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CORRELATIONS BETWEEN SECONDARY GLAUCOM AND OCULAR HIPERTONY AFTER BLUNT TRAUMA

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Abstract: *Blunt trauma represents a common finding in the ophthalmology department. Some patients after blunt trauma have a peak in intraocular pressure. This peak can be transitory or it can damage de the optic nerve, causing secondary glaucoma. Secondary glaucoma is an insidious disease that can appear immediately after trauma or many years later. We tried to determine the most common injury mechanism that rises the ocular pressure and the circumstances in which they happen. Also, we are looking to see if we can find a correlation between age, gender and environment.*

Key words: *secondary glaucoma, cloded globe injury, ocular hypertension.*

1. Introduction

The rise of intraocular pressure is a common finding in the ophthalmology emergency room after blunt trauma. There can be on or more mechanism involved. The incidence of posttraumatic glaucoma is hard to estimate because of low patients' compliance and the long period these optic neuropathies can appear. Intraocular pressure can be an accidental finding many years after trauma and in some cases the patients does not remember the incident at first or at all.

2. Objectives

Our objective is to determine the incidence of ocular hypertension or posttraumatic glaucoma after closed globe injury, to determine the most common mechanism of trauma and circumstances. Also, we wish to study what were the therapeutic options and their result.

3. Material and Method

We conducted a retrospective-prospective study in the Department of ophthalmology of County Emergency Hospital of Sibiu, between 2008-2016. There were enrolled in this study a number of 194 injured eyes.

The inclusion criteria were closed globe injury using Birmingham Eye Trauma

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Terminology System (BETTS), presenting time from the trauma less than 24 hours.

The exclusion criterion was open globe injury, chemical or thermal injury of the eye.

Other exclusion criteria were: any type of pre-existing glaucoma, other ocular trauma before the presenting incident.

Clinical examinations of the patients was made in the Department of ophthalmology and included: history of injury, visual acuity, intraocular pressure, slit lamp examination of the anterior and posterior pole.

Diagnostic of glaucoma was in correlation with European Society of Glaucoma Guidelines.

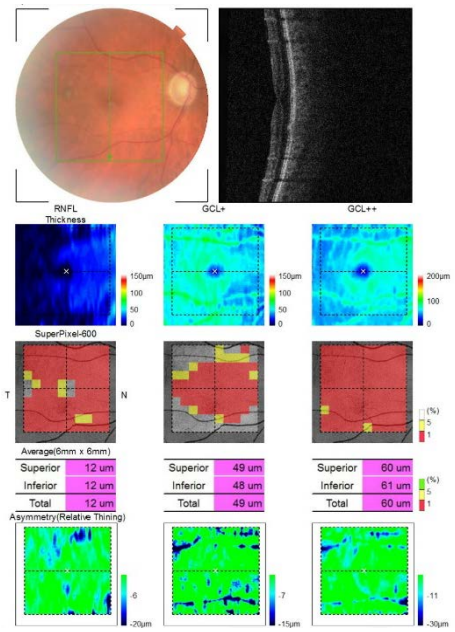

Fig. 1. *Ganglion cells OCT of a patient if secondary glaucoma performed on TOPCON OCT 3D 2000 (personal case)*

In the diagnostic we took in consideration intraocular pressure, optic disc appearance, visual field and Ocular coherence tomography of optic nerve and macula.

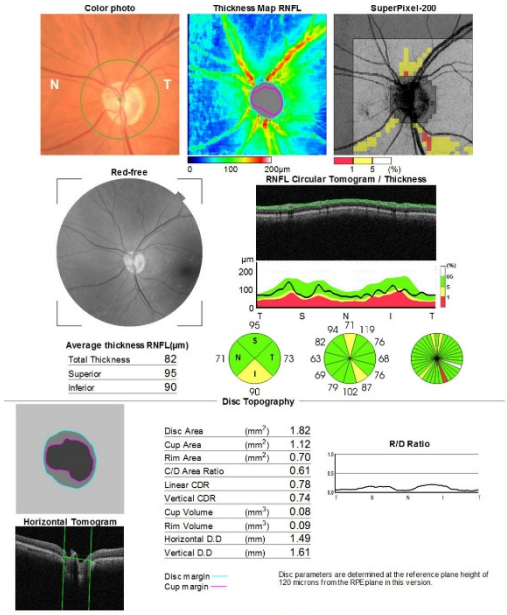

Fig. 2. *Optic nerve OCT of a patient with secondary glaucoma and RNFL defect in the inferios segment performed of TOPCON OCT 3D 2000 (personal case)*

In processing the data we evaluated: age, gender, location, cause and mechanism of injury, visual acuity on admission and demission, intraocular pressure on admission and demission, presence of hiphema, lens malpositions or cataract.

We grouped visual acuity as follows:

1	≥0.5 (1/2)
2	0,3 – 0,2 (1/3 – 1/5) (including)
3	0.16 – 0.025 (1/6 – 1/40)
4	0.02 (1/50), couting fingers, hand movement, light perception
5	without light perception

The mechanisms of injury were classified as follows:

1	Contusion
2	Lamellar Laceration (partial thickness)
3	Superficial foreign body
4	Mixed

Circumstances of injury where also classified as seen in the table below:

1	While being engaged in work
2	Contact with an object, undeterminate intent
3	Aggression by physical force or the use of a blunt object
4	Road accident
5	While Cutting wood

Data analysis was performed using SPSS Statistics (v. 20) [5] and Microsoft Excel 2013[7]. For continuous variables was first checked the normality criterion and variable description was made using indicators mean, standard deviation (SD), percentiles (P25, P50, P75) and for comparison we used Student T-Test. In case of categorical variables frequencies and percentages were computed and for comparison the Chi-Square test, Odd Ratio (OR), Relative Risk (RR) and 95% confidence interval (CI) were used. A p value less than 0.05 was considered statistically significant. [4]

4. Results and Discussions

During our study we examined among 10 (2016) and 33 (2013) patients, with an average on the 9 analysed years of M= 21.55 (SD=7.58) patients. The low number of patients in 2016 is caused by the fact we included only the 6 months of 2016 in the study.

For all the analysed period, in February were examined the fewest patients (N=10, 5.2%) and the greatest number of patients were examined in November (n=25, 12.9%), with a month average, on the 9 analysed years of M=16.54(SD=4.03) patients

From all the 194 cases, 76.3% were without any modification, 5.2%(21.7% from complication) with hypertoni and 5.2%(21.7% from complication) with hypotoni, and 13.4% (56.5% from complication) with posttraumatic glaucoma.

We studied two lots, one without modifications (N=148) and one with posttraumatic glaucoma (N=26).

On admission, the patients with glaucoma had ocular hypertension in 53.8%(right eye) and 26.9% (left eye).

From all the patients with glaucoma and ocular hypertension, on admission 57.1% had normal tension on discharge (28.6 % hypertension and 14.3% hipotension).

From the patients diagnosed with glaucoma 15.4% had cataract while the patients with normal tension only 6.8% had cataract (Chi-Square test, p=0.136, OR: 0.399, 95%CI:0.115-1.382).

In the lot of patients who had glaucoma 7.7% had retinal detachament while in the group of patients with normal tension 2% had retinal detatchament and 1.4% a retinal tear after blunt trauma without detachament (Chi-Square test, p=0.239).

In the group of patients with glaucoma, 57.7% of cases where on the right eye, and 43.3% on the left eye. In the lot of patients with normal tension 54.1% sustained a blunt trauma on the right eye and 42.3% on the left eye (Chi-Square test, p=0.269), therefore we cannot say there is a predominance in one of the eyes, fact than can be seen in the repartition of trauma along the years according to the injured eye.

19.2% from the lot of patients with glaucoma had lens malpositions compared with only 4.7% of those who had no glaucoma, but a malpositioned lens, therefore the risk of having a malpositoned lens is four folds higher in those with glaucoma than in those with normal tension (Chi-Square test, p=0.019, OR: 4.796, CI95%: 1.394-16.504, RR:4.066, CI95%: 1.396-11.845).

The risk of developing glaucoma is also higher in those patients who have a

subluxated lens 34.6% from our glaucoma group compared with only 2% of lens subluxation in those with normal tension, (Chi-Square test, p=0.000, OR: 25.588, CI95%: 6.310-103.757, RR:17.077, CI95%: 4.950-58.916).

In al cases treatment has been started with ocular hypotensive medication and in some cases, surgery was needed to lower the pressure.

26.9% of the patients diagnosed with glaucoma had anterior chamber alterations, 50% had hiphema, 11.5% hematic tyndal and 11.5% vitreous in the anterior chamber (Chi-Square test, p=0.216, OR: 1.691, CI95%: 0.731-3.909, RR:1.559, CI95%: 0.770-3.158).

When taking in consideration the days spent in the hospital the patients with glaucoma had a longer period than those with normal tension (glaucoma: M=9.12, SD=4.41, Min=2, Max=19, P25:6, P75:12; normal tension: M=6.65, SD=3.87, Min=1, Max=22, P25:4, P75:8, Student T test, p=0.004)

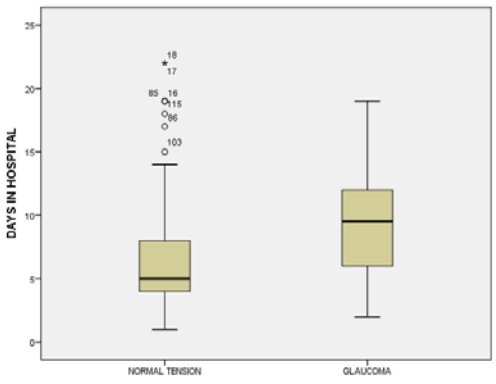

Fig. 3. *Days in hospital for both groups*

We present the case of a young man who rides and enduro bike and had his helmet off for a few minutes. In those minutes another participant passed and a rock was project from the terrain in his eye.

The patient presented to the ophtalmology emergengy room after 2 hours for decrease in visual acuity, pain an photofobia.

Fig. 4. *Young male who suffered closed globe injury, corneal erosion, hyphema and had high intraocular pressure (personal case)*

This patient had a high intraocular pressure and a corneal erosion after closed globe injury. He was treated for the corneal erosion and put on hypotensive drops.

The mechanism of posttraumatic glaucoma is complex and it can be caused by angle recession, lesion of the trabecular meshwork or by the blood in the anterior chamber that blocks the trabecular meshwork.

Intraocular pressure can be high immediately after trauma or can rise many years later.

Hyphema and lens malposition have a direct connection with intraocular pressure.

If the hyphema is not very high it is best not to was the anterior chamber because the risk of recurrent bleeding is high in the first 3 days.

Intraocular pressure has a direct connection with the damage to the optic nerve. In the literature it is mentioned that a pressure higher than 35 mmHg for more than 5 days increase the risk of optic nerve damage.

Prostaglandin analogues are not recommended in posttraumatic glaucoma because they can rise the intraocular pressure.

It is recommended that patients who sustained a traumatic injury of the eye and had high intraocular pressure to have regular check-ups.

Goldman applanation tonometry remains the gold standard in measure intraocular pressure. Unfortunately, in our region applanation tonometry is not used for routine examination. There are others methods for measuring intraoculare pressure: non-contract tonometry, rebound tonometry (Icare) and tonopen (involves both applanation and indentation processes)

In order to say that a patient has glaucoma we need to have optic nerve damage characterized by:

- changes on OCT
- optic disc alterations
- visual field defects

Glaucoma is an insidious disease that affects visual acuity and visual field.

In some cases, if the patient is a professional driver his ability to perform his job can be affected and he may need to do something else.

It is recommended that specific examinations, like OCT and visual field to be performed on the same machine, because they have special software installed on them than can detect progression.

In the evolution of the visual field we must always take into account the the cornea and lens. If we have lens desification that affect the visual field.

If the IOP can't be lower by drops surgery may be needed: trabeculectomy or shunts and implants (Ex-Press Glaucoma Filtration Device, DeepLight Glaucoma Treatment System, iStent Trabecular Micro-Bypass, Durasert, Hydrus Microstent)

5. Conclusions

Secondary glaucoma after closed globe injury is an insidious disease and these patients need to be monitored for many years.

The fewest patients for in all the years in our study were in February and the most in November.

Some of the patients developed optical nerve damage very quickly others remained in observation with ocular hypertension.

Having a luxated lens increases the risk of developing secondary glaucoma 4 times.

The risk of developing an optic nerve neuropathy is higher in the patients with suluxated lens as well.

On demission most of the patients had IOP within normal range, some of them only with hypotensive drops and some of them underwent surgery.

Close monitoring of these patients is a challenge because of low complains to therapy and the increased cost for the public system for the drops.

There is no predisposition for the right of left eye when we are talking about glaucoma after closed globe injury.

None of the patients declared that they were injured during work hours.

Visual field and OCT should be performed on the same device in order to observe progression.

If hypotenstive drops and not enough to lower the IOP surgery may be needed.

References

1. Cennamo, G., Forte, R., Reibaldi, M., Magli, A., de Crecchio, G., Cennamo, G.: *Evaluation of retinal nerve fiber layer and ganglion cell complex thickness after ocular blunt*. In: Eye (Lond) (2013) Dec; 27(12): 1382–1387. Published online 2013 Sep 13. doi: 10.1038/eye.2013.203

2. Dumitrache, M.: *Tratat de Oftalmologie*, vol. III. Bucureşti. Editura universitară ,,Carol Davila, 2012.
3. Kuhn, F., et al.: *Epidemiology of blinding trauma in the United States eye injury registry*. In: Ophthalmic Epidemiol. (2006); 13(3), p. 209–216. [PubMed]
4. Maniu, I.: *Tehnici de analiză a datelor: statistica*. Sibiu. Ed. Univ. „Lucian Blaga" Sibiu, 2014.
5. Mocan, I.: SPSS *Introducere în analiza datelor*. Sibiu. Ed. Univ. „Lucian Blaga" Sibiu, 2005.
6. Onakpoya, O.H., et al.: *Epidemiology of ocular trauma among the elderly in a developing country*. In: Ophthalmic Epidemiol. 2010;17(5):315–320. [PubMed]
7. Popa, E. M., Hunyadi, D., Muşan, M., Maniu, I., Brumar, B., Stoica, E.: *Manual de inițiere în birotică*. Sibiu. Ed. Univ. „Lucian Blaga" Sibiu, 2007.
8. ***Terminology and Guideliness for Glaucoma* 4th Edition, Junde 2014, page 96, 131-137.
9. Vukša, et al.: *Associated ocular findings in patients with ocular contusion with hiphema*. In: Praxis medica (2011); 39(1-2), p.59–63.