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Clinical Experience in Complex Treatment of Patients With Fractures of the Zygonoorbital Complex

Tulyaganov N. A.
Independent applicant of the Department of Otolaryngology Samarkand State Medical University

Rizaev J.A.
DSc, professor, Rector of Samarkand State Medical University

Agzamova S. S.
DSc, Professor of the Department of Ophthalmology, Samarkand State Medical University

Annotation: The article is devoted to determining the effectiveness of complex treatment of patients with associated orbital injuries complicated by traumatic optic neuropathy.

Materials and methods: from 2023 to 2024, 152 patients with traumatic brain injury were hospitalized in the Department of Maxillofacial Surgery, 103 of them were diagnosed with various fractures of the bones of the middle zone of the face, among which 35 patients (35 eyes) had fractures of the zygomatico-orbital complex complicated by traumatic optic neuropathy. Patients were divided into two groups, depending on the therapy

Keywords: traumatic optic neuropathy, zygomatic-orbital complex, hemodynamics, concomitant injury

Results. Analysis of the results of combined surgical and joint ophthalmic conservative treatment of patients in the main group showed a significant improvement in hemodynamic parameters, which indicate stabilization of the ischemic process in 95% of cases, and the analysis also showed the achievement of good anatomical, functional and aesthetic results. These parameters in patients of the main group significantly correlated with visual acuity

Relevance. According to the statistics department of the Ministry of Health of the Republic of Uzbekistan and domestic authors, in the structure of primary disability, blindness and low vision, damage to the organ of vision is in third place (16-18%) after primary glaucoma and degenerative changes in the eye [2,10,13,14]. Of all injuries of the facial skeleton associated with injuries of the organ of vision and its adnexa, trauma to the orbit takes 13-36%, of injuries of the maxillofacial skeleton, in terms of frequency of occurrence, fractures of the zygomatic-orbital complex (ZOC) are in second place after fractures of the lower jaw or nose bones. At the same time, 16-30% of injuries of the upper zone of the facial skeleton in traumatic brain injury (TBI) are never diagnosed, but their untimely and incorrect treatment causes functional impairment of the organ of vision [1,2]. Despite significant progress in maxillofacial surgery, the rehabilitation of patients with orbital floor fractures is one of the urgent problems of modern maxillofacial surgery and ophthalmology in particular. In the structure of craniocerebral injuries, fractures of the inferior wall of the orbit account for 7.9% [15].

One of the main problems of fractures of the lower walls of the orbit is the enophthalmos of the eyeball, accompanied by prolapse and a sharp limitation of the movement of the eyeball. Usually, the cause of movement restriction is the interposition of the orbital tissue and perforation into the maxillary sinus, followed by a partial or complete decrease in the function of the visual analyzer, leading to disability. According to B.L. Polyak (1972), with trauma of the above localization, damage to the visual analyzer occurs in 57% of cases [15,16].

The main goal of surgical treatment of orbital inferior wall fractures is to restore its anatomical integrity and functional perfection, which is achieved either by repositioning and keeping fragments in the correct position, or by replacing a bone defect using grafts.

Traumatic optic neuropathy (TON), according to different authors [4,8], is observed in 0.5-10% of cases of closed injuries of the organ of vision(CIOV) and TBI. At the same time, many authors often note the clinical manifestations of TON with a pronounced decrease in visual functions. With high visual functions and preservation of visual fields, the clinical diagnosis of traumatic optic neuropathy is not made, and the condition of the optic nerve in this category of patients remains an insufficiently studied issue. Late diagnosis leads to functional and cosmetic defects, the development of purulent-inflammatory diseases of the orbit. The main significance of reduced vision and post-traumatic atrophy of the optic nerve is attributed to vascular changes in the blood supply to the optic nerve and retina [2,6]. Post-traumatic change in the normal hemodynamics of the main vessels of the orbit reduces the trophism of eye tissues and causes structural changes and functional disorders [2,9].

Widely used in the diagnosis of damage to the structures of the eye and orbit, ultrasound methods allow not only to determine the localization and severity of post-concussion changes, but also to assess the state of regional hemodynamics of the eye.

The use of traditional X-ray examination does not provide information about the state of the deep parts of the orbit, the lower group of extraocular muscles, it is impossible to determine the dislocation of the eyeball. In this regard, computed tomography has become an integral part of the diagnostic study. E.K. Kolesnikova [10], 1995; S.H. Miller (1972) [11], N.A. Rabukhina (2006) [12].

In this regard, it is very relevant and justified to search for new studies aimed at early detection, development of algorithms for the diagnosis and treatment of combined zygomatic-orbital injuries, prevention of complications, prevention of disability and complete loss of vision, effective rehabilitation together with maxillofacial surgeons and other related specialists.

Purpose of the study: to determine the effectiveness of complex treatment of patients with concomitant orbital injuries based on functional and hemodynamic parameters.

Material and methods of research: Since 2023-2024, 152 patients with TBI have been hospitalized in the Department of Maxillofacial Surgery of the Tashkent State Dental Institute (TSDI), of which 103 were diagnosed with various fractures of the bones of the middle zone of the face (MZF). 68 (66%) cases accounted for ZOC fractures, among which 35 patients (35 eyes) were diagnosed with TON. The age of patients ranged from 19 to 45 years (mean age 32 + 4), men - 32 (91.4%), women - 3 (8.5%). All patients are of working age.

The patients were examined by a maxillofacial surgeon, a neurologist and an ophthalmologist. CT of the bones of the maxillofacial region in the axial and frontal planes was performed in patients with suspected ZOC fractures. If contusion of the eyeball and orbital walls was suspected, MRI of the brain and orbit was performed. On the basis of brain MRI data and clinical signs, the nature of TBI was determined, brain concussion was diagnosed in 114 (75%) patients, brain contusions in 38 (25%) patients.

We performed 35 operations according to the proposed method. This method is easy to perform and, according to its technical characteristics, justifies itself in the anatomical and functional restoration of the damaged area of the face, providing good aesthetic results.

In the postoperative period, we carried out antibacterial and restorative therapy. Physiotherapeutic treatment including magnetic and color stimulation was recommended 2-3 weeks after the operation and then for 3 months.

During the initial examination, the pathological process in most patients was observed in one eye, and therefore, when describing the results obtained, data on the number of eyes will be given.

The comprehensive examination included: general ophthalmological examination (visiometry, tonometry, biomicroscopy, ophthalmoscopy, perimetry), as well as ultrasound ophthalmologic dopplerography (USODG).

Patients were divided into two groups, depending on the therapy.

The first (main) group consisted of 20 patients (20 eyes), who underwent primary reconstruction of the orbit by maxillofacial surgeons. An ophthalmological examination was performed on the day of admission, on the next day after the reconstructive operation, and to the traditional conservative treatment by the ophthalmologist, Ethylmethylhydroxypyridine succinate 50 mg (Mexidol is dissolved in 100 ml - 0.9% sodium chloride solution) intravenously drip for 10 days, Lyophilisate 10 mg - 2.0 ml (Cortexini was dissolved in 0.5 ml of a 0.5% solution of Novocain) at a dose of 0.5 ml, which was administered parabulbarno for 10 days.

The second (control) group included 15 patients (15 eyes), who also underwent primary reconstruction of the orbit, an ophthalmological examination was performed on the day of admission, but the ophthalmologist did not prescribe additional treatment to the traditionally conservative treatment (the patient received only treatment prescribed maxillo -facial surgeons).

According to X-ray data, only indirect signs of a fracture of the bone walls of the orbit were determined. And in 11 (8%) of 35 patients during the initial examination and radiography, there were no signs of a fracture of the bone walls of the orbit. Whereas CT made it possible to determine in detail the condition of the bone walls of the orbit and soft tissue structures in 35 (100%) patients. Fracture of the inferior wall of the orbit was diagnosed in 35 (100%) patients, of which 23 (37%) patients had an isolated fracture, 7 (54%) combined with a fracture of the inner wall, and 5 (9%) of the outer wall.

Ultrasound Ophthalmo-Dopplerography (USODG) in the basin of the ophthalmic artery was performed at the ANDROMED & HOREV clinic in Tashkent on an expert-class ultrasound system PHILIPSHD11XE in the standard position of the patient lying down using a linear sensor, at a radiation frequency of 4 and 8 MHz in continuous (or pulsed) mode.

Hemodynamic characteristics were determined in the ophthalmic artery (OA) in the segment before the formation of its arc over the optic nerve, in the central retinal artery (CRA) no further than 10 mm from the posterior pole of the eyeball in the immediate vicinity of the optic nerve, in the posterior short ciliary arteries (PSCA) in 0.7-0.33 mm from the posterior pole of the eyeball in close proximity to the optic nerve.

The average statistical indicators of blood flow velocity in the ophthalmic artery are normally: Vsyst - from 32.7 cm/s to 37.3 cm/s, Vdiast - from 8.3 cm/s to 9.2 cm/s.

Statistical analysis of the results was carried out using the Statistica 7 software package, using the methods of descriptive statistics, one-way analysis of variance and Duncan's post hoc test for multiple comparisons. The difference between the compared rows was considered significant with a level of significant probability of 95% ($p < 0.05$). The results of descriptive statistics in most tables are presented as $M \pm \sigma$, where M is the mean value, σ is the standard deviation. The critical level of statistical significance when testing the null hypothesis was taken equal to 0.01, 0.02, and 0.05, depending on the criterion used.

To restore the anatomical structures of the orbit, individual implants were used, made of bone cement "Surgical Siplex P" in special laboratory conditions. In 35 patients, the reconstruction of the destroyed anatomical zone was carried out in 2-3 stages, depending on the severity of the damage. The evaluation of the results was carried out 6-8 months after the last operation, anthropometric measurements and photo-registration of the face were carried out, the asymmetry index was calculated.

Research results and discussion:

Symptoms of damage to the anterior segment of the eye (hyperemia of the conjunctiva, subconjunctival hemorrhages and corneal edema), observed on the first day mainly in all patients with combined trauma, disappeared 14 days after the injury. In the early post-traumatic period, changes in

the fundus were characterized by a decrease in the caliber of the retinal arteries (48.7% and 64.7%, respectively), retinal ischemia (43.4% and 48.8%). On the background of the therapy, retinal ischemia disappeared in most patients a week after the injury, however, in 5 (14.7%) patients of the control group, changes in retinal vessels persisted for 1 month. By the end of 3 months of observation in patients of all groups, the ophthalmoscopic picture of the fundus returned to normal.

Satisfactory results were obtained in all cases of primary orbit reconstruction. The asymmetry coefficient did not exceed 1.8.

Prior to the start of complex treatment, visual acuity (VA) indicators in the main and control groups were 0.7±0.07 and 0.8±0.06, respectively.

After the treatment (10 days), we found that in patients of the main group, visual acuity increased to an average of 09 ± 0.3 ($p < 0.05$), in the control group it remained stable to 0.8 ± 0.03. The data obtained indicate a positive trend in the dynamics of VA in patients of the main group, where the VA indicator had a positive effect and the stabilization of indicators by 1 month of observation was 57% higher than the initial level, while 3 months after treatment, visual acuity improved by a maximum of 26 %, in contrast to the control, where there was a deterioration in performance by 3 months of observation by 8%.

Studies of blood flow in the vessels of the eye in patients of the control group in terms of 1 to 3 months, there was a decrease in the achieved functional indicators, namely, the intensity of chorioretinal microcirculation decreased in OA by 13.2%, in the CRA by 17.4% and in PSCA by 16,8%. This was confirmed by an increase in RI in OA by 5.4%, in CRA by 4.1% and in PSCA by 4.2% and a decrease in CI by 2.5% from the initial level, which indicates progression of the chorioretinal ischemic process and further progression of TON.

Thus, conservative treatment used in the control group causes a short-term (up to 1 month) dilation of the arteries, a decrease in RI and an increase in CI. In the future, the indicators return to the original level.

The effectiveness of treatment in the main group persists for a long time (3 months). Improvements in retinal blood supply are correlated with indicators of visual functions and explain their stabilization and improvement (Table 1).

Table 1. Dynamics of USODG in patients with fracture ZOC during treatment

Terms of observation		CRA		PSCA		OA		КИ
		Vmax	IR	Vmax	IR	Vmax	IR	
Control group								
Before treatment		12,62±1,21	0,74±0,02	12,98±1,29	0,72±0,02	39,38±4,59	0,74±0,02	0,78±0,01
After treatment	**1**	13,63±1,01	0,73±0,02	15,11±1,16	0,71±0,02	40,15±3,58	0,74±0,02	0,82±0,02
	3	11,49±0,94	0,75±0,02	12,33±0,96	0,75±0,03	35,56±3,40	0,77±0,01	0,77±0,03
Main group								
Before treatment		8,83±0,54	0,74±0,02	11,58±0,86	0,73±0,01	37,0±2,61	0,78±0,01	0,76±0,02
After treatment	**1**	14,47±0,48^	0,72±0,01	15,24±0,75^[1]	0,69±0,01	44,01±1,75*	0,76±0,01	0,83±0,02*
	3	12,7±0,6^	0,72±0,01	14,13±0,79*[1]	0,7±0,01	40,38±1,79	0,77±0,01	0,82±0,02*

Note: * - significant in relation to the data of the group before treatment ($P \leq 0.05$);

^ - significant in relation to the data of the group before treatment ($P \leq 0.01$);

[1] - significant in relation to the data of the control group ($P \leq 0.05$).

Clinical example

Patient T.R. born 1974 (case history No. 1163/217), was hospitalized in the department of the PCLS of the TSSI clinic with a diagnosis of CTBI. SGM. The consequence of a fracture of the SOC on the left. For the first time, she turned to an ophthalmologist at the consultative polyclinic of the TMA multidisciplinary clinic with complaints of decreased vision, double vision, cosmetic defect, and strabismus. The diagnosis was made: OS- A consequence of contusion of the organ of vision of an average degree. TONE. Enophthalmos. Divergent strabismus of the left eye.

From the anamnesis: according to the patient, she was injured 8 months ago. After the injury, she did not seek medical help. In the last 2 months, she has been experiencing severe discomfort, a cosmetic defect, decreased OS vision, and dizziness. A consultation with a neurologist, an ophthalmologist was appointed, MSCT of the bones of the facial skull, ultrasound was performed.

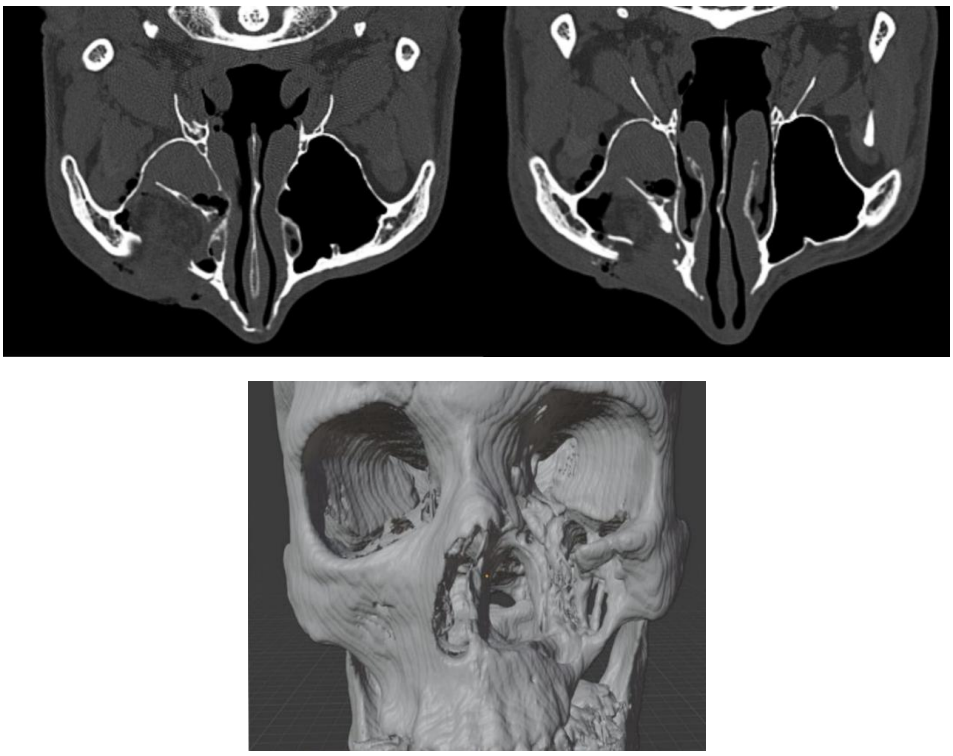
Status oculorum: Visual acuity (VA) upon admission Vis=OD/OS=0.7/0.1 does not correct. Limited movement of the eyeball upwards and inwards, the optical media are transparent, the pupils are equal in size, the reaction to light is lively.

Ophthalmoscopically: OD - within normal limits. OS – optic disc rounded, with clear boundaries, peripapillary atrophy, temporal side of the optic nerve tissue is slightly decolorized. The course of the vascular bundle is central, the arteries are narrowed, filiform, the veins against their background are full-blooded. The retina is attached, thinned in places (Picture. 1).

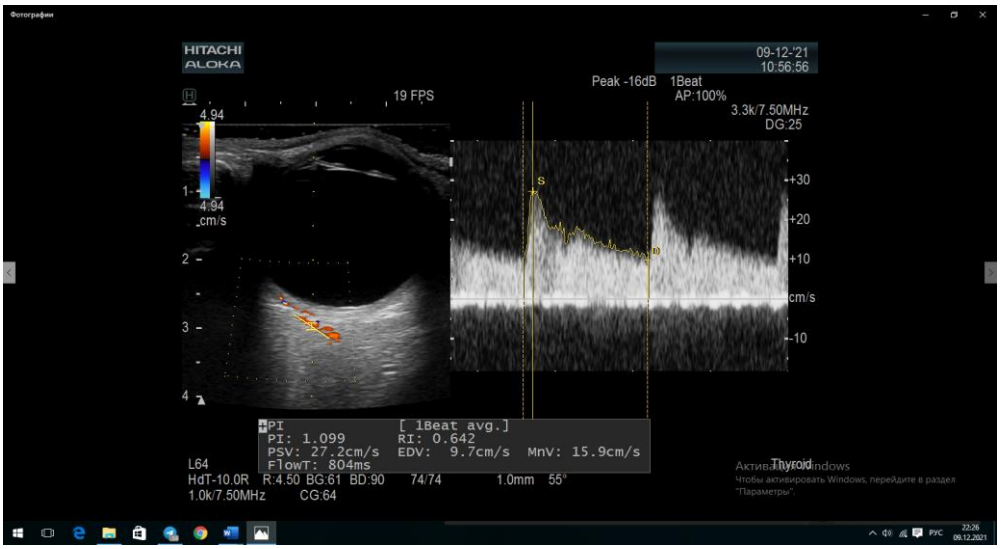
Picture. 1. The fundus of the patient Z.K. (picture TON)

The patient was prescribed MSCT of the bones of the facial skeleton, as well as USODP to confirm the diagnosis.

MSCT conclusion: signs of a fracture of the lower and lateral wall of the left orbit with displacement of bone fragments. Fracture of the anterior and lateral wall of the left maxillary sinus. Fracture of the zygomatic arch. Fracture of the lower wall of the left orbit with the transition to the anterior wall of the left maxillary sinus. Curvature of the nasal septum (Picture 2). USODG revealed a decrease in blood flow velocity (Vs) in the CRA by 25%, in the PSCA by 23%, in the OA by 23% and an increase in RI in the CRA up to 8%, in the PSCA up to 3% and in the OA up to 9%, as well as , reduction in ischemia ratio (CI) by 10% (Picture 3).



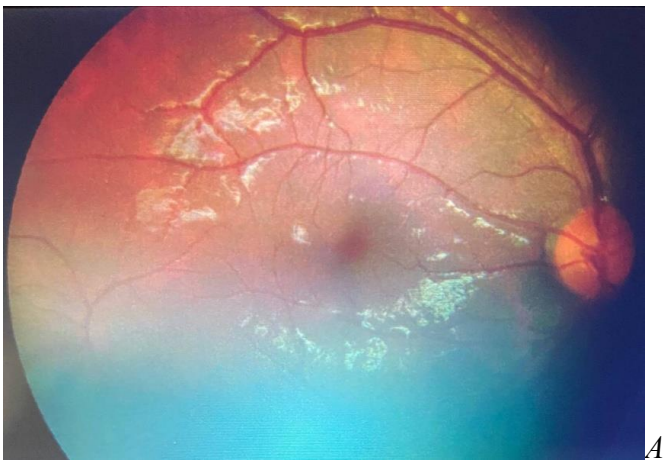
Picture.2. Patient T.R. with a fracture of the SOC on the left (later treatment)



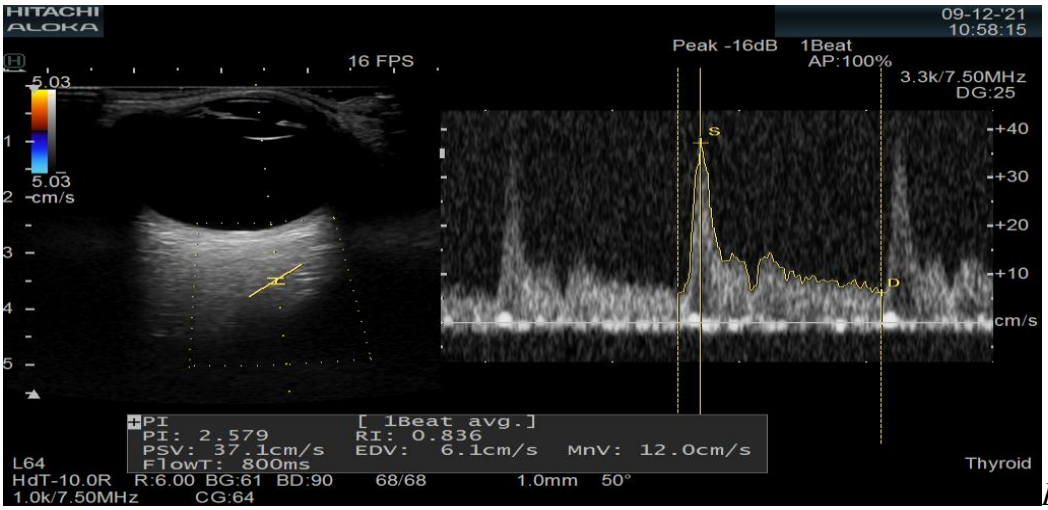
Picture.3. USODG of patient Z.K. before treatment

The analysis of the results of the performed operations showed that after the surgical treatment in patients with fractures of the zygomatic-orbital complex, the general state of health improved, the intensity of pain in the eyeballs during movement significantly decreased, and there was no asymmetry of the eyeballs.

With the joint treatment of an ophthalmologist and a maxillofacial surgeon, the deformation of the orbital walls, leading to a cosmetic defect, was corrected, the movement of the eyeballs in all directions was restored, and hemodynamic parameters decreased to normal values. VA improved to Vis=OD/OS=1.0/0.5 and does not correct (picture 5).



A



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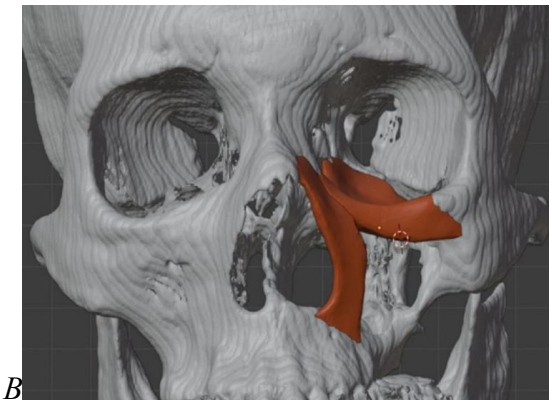

B

Picture.5. A- fundus. B-USODG. B-Patient Z.K., repair of left ZOC fracture (late referral)

Conclusion. Thus, the analysis of the results of combined surgical and joint ophthalmic conservative treatment of patients showed good anatomical, functional and aesthetic results, as well as a significant improvement in hemodynamic parameters, which indicate stabilization of the ischemic process in 95% of cases. These parameters in patients significantly correlated with the parameters of VA.

Findings:

1. Detection of a decrease in the linear velocity of blood flow in the CRA (12.62±1.21; 8.83±0.54) and PSCA (12.98±1.29; 11.58±0.86) states a deficiency of blood flow in the retinal and choroidal vessels as early as the first day after injury, which negatively affects retinal neurons and the optic nerve. The increase in the rate of hemodynamics in the HA (39.38±4.59; 37.0±2.61) most likely has a compensatory character for slowing down the hemodynamics of smaller vessels.

Comprehensive treatment of patients with zygomatic-orbital injuries should be started early after the injury.

2. The proposed scheme of drug prevention of TON leads to stable preservation of visual functions, improvement of hemodynamic parameters (83%).
3. Comprehensive treatment is pathogenetically justified, as it significantly improves hemodynamic parameters, reduces the level of chorioretinal ischemia and increases visual acuity within 3 months after treatment.
4. Comprehensive treatment contributes to the prevention of TON progression in concomitant zygomatic-orbital injuries.
5. Comprehensive treatment of patients with zygomatic-orbital injuries should be started early after the injury.

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