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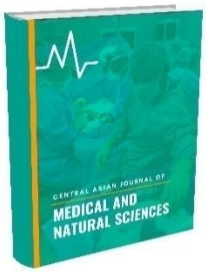

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Treatment Tactics for Orbital Wall Fractures with Regard to Visual Function

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Abstract: Orbital fractures are one of the most common injuries of the midface, second only to injuries of the nasal bones. Fractures of the orbit make up 40% of all fractures of the facial skeleton. The number of injuries to the orbit accompanied by fractures of its walls is steadily increasing.

Keywords: orbital reconstruction, orbital fractures, visual function, maxillofacial surgeons, ophthalmologists.

Introduction: Reconstruction of the orbit is a very complex problem, which has not yet been completely solved, and it is dealt with by surgeons of different specialties - neurosurgeons, maxillofacial surgeons, ophthalmologists. Three quarters of the victims are men. Particularly high rate of binocular vision impairment is observed with fractures of the lower orbital wall, and this is the most common type among all orbital fractures. Current statistics indicate an increase in the number of victims with fractures of the facial skeleton bones. The most frequent damage to the orbital walls occurs with fractures of the zygomatic, maxillary, frontal bones and bones of the naso-atmoidal complex; isolated fractures of the orbit are rare. In 39% of malar bone fractures there is damage to the lower orbital wall, in 6.6% of cases the fractures are combined with injuries to the eyeball, in 25.5% of eyelids, and in 72.2% of soft facial tissues.

Purpose of the study: Treatment tactics of orbital wall fractures with regard to visual function

Material and Methods: Three fourths of the victims were men. The level of binocular vision impairment is particularly high in lower orbital wall fractures, and it is the most common type among all orbital fractures. Current statistics indicate an increase in the number of victims with fractures of the facial skeleton bones. The most frequent damage to the orbital walls occurs with fractures of the zygomatic, maxillary, frontal bones and bones of the naso-atmoidal complex; isolated fractures of the orbit are rare. In 39% of malar bone fractures there is damage to the lower orbital wall, in 6.6% of cases the fractures are combined with injuries to the eyeball, eyelids in 25.5%, and facial soft tissue in 72.2%. The work is based on the analysis of the complex clinical examination of 62 patients with cranioorbital injuries, of them orbital wall reconstruction was performed in 47 patients, 15 patients had isolated orbital wall injuries who were hospitalized in the maxillofacial surgery departments of the dental clinic of Tashkent State Dental Institute and 2 - clinic of Tashkent Medical Academy during the period from 2016-2019. 38 patients had fractures with displacement of bone fragments, 9 patients had injuries of vital organs. We did not include patients with unconsciousness and damage to vital organs. The analysis of clinical material revealed the most effective methods of surgical treatment of defects and deformities of the orbital base, complications of each type of surgery, and the number and types of repeated operations. Examination and treatment were preceded by informed voluntary medical consent signed by all patients with traumatic orbital injury.

Table 1. Distribution of patients by age and sex in Group I

Age/sex	Up to 20	21-30	31-40	41-60	Total
man.	18	10	12	6	46 people - 74,2%
wives.	2	7	5	5	16 people - 28,8%
Total:	20	17	17	8	62 persons -100%

All patients were divided into three groups:

Group I: 30 patients who underwent closed zygomatic bone repositioning with Limberg hook fixation in order to eliminate the orbital wall deformity;

Group I consisted of 4 patients who used Esfil endo-prosthetic mesh to eliminate the deformation of the lower orbital wall;

Group III - 13 persons in whom titanium mini plates were used to eliminate the deformation of the lower orbital wall.

The reasons leading to defects and deformations of the orbital base are different. Figure 1 shows that the main etiological factor is motor vehicle accidents-64% (39 patients). The second place is occupied by domestic trauma: 30.7% (19 patients). In the third place is occupational trauma: 6.4% (5 patients).

Research results and discussion: In the first place, patients, when listing their complaints, put the cosmetic defect in the second place, and functional disorders in the second place. Thus, the "inferiority complex" that forms soon after trauma in most patients with posttraumatic defects and deformities of the orbital base is exacerbated if treatment proves ineffective and its duration is prolonged. The chief complaints are sufficiently characteristic, in Tables 3; 4; 5 they are divided into groups and presented in absolute numbers. We can see from the data in the tables that ophthalmologic symptomatology manifested itself practically in all patients in the acute period of trauma in the majority of patients with consequences of orbital injuries. Knowledge of the main complaints enables the clinician to formulate a preliminary conclusion about the diagnosis, for specification of which the tactics of further examination and treatment can be determined.

When studying the anamnesis, special attention is paid to identifying the causes of injury, the timing of initial referral to a specialized medical institution, and the nature and extent of primary medical and specialized care.

Lesion of the zygomatic-orbital-mandibular complex is considered the most complex deformity of the midface. The deformity is manifested by flattening of the zygomatic-orbital region with displacement of the lower orbital margin and eyeball downward and backward, resulting in diplopia. The internal angle of the eye is rounded, somewhat swollen and displaced downward and forward as a result of a fracture of the medial wall of the orbit. The deformation of the aperture can be aggravated by the ptosis of the upper eyelid.

Let us elaborate on the ophthalmologic symptomatology, as it leads to the greatest number of functional disorders in this group of patients. This examination is performed to determine the condition of the eye, its position in the orbit, and the function of the oculomotor muscles. The simple and accessible methods used in our department usually make it possible to estimate the degree of pathology and choose the treatment tactics. Special instruments and devices are used for a more precise and detailed assessment of the condition of the eye and its appendages; if such examination is necessary, the patient is referred to the ophthalmology departments of other clinics. The position of the eyes in the orbit (exophthalmus, enophthalmus, lateral dislocation) was determined by a simple examination (width of the eye slits, protrusion or recession, axial position). In case of unilateral exophthalmus we measured prolapse by comparative method, i.e. by measuring the difference of one eye stand in comparison with the other in mm by putting a ruler in horizontal position to the nose bridge of the patient and mentally defining the distance from it to the cornea apex of each eye. Exophthalmometers are used to estimate the degree of displacement more accurately; the simplest is a Hertel exophthalmometer. Diplopia is determined by moving an object (pencil, pen) at a distance of 1 m in different directions in front of the examinee's eyes. If there is doubling, find out where it increases and disappears (when looking directly, vertically, horizontally, to the right, to the left). Quantification of diplopia is done by the Madzox method. Restriction of eyeball movements: the patient is asked to close one eye with his hand, and to follow the movement of an object in different directions with the other eye. This is how the deficit of amplitude of movement of each eye is visually determined. Quantitative determination of eye movements is performed with the help of an ophthalmic device-perimeter. Visual acuity of each eye is checked separately with a standard distance test using Golovine-Sivtsev tables, maximum visual acuity is carried out. The condition of the anterior, posterior eyeball and ocular fundus (hemorrhages, examination of the papilla, etc.) is evaluated by ophthalmoscopy. Special treatment may be prescribed to relieve inflammation and prevent scarring of the visual organ.

Ophthalmological examination consisted in determination of visual acuity and fields, examination of the ocular fundus, detection of hemorrhages and the presence of diplopia. Computer tomography data were used to measure exo- and enophthalmos. Traction test, an important diagnostic method, allows to estimate the eyeballs motility. To perform it under anesthesia ophthalmic forceps grasped the base of inferior rectus muscle and moved the eyeball to all sides. The test was negative if passive eyeball mobility was carried out in full, restriction of mobility indicated possible impingement of the oculomotor muscles. This test was also performed under the conditions of surgical intervention. Changes in structural features of the retina and optic nerve were studied using OCT modern technology for qualitative and quantitative assessment of the optic disc, retinal layer of nerve fibers and retinal ganglion cell layer. Damage in all cases we studied was unilateral. Concomitant severe trauma of other organs, including moderate and severe traumatic brain injury (severe and moderate brain contusion, intracranial hematomas, penetrating fractures of the skull vault and skull base) were exclusion criteria for OCT.

Ultrasound examination of the eye cavity revealed signs of contusion of the oculomotor muscles, such as increased thickness and heterogeneity of their echo structure in 8 (12.8%) patients.

Analysis of visometry data showed that visual acuity was altered in 8 (12,9%) patients. Visual acuity (with maximal correction) equal to 1,0 was observed in 42 (67,7%) patients. In 15 (24,2%) patients the visual acuity (with the maximal correction) was slightly decreased to 0,7-0,9. Another 5 (8.1%) patients had visual acuity (with maximal correction) decreased to 0.5-0.6(Fig.1.)

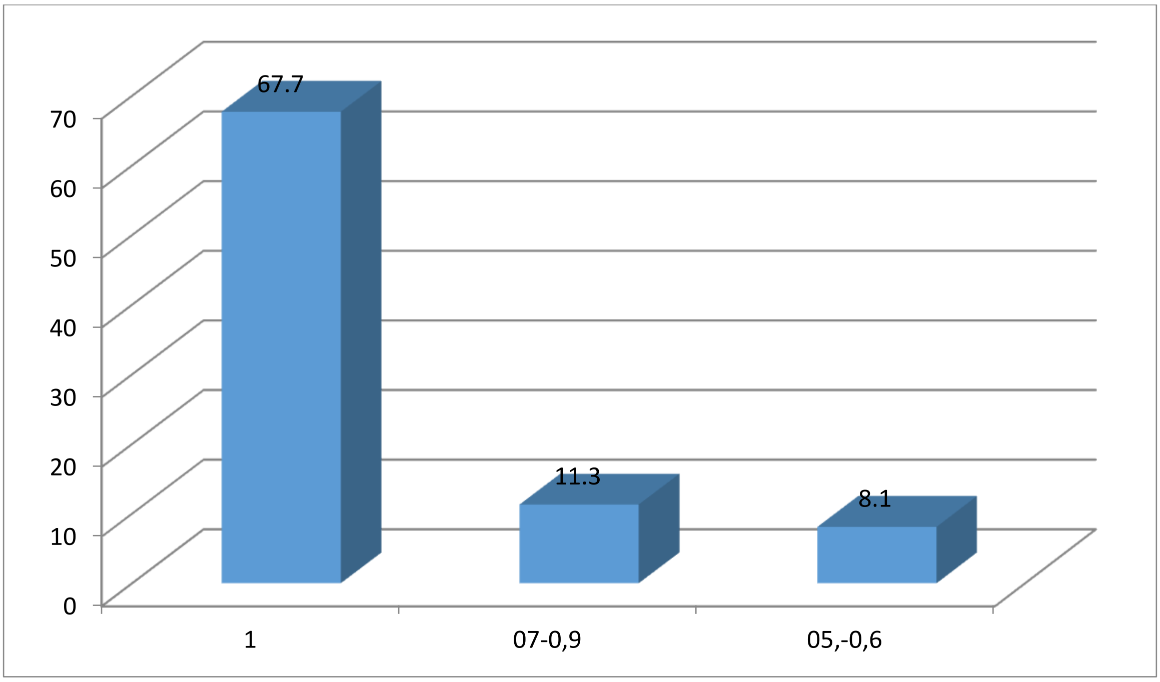

Fig.1. Changes in visual acuity in the examined patients

Ophthalmoscopy revealed changes in the fundus picture in 26 (41,9%) patients. The traumatic angioretinopathy was diagnosed in 14 (22,58%) patients, edema of optic disk due to its compression - in 5 (8,1%), anterior ischemic neuropathy - in 4 (6,5%), posterior ischemic neuropathy - in 2 (3,2%), retinal opacity in 1 (1,6%) patient.

Perimetry revealed changes of peripheral visual fields in 7 (11.3%) patients, including 1 (14.5%) with traumatic optical neuropathy.

Intraocular pressure in all patients was within normal values and averaged 17,5±1,3 mm Hg. In the study of hydrodynamics parameters we found that all patients' intraocular fluid secretion index and Becker's coefficient were within normal values.

We also performed OCT examinations and studied morphometric parameters of the retina and optic nerve. When analyzing retinal thickness in three regions - fovea, parafovea, perifovea, as well as retinal nerve fiber layer (RNFL) - average values of all parameters corresponded to normal. Analysis of the studied morphometric parameters of the retina and optic nerve in patients with orbital trauma showed that in the majority of patients (70%) all parameters were within normal limits. In 13 (20.9%) cases there were deviations of 1-2 indicators and in 6 (9.6%) cases there were deviations of more than 2 indicators. In all cases, the deviations were not pronounced. As follows from Table 2, in this pathology, 100% of patients had a cosmetic defect expressed as a recession of the zygomatic and suborbital areas. Ophthalmological symptoms were manifested in almost all patients in the acute period of trauma and in the majority of patients with consequences of orbital injuries.

Table 2 systematizes the clinical manifestations of orbital wall injuries.

As can be seen from the data, all patients had a cosmetic defect (100%). Ophthalmic symptomatology was manifested as oculomotor disorder in 25(41.9%), ocular dystopia and limitation of eyeball movements occurred in 18 (29%) cases.

The study of the position of the eyes in the orbit revealed that 29 patients (46.7%) had correct eye position, in 18 (29%) cases they were displaced downwards. Enophthalmos and exophthalmos occurred in 16.1% and 8.06% of cases, respectively.

Table 2. Clinical manifestations of orbital wall injuries in patients

Symptoms	number of patients	interest rate characteristic
Cosmetic defect	62	100%
Ophthalmic symptomatology:		
Oculomotor impairment	26	41,9%
Dystopia of the eyeball	18	29%
Restriction of eyeball movements	18	29%
Position of the eyes in the orbit		
Correct position	29	46,77%
Downward displacement	18	29,03%
Enophthalmus	10	16,12%
Exophthalmus	5	8,06%
Visual acuity with maximum correction:		
Visus=1.0	42	67,7%
Visus=0.7-0.9	15	24.2%
Visus=0.5-0.6	5	8,1%
Ocular fundus changes:		
Angioretinopathy	14	22,58
Optic nerve edema	5	8,1%
Anterior ischemic neuropathy	4	6,5%
Posterior ischemic neuropathy	2	3,2%
Berlin retinal opacity	1	1.6%

The research of vision with maximal correction revealed that 42 patients (67.7%) had Visus=1.0, 15 (24.2%) - Visus=0.7-0.9, 5 patients (8.1%) had visual acuity between 0.5-0.6.

Radiological examination of a patient plays an important role in the diagnosis. When analyzing the X-ray pictures of patients with this pathology the typical localization of the lesions at PTD of the orbital base has been revealed (Table 3).

From the data shown in Table 3 we can see that the lateral wall is affected most frequently - 62.5%, the upper and lower walls - 39.1%, the orbital floor - 8.3%, and only isolated damages are 32.4%. Consequently, when planning and carrying out reconstructive measures, the necessity and peculiarities of the subsequent ocular prosthetics should be taken into account.

Table 3. Localization of PTD lesions according to radiological findings

LESION LOCALIZATION	NUMBER PATIENTS	PERCENT CHARACTER
Medial wall.	30	*62.5 %*
Upper to lower.	13	*39.1 %*
Orbital floor	4	*8.3 %*
Isolated damage to the walls of the orbit	15	*32.4 %*
Total:	62	*100 %*

In recent years, the scheme of radiological examination has been supplemented by multispiral computed tomography (MSCT), which allows obtaining multiplanar reformats, fragmentary and three-dimensional images and enables a detailed study of changes in bone and soft tissues. Computed tomography (CT) analysis allows to determine the position and degree of eyeball displacement, the direction of displacement of fat and muscle tissue together with bone fragments, the condition of the supporting and muscular apparatus of the eye and orbit, the volume of destruction of the external lower, internal and upper walls of the orbit. Use of CT scanning does not lead to withdrawal from use of observation and panoramic zonography. They are necessarily used in combination with SCT, which allows obtaining the most accurate diagnostic data, on the basis of which a correct planning of surgical intervention is possible. When predicting postoperative results with programming changes in soft tissues and the human appearance, it is necessary to take into account the possibilities of the individual course of healing (possible soft tissue atrophy, bone resorption, scarring features), which is not reflected by computer modeling techniques. We performed three types of surgical interventions to eliminate defects and deformities of the orbital walls as follows:

Group I consisted of 30 patients, which included 24 (male), 6 (female). When removing the deformation of the medial wall of the orbit, Limberg method was used: We used a single-tooth hook with a transversal handle. We also cut the skin up to 1 cm in length at the intersection of mutually - perpendicular lines: the first one goes along the lower edge of the zygomatic bone, the second one goes down along the outer edge of the orbit. We inserted a single-tooth hook under the displaced fragment, picking it up from the inside and repositioning the bone (arch) in the correct position with a motion opposite to the displacement.

Group II consisted of 4 patients, 3 (male), 1 (female), in whom Esfil endoprosthetic mesh, which is mainly applied to restore the lower wall of the orbit, was used when there was no atrophy of the para-orbital tissue, accompanied with a defect up to 1.0 cm^2, when acute injury of the midface area bones occurred. The Esfil mesh used could be easily modeled and implanted and functioned as a support for the orbital structures; it had a stable implanted position due to its fast integration with the surrounding tissues; it was resistant to bacterial contamination.

In Group III there were 13 patients, including 8 (male), and 5 (female), in whom we used a tampon impregnated with iodolicylic preparation to eliminate the deformation of the medial orbital wall (Fig.3). Indications for the use of tampons are chronic fractures and deformities with destroyed or missing parts of bone tissue. It is reasonable to use this material for defects up to 1.5 cm.

After studying the patient's computed tomography result, it is determined in which area of the medial wall of the orbit the fracture is noted, and then its position relative to the nasal passage is measured.

The second stage is treatment of the operational field and nasal passages with antiseptic solutions under intubation anesthesia.

During the third stage, with the help of a Volkov elevator the medial wall of the orbit is reponed through the nasal passages using movements towards the opposite side of the nasal septum until the characteristic bone crunch, and simultaneously control the pupil eye line until the alignment of the eyeballs is set.

During the fourth stage, the medial wall of the orbit is fixed in the correct position with anatomical forceps or Kocher's clamp by introducing iodociline tampons at the level of the upper and middle nasal passages; rubber tubes are inserted into the bottom of the lower nasal passages for additional fixation of tampons and improved nasal breathing. The last step is to place a bandage on the nose

A great preference is given to iodolicyne tampon which has valuable physical and chemical properties: corrosion resistance, biological inertness, nontoxicity, plasticity, amagnetism and low specific weight.

The results of surgical treatment of defects and deformations of the orbital complex prove high efficiency of using iodoform tampons as a fixation material. Iodolicyne tampons were used in 13 patients of the group III under study. A good therapeutic effect was achieved in 88.4-89.2%. Among the complications of osteosynthesis, 2 cases of cold reaction were identified.

The use of such tampons makes it possible to perform surgeries quickly and qualitatively and reduces the treatment period of patients and prevents the development of complications associated with tissue reaction to cold exposure and contouring of the implant.

Surgical interventions performed on the bones of the facial skull for deformities of the maxillary complex are accompanied by significant blood loss (500-1500 ml). The vast majority of patients with blood loss of more than 10% of circulating blood was compensated during surgery or in the immediate postoperative period by transfusion of donor red blood cell mass or whole blood.

Our analysis revealed that the majority of patients with this pathology were admitted to the hospital in the distant (first two days) period after injury - 56.2%. In late (two weeks and more) treatment and delayed care, patients had already formed persistent segmental tissue displacements - 6.25%; scarring processes had developed at different levels (superficial, deep); structures acquired a vicious memory, maintaining deformity and neuromuscular function impairment. Elimination of the mentioned anatomical and functional phenomena presents significant difficulties. Among the patients with early surgical intervention, diplopia and limitation of movements of the GS were transient and eliminated in the immediate postoperative period due to timely soft tissue plasty and restoration of the integrity of the orbital bone walls.

Conclusions: Thus, the key to optimal functional and aesthetic results of treatment is a complete diagnosis and adequate comprehensive restoration of soft tissue and bone structures in patients with pathology.

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