

Original article



INJURIES OF EYE AND ITS ACCESSORY ORGANS

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ABSTRACT:

The traumas of eye and orbit are important for the ophthalmological practice because they are a leading cause of the irreversible blindness of people employable by age. The main method is comparative analysis of the data. Data from scientific literature on the subject were used in connection with the analysis. Results and discussion: The main types of injuries of the eye are reviewed in the article. The therapeutic measures in the presence of injury to an eye - according to its type and severity - are discussed. Conclusion: The injuries of the eye and its accessory organs are among the leading causes for irreversible blindness of people employable by age and have a social and economic effect.

Keywords: injury of eye, closed eye trauma, open eye trauma

INTRODUCTION

The traumas of eye and orbit are important for the ophthalmological practice because they are a leading cause of the irreversible blindness of people employable by age. They may be isolated, or a part of head traumas and the whole body. They may be related to presence or absence of a foreign body. Men in active age are most frequently involved.

MATERIAL AND METHODS

The main method is comparative analysis of the data. Data from scientific literature on the subject were used in connection with the analysis.

RESULTS AND DISCUSSION

The recognized international classification of eye traumas is Birmingham Eye Trauma Terminology System (BETTS). The traumas - according to it - are closed and open. There is no interruption of the entire thickness of the fibrous layer of the eyeball in connection with the closed traumas, while in connection with the open traumas, the entire thickness of the fibrous layer of the eyeball is interrupted. The rupture occurs as a result of blunt trauma, while the laceration is a result of the action of the sharp object. The penetrating wound has only one opening, while there is an incoming and outgoing opening in connection with the perforating wound. According to the severity of the in-

jury, the eye traumas are mild ones, traumas of middle grade, and severe traumas. [1, 2, 3]

The conjunctival haemorrhages, the corneal and conjunctival foreign bodies, the erosions, the thermal traumas of mild grade (first grade), the injury from ultraviolet light are defined as mild traumas.

The lacerations of eyelids and lacrimal system, the lacerations of the conjunctiva, the stromal corneal foreign bodies, and the burns of second grade are defined as traumas of middle grade.

The severe impairments in connection with eye trauma are the penetrating injuries, the lacerations of eyelids with the absence of tissue, the fractures of orbit, the traumatic the traumatic hemophthalmia, the chemical burns of second grade or higher, and the injuries from ionizing radiation.

It is important to know that the treatment of eye traumas falls within the competence of ophthalmologist. Patient must be transported to specialized healthcare institution immediately after providing of first medical aid. The latter includes administration of antibiotic or sulphonamide drops in the injured eye and sterile dressing, which to prevent the superimposing of additional infection. The tetanus vaccine is administered in connection with the interruption of the integrity of eyelids or eye. If the patient has not been immunized for tetanus, antitetanus serum is administered. Broad-spectrum antibiotics and analgesics are also administered. [3, 4, 5]

Corneal and conjunctival foreign bodies are among the most frequent reasons for seeking emergency ophthalmological aid. The foreign bodies are most frequently metal, but they could also be non-metal. (fig.1) Patients report of the way of the foreign body getting into the eye, for example in connection with flex cutting. They complain of pain upon blinking, irritation, tear secretion, photophobia, blepharospasm. If a metal magnetic foreign body stays a long time, rust penetrates in the stroma of cornea and causes a reaction - the symptoms intensify, and injection (hyperemia) of the conjunctiva occurs. The non-metal foreign bodies as the glass usually do not result in a severe reaction. The organic bodies may cause a reaction or superimpose of infection. If no foreign body is found upon the examination, turning of the eyelids is necessary, as well as inspection of the fornices. In order to be found superfi-

cial defects or the foreign body itself, the dye fluorescein is used. The removal of foreign body from the cornea and conjunctiva is done by a needle or a lancet upon local anaesthesia. Administration of antibiotic drops and ointment for five to seven days is necessary, and also anti-inflammatory therapy upon pronounced concomitant reaction of inflammation. [4, 5, 6]

Fig. 1. A metal foreign body (“shaving”) in the cornea.



Erosions (epithelial defects) of the cornea may be caused by trauma, scratch, foreign bodies retained on the eyelids. Patients complain of severe pain, irritation, sense of a foreign body, tear secretion. A defect of the corneal epithelium is found upon biomicroscopy; it is best visible with the blue filter after fluorescein eye stain. The defect usually epithelializes again in several hours. Antibiotic drops and ointment are administered for prophylaxis of infection. The recovery is facilitated when the eye is closed under dressing. Sometimes the new epithelium does not grow well within its basement membrane, and after some time, it may separate, which results in the formation of **re-lapsing erosion**. The latter occurs most frequently in the morning upon waking up and is accompanied by severe pain, photophobia, tear secretion, reduced vision. The therapy includes frequent administration of moistening drops and gels, possibly bandage soft contact lens. Abrasion of the epithelium or eximer laser keratectomy may be performed in severe cases. [6, 7, 8]

Upon injuries of the eye, its external covering - the conjunctiva - may lacerate. The **conjunctival laceration** is usually accompanied by subconjunctival hemorrhagia. Patients report of trauma, and complain of a sense of a foreign body and “haemorrhage in the eye”. The defect of the conjunctiva may be covered with epithelium and, sometimes, it may be visualized only by the use of fluorescein. Exclusion of any underlying rupture of sclera is necessary. The small lacerations do not require treatment, while the bigger are stitched with a resorbable suture. Antibiotic drops are administered.

Blunt trauma (contusion) of the eye may cause different - by degree and type - damages according to the size and strength of the object that caused the injury. That may be tennis balls, fists, stoppers of champagne, stones, horns or tails of cattle. The impact results in deformation, which presses the eye tissues and may cause lacerations. The anterior chamber of the eye or the vitreous body may possibly be filled with blood (hyphema, respectively hemophthalm), and the underlying structures may not be examined. Performing of echographic examination is well-grounded in those cases. The trauma may cause partial or complete avulsion of root of iris (iridodialysis), laceration of the angle of anterior chamber of eye, of the ciliary body (cyclodialysis), of suspensory ligaments of the lens, and dislocation of the lens, separation of the vitreous body, rupture and detachment of the retina, traumatic cataract, edema of the retina, ruptures of the choroid, traumatic retino-choroideopathy, trauma and/or laceration of the optic nerve, avulsion of the eyeball, retrobulbar hematoma, rupture of the eyeball, fracture of the orbit. Various combinations of the listed impairments are possible. The therapeutic approach is different according to the severity and localization of the lesions. The vision is irreversibly lost upon avulsion of the eyeball when the latter is outside of the orbit, and the optic nerve is interrupted. Enucleation is performed in that case. In connection with traumatic retino-choroideopathy, severe trauma, and laceration of the optic nerve, the vision is usually irreversibly impaired; therefore there is no specific therapy. The vision may remain good upon ruptures of the choroid if the central part of the eye fundus is not involved. The traumatic edema of retina responds well to the infusion of saline solutions. The laceration and traumatic detachment of the retina are treated surgically with pars plana vitrectomy. The lacerations of the pupillary sphincter lead to traumatic mydriasis, which may be temporary or permanent. Therapy with miotics may be attempted, but it is frequently without any particular success. If there is irritation by light, the use of sunglasses is appropriate. Severe iridodialysis requires stitching to of the root of iris. Intraocular lens with a tinted pupil or with artificial iris may be implanted in connection with total aniridia and concomitant cataract. Upon presence of cyclodialysis, the ciliary body is stitched to in order to be prevented the phthisis (shrinkage and atrophy) of the bulb of the eye to be prevented. Late complications of the blunt trauma are cataract, glaucoma, and detachment of the retina. Severe contusions may lead to rupture of the sclera, most frequently in the area of the limbus, at the insertions of the rectus muscles or along the edge of the optic nerve. There is a possibility the integrity of the conjunctiva - covering the defect - to be without any interruption due to its elasticity. In the latter case before stitching the sclera, a revision and incision of the overlying conjunctiva are necessary. [8, 9, 10, 11]

In connection with blunt trauma, **fractures of the orbit** may occur, and, at the same time, the thinnest part - the floor of orbit - is usually affected; the latter borders on the maxillary sinus. The orbital adipose tissue and inferior

rectus muscle may possibly be involved in the fracture. Upon rupture of the medial wall, air may infiltrate from the side of the ethmoidal sinus, which may result in emphysema of the eyelids, and a diagnosis of the latter as crepitations to be made. The sound bones along the edge of orbit usually remain with preserved integrity. The clinical manifestation in connection with fractures of the orbit is different; there is the presence of ecchymosis over the eyelids and in orbit. Upon involvement of the inferior rectus muscle, the complaints involve double vision, especially in connection with an upward glance. After resolution of the edema, the double vision may worsen, the eye may sink in the orbit, and the palpebral fissure may narrow. Involvement of the infraorbital nerve may lead to disturbance in the sensation in the area affected. It is necessary to be avoided inflating and blowing of the nose - upon the presence of crepitations - so that no air or pathogens penetrate the orbit. The roentgenography and computed tomography are on the basis of making the diagnosis. In order to be avoided complications - mostly due to the involvement of the inferior rectus muscle - the reconstruction must be done within several days in co-operation with a neurosurgeon.

Upon a blunt trauma of eye, haemorrhage within the anterior chamber may occur - **hyphema**. Those affected complain of vision reduced to a different degree. The therapy includes rest, holding the head in high position, which allows the blood to gravitate, treatment with vitamin C or rutascorbin as capillarotonics, ethamsylate, intake of more liquids. Hypotensive ocular therapy is necessary upon increased intraocular pressure. Hyphema may develop rarely in connection with neovascularization of the iris caused by diabetes, vascular occlusions of the retina or inflammations. [11, 12, 13]

The blunt trauma of the eye may lead to **dislocation of the lens**. It may be complete, when the lens "has fallen" in the vitreous body - luxation, or partial, when it is only shifted - subluxation. Besides trauma, other causes could be a weakness of the ligaments of the lens - degenerative changes (pseudoexfoliation syndrome), hereditary diseases (syndrome of Marfan, hyperlysinemia, homocystinuria), eye tumours. Slight shifting may not cause complaints, while greater one may result in worsened vision. Upon examination, the condition of severe hypermetropia is found, tremulousness of the iris and lens (irido- and phacodonesis), as well as the shifting itself after mydriasis. In connection with risk from glaucoma and reduced vision, surgical removal of the lens is imperative. Even upon subluxations without any serious disturbances of the vision, if the cause is a trauma, cataract develops within months or years, which requires operative removal of the lens.

Upon **penetrating injuries**, the integrity of the eyeball is interrupted in its entire depth. They may be with or without the presence of a foreign body. If the foreign body moves with high velocity, there is a possibility of it passing through the eyeball - incoming and outgoing opening

will be found then. Upon penetrating injuries of the eye, administration of tetanus toxoid is obligatory. **Penetrating injuries without a foreign body** according to their localization involve the cornea or the sclera. When the latter injuries are small, they may be covered with epithelium, while the eye preserves its tone and form. The danger in those cases is related to the occurrence of infection, which may lead to loss of the eye. The treatment includes antibiotic drops, and also systemic antibiotics and anti-inflammatory therapy as needed. The big wounds of the cornea lead to the emptying of the anterior chamber of the eye, sometimes accompanied by prolapse of the iris. The wounds of the sclera are related with prolapse of the uvea, retina, and vitreous body. In those cases, the eye has reduced tone and is sometimes deformed. If the lens is involved, it may quickly grow turbid and swell up. That may cause an increase in the intraocular pressure. In connection with a perforating injury, as a rule, the outgoing opening has bigger sizes. The inspection of the posterior segment may be difficult due to the presence of hyphema, hemophthalm, or cataract. The first medical aid in connection with penetrating injuries of the eye includes irrigation with sterile serum, application of antibiotic drops, sterile dressing and transport towards an ophthalmosurgeon, who is able to recover the integrity of the eyeball. The prolapsed parts are irrigated with sterile serum, they are gathered, or excision is performed. The wounds of the cornea and sclera are stitched. The conjunctiva is stitched as well. In connection with excision of prolapsed choroid, retina and vitreous body, cryo- or thermo-coagulation is performed around the wound in order to be prevented the separation of the retina. Irrigation with an antibiotic of the anterior chamber may be performed according to the assessment made; injection of an antibiotic in the vitreous body is also possible. Systemic antibiotic therapy is initiated. Upon great lacerations, when the integrity of the bulb of the eye cannot be recovered, enucleation may be undertaken. [7, 9, 11]

The **foreign bodies** in connection with penetrating injuries may be metal or non-metal, single or multiple. The metal foreign bodies are frequently magnetic and get into the eye upon knocking of metal on metal. When they remain in the anterior chamber, they gravitate in the inferior sections of the angle of the anterior chamber. If they pass through different ocular tissues, they leave openings, and the foreign body may be reached upon their tracing. In all cases upon the suspected foreign body, the roentgenographical examination is obligatory, which assists for its proving and localization. The surgical removal of the foreign bodies from the eye in terms as brief as possible is as a rule necessary. That is especially valid for magnetic foreign bodies and metal foreign bodies containing copper, which are toxic for the tissues. Pars plana vitrectomy is the most suitable for extraction of foreign bodies from posterior segment of the eye, while in connection with those in the anterior segment of the eye direct access is used. The non-metal foreign bodies may have a non-organic or organic origin, while the organic has hidden in plain sight - high risk of infection. After removal of

the foreign body, treatment with systemic and local antibiotics, corticosteroids and non-steroid anti-inflammatory drugs is performed. [5, 11, 13]

The injuries with **lacerations of the eyelids** may occur upon trauma of the face. (fig.2, fig.3) Upon profuse blood supply of the area, profuse bleeding is characteristic for them. Massive hematomas and pronounced edema occur frequently due to the specifics of the connective tissue. The injuries may be superficial abrasions, piercing injuries, lacerations including those resulting from blunt trauma or bite. Surgical manipulation and layer-by-layer adaptation of the defects are necessary. Particularly noteworthy are the lacerations, which involve the palpebral edge, as well as those involving the internal edges and lacrimal ducts, because scar complications may occur in connection with their recovery. Upon involvement of the lacrimal system, the recovery of the integrity of the eyelids is necessary to be performed by an ophthalmologist, while sometimes implantation of silicone stent is required for several months. The edema of the eyelids responds well to cool compresses. [9, 10, 11]

Fig. 2. Hematoma of the eyelids after blunt trauma.



Fig. 3. A lacerated contused wound of the palpebral edge.



CONCLUSION

The injuries of the eye and its accessory organs are among the leading causes of the irreversible blindness of people employable by age and have a social and economic effect.

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Please cite this article as: Dimitrov T. Injuries of Eye and its accessory organs. *J of IMAB.* 2017 Oct-Dec;23(4):1795-1799. DOI: <https://doi.org/10.5272/jimab.2017234.1795>

Received: 25/08/2017; Published online: 07/12/2017



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