

CORNEAL INJURIES IN CLOSED GLOBE OCULAR TRAUMA: A CASE STUDY

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Abstract: The present study aims to identify the characteristics of corneal damage cases in the context of closed globe ocular trauma. The study population were patients presenting closed globe injury from the Department of Ophthalmology of the County Emergency Hospital of Sibiu (2008-2016). Of the 111 cases with corneal damage, 68% were with edema, 40% were with erosions and 5% were ulcers. The most common trauma was contusion (57%). Contact with an object or an undetermined intent was the most common circumstance in which corneal damage was identified (66%) and the zones most coincident with corneal damage was zone II. Of the cases with corneal damage over 30% were situation of light perception/hand movement and also 30% were with AVI ³ 0.5 and at discharge visual acuity was improved: 70.27% had AVE ³ 0.5. Of the total number of corneal injury cases, 67% had a normal intraocular tension at admission while at discharge 85% of cases had a normal tension. Therapeutic contact lenses are a good choice in corneal erosions, provide binocular visual acuity, relief pain and do not impair driving and working.

INTRODUCTION

In the majority of ocular trauma cases either open or closed globe injuries, the anterior segment bears the consequences of direct or indirect forces. The specialized structures of the eye have limited repair capabilities resulting in nonfunctional scars. Blunt ocular trauma may also damage the posterior segment of the eye, although this is less likely to happen in the absence of anterior segment damage. This can happen when traumatic injury is applied directly to the sclera.(1)

Focal or generalized lesions of the cornea are frequent but usually heal within 24-48 hours. The symptoms can be alarming for the patient and they can also be the reason why they present to the emergency room. The symptoms are decreased visual acuity, pain, foreign body sensation, photophobia and hyperlacrimation.

PURPOSE

In this study, an attempt was made to identify the characteristics of corneal damage cases in the context of closed globe ocular trauma. The therapeutic options and their result were also presented.

MATERIALS AND METHODS

Study population

The subjects are patients presenting closed globe injury from the Department of Ophthalmology of the County Emergency Hospital of Sibiu, between 2008-2016. A total of 194 injured eyes were analyzed. Of the 194 injured eyes, 111 (57.2%) were cases with corneal damage and were considered for this study.

The inclusion criteria were: closed globe injury according to BETT classification, the traumatic injury must have happened in 24 hours before the patient presented to the

emergency room, all the data followed in the study have to be completed in the admission papers (visual acuity, intraocular pressure, anterior and posterior pole examination on admission and discharge).

The exclusion criteria were: open globe injury, chemical or thermal injury of the eye, any type of other ocular trauma before the presenting incident, presentation to the emergency room after 24 hours since the traumatic incident.

This is a prospective and retrospective study. Best corrected visual acuity and intraocular pressure was measured on admission and discharge. Visual acuity was determined using a Snellen chart and intraocular pressure was measured using a rebound tonometer. Anterior and posterior pole were examined on a slit lamp with Zeiss illuminating system and posterior pole examination was made with 90D and 78D lens.

According to the affected area we have the following 3 zones: Zone I – superficial lesions of bulbar conjunctiva, sclera and cornea; Zone II – anterior chamber, iris and lens; Zone III – retina, vitreous, optic nerve and uvea.

According to the type of trauma like contusions, lacerations (non penetrating), superficial foreign bodies and mixed mechanism were considered.

Visual acuity was classified in the following groups: 1 for ≥ 0.5 (1/2), 2 for 0,3 – 0,2 (1/3 – 1/5) (including), 3 for 0.16 – 0.025 (1/6 – 1/40), 4 for 0.02 (1/50), counting fingers, hand movement, light perception and 5 for no light perception.

For every patient we have measured the intraocular pressure and we classified it as follows: ocular hypotension (≤ 9 mmHg), normal tension (10 – 21 mmHg), ocular hypertension (≥ 22 mmHg).

Data analysis

Data analysis was conducted using IBM SPSS Statistics v20 and Microsoft Office Excel v13 software (2,3). The results were presented in numerical and percentage, both for

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the whole group and for subgroups. For comparison Chi-Square test (4) was used considering significance level at 0.05.

RESULTS

Demographic Characteristics

Of the 111 cases with corneal damage, 68.5% (N = 76) were edema, 39.6% (N = 44) were erosions and 5.4% (N = 6) were ulcers.

78.38% of those with damaged corneas were men (p=0.000). Edema and ulcer were present in both men (edema: 68.97%, ulcer: 5.75%) and in women (edema: 66.67%, ulcer: 4.17%) in over 65% respectively 5%, while in the case of erosion it was present in 54.17% of women and less in males (35.63% of males).

Regarding the environment of origin, 54.05% of cases with corneal damage were from rural areas (p=0.393). Erosion and ulcer were approximately 40% and respectively 5% both in rural patients (erosion: 38.33%, ulcer: 5%) and in the urban patients (erosion: 41.18%, ulcer: 5.88%). In the case of edema the percentage of urban cases (72.55%) is slightly higher than in rural areas cases (65%).

Traumatized eye

Corneal injury was identified in 50% of both the left eye (49.55%) and the right eye (50.45%). Cases of erosion and ulcer were more to the left eye (erosion: 49.09%, ulcer: 7.27%) than to the right eye (erosion: 30.36%, ulcer: 3.57%) while in case of edema there were more cases in the right eye (71.43%) than in the left eye (65.45%)

Trauma type

The most common trauma in case of corneal injury were contusion (56.76%), followed by mixed injuries (25.23%), lamellar lacerations (14.41%) and less superficial foreign bodies (3.60%) (p=0.000).

Edema occurred in 80.95% of contusion cases, 64.29% of mixed trauma cases, 50% of superficial foreign bodies cases and only in 31.25% of lamellar lacerations cases.

Erosion had 50% of cases with lacerations and the same percentage in cases with foreign bodies, respectively 42.86% of cases of mixed trauma and only 34.92% of cases of contusions.

The ulcer was present in 25% of cases of superficial foreign bodies, 12.50% of cases of lamellar lacerations, respectively, in 7.14% of mixed trauma and 1.59% of contusions.

Figure no. 1. Epithelized cornea at 24 hours after treatment



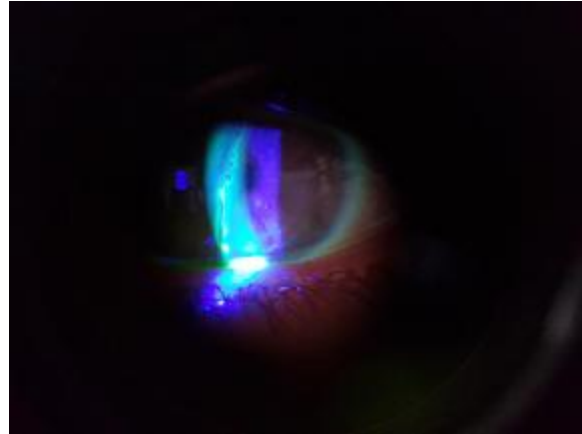
Trauma circumstances

Contact with an object or an undetermined intent was the most common circumstance in which corneal damage was identified (65.77%) followed by wood trimming (10.81%),

while the person was at work (10.81%), physical force aggression (8.11%) and road accident (4.50%) (p=0.000).

80% of cases in which the production circumstance was a road accident showed edema, in other situation edema cases occurring at a percentage ranging between 66.67% - 68.49% of cases. Erosions were present in 50% of the cases when the person was working, 41.10% of the cases when de circumstances was contact with an object or indefinite intention, 33.33% of the cases of aggression and wood cutting and in 20% of the cases of road accident. Only 33% of the cases when the person was working and 2.74% of contact with an object or an indefinite intention coincided with ulcer situations.

Figure no. 2. Corneal laceration after mixed trauma in coloration with fluorescein



Zone

The hierarchy of zones coincident with corneal damage is as follows: 45.95% of the area II and respectively the corneal affection also coincided in 38.74% of cases with zone I and in 15.32% of cases with zone III (p=0.000).

The edema coincided with the damage of the first zone in 26.32% of the cases but most cases of edema being encountered in the cases that affected the zone II (57.89%) respectively in only 15.79% of the cases that affected the zone III.

In case of erosion and ulcer the situation is different. In the case of erosions, most cases were when the affected area was zone I (56.82%) and in 34.09% of the cases was affected zone II respectively in 9.09% of cases was affected zone III.

In the case of ulcers, 50% of these were encountered when zone I was affected, and the remaining 50% when zone III was affected.

Visual Acuity (Initial (AVI) and at discharge (AVE))

Of the cases with corneal damage, 34.23% were situation of light perception/hand movement, 31.53% were with AVI \geq 0.5, 18.02% with AVI between 0.16-0.025, 15.32% with AVI between 0.3-0.2 (p=0.000) and only one case was without light perception

In the case of edema 43.42% were cases with light perception, 23.68% with AVI \geq 0.5, 17.11% with AVI between 0.16-0.025, 14.47% with AVI between 0.3-0.2 while at erosions 40.91% of cases had AVI \geq 0.5, 27.27% FPL, and 15.91% were AVI between 0.16-0.025 respectively with AVI between 0.3-0.2.

In the case of ulcers, 66.67% were AVI between 0.16-0.025 and one case (16.67%) with AVI \geq 0.5 and one (16.67%) with light perception.

For the whole group of patients, visual acuity at discharge improved, so 70.27% had AVE \geq 0.5 and

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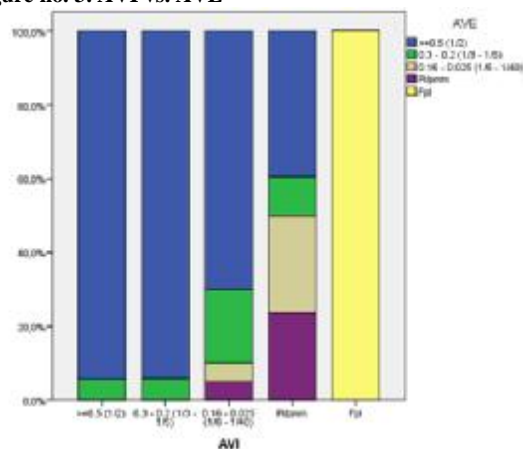
approximately 10% for each of the other situations. Over 80% of cases of erosion or ulcer had $AVE > 0.5$ and in the case of edema this AVE value was found in over 60% of cases.

94.1% of cases with AVI between 0.3-0.2 had at discharge the $AVE > 0.5$.

70% of cases with AVI between 0.16-0.025 had $AVE \geq 0.5$ and 20% had AVE between 0.3-0.2.

Of the cases with intuitive light perception, 39.5% had $AVE \geq 0.5$, 26.3% had AVE between 0.16-0.025 and 10.5% were cases with AVE between 0.3-0.2 while 23.7% remained without light perception.

Figure no. 3. AVI vs. AVE



Intraocular tension at admission and discharge

Of the total number of corneal injury cases, 66.67% had a normal intraocular tension at admission, 29.73% being hypertension and the rest with hypotension (3.60%) ($p=0.000$). Normal tension at admission occurred in over 80% of cases with edema and ulcer (approximately 15% of hypertension) and in only 57.89% of those with erosion (in this case hypertension with 38.16% of patients).

At discharge, 84.68% of cases had a normal tension, 9.01% being with hypertension and 6.31% with hypotension. From the tension evolution point of view, the best evolution was in the case of erosions (93.18% cases with normal tension at discharge) followed by ulcers (83.33% of cases with normal tension at discharge and no cases of hypotension) and then edema (78.95% normal, 13.156% hypertension and 7.89% hypotension)

DISCUSSIONS

The following characteristics of corneal damage cases in the context of closed globe ocular trauma were extracted using data pre-processing (5) and data analysis (6): 68% were with edema, 40% were with erosions, 5% were ulcers, most common trauma was contusion (57%), followed by mixed injuries (25%), lamellar lacerations (14%) and less superficial foreign bodies (4%). Contact with an object or an undetermined intent was the most common circumstance in which corneal damage was identified (66%) followed by wood trimming (11%), at work (11%), physical force aggression (8%) and road accident (4%). The hierarchy of zones coincident with corneal damage is: zone II (46%), zone I (39%) and zone III (15%). Of the cases with corneal damage over 30% were situation of light perception/hand movement or $AVI \geq 0.5$, under 20% were with AVI between 0.16-0.025 or with AVI between 0.3-0.2 and only one case was without light perception. Visual acuity at discharge improved: 70.27% had $AVE \geq 0.5$ and approximately 10% for

each of the other situations. Of the total number of corneal injury cases, 67% had a normal intraocular tension at admission, 30% being hypertension and the rest with hypotension (3%). At discharge, 85% of cases had a normal tension, 9% being with hypertension and 6% with hypotension.

Focal or generalized lesions of the cornea are frequent and most of them caused by contusions, mixed mechanism or superficial foreign bodies. Most lesions such and corneal erosions, superficial foreign bodies, or edema heal quickly and resolve without affecting the visual acuity. Prolonged corneal edema can be caused by breaks in the Descemet's membrane or by damage of the endothelial cells. One way to monitor the endothelial cells is to perform specular microscopy to these patients. Corneal endothelium is in general resistant to blunt trauma and recovers quickly. Corneal scars usually appear after a full thickness perforating injury and not usually after closed globe injuries.

This symptom is caused by the superficial lesions of the cornea and because it is very well innervated. The cornea is the most densely innervated structure of the body. The cornea has between 50 to 450 sensory trigeminal neurons that transmit the impulses to the ophthalmic division of the trigeminal nerve, cranial nerve V.(7) Corneal lesions are so painful because it has free nerve endings in the corneal epithelium. The treatment in this symptoms consists in epithelization drops or gels and eye patch for 24 hours. Antibiotics drop are usually used in the treatment of corneal erosions and abrasions; the use of antibiotics is mandatory in the treatment of corneal ulcers.

An eye patch has some disadvantages like reduced visual field and the lack of stereoscopy which can impair the patient's ability to work or drive. In this case a therapeutic contact lens can be applied. According to a paper published by Professor Adriana Stanila (8,9,10), therapeutic contact lenses, provide a high oxygen supply, relief pain caused by blinking, restore stereoscopy and provide a normal binocular visual field. This practice is somehow reduced in our country because of the price of the therapeutic contact lens, the lack of these medical devices in their practice, therefore not all practitioners offer this option to the patients. We consider therapeutic lens of great value in restoring visual acuity and are comfortable and safe to use.

CONCLUSIONS

Corneal posttraumatic injuries are more frequent in men. The incidence for the traumatized eye is the same, there is no significant predisposition for the right or the left eye.

The most frequent trauma mechanisms that lead to corneal damage were contusions in 56.76% followed by mixed mechanism in 25.23% of cases.

Contact with an object or undefined intent was the most frequent circumstance in which corneal injuries were identified, 65.77.

In 80% of cases in which the circumstance of trauma was a road accident patients presented with corneal edema.

For the entire patients take into study visual acuity improved at discharge in 70.27% of cases to ≥ 0.5 . On discharge 84.68% of cases had normal tension, 9.01% had ocular hypertension and 6.31% hypotension.

Therapeutic contact lenses are a good choice in corneal erosions, provide binocular visual acuity, relief pain and don't impair driving and working. If we do not apply a therapeutic contact lens it is recommended to patch the eye for the next 24 hours. Antibiotic treatment and epithelisation drops are usually recommended.

It is mandatory to use antibiotics in corneal ulcers and to monitor the patient during treatment.

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Corneal edema usually clears, if there is no endothelial cell damage caused by the traumatic incident.

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