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# Clinical study on Hypotony following blunt ocular trauma

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## Abstract

• AIM: To evaluate the incidence and risk factors of hypotony in patients with blunt ocular trauma.

• METHODS: The medical records of 145 patients with blunt ocular trauma were reviewed. Hypotony was defined as an average intraocular pressure (IOP) of 5mmHg or less for three times.

• RESULTS: Among these 145 patients, hypotony was noted in 10 (6.9%) patients. The rate of hypotony in patients with ciliochoroidal detachment was 66.7% (2 out of 3 eyes), and 5.6% (8 out of 142 eyes) in patients without ciliochoroidal detachment, the difference was statistically significant ($P$= 0.003). The rate of hypotony in patients with traumatic retinal detachment was 18.5% (5 out of 27 eyes), and 4.2% (5 out of 118 eyes) in patients without traumatic retinal detachment, the difference was statistically significant ($P$= 0.026). The rate of hypotony in the patients with anterior proliferative vitreoretinopathy was 42.9% (3 out of 7 eyes) and 5.1% (7 out of 138 eyes) in the patients without anterior proliferative vitreoretinopathy, the difference was statistically significant($P$=0.002).

• CONCLUSION: Ocular hypotension is a complication of blunt ocular trauma. The risk factors include ciliochoroidal detachment, traumatic retinal detachment, and anterior proliferative vitreoretinopathy.

• KEYWORDS: hypotony; blunt trauma; anterior proliferative vitreoretinopathy; ciliochoroidal detachment; traumatic retinal detachment

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## INTRODUCTION

Hypotony following blunt ocular trauma is a severe complication whose exact pathogenesis is not clear. Ocular hypotension can be associated with several complications such as macular edema, disc edema, hypotony maculopathy, corneal edema, shallow anterior chamber, choroidal effusion or hemorrhage, exudative retinal detachment, or cataract formation, ultimately leading to phthisis bulbi [1-3]. Any of these complications can be associated with visual symptoms or a reduction in visual acuity. There is relatively less data on the risk factors for hypotony after blunt ocular trauma. So this article briefly discusses the risk factors of hypotony following blunt ocular trauma.

## MATERIALS AND METHODS

**Study Design** This was a retrospective study of patients seen in the ophthalmology department at the Second Xiangya Hospital's emergency service over two and a half years period (January 2006 to July 2008). All patients, who had suffered blunt ocular trauma without penetrating laceration, were included in the study. The nature of injury included boxing in 45, car crash in 32, ball or stone damage in 25, iron stick injury in 21, firecracker injuries in 19, toy gun shot injury in 3 patients. Data was obtained by reviewing the case sheets. Patients' demography (age, sex), eye findings at clinical presentation (visual acuity, intraocular pressure with applanation tonometry, ocular injury as found on examination by slit lamp biomicroscopy, UBM, B-scan and fundus examination were noted. Hypotony was defined as an average intraocular pressure (IOP) of 5mmHg or less for three times [4]. The study was approved by the Ethics Committee of the Second Xiangya Hospital.

**Statistical Analysis** The statistical analysis was conducted using SPSS12.0 (Statistical Package for Social Science, Chicago, IL). All tests were two-tailed, and $P$ values of less than 0.05 were considered to be significant. The $\chi^2$ test was utilized for the analysis of parameters.

## RESULTS

A total of 10 out of the 145 patients (6.9%) presented with a diagnosis of hypotony during the study period in the ophthalmology department. The mean age was (19.54±6.1) years (range, 6-78 years). Totally 123 (84.8%) patients were

**Table 1 The visual acuity of the eyes with blunt injury**

| Visual acuity | Eyes (*n*) | Percentage (%) |
|---|---|---|
| No light perception | 3 | 2.1 |
| Light perception | 20 | 13.8 |
| Hand motion | 35 | 24.1 |
| Finger counting | 26 | 17.9 |
| 0.02-0.04 | 16 | 11.0 |
| 0.05- 0.09 | 11 | 7.6 |
| 0.1-0.2 | 11 | 7.6 |
| 0.3-0.5 | 13 | 9.0 |
| 0.6- 1.0 | 7 | 4.8 |
| Uncooperative | 3 | 2.1 |
| Total | 145 | |

**Table 2 Eye findings in 145 eyes of blunt injury**

| Eye finding | Eyes (*n*) | Percentage(%) |
|---|---|---|
| Macular hole | 2 | 1.4 |
| Choroidal rupture | 2 | 1.4 |
| Cilio-choroidal detachment | 3 | 2.1 |
| Optic nerve contusion | 3 | 2.1 |
| Anterior proliferative retinopathy (aPVR) | 7 | 4.8 |
| Traumatic mydriasis | 13 | 9.0 |
| Angle recession | 43 | 29.7 |
| Iridodialysis | 20 | 13.8 |
| Corneal contusion | 19 | 13.1 |
| Traumatic retinal detachment | 27 | 18.6 |
| Lens dislocation | 42 | 29.0 |
| Hyphema | 67 | 46.2 |
| Vitreous hemorrhage | 53 | 36.6 |
| Commotio retinae | 78 | 53.8 |

**Table 3 Risk factors in eyes with hypotony following blunt ocular trauma**

| Eye finding | Eyes (*n*) | Hypotony | Percentage(%) | *P* |
|---|---|---|---|---|
| Ciliochoroidal detachment | 3 | 2 | 66.7 | |
| Without ciliochoroidal detachment | 142 | 8 | 5.6 | 0.003 |
| Iridodialysis | 20 | 3 | 15 | |
| Without iridodialysis | 125 | 7 | 5.6 | 0.287 |
| Traumatic retinal detachment | 27 | 5 | 18.5 | |
| Without traumatic retinal detachment | 118 | 5 | 4.2 | 0.026 |
| Anterior proliferative retinopathy (aPVR) | 7 | 3 | 42.9 | |
| Without aPVR | 138 | 7 | 5.1 | 0.002 |
| Lens dislocation | 42 | 6 | 14.3 | |
| Without lens dislocatiom | 103 | 4 | 3.9 | 0.06 |

male and 22 (15.2%) females. All the 145 patients was blunt injury unilateral (only one eye involved) (Table 1).

Among the patients with blunt ocular trauma: 2 (1.4%) eyes with macular hole, 2 (1.4%) eyes with choroidal rupture, 3 (2.1%) eyes with ciliochoroidal detachment, 3 (2.1%) eyes with optic nerve contusion, 7 (4.8%) eyes with anterior proliferative retinopathy (aPVR), 13(9.0%) eyes with traumatic mydriasis, 43(29.7%) eyes with angle recession, 20(13.8%) eyes with iridodialysis, 19 (13.1%) eyes had a corneal contusion, 27 (18.6%) eyes with traumatic retinal detachment, and 42 (29.0%) eyes with lens dislocation, 67(46.2%) eyes with hyphema, 53 (36.6%) eyes with vitreous hemorrhage, 78 (53.8%) eyes with commotion retinae(Table 2).

A significant association was found between ciliochoroidal detachment ($P$=0.003), traumatic retinal detachment ($P$= 0.026), anterior proliferative retinopathy ($P$=0.002) and hypotony;while iridodialysis ($P$=0.287) and lens dislocation ($P$=0.06) were not significantly associated with hypotony (Table 3).

## DISCUSSION

It is generally believed that when the intraocular pressure is lower than 10mmHg, it is defined hypotony. However, clinical observation showed that the majority patients with intraocular pressure at or below 5mmHg can lead to structural and functional changes in the eye [4]. Most eyes will be symptomatic at or below 5mmHg. Hypotony can be defined as the low pressure (whether acute, transient, chronic or permanent) which, in an individual eye, leads to functional changes (whether asymptomatic or symptomatic) and structural changes (whether reversible or irreversible)[5]. In this study, we selected cases of the patients with intraocular pressure at or below 5mmHg after blunt ocular trauma.

At present, the exact mechanism of hypotony after blunt trauma is not clear, which occurs when aqueous humour production does not keep pace with outflow decreased aqueous humour production and/or enhanced aqueous humour leakage [6,7]. Ocular hypotony after blunt injury can be transient or persistent. The transient hypotony: external forces can result directly in intraocular neurovascular dysfunction, ciliary epithelial edema, circulatory disturbance, which lead to lower aqueous production. The persisting hypotony: the specific mechanism of the persisting hypotony after blunt ocular trauma is not clear. In present study, we found the main considerations as the following situations: ciliochoroidal detachment caused by blunt ocular trauma frequently resulted in hypotony. Ciliary body injury and/or detachment resulted in the declined aqueous humor secretion. Cyclodialysis established a direct outlet pathway for the aqueous humor to the supra-choroidal space, which determined a persistent ocular hypotony [8]. Choroidal fluid was believed to accumulate as a result of

enhanced uveoscleral outflow and decreased aqueous humour production, a cycle that was often perpetuated once choroidal effusion develops. A ring of anterior choroidal fluid can rotate the ciliary body forward, impairing its ability to produce aqueous humour [9]. Our study indicated that traumatic retinal detachment was also a factor resulting in ocular hypotony following blunt injury. We can consider the retinal detachment caused hypotony by the following points: 1) traumatic retinal detachment often incorporate with ciliary body injury, which results in the reduction in aqueous secretion; 2) aqueous draining into the suprachoroidal space. The majority of aqueous humor flow through the vitreous, retinal tears to the subretinal space, and then through the retinal pigment epithelial cells which can pump choroidal liquid, the new drainage channel increases the uveoscleral outflow [10]. In our study, we found that aPVR was a reason of hypotony. It is reported that aPVR is a long-term complication of blunt ocular trauma, once formed, the proliferative membrane (ciliary membrane) creates traction at the surface of ciliary body, resulting in ciliary body functions and structure damage[11]. The hyperplasia and distraction of ciliary membrane cause ciliary body edema, and decreased aqueous humor secretion, which may be the main reason of chronic hypotony [12]; the serious traction of the aPVR membrane can cause a wide range of the ciliary body, choroid, retinal detachment, resulting in a low secretion of aqueous and enhanced uveoscleral outflow results in hypotony; late or obsolete aPVR, ciliary body or ciliary process fibrosis and ciliary epithelium atrophy result in a low secretion of ciliary body.

Hypotony caused by blunt ocular trauma is not uncommon, and persisting hypotony causes complications that involve all ocular tissues and leads to corresponding visual loss [1,2] and therefore we should attach adequate importance to it. According to the different reasons for hypotony after blunt ocular trauma, we should take effective measures to save the patients' visual acuity.

**REFERENCES**

1 Aminlari A, Callahan CE. Medical, laser, and surgical management of inadvertent cyclodialysis cleft with hypotony. *Arch Ophthalmol* 2004;122 (3):399-404

2 Razeghinejad MR, Dehghani C. Effect of ocular hypotony secondary to cyclodialysis cleft on corneal topography. *Cornea*2008;27(5):609-611

3 Kim HC, Hayashi A, Shalash A, de Juan E Jr. A model of chronic hypotony in the rabbit. *Graefes Arch Clin Exp Ophthalmol* 1998;236(1): 69-74

4 Pederson JE. Ocular hypotony. *Trans Ophthalmol Soc U K*1986;105 (Pt 2):220-226

5 Schubert HD. Postsurgical hypotony:relationship to fistulization, inflammation chorioretinal lesions, and the vitreous. *Surv Ophthalmol* 1996;41(2):97-125

6 Costa VP, Arcieri ES. Hypotony maculopathy. *Acta Ophthalmol*2007;85 (6):586-597

7 Küçükerdönmez C, Beutel J, Bartz-Schmidt KU, Gelisken F. Treatment of chronic ocular hypotony with intraocular application of sodium hyaluronate. *Br J Ophthalmol* 2009;93(2):235-239

8 Cerio-Ramsden CD, Muñoz-Negrete FJ, Rebolleda G. Post-traumatic cyclodialysis cleft treated with transscleral diode laser. *Arch Soc Esp Oftalmol* 2009;84(1):47-50

9 Amini H, Razeghinejad MR. Transscleral diode laser therapy for cyclodialysis cleft induced hypotony. *Clin Experiment Ophthalmol* 2005; 33(4):348-350

10 Fine HF, Biscette O, Chang S, Schiff WM. Ocular hypotony: a review. *Compr Ophthalmol Update*2007;8(1):29-37

11 Waters T,Vollmer L, Sowka J. Proliferative vitreoretinopathy as a late complication of blunt ocular trauma. *Optometry* 2008;79(4):197-202

12 Faude F, Wiedemann P. Vitreoretinal endoscope for the assessment of the peripheral retina and the ciliary body after large retinectomies in severe anterior PVR. *Int Ophthalmol* 2004;25(1):53-56