HEALTH, ENVIRONMENT, DEVELOPMENT

RESULTS OF SURGICAL TREATMENT OF RETINAL DETACHMENTS DUE TO BLUNT EYE INJURY

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Summary

The article analyzes the surgical treatment of 96 patients who underwent surgery for retinal detachment. The cause of retinal detachment in all cases was an eye contusion. The author analyzed the age, gender, visual acuity before and after surgery, the cause of contusion, the time of onset of retinal detachment, concomitant pathology, type of retinal tear, surgical technique, results of ophthalmological examinations in the pre- and postoperative period, postoperative complications. The factors that affect visual functions in the early and late postoperative period were determined. Visual acuity after surgery depends on the initial visual acuity. Delaying the time of surgery leads to a decrease in visual functions in the postoperative period. Proliferative vitreoretinopathy and traumatic optic neuropathy were the most common complications that led to vision loss 6 months after surgery. Traumatic optic neuropathy is the result of trauma and is not associated with surgery. There are no effective treatments. Proliferative vitreoretinopathy is a complication of surgical treatment of retinal detachment. Repeated surgical treatment does not improve vision.

Keywords: eye contusion, traumatic retinal detachment, traumatic optic neuropathy, vitrectomy, vireoretinopathy.

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1. Introduction

Every year, 2.4 million people get eye injuries, 40 thousand of which have a persistent decreased vision, 75% have visual acuity 20/200 and less (*Pravin U.Dugel,2006)*. A third of patients develop retinal detachment after contusion (*Ferenc Kun,2008*). In patients with pathology of the posterior segment of the eye caused by contusion, retinal detachment was the most common cause of vitreoretinal surgery in patients with closed-globe injury *(Cuneyt F Erdurman, 2011)*.

According to Cox et all (*1966*), 12% of traumatic retinal tears or detachments occurred immediately and 30% within the first month after injury. Some scientists noted that 60% were diagnosed within eight months of injury *(Goffstein R., 1982).*Traumatic detachment after an

injury occurs as a result of a strong blow to the eyeball – usually a high-velocity objects, such as a ball, fist or foot. Retinal tears have specific characteristic and are of two types: retinal dialysis (usually in the superior nasal or inferior temporal quadrant) and large, round, irregular tears at the level of the equator (usually in the inferior temporal quadrant). Dialysis is associated with a detachment of the base of the vitreous body in the flat part of the ciliary body, where the detachment of the retinal pigment epithelium occurs *(Duke-Elder S., 1972)*. Large rounded tears in the inferior temporal quadrant are associated with gliosis and scarring of the surrounding retina, as well as disorganization of the underlying choroid *(Ross WH, 1981)*. The mechanism causing these breaks is described by Weidenthal and Schepens (*1966*). A blunt object impact on the eye causes direct tissue damage at the site of impact and indirect damage to the intraocular tissues under the action of the transmitted forces. This type of contusion injury is a well-known cause of rhegmatogenous retinal detachment, which, according to Eagling (*1974.*), occurs in 4-6% of such injuries. The characteristics of post-contusion retinal detachment have been described by Cox et all (*1980*), and the mechanism of tear formation has been explained by Delori et all (*1969*), who studied the effects of high-velocity objects on enucleated eyes. Experimental data indicate that retinal breaks are formed during impact of the eye. Eye injury may require a variable number of surgeries and the prognosis is unpredictable (*Natalia K Bober, 2021*).

Purpose: To evaluate the clinical features, anatomical and visual outcomes in the early and late postop period in patients with retinal detachment due to closed-globe injury.

2. Materials and Methods

Patients who were in the Dnipro Regional Clinical Ophthalmological Hospital from 2016 to 2021 were monitored. All patients underwent pars plana vitrectomy for retinal detachment. The cause of retinal detachment was a closed injury of the eyeball. The following data were analyzed: age, gender, visual acuity before and after surgery, the cause of contusion, the time of onset of retinal detachment, concomitant pathology, type of tear, surgical technique, follow-up period, postoperative complications. Statistical analysis was performed using SPSS 13.

Results: The study included 96 eyes of 96 patients who underwent vitrectomy after eye contusion. Among them were 80 men (72%) and 16 women (28%). The mean age was 34.9±9.8 years.

Among the causes of eye injury, the following were most often noted: explosions of firecrackers and fireworks – 35 eyes (36%), a blow to the eye (domestic injury) 38 eyes (39%), sports injuries 15 eyes (16%), traffic accidents 9 (9%) eye.

Total retinal detachment was diagnosed in 67.2%.

Types of retinal breaks. Dialysis tears at the ora serrata were found in more than half of the patients – in 54 eyes (56%), 27% of which were located in the inferio-temporal quadrant, 11% in the upper-temporal, 9% in the upper-nasal, and 2% in the inferio-nasal.

3. Examinations of the patients

The best corrected visual acuity (BCVA) is summarised in Table 1, which shows that 4 patients (3.1%) saw 20/25 or better and 25 (29,3%) patients were 20/200 or worse. All patients were divided in the groups according to the initial visual acuity (Table 1).

Table 1

Preoperative BCVA (Snellen)

BCVA	No	%
20/25 – 20/20	4	(3,1%)
20/32– 20/50	8	(6,2%)
20/63 – 20/100	59	(61,4 %)
20/200 and less	25	(29,3%)

The presence of retinal detachment was associated with poor visual outcome (<20/100), (P<0.001).

19 patients had complications, that affected visual acuity, among tham were vitreous haemorrhage in 6 patients (31,5%), hyphaema in 4 patients (21%), macular hole in 2 patients (10,5%), choroidal tears in 4 patients (21%), proliferative vitreoretinopathy in 3 patients (16%), (Table 2).

Table 2

Associated ocular injury

	No	%
Vitreous haemorrhage	6	31,5
Hyphaema	4	21
Macular hole	2	10,5
Choroidal tears	4	21
Proliferative vitreoretinopathy	3	16

The follow-up period was 6 months (range, 1 to 18 months).

Time of onset of retinal detachment

from 1 day to 4 weeks – 12 eyes (13%)

4 weeks – 8 weeks – 16 eyes (16%)

2 months – 6 months – 18 eyes (19%)

6 months – 1 year – 50 eyes (52%)

From the moment of diagnosis of retinal detachment to the surgical treatment, it took from 3 days to 2 months, in average 14 days.

All patients underwent a standard three-port vitrectomy using 25 gauge instruments, endolaser coagulation of the retina, tamponade with silicone oil or gas. Surgical reattachment of the retina was successful in 96% of eyes

4. Postoperative visual acuity

A significant positive correlation was obtained between the initial and final visual acuity during surgical treatment (P<0.05). Postoperatively, final visual acuity of 20/50 and above was achieved in 35 eyes (36.5%), and in 11 eyes (11.4%) visual acuity was below 20/200 (poor visual outcome). The postoperative visual acuity is summarised in Table 3.

There was also an inverse correlation between the time of vitrectomy and postoperative visual acuity (P<0.05). Patients with delayed vitrectomy (more than a month after diagnosis) had an average postoperative visual acuity 20/100 and lower compared to early surgical intervention.

Table 3

Postoperative BCVA (Snellen)

BCVA	No	%
20/25 – 20/20	7	(7.3%)
20/32– 20/50	28	(29,2%)
20/63 – 20/100	50	(52%)
20/200 and less	11	(11,5%)

5. Complications

With further observation in the period up to 6 months, a decreased of visual function was noted in 31.1% of cases (30 eyes). Of these, 15 eyes (50%) due to the development of proliferative vitreoretinopathy, 9 eyes (30%) due to posttraumatic optic neuropathy and 6 eyes (20%) due to macular complications.

Posttraumatic proliferative vitreoretinopathy (PVR) is one of the actual and unresolved problems in ophthalmology. It is a complication of rhegmatogenous retinal detachment or severe eye injury (intraocular foreign body, penetration, perforation, contusion, rupture). According to statistics, the risk of PVR ranges from 10 to 40% in rhegmatogenous cases *(Bernd Kirchhof, 2004).* In the case of traumatic retinal detachment, this number is increasing. All 15 patients complained of decreased vision, fog, changes in peripheral vision. Ophthalmoscopy revealed the presence of subretinal membranes and the presence of traction retinal detachment. No relationship was established with the type of injury and preoperative visual function. Repeated surgical intervention in all patients did not lead to improvement in vision.

The development of macular holes, scarring of the macula, macular folds are both a complication of vitrectomy and contusion. Surgical treatment does not improve vision due to the death of retinal photoreceptors.

Traumatic optic neuropathy (TON).The exact pathology of indirect TON is not well understood. The optic nerve dura is continuous with the orbital periosteum, leaving the optic nerve susceptible to transmission of force from blunt trauma. Indirect TON has been hypothesized to result from shearing injury to the intracanalicular portion of the optic nerve, which can cause axonal injury or disturb the blood supply of the optic nerve. It has also been suggested that the optic nerve may swell in the optic canal after trauma resulting in increased luminal pressure and secondary ischemic injury *(Yu-Wai-Man, 2015)*. The management of TON is controversial, however, the data in the literature to date has not shown any treatment to be superior to observation (*Wladis EJ,2020).*

Examination of patients revealed: decreased visual acuity, changes in color vision (dyschromatopsia), afferent pupillary defect, visual field deficits. All patients underwent CT scan or MRI to rule out concomitant brain pathology. Further follow-up was recommended. No relationship with the type of the injury and visual functions before surgery was found.

6. Conclusions

1. In patients with pathology of the posterior segment of the eye caused by ocular trauma, retinal detachment was the most common cause of vitreoretinal surgery.

2. Prognostic factors associated with poor outcomes included delayed time of surgery, visual acuity less than 20/100.

3. The main causes of vision loss in the long-term period were proliferative vitreoretinopathy and traumatic optic neuropathy.

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