ORBITAL TRAUMA: MEDICO-LEGAL ASSESMENT OF ITS OUTCOMES

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ABSTRACT

Functional assessment of visual system in orbital traumas is very important both for practical treatment and in further forensic medical examination of victims. The aim of our clinical studies was to reason the differentiated approach in determining the severity of harm to the health in case of orbital trauma combined with mild craniocerebral injury. Thirty-four patients with orbital trauma have been studied within a period of 3 weeks — 2.5 months after the injury. A comprehensive check of the ophthalmologic status was performed including standard and precise methods of testing the retina and the optic nerve. An overall examination allowed to exclude eye disorders in patients with orbital trauma combined with mild craniocerebral injury, which provided an objective approach in determining the severity of harm caused to the health.

Keywords: orbital trauma, medico-legal investigation, harm to the human health.

INTRODUCTION

Orbital trauma involving the visual organ and its supplementary organs amounts 36-64% among all injuries of facial bones [1,2]. The scope of ophthalmic examination of patients with injuries of the orbit during the medico-legal procedure is important in assessing the severity of health damage. In modern forensic practice, orbit wall fractures which do not penetrate into the cavity of the skull, are assessed on the basis of permanent loss of general ability to work under paragraph 23 "Table ..." [3]. Minimum damage in this case can not be lower than 10%, which corresponds to moderate personal injury. However, in clinical practice, there are "mild" orbital wall fractures, which have a favorable functional outcome and no set of basic symptoms.

Aim of study. Substantiation of the differentiated approach to qualification of the degree of injury in orbital trauma combined with mild traumatic brain injury (TBI).

MATERIAL AND METHODS

We examined 34 patients aged 17-67 with orbital trauma, who received medical assistance in general hospitals. The comprehensive assessment of the ophthalmic status using standard methods was conducted 3 weeks-2.5 months after the injury, also involving high-precision modern methods for evaluation of the state of the retina and optic nerve — automatic static perimetry and optical coherence tomography (OCT).

Automated static perimetry was aimed at quantifying the sensitivity threshold, as well as identification and evaluation of visual field defects of varying severity. We calculated 2 main *indices:* MD (mean deviation) — the average deviation from the age norm, showing a total depression of sensitivity or the presence of areas with normal sensitivity and defects in the field of vision, and *sLV (loss variance)* — the indicator of local decrease in light sensitivity. *MD* -2...2 dB is the normal value, *MD*>2 dB indicates decrease in sensitivity, disturbance of the retina and optic nerve functioning. *sLV*<2.5 dB is the normal value, sLV>2.5 dB indicates disturbance of the retina and optic nerve functioning.

The study of the structural features of the retina and the optic nerve was performed with the help of OCT, the modern technology of qualitative and quantitative evaluation of the optic nerve, nerve fiber layer and ganglion cells layer.

In all cases damages were unilateral. Exclusion criteria were severe concomitant

injuries to other organs, including moderate and severe traumatic brain injury (moderate and severe brain contusion, intracranial hematomas, penetrating fractures of the roof and base of the skull). In 20 cases, an isolated orbital injury was observed. In 2 patients, orbital trauma was combined with mild brain contusion, in 12 patients it was combined with mild brain concussion.

RESULTS AND ITS DISCUSSION

Victims were distributed according to the trauma origin as follows: 24 (58.5%) patients were injured in the attack by persons unknown, 11 (26.8%) patients were injured as a result of falling from their own height. Four (9.8%) patients suffered in a road traffic accident and 2 patients (4.8%) had other reasons of injuries. Consequently, 73.2% of victims (except cases of falling due ones own negligence) were potential candidates for medico-legal expertise.

We studied traumatic injuries considering anatomical variants of orbital walls fractures according to the computed tomography. The inferior wall fracture was diagnosed in 10 (29.4%) cases, zygomatic-orbital fracture was diagnosed in 13 (38.2%) cases, fracture of the zygomatic bone was revealed in 11 (32.4%) cases.

Surgical treatment was carried out in 29 (87%) patients. Closed reposition of the zygomatic bone and fixation with a Kirschner wire according to Makiyenko were performed in the fracture of the zygomatic bone with displacement. Plastic reconstruction of orbital walls was performed when indicated.

The most typically occurring complaint in patients with orbital trauma was about the doubling of objects which could be permanent or occurring when abducting eyes aside.

Upon external examination, the position of the eyes on the injured side in 28 patients was correct. In other cases the eye was displaced: in 2 patients it was displaced downwards, exophthalmos without displacement of the eyeball was observed in 2 cases, enophthalmos was observed in one patient, and hypophthalmos was also observed in one patient.

The clinical signs characterizing the severity of post-traumatic orbital damage is disturbance of the eyeball mobility in the deformed orbit, developing due to damaged motor nerves, or entrapement of the muscles in the area of the fracture, or after functional activity fall, assosiated with muscle hematomas. Violations of the eyeball movements in patients with orbital injuries were identified in 12 (35.3%) cases. Limitation of eyeball mobility was determined by 4 main directions (upwards, downwards, outwards, inwards) and 4 intermediate directions. In our patients, we revealed upward mobility disorders in 2 (5.9%) cases and combined forms in 2 (5.9%) cases.

Examination of patients revealed that the width of the palpebral fissure ranged from 7 to 13 mm, and averaged 10±1.6 mm.

Ultrasound examination of the eye socket identified indirect signs of eye muscles contusion in 5 (14.7%) patients such as thickening and heterogeneity of its echo structure.

Visometric findings showed that almost all patients had visual acuity unchanged. The visual acuity (with maximum correction) equal to 1.0 was observed in 27 (79.4%) patients. In 4 (11.8%) patients, the visual acuity (with maximum correction)

was slightly reduced down to 0.7-0.9. In the other 3 patients (8.8%), the visual acuity (with maximum correction) was lowered to 0.5-0.6. Low values of visual acuity in all cases were associated with the presence of concomitant disorder of vision (non-traumatic): initial cataract, degenerative changes of the retina and vitreous body, associated with high myopia, and age-related macular degeneration.

It is important to note that subjectively 14 (41.2%) patients had reduced vision in the early hours (days) after the injury, but under the complex ophthalmic examination (3 weeks-2.5 months after the injury) subjective visual impairment was observed only in 4 (11.8%) patients. In 18 (52.9%) patients, we managed to compare visometry findings with objective ophthalmological examination data prior to injury (records from the clinic during planned dispensary examinations). At the same time, in 15 (85%) patients of 18, the data of corrected visual acuity coincided with physical examination data before the injury and only 3 patients had decreased corrected visual acuity.

The intraocular pressure in all patients was within the normal range and averaged 18.5±1.4 mm Hg. The study of hydrodynamic parameters revealed that in all patients intraocular fluid secretion and Becker's coefficient were normal.

During the study, patients underwent electrophysiological methods of investigation that allow to detect violations of visual functions to confirm the presence or absence of traumatic optic neuropathy.

During the critical flicker fusion frequency test (CFFF) in patients with orbital trauma, following results were obtained. CFFF within the normal range (38-41 Hz) was recorded in 23 (69%) patients, a slight decrease (35-37 Hz) was detected in 11 (31%) of them. Moderate or severe decrease in CFFF was not observed in any case.

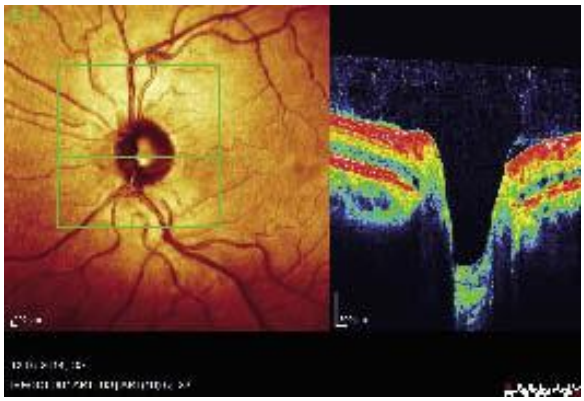
For an objective assessment of damage to the optic tract, revealing the functional status of retinal ganglion cells, axons and myelin sheath of the optic nerve, recording of visually evoked cortical potentials (VECP) on the pattern using standard protocols was performed in all patients

The results of visually evoked cortical potentials showed no clinically significant abnormalities: N 75 latency performance (64.2±1.7 ms), latency P 100 (105.8±1.3 ms) and amplitude N 75-P 100 (7.78±0,5 mV) in all patients were within the normal range. There were no significant differences in the amplitude and latency of the injured eye upon stimulation compared to the intact side, indicating preservation of the significant portion of optic nerve fibers in victims.

According to the static perimetry, signs of optic nerve damage were absent in the majority of patients. Perimetry indices were normal in *85%* (MD) and 79% of cases *(sLV); 15%* (MD) and 18% *(sLV)* of cases**,** slight (0.2) deviations were revealed which could evidence disturbances of retinal and optic nerve functioning.

In all patients studied with OCT we analyzed morphometric parameters of the retina and the optic nerve (Figure).

The retinal thickness in three areas — fovea, parafovea, perifovea and retinal nerve fiber layer (RNFL), average values of all indicators were normal (Table 1).



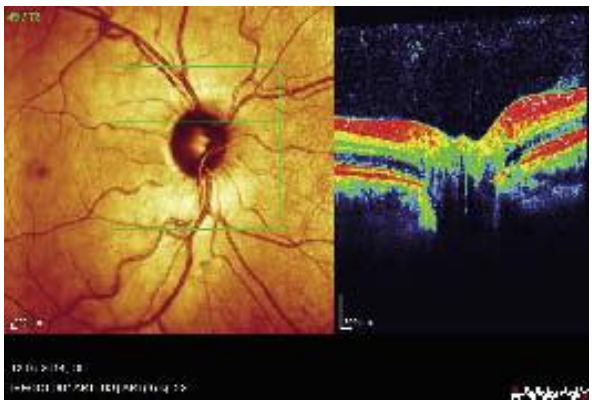


Figure. Morphometric parameters of the retina and optic nerve in a patient with orbital trauma (no change detected)

Table 1

Retinal thickness of the macular area and RNFL

Index	Foveal thickness *(M±m)*	Parafoveal thickness *(M±m)*	Perifoveal thickness *(M±m)*	RNFL thickness *(M±m)*
Value, mkm	244.6±12.5	302.4±13.1	277.3±11.8	101.5±9.2

Note: RNFL — retinal nerve fiber layer

The analysis of morphometric parameters of the retina and optic nerve in patients with orbital trauma showed that the majority of patients (70%) had all the parameters within normal limits. In 7 (21%) cases, deviations of 1-2 indicators were observed, and in 3 (9%) cases we observed deviation of more than two parameters. In all cases, deviations were not pronounced.

CONCLUSIONS

1. The main ophtalmologic symptoms in orbital trauma resulting in stable loss of general capacity for work, are dystopia of the eyeball, oculomotor disorders and diplopia.

2. Complex ophthalmologic examination of patients using traditional methods and electrophysiological studies of the retina and optic nerve functioning allow to eliminate the presence of vision disorder in craniocerebral mild trauma combined with orbital trauma, which should provide an objective approach in qualifying the severity of injury.

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