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CLASSIFICATION, CLINIC, AND DIAGNOSIS OF ORBITAL FRACTURES (LITERATURE REVIEW)

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Abstract:

Contusion trauma of the orbit is characterized by particular severity, high risk of blindness, the possibility of purulent-inflammatory complications, functional and cosmetic defects [1]. The multiple nature of traumatic injuries leads to the need to use accurate topical diagnosis and plan treatment. The study of traumatic lesions of the orbit is relevant.

Keywords: orbital contusion trauma, fractures, eye sockets, facial skeleton

INTRODUCTION: Epidemiology of orbital trauma. Orbital contusion trauma accounts for 36 to 64% of all injuries to the facial skeleton involving the visual organ and its accessory organs [1, 2]. About 85% of all orbital traumas requiring inpatient treatment are bone wall integrity disorders [3]. According to epidemiological studies, in Russia, there is an absolute prevalence of domestic (64.5%) orbital injuries over criminal (21.7%) and occupational (15.5%) injuries [1, 4]. This pattern is not so much due to a decrease in the number of criminal and occupational orbital injuries per se, as to the fact that in many cases they are recorded according to the patient's word as domestic [5]. Many authors have noted an increase in orbital transport injuries over the past 5 years from 4.9% in 2007 to 12.8% in 2010, due to the quantitative increase in means of transportation, high speed on the roads, and alcohol consumption while driving [2, 6, 7]. Often orbital trauma is a consequence of sports activities [3]. According to the data presented by the staff of ophthalmology department of Perm medical institute over 10 years (2000 - 2010) sport traumatism accounts for 9 - 11 % of fractures of the bones of the middle zone of facial skeleton [8]. The bones of the middle zone of the facial skeleton are also involved in the formation of the orbit, so injuries to this zone are reflected in the nature of damage to the bony walls of the orbit. Fractures of the midface zone are combined with orbital fractures in 80% of cases [4], of which isolated fractures of the lower orbital wall are the most common, accounting for 6-12% [9]. In 29 - 37% of patients, two orbital walls are identified as damaged. Fracture of three orbital walls was registered in 12 - 18 % of patients and all four - in 3 - 7 % of patients. In the structure of all orbital diseases in peacetime, according to data from the St. Petersburg Military Medical Academy (VMa SPb), orbital fractures comprise from 2 to 8 % [4], in children - 0.9 % [10]. In children, blunt trauma fractures of the bony walls of the orbit account for 23% of all facial injuries. Of all orbital fractures encountered in pediatric practice, 25 to 70% are injuries to the lower wall in the linear fracture without displacement of the fragments, the "trap" type with impingement of the inferior rectus muscle [3, 11]. Orbital trauma is combined with injuries of ENT organs in 92 %, maxillofacial region in 47 %, skull and brain bones in 45 %, other organs in 11 % of cases, according to data of the Military Academy of St. Petersburg. In 65-66% of cases orbital traumas are combined with contusions of the eyeball and its accessory organs [4, 12]. The ophthalmology literature distinguishes between orbital soft tissue contusions without orbital fracture and with fracture [13]. In most cases, orbital contusion trauma is unilateral; bilateral injuries are less common. In terms of frequency, orbital bone wall fractures in orbital contusions are one of the most common midface injuries and account for 31% [3]; in children, 23% of all left skeletal injuries [10]. Orbital contusions without fracture occur in 78% of all orbital injuries [13]. The social significance of orbital trauma is determined by the young working age of patients, with a bimodal distribution of orbital contusions with peaks of frequency at the ages of 16-21 and 39-55 years, reduced adaptation to labor activity with diplopia in 89%, resulting in significant economic losses [6, 14]. A reliable difference in the distribution of orbital contusion trauma by sex was determined: three

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quarters of the victims were men [3]. The possibility of seasonal dependence of the frequency of orbital trauma was also studied. It was noted that the number of orbital bone wall fractures increases sharply between April and October; according to other data, this occurs between July and September [2]. Analyzing the population of victims with orbital trauma, it was found that in 42% of cases the patients were under the influence of alcohol at the time of injury [3].

CLASSIFICATION OF ORBITAL TRAUMA. According to Gundorova's classification (2009), orbital trauma is divided into domestic, transport, criminal, industrial, sports, agricultural, man-made, and pediatric [1]. In the literature, the only complete classification of orbital fractures was proposed by Nikolaenko V.P. (2009), according to which the most common types of orbital fractures, which may occur in isolation or in various combinations with other facial injuries, were identified.

- "Explosive" and depressed fractures of the lower wall of the orbit;
- "blast" and depressed fractures of the inner wall of the orbit;
- fractures of the zyco-orbital complex;
- fractures of upper jaw of Le Fort I, II, III* type;
- nasoethmoidal fractures;
- "explosive" and depressed fractures of the upper wall of the orbit;
- Fronto-basal fractures (including supraorbital, glabellar, and isolated fractures of the orbital head);
- fractures of the orbital apex, including concomitant damage to the optic nerve canal;
- local fractures caused by sharp objects inserted into the orbit.

*Fractures of the maxilla make up 2-5% of all facial bone fractures. The most common classification of fractures of the upper jaw is according to LeFort (1901). It distinguishes three main types of fracture [3]. Inferior (LeFort-I; transverse). Its line runs in the horizontal plane. Starting at the edge of the sternal foramen on both sides, it goes to the back above the level of the floor of the maxillary sinus and passes through the tubercle and the lower third of the pterygoid process of the sphenoid bone. Median (Lephor-II; suborbital). Its line passes through the junction of the frontal process of the maxilla with the nasal part of the frontal bone and the nasal bones (nasolabial suture), then goes down the medial and lower walls of the orbit, crosses the bone along the suborbital margin and reaches the winged process of the sphenoid bone. Often, the cervical bone with the cervical plate is injured.Upper (Lephorus-III; subbasal). Its line passes through the nasolabial suture, along the inner and outer walls of the eye socket, and reaches the upper part of the pterygoid process and the body of the sphenoid bone. At the same time, the zygomatic process of the temporal bone and the nasal septum are broken in the vertical direction. Thus, the facial bones are separated from the skull bones.The orbit is injured in subbasal and suborbital fractures. Traumatic upper jaw injuries according to LeFort classification are bilateral and their lines run symmetrically. Typical location of fracture lines is rare, more often the fracture line runs atypically or asymmetrically [13].In scientific works, the focus is on the lower wall, since it is the most frequently injured in orbital trauma.According to the classification of A. C. Kiselev (2006) identified types of "blast" fractures of the lower orbital wall:

- Small splintering, when the lower orbital wall is "scattered" into a large number of small fractures and is practically absent in a certain, depending on the fracture, area;
- large-dislocated, consisting of one or two large fractures, which descend into the cavity of the maxillary sinus together with the tissues of the orbit;
- flap fractures, which do not lose contact with the bone and tend to return to their original position, impinging on the orbital tissues wedged between them.

In addition, Professor V. P. Ippolitova (2004) developed a classification of post-traumatic deformities of the midface based on the clinical and radiological picture of injuries of the zyco-orbital complex (SOC). M. M. Khitrina (2007) based on her classification made a working scheme of fractures of the zyglo-orbital complex (SOC), features:

1. excludes the term "zygomatic bone fracture" because the fracture lines are always localized outside the zygomatic bone with involvement of the orbital margins and walls.
2. It takes into account the multiple nature of the fractures of the MLC and highlights the

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localization of maximum displacement and diastasis, which facilitates the choice of surgical treatment method.

5 GROUPS OF FRACTURES:

1. Fractures of the EOS with maximal displacement of fragments and diastasis along the inferior orbital margin.
2. Fractures of the EOS with maximal displacement of fragments and diastasis along the zygomatic suture.
(3) Multiple SDS fractures without significant diastasis between the fragments.
4. Fractures of the ETS combined with fractures, orbital floor defect.
5. Fractures of the zygomatic arch [15].

According to the working classification of Gorbunova E. D. (2006) fractures of the lower orbital wall in children according to clinical and radiological signs: presence and terms of disappearance of diplopia, limitation of eyeball mobility, transverse size of through defect, size of displacement of the lower orbital wall toward the maxillary sinus, presence of CT signs of orbital soft tissue impingement in the fracture area.

1. CT - signs of fracture with transverse size of the penetrating defect up to 0.5 cm and minimal displacement of the lower orbital wall up to 0.2 cm without signs of orbital soft tissue impingement in the fracture zone. Clinical signs (diplopia, limitation of mobility) disappear on the 2nd - 5th day.
2. CT - signs of fracture with transversal size of a through defect of more than 0.5 cm and displacement of the lower orbital wall of more than 0.2 cm, without signs of impingement of orbital soft tissues in the fracture zone. Clinical signs (diplopia, limitation of mobility of the eyeball) disappear on the 7th to 10th day.
3. CT scan - signs of a fracture with impingement of the orbital contents and its prolapse into the maxillary sinus. Clinical signs (disorder of the eyeball mobility, double vision, enophthalmos, including progressive ones) remain unchanged [10].

Definition and mechanism of orbital contusion injury. An orbital contusion is a closed, non-injurious injury resulting from blunt force (contusion, compression) to the bony walls of the orbit and its contents [1].

Blunt orbital trauma results from a blow where the injuring object is in motion: a blow with a fist, leg, stick, log, puck, ball, swing; or where the subject remains motionless: a fall to the ground from a height (from a tree, bicycle), a traffic accident [11, 13]. A detailed assessment of the mechanism of orbital trauma in a contusion is helpful in making the diagnosis. For example, if the area of a blunt solid object is smaller than the size of the orbital inlet, the patient may develop a subconjunctival scleral tear without damage to the orbital bone walls. If the size of the damaging object is larger than the size of the orbital inlet, two options are possible: an "explosive" fracture of the orbital wall (lower or inner) occurs when an agent with relatively low speed and low kinetic energy is applied; a combined fracture (lower ocular margin and the orbital floor or inner wall; upper ocular margin and inner wall, the orbital roof) occurs when a strong impact is applied [1]. If the object of impact is large and has high kinetic energy, it causes not only a fracture of the "bone ring" of the orbit, but also other facial bones, up to the formation of panfacial fractures [3].

The type of injury in orbital contusions is determined by the state of the eyeball and the anatomical features of the orbital structure. If the outer membranes of the eye are incomplete, for example, after keratotomy or scleromalacia, the "capsule" of the eye is torn and this "saves" from a fracture. The normal eyeball in a contusion, does not rupture from a blunt flat blow, but deforms and shifts deep into the orbit, compressing its contents and sharply increasing intraorbital pressure, which causes the weakest lower orbital wall to push into the maxillary sinus [3, 15, 16]. The anatomic structure of the lower orbital wall - thin periosteum, cellular structure of the spongy substance, and topographic location - nodal position in the system of natural bone connections of the orbit result in high incidence of single and combined fractures in 87.3%. Fractures of external, upper, and internal walls isolated and combined are less common - 15.8 % [1, 9].H. Takizawa et al. (1998) demonstrated, based on experiments and subsequent computer modeling, that the contour (profile) of the orbital walls plays an important role. In particular, the arch-shaped roof of the orbit is much more resistant to deformation than a nearly flat bottom, which deforms and breaks more easily. The inner wall of the orbit is even thinner, but the lattice

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labyrinth cells reinforce it like buttresses at the back, so more mechanical energy is required to fracture the medial wall than to fracture the orbital floor [3, 13]. The reflex contraction of the circular muscle of the eye and the presence of a large air cavity under the orbit also contribute to more frequent damage to the lower orbital wall [17]. It is the underdevelopment of the maxillary sinus and the continued growth of the orbit that explains the rarity of orbital floor fractures in children under 7-8 years of age [3,18].In "straight" fractures, the malar bone is damaged and "breaks out" along the joints connecting it to the frontal, temporal and maxillary bones. The entire force of the impact falls on the edges of the orbit, causing them to fracture or end up forming fragments in the trauma area, or spreading inward along the walls. Such a fracture is accompanied by almost complete loss of the lower orbital wall [19].

The clinical presentation of orbital trauma with contusion in the acute period is determined by the localization of the fracture of the orbital bone wall. Symptoms of fracture of the lower orbital wall are well described: edema, hematoma of the eyelids, hyposphere, bulbar conjunctiva chemosis, displacement of the eyeball downward (hypophthalmos), limitation of active and passive eye movements, impaired sensitivity in the zone of innervation of the suborbital nerve [1, 3].

The symptoms of the internal orbital wall fracture are not as distinct as those of the lower wall fracture: emphysema of the eyelids, conjunctiva, unilateral nasal bleeding. With the fracture of the internal wall of the orbit, enophthalmos with impingement of the internal rectus muscle in the fracture zone is revealed [9, 20]. In this type of fracture, the medial ligament of the eyelids, lacrimal ducts, and lacrimal sac can also be damaged [1]. In the case of a fracture of the upper orbital wall, along with a severe general condition of the patient, there are often disorders of eyeball movement, upper orbital slit syndrome, pulsating exophthalmos, anisocoria due to impaired pupillary innervation, optic nerve damage in the bone canal, optic nerve pathway, lycvoria, "symptom of glasses". [1, 21].Symptoms of fracture of the external wall of the orbit, which includes the zygomatic complex (asymmetry of the face, violation of the contour of the zygomatic bone, limitation of mandibular movements to the sides and downwards when opening the mouth). Also displacement of the eyeball, limitation of active and passive movements, damage to the external commissure of the eyelid [1, 13].The complexity of clinical examination of a patient with orbital trauma is due, on the one hand, to the uniformity of clinical symptomatology in various orbital and optic nerve injuries, on the other hand, to inaccessibility of the orbit for examination and limited known examination techniques, and difficulty of differential diagnosis with intracranial injuries and damage to the optic path [3].Clinical examination This explains the importance of the stage of radial diagnosis, the objectives of which are to clarify and confirm the clinical diagnosis, develop optimal treatment tactics, and determine the prognosis of orbital contusions [1, 22].

The diagnosis of orbital trauma in contusion is difficult because of the need to use various instrumental methods to examine the orbit [3]. Radial diagnosis is the leading method for examining the state of the orbit. The diagnosis of traumatic injuries to the orbital bone structures begins with traditional cranial radiography in the direct, lateral, and anterior semiaxial projections, or orbital radiography in 2 projections. In case of suspected damage of the posterior wall of the orbit, optic nerve canal, frontal, orbital bone, we perform a targeted X-ray of the orbital area by the method of O. According to different authors, many time-consuming radiological examinations are not very informative and often mislead the doctor and significantly delay the diagnosis. The probability of error (a missed X-ray fracture diagnosed by subsequent coronary computed tomography) is 10-13% for the lower wall and 20-27% for the inner wall fracture. However, radiography is 100% effective in diagnosing an upper and outer orbital wall fracture [3, 10, 22, 23, 24]. Therefore, at present, radiography in the scope of cranial and orbital cavity examinations in straight, lateral, and anterior semiaxial projections is used only at the stage of patient admission as a screening method. When analyzing the radiographs obtained, attention is mainly paid to indirect signs of orbital damage: darkening of the orbit due to a pronounced edema of the eyelids and retrobulbar tissue in the area of damage, air in

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the upper parts of the orbit. This technique is used to diagnose severe fractures of the orbital wall, large bone fragments, hemosinus due to the obscuration of the paranasal sinus adjacent to the fracture zone [22]. The disadvantages of this technique are the lack of a possibility to estimate changes and mutual location of soft tissues of the orbit with bone structures (impingement, change of the shape, muscle tears), to determine the fracture extent in the direction of the orbital vertex, the width along the whole orbital length. In radiography there is projection layering of bones, so it is impossible to get an idea of small fractures with small fragments or fractures of thin bones, comminuted fractures without significant displacement, to determine the penetration of bone fragments into the skull cavity, the appendicular sinuses. X-rays cannot be used to assess and decide whether surgical intervention is necessary [6, 10, 23].

Traditional radiography may be limited to the diagnosis of an extensive orbital fracture with an appropriate clinical presentation. When the traditional radiological examination is positive and the radiologist gives a negative report, and the clinician's suspicions remain, the patient is referred to a computed tomography (CT) scan for detailed diagnosis of orbital contusion injury features [19]. The reality of our time is that urgent CT scanning is becoming the method of choice. Although the optimal time for CT scanning is considered to be a delayed period after orbital trauma (soft tissue edema reduction) [3, 25]. The advantages of CT scanning include the ability to differentiate tissues of different density due to high resolution (determine the condition of bone structures of the orbit, eye cavity and orbital contents), also noninvasiveness, small time and financial expenses. Furthermore, computed tomography can clearly visualize small and combined (several walls) fractures, estimate the size and position of bone fragments, diagnose complications of contusion trauma such as retrobulbar and subperiosteal hematoma, hemorrhage in the subchamber spaces of the optic nerve, extraocular muscles, and identify the condition of mucosa of the sinuses (signs of hemorrhage, inflammation) [3, 10]. A significant disadvantage of CT scanning, especially repeated one, is the radiation load on the lens [3, 26].

For a complete analysis of lesions of the orbital bone and its contents, the study is performed in two planes at 1.25 mm increments. Coronal (frontal) tomograms are more informative when analyzing deformities, defects of lower and upper walls of the orbit, orbital herniation into the maxillary sinus or cerebral herniation into the orbit, tears and places of fusion of extraocular muscles with bone. Axial slices better visualize fractures of the medial and lateral walls of the orbit, optic nerve and optic nerve canal, and the shape of the straight extraocular muscles [26, 27]. When analyzing CT data in unilateral fractures, attention is paid to the symmetry of the shape and volume of the orbit, the position of the eyeballs and extraocular muscles, the condition of the optic nerve and its bone canal, and the presence of foreign bodies [1, 28]. In bilateral fractures, the shape of the entire orbit, fracture walls and margins, and position of soft tissue in comparison with the normal anatomy are evaluated. In normal cases the eyeball occupies a central position in the orbit, its displacement close to any wall shows the impingement of the corresponding muscle in the fracture zone. Normal straight muscle shadows are 0.1-0.3 cm away from bone walls. If there is no X-ray-negative stripe between the muscle and bone, scar fusion of the muscle and bone or muscle impingement are suspected [3, 10, 26]. Coarse comminuted fractures in midface fractures more often involve the zygomatic, frontal bones, and the maxilla. Small comminuted fractures are characteristic of "blast" orbital fractures with damage to the thin bones of the labyrinth or lower orbital wall.Crack fractures are usually found in "blast" fractures (lower wall crack) and frontal bone fractures (upper wall crack). CT scanning helps to identify secondary involvement of the inferior and inner rectus muscles near the displacement of bone fragments in "explosive" orbital wall fractures, differentiates the causes of diplopia due to muscle impingement and muscle hematoma development, and helps to identify parabulbar soft tissue prolapsed into the adjacent orbital sinuses [1, 27, 28]. The obtaining of coronary images may be hindered by a severe general condition of the patient, the presence of an intubation tube in the trachea (its image is superimposed on the orbital contours), or neck trauma preventing its hyperextension. In these cases spiral computed tomography (SCT) or multidetector spiral computed tomography (MSCT) are irreplaceable, distinguished by high diagnostic informativity, fast scanning speed, possibility to image orbits in bone and soft tissue modes, create 3D and multiplanar reforms based on multiple sections - high frequency scanning. In addition, there is no need to overextend the neck to obtain coronal slices [29, 30].Many authors claim that CT and MSCT methods will eliminate the need for magnetic resonance imaging (MRI) in patients with orbital trauma. However, the use of these methods in the diagnosis of orbital contusion trauma has been presented in the literature by a single author [31].

In addition, a noninvasive low-dose (2 mSv) functional MSCT (fMSCT) of the extraocular muscles in orbital trauma was developed by the staff of the Department of Radiation Diagnostics of the First Sechenov Moscow State Medical University. The study is performed in dynamic scanning mode according to the program of bone and soft tissue reconstruction with a slice thickness of 0.5 mm in axial projection followed by obtaining multiplanar and three-dimensional reconstructions with simultaneous eye movement in a certain sequence. When fMSCT is performed in the presence of functional muscle activity, extraocular muscle fixation in the fracture zone can be detected. In the absence of movement and contractility of the muscle, the paralysis of nerves involved in muscle innervation can be confirmed or muscle detachment from the eyeball, from the orbital apex can be diagnosed [32].

MRI plays an auxiliary role in the diagnosis of orbital trauma in contusion, due to poor visualization of bone fragments, long scanning time, and high cost. The use of MRI for diagnosing orbital trauma is limited by numerous contraindications, including the presence of a pacemaker, metal implants, permanent makeup and tattoos (which create artifacts and complicate image interpretation), claustrophobia, pregnancy and lactation, and uncontrollable patient movements during the exam, while the undeniable advantages of MRI - good soft tissue visualization and no radiation exposure - allow nuclear magnetic resonance to be used to assess the condition of the orbit. Ultrasound can assess the shape, size, clarity of contours, structure, echogenicity of eyeballs, as well as the location and size of the main intraocular structures: cornea, anterior chamber, iris, ciliary body, lens, vitreous body, retina, vasculature; condition of optic nerve area, retrobulbar space, extraocular muscles [32, 33]. In recent years, ultrasound diagnosis of orbital fractures in contusive orbital trauma has been actively introduced [34]. The main arguments are economic feasibility, widespread use of ultrasound equipment, the absence of radiation exposure, and the possibility of long-term examination. The use of ultrasound to diagnose fractures of the lower edge and anterior parts of the orbital floor proved to be the most justified; the technique was proposed by Medvedev Y.A. and Konyakhin A.F. (2007). The principle of the method is that ultrasound probes are placed on the patient's face to study bone tissue throughout the fracture line on the injured side and the same amount of bone tissue on the undamaged side, taking into account the complex topography and anatomico-topographic structure of the midface bones.Based on this method, it is determined that the rate of ultrasound signal passage is slower on the injured side compared to the healthy side, in dynamics the injury line approaches the indicators of the healthy side Dynamic studies provide data on the course of reparative processes along the fracture line, enable timely transition to functional treatment, assess this or that method of bone fragment fixation, and reduce the number of radiological studies [35].

CONCLUSIONS: Thus, we can note that the incidence of blunt orbital trauma among all injuries of the facial skeleton with involvement of the visual organ and its accessory organs ranges from 36 to 64%. In the early stages, the uniformity of clinical symptoms does not allow a precise topical diagnosis to be made. Currently, different diagnostic methods (X-ray, CT, MSCT, fMSCT, MRI, ultrasound) are used to diagnose the localization of the orbital injury site. However, the published materials do not provide clear indications for the use of each of these methods. To systematize and build an effective targeted algorithm for examination of patients with blunt orbital trauma is the task of our further research.

LIST OF REFERENCES

World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-21, April 2023
ISSN: 2749-3644

1. Gundorova R.A., Neroev V. V., Kashnikov V. V. Eye trauma. - Moscow: GEOTAR-Media, 2009. - C.
2. Gundorova R.A., Kapelyushnikova N.I. Structure of eye traumatism. / New technologies in plastic surgery of the eye appendages and orbital cavity in cases of emergencies and disasters: Mater. nauch. conf. - Moscow, 2007. - C. 152-154.
3. Nikolaenko V.P., Astakhov V.P. Part 1: Epidemiology and classification of orbital fractures. Clinic and diagnostics of fractures of the lower orbital wall / Ophthalmologic reports. - 2009. - Vol. II. - №2. - C. 56 - 70.
4. Danilichev V. F. Modern ophthalmology. - Saint-Petersburg: PITER, 2000. - C. 477-490.
5. Goncharenko N.I., Gurdjian K.D. Peculiarities of diagnostics and treatment of combined orbital trauma. /
6. Goncharenko N.I., Gurjiyan K.D. Peculiarities of diagnostics and treatment of the combined traumatisms of the eye and orbital apparatus in cases of emergencies and disasters: Materials of scientific conferences. - Moscow, 2007. - C. 25-27.
7. Kataev M.G., Yolchiyan S.A., Tishkova A.P. Diagnostics and treatment tactics of orbital fractures / Vestnik Ophthalmologii. - 2006. - №1. - C.26 - 32.
8. Korotkikh S. A., Kuznetsova N.L., Kolesnikova E.I., Bobykin E.V. Sverdlovsk regional ophthalmotraumatology center: results of 30 years work / XVI scientific conference of Ekaterinburg center of MNTK "Eye Microsurgery": Mater. conf. - Ekaterinburg, 2008. - C. 57 - 61.
9. Chernysheva E. Z. Sports eye traumatism according to the materials of eye clinic of Perm medical institute for 10 years (2000-2010) / Voprosy ophthalmologii. - 2011. - № 2. - C. 48-52.
10. Panina O.L. Combined severe trauma of the eye socket: Author's abstract. Candidate of medical sciences. - Л., 1986.
11. Gorbunova E. D. Clinic, diagnosis and treatment of orbital wall fractures in children: Author's dissertation. D. in medical sciences. - M., 2007.Nagase D. Y., Courtemanche D. J., Peters D. A. Facial fractures – association with ocular injuries: 13 – year review of one practice in a tertiary care centre / Can. J. Plast. Surgery. – 2006. – V.14. – №3. – P. 167–171.
12. Даниличев В.Ф., Киселев А. С., Горбачев Д. С., Лугина В. Д. Сочетанные повреждения глазницы и ЛОР – органов / Актуальные проблемы современной офтальмологии: Матер. Поволжской науч.-практ. конф. – Саратов, 1996. – С . 39 – 41.
13. Josef J. M., Glavas I. P. Orbital fractures: a review / Clinical Ophthalmology. – 2011. – V.5. – P. 95 – 100.
14. Brown M. S., Ky W., Lisman R. D. Concomitant ocular injuries with orbital fractures / The Journal of Cranio-maxillofacial Trauma. – 1999. – V.5. – №3. – P. 41–46.
15. Хитрина М. М. Оптимизация диагностики и лечения больных с переломами скуло-орбитальной области: Автореф. дис. … канд. мед. наук. – М., 2003.
16. Bunstitle, M. A. Clinical recommendation for repair of isolated orbital floor fractures / Ophtalmology. – 2002. –V. 109. – №7. – P. 1207–1210.
17. Kang B. D., Jang M. H. A case of blowout fracture of the orbital wall with eyeball entrapped within the ethmoid sinus / Korean J Ophthalmol. – 2003. – V. 17. – P. 149-153.
18. Baek S. H., Lee E. Y. Clinical analysis of internal orbital fractures in children / Korean J. Ophthalmol. – 2003. – V.17. – P. 44–49.
19. Karsterer P. A., Yunker C. Recognition and management of an orbital blowout fracture in an amateur boxer / J.of orthopaedic and sport physical therapy. – 2006. – V. 36. – №8. – P. 610-616.
20. Wang L., Wang J. On the positive correlation between the percentage of acute fracture of medial orbital wall and the degree of injury of affected medial rectus muscle by CT image / European Journal of Radiology. – 2011. – Vol. 17. – № 6. – P. 154–158.

World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-21, April 2023
ISSN: 2749-3644

21. Song W. K., Lew H., Yoon J. S., Oh M. J., Lee S. Y. Role of medial orbital wall morphologic properties in orbital blow-out fractures / Investigative Ophthalmology and Visual Science. – 2009. – V.50. – №2. – P. 495–499.
22. Filatova I. A., Tishkova A. P., Beraya M. Z., Polyakova L.Y., Tkhelidze N.R. Computer tomography in diagnosing and determining treatment tactics in patients with posttraumatic pathology of the eye and orbit / Vestnik ophthalmologii. - 2005. - N 6 - P. 9-14.
23. Sangaeva L.M., Vykluk M.V. Radial diagnostics of eye and orbital structures traumas / Vestnik roentgenologii i radiologii. - 2007. - № 2. - C. 60 - 63.
24. Gorbachev D. S., Lugina V. D., Mazur M.V. Roentgenlocalization of the basic anatomic formations of the orbit in various roentgenologic folds/ New technologies in plastic surgery of the eye and orbital appendages in conditions of emergency situations and disasters: Mater. nauch. - prakt. conf. - M., 2007. - C. 27-29.
25. Jarrahy R., Vo V., Goenjian H. A., Tabit C. J., Katchikian H. V., Kumar A. K., Meals C., Bradley J. P. Diagnostic accuracy of maxillofacial trauma two – dimentional and three – dimentional computed tomographicscans: comparison of oral surgeons, year and neck surgeons, plastic surgeons, and neuroradiologists / Plast. Reconstr. Surg. – 2011. – Vol. 127. – №6. – P. 2432–2440.
26. Kreipke D.L., Moss J.J., Franco J.M., Maves M.D., Smith D.J. Computed tomography and thin – section tomography in facial trauma / American Journal Radiology. – 2004. –V. 4. – №17. – P. 43–46.
27. Trivellato P. F. A retrospective study of zygomatico – orbital complex and / or zygomatic arch fractures over a 71 – month period / Dental traumatology. – 2011. – Vol. 27. – P. 135–142.
28. Shimia M., Sayyahmelli S. Traumatic displacement of the globe into the brane / The Journal of Pakistan Medical Assosiation. – 2009. – V.34. – № 2 – P. 234–235.
29. Antsiferova N.G., Puzyrevsky K.G., Plisov I.L. Diagnostic significance of multislice spiral computer tomography of orbits at posttraumatic heterotropia/ N.G. Antsiferova, // Fedorovsky readings: Theses of VIII All-Russian scientific - practical conference with international participation. - M., 2009. - C.178 - 180.
30. Amosov V. I., Speranskaya A. A., Lukina O.V. The use of multispiral computer tomography (MSCT) in ophthalmology/ Ophthalmology news. - 2008. - Vol. - № 3. - C. 54 - 56.
31. Datsko A. A., Piven I. A., Obodov V.A. Magnetic resonance imaging in diagnostics and treatment of post-traumatic dislocations of the eyeball with fractures of the midface / Achievements, unsolved problems and prospects of dentistry development in the Urals: Mater. nauch. - prakt. conf. - Ekaterinburg, 1999. - C. 20 - 21.
32. Danilov S. S., Chupova N.A. Functional multispiral computer tomography in diagnostics of the eye appendicular apparatus lesions / Actual problems of ophthalmology: collection of scientific works of All-Russian conference of young scientists / Ed. by H.P. Takhchidi. - M., 2011. - C. 97 - 99.
33. Lezhnev D. A., Sangaeva L.M. Radial technologies in diagnostics of the combined injuries of facial cranium bones and orbital structures // Siberian Medical Journal. - 2010. -Tom 25. - №3. - C. 91-92.
34. Shabrabi S.E., Kosy J. G., Thornton J. F., Hollier L. H. Facial fractures / Plastic and reconstructive surgery. - 2011. -V. 9. - P. 25-34.
35. A. Medvedev and A.F. Konyakhin. Positive decision to grant a patent for "Method of ultrasound diagnostics of fractures of the lower edge and anterior parts of the orbital floor" from January 14, 2007, №2007125405/14.