome decreased by 53.2%, neurological symptoms normalised, regeneration of the tooth socket and bone wound accelerated, and thus the probability of complications decreased [8, 10, 25].

Conclusions: Based on the above, it is obvious that timely diagnosis of complications arising from fractures of bones of the maxillofacial region, and carrying out complex treatment gives a high rate of positive outcome and maximum restoration of sensation and motor functions in the zone of innervation of the damaged branch of the trigeminal nerve. The complex of therapeutic measures for injuries of the maxillofacial region should also be timely with the parallel application of the most appropriate effective surgical methods of treatment aimed at the elimination and treatment of fractures of the bones of the facial skeleton, and drug therapy of neurological disorders with subsequent rehabilitation period.

Literature

1. Dr G. S. Radhakrishnan, Dr R. Selvan, Dr Govindharaj, Dr Dexter R Marak. Status and Management of Nerves in Strategic Locations of Facial Fractures. International Journal of Science and Research. 2019; 8(3): 476-480.
2. Timofeev A.A. Chelustno-facial surgery and surgical dentistry: in 2 books. All-Ukrainian specialised publishing house "Medicine", 2020. 992 c.
3. Karpov S.M., Gandylian K.S., Karakov K.G., Zelensky V.A.,
4. Porfiriadis M.P., Khachaturyan E.E., Domenyuk D.A., Chalaya E.N. Maxillofacial trauma as a factor of neurophysiological CNS disorders. Medical Bulletin of the North Caucasus. - 2015 - VOL.10, NO.4 - PP.361-365.
5. Karpov, S. M. Neurophysiological and immunological course of maxillofacial trauma in mild craniocerebral trauma / S. M. Karpov, V. A. Baturin, D. Y. Christoforando [et al.] // Clinical Neurology. - 2011. - № 1. - C. 3.
6. Karpov, S. M. Combined trauma of maxillofacial region, diagnostic issues, neurophysiological aspects / S. M. Karpov, D. Y. Christoforando // Russian Dental Journal. - 2011. - № 6. - C. 23-24.
7. Operative maxillofacial surgery and stomatology: textbook / edited by V.A. Kozlov, I.I. Kagan. Moscow: GEOTAR-Media, 2014. 541 c.
8. Bakhteeva G.R. Features of the course and treatment of mandibular fractures accompanied by damage to the third branch of the trigeminal nerve: Cand. ... kand.med.nauk: 14.01.14. - Stomatology. Volgograd., 2010. 24 c.

9. Bakhteeva G.R., Lepilin A.V., Soicher M.G., Bulkin V.A., Mukhina N.M. Course and healing of mandibular fractures accompanied by damage to the branches of the trigeminal nerve // Saratov Scientific Medical Journal. - 2012. - VOL. 8, NO. 2 - P. 399-403.
10. Behnaz Poorian, Mehdi Bemanali, Mohammad Chavoshinejad. Evaluation of Sensorimotor Nerve Damage in Patients with Maxillofacial Trauma; a Single Centre Experience. Bull Emerg Trauma. 2016, Apr; 4(2): 88-92.
11. Pokhodenko-Chudakova I.O., Avdeenko E.A. Modern possibilities of complex treatment of traumatic injuries of peripheral branches of trigeminal nerve. News of Surgery. - 2010 - VOL. 18 - NO. 2 - PP. 123-132.
12. Shahrokh C. Bagheri, Roger A. Meyer, Husain Ali Khan, Martin B. Steed. Microsurgical Repair of Peripheral Trigeminal Nerve Injuries From Maxillofacial Trauma. American Association of Oral and Maxillofacial Surgeons J Oral Maxillofac Surg. 2009; 67: 1791-1799.
13. Rizaev J.A., Shomurodov K.E., Agzamova S.S. Medical rehabilitation of patients with fractures of the zygomatic-orbital complex. Journal of Dentistry and Craniofacial Research - 2020 - No. 2 - P. 8-11.
14. Kryukov K.I. Morphological changes of neurons of the Gasser's node at compression trauma of the facial part of the rat head (experimental study): diss. ... candidate of medical sciences. M.: 2008. 20 c.
15. Politoun A.M., Compressive-toxic neuropathy of a peripheral branch of the n.trigeminus in humans / Politoun A.M., Znachkova Y.A., Kostyuk T.M. // Neurophysiology. 2013. T. 45. № 3. P. 214-218.
16. Karpov S. Combined craniofacial trauma and neuropsychiatric symptoms / S. Karpov. Karpov, K. Gandylyan, E. Eliseeva [et al.] // European science review. - 2015. - № 3-4. - P. 25-28.
17. Kopylov A.V. Complex treatment of odontogenic injuries of the inferior alveolar nerve [Electronic resource] / A.V. Kopylov, S.V. Sirak, I.A. Kopylova [et al] // Modern problems of science and education. - 2013. - №4.
18. Eryomin D.A. Improvement of pharmacotherapy of the lower alveolar nerve injuries in mandibular fractures: Cand. ... candidate of medical sciences: 14.01.14. - Stomatology. M.: 2019. 27 c.
19. Shomurodov K.E., Mirhusanova R.S. Improvement of surgical treatment of fractures of the lower wall of the orbit. BGMU. - 2020 - C. 660-664.
20. Inkarbekov J.B., Kastey R.M., Amanzholov A.K., Mailikbaeva A.K. Combined injuries of bones of the middle zone of the face with craniocerebral trauma: algorithms of diagnostics and treatment. Bulletin of AGIUV. - 2013 - №4 - C. 85-89.
21. Krasnogolovy V.A. Complex restorative treatment of patients with traumatic neuropathy of the lower alveolar nerve: Cand. ... kand.med.nauk: 14.01.14. - Stomatology. Volgograd., 2013. 23 c.
22. Fan G.S. Prediction, complex treatment and prevention of complications of traumatic fractures of the mandible: Cand. ... kand.med.nauk. 2008. 21 c.

23. Lepilin A.V., Raigorodsky Y.M., Bakhteeva G.R., Fedotenkova D.A., Ramazanov A.H. Use of electroneurostimulation and laser therapy in treatment of patients with fractures of the lower jaw. Physiotherapy, balneology and rehabilitation. - 2014 - №2 - C. 22-25.
24. Nazarov V.M. Neurostomatology / V.M. Nazarov, V.D. Troshin, A.V. Stepanchenko. Moscow: Academy, 2008. 256 c.
25. Kraut R.A. Management of patients with trigeminal nerve injuries after mandibular implant placement / R.A. Kraut, O. Chahal // J. Am. Am. Dent. Assoc. 2002. N 10., P. 1351-1354.
26. Complex treatment of patients with traumatic injuries of the inferior alveolar nerve: textbook / I.O. Pokhodenko-Chudakova, E.A. Avdeeva, K.V. Vilkitskaya. - Minsk: BGMU, 2015. - 31c.