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# CEOTI

## Clinical and Experimental

# Ocular Trauma and Infection

International Society Ocular Trauma

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## Clinical and Experimental Ocular Trauma and Infection

**Clinical and Experimental Ocular Trauma and Infection** is a peer reviewed scientific journal that is focused on every aspect of ocular traumas, treatments, rehabilitation, protection, and every aspect of ocular infections, treatments both in children and adults. Additionally new experimental models for trauma and infection and experimental studies for understanding effects of the trauma and infection on eye are within the Scope of the journal.

## Aim

**Clinical and Experimental Ocular Trauma and Infection** is a peer-reviewed scientific electronical journal. The language of the journal is English. Three issue will be published annually. A manuscript will be considered only with the understanding that it is an original contribution that has not been published elsewhere.

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The aim of the CEOTI is to develop a scientific platform for discussing ocular traumas and ocular infections.

## Scope

**Clinical and Experimental Ocular Trauma and Infection** is a scientific journal that is focused on every aspect of ocular traumas, treatments, rehabilitation, protection, and every aspect of ocular infections, treatments both in children and adults. Additionally new experimental models for trauma and infection and experimental studies for understanding effects of the trauma and infection on eye are within the Scope of the journal.

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## INSTRUCTION TO AUTHORS

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**Book:** Kuhn F. Ocular traumatology (1st ed). Heilderberg; Springer; 2008.

**Book Chapter:** Kuhn F, Morris R, Witherspoon CD. BETT: The terminology of ocular trauma. In: Kuhn F, Pieramici DJ eds. Ocular trauam: Principles and practice (1st ed). New York; Thieme; 2002: 3-5.

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# EDITORIAL

**Assoc. Prof. Dr. Berna Akova, MD, FICOpht**

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The third and last issue of CEOTI in 2019 just before new year eve is mainly focused on ocular trauma.

Dr. Uyar in his letter to the editor describes the details of ocular trauma and suturation training of mainly young opthalmologists in well structured wetlabs organised by Turkish Society of Ergophthalmology and Medicolegal Ophthalmology (TSEMO). He points out to the importance of this education for the proper management of ocular trauma with decreased rates of complications. The wetlabs are invaluable for teaching primary suturation.

The original article focuses on a potentially overlooked trauma type in children; eyelid foreign bodies which may lead to devastating complications when misdiagnosed. The authors state that complete ophthalmologic examination is crucial in children with history of trauma and if not possible examination under general anesthesia is recommended.

A comphrehensive review by Dr. Besirli discusses pediatric ocular trauma, its epidemiology, etiology, diagnosis and management of pediatric ocular trauma that is still the leading cause of monoocular blindness in children.
There are 2 case reports in this issue. One of the reports presents persistance of chorioretinal folds in malign hypertension. In differential diagnosis of chorioretinal folds, orbital inflammation, orbital infections, dysthyroid eye disease, hypermetropia, and following scleral buckling, a non-specific sign of orbital tumours, hypotony, papilloedema, intracranial hypertension, microgravity space flight or hyperopia should kept in mind according to the report.

The other report is about the management of phthisis bulbi in a young male by foldable capsular vitreus body implantation. The case was followed for 3 months without any apparent complication.
Wish you a happy new year.

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## LETTER TO THE EDITOR

Received Date: 29 December 2019 Accepted Date: 30 December 2019 Publication Date: 31 December 2019

# Wet Lab of Ocular Trauma Models and Primary Suturation Techniques on Pig Eyes

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We live in a geographical region not only with many work and traffic accidents, domestic violence, but also wars and terrorist attacks around. The eyes are one of the most injured organs in all body injuries. (1) Most of the open globe injuries include zones 1 and 2. (2) These are real ophthalmologic emergencies and require urgent treatment. Primary suturation helps both preservation of the globe integrity and prevention from endophthalmitis. Here a question comes to mind. How much the ophtalmologists are experienced in this issue? In daily practice this kind of cases are usually treated by the most experienced surgeons in the clinic. Therefore, it is very valuable to increase the experience of young colleagues. Wet lab or simulator training is very useful to fill the gap in this topic. In a study preoperative simulator training prepared residents for the operating room as effectively as the wet lab, there was no significant difference in overall score between the 2 groups. (3) In another EyeSi simulator training there has been 68% reduction in errant capsulorhexes rates. (4) Many studies have been published since 1998 about wet lab in every section of ophthalmology.(3,5) Pig eyes are mostly used as wet-lab teaching model.

As the former chair and executive board of Turkish Society of Ergophthalmology and Medicolegal Ophthalmology (TSEMO) we planned a wet lab of trauma models and primary suturation techniques on pig eyes. We aimed to find solutions to the situations that are encountered frequently in especially the last years of residency training and in the daily practice of newly graduated specialist level by conveying them approach to ocular trauma patient, general classification of globe injuries, suturing techniques and suturing tips. During the last year we performed two courses with 50 participitants. Due to the intense interest, bookings were full in the first days. These wet labs were done in two stages. In the first stage, general theoretical information were given in approximately one hour by five trainers. In the second stage, 5 groups of 10 ophthalmologists had practical courses for 45 minutes (Figure 1). Each two candidates had practice by one trainer about basic microsurgical suturing techniques, needle and suture types, algorithms used for placement of these sutures used to close the wound sites due to incisions created in eye. The pig eyes were positioned in the eye sockets of a model head and stabilized with a pin. A central irregular corneoscleral laceration was created in two steps and sutured by 10/0 nylon and 8/0 vicryl sutures (Figure2). Participants then completed satisfaction questionnaires regarding their preoperative training. The porcine model worked well to demonstrate and perform steps associated with wet-lab environment improves trainee confidence in these procedures. Our questionnaires, like many studies confirm the importance of mentorship and that

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Figure 1: Working stations and microscopes in the wet lab.


Figure 2: Microsurgical suturing techniques training under the supervision of the trainer.

the accompaniment of an experienced colleague during the learning curve is associated with lower rates of complications. We think that wet laboratories will become an increasingly important aspect of a comprehensive ophthalmology training program.

On this occasion, I would like to inform you that two wet labs will be held in Istanbul Turkish Ophthalmology Association Education Center (TODEM) on 16th of February and 7th of June 2020.

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ORIGINAL ARTICLE

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# Unusual Foreign Bodies in Eyelids in Childhood

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## Abstract

Purpose: To evaluate the importance of the foreign bodies in the eyelid of pediatric patients.
Method: The charts of pediatric patients who referred to Department of Ophthalmology with eyelid trauma were retrospectively reviewed. Children with foreign bodies were included in the study.
Results: Seven of the 82 pediatric patients had foreign bodies in their eyelids. Mean age of the children was 5,6±2.4 years. In all cases globe was intact but one who was injured with bullet. Five of 7 patients were injured outdoor. In 2 patients foreign bodies were organic. Only one patient, who had injury with bullet, had low vision; visual acuity was 20/20 in rest of the patients.
Conclusion: Detailed ophthalmic examination is crucial in trauma patients. Examination under general anesthesia and surgical intervention should be kept in mind especially in children with unusual injuries.

## Introduction

Eyelid trauma is one of the most encountered ocular traumas in childhood. Because of the lids anatomical position, they were likely to be damaged more than other ocular structures. During childhood, the reasons of ocular trauma differ from adults. Nail scratches ,chemical traumas, foreign body injuries are among them. In a study, eyelid injuries was found 22 % among all reasons in children. (1) Children with apparent foreign bodies present as an ocular emergency to the ophthalmic clinics while some foreign bodies may be hidden and only can be seen as chronic relapsing ocular inflammation which is resistant to medical therapy. (2-7) Most injuries occurred at home and at school, which shows the presence in these places of potential hazards, often unrealized or neglected. (1)
In this study we present 7 unusual foreign bodies in the eyelids of children.

## Methods

The charts of pediatric patients who were referred to Bursa Uludag University Department of Ophthalmology as emergency cases between July 2017 and December 2019 were reviewed retrospectively. From 82 pediatric patients 7 were identified as unusual cases with foreign body in the eyelid. Those 7 cases were included in this study. Seven cases were underwent total ophthalmic examination and imaging was carried out. Only one family did not accept imaging or surgical intervention.

## Results

Twenty three percent of ocular emergencies that underwent surgical intervention or repair were children. Seven of the 82

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*This study was presented as free paper at ISOT 2018 meeting.*

Figure 1: Case1. He had a swollen eyelid, purulent discharge and hyperemia on his left eye.

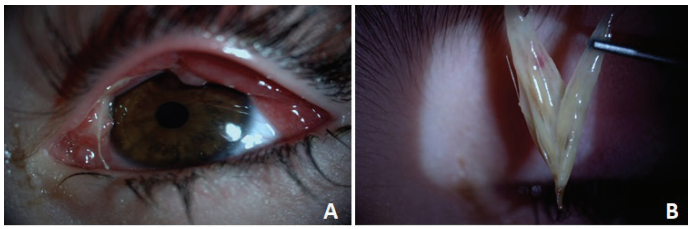


Figure 2: Case 1. Oat seeds are in the superior conjunctival fornix. A)Purulent discharge B) Oat seed

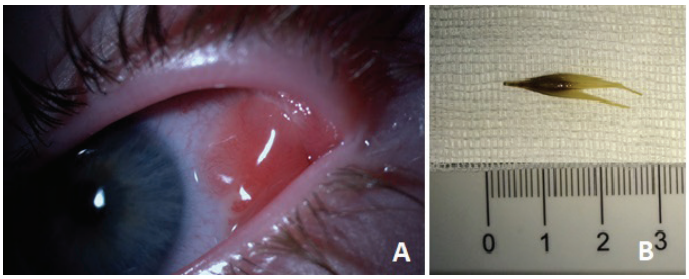


Figure 3: Case 2. A)Pyogenic granuloma B)Oat seed

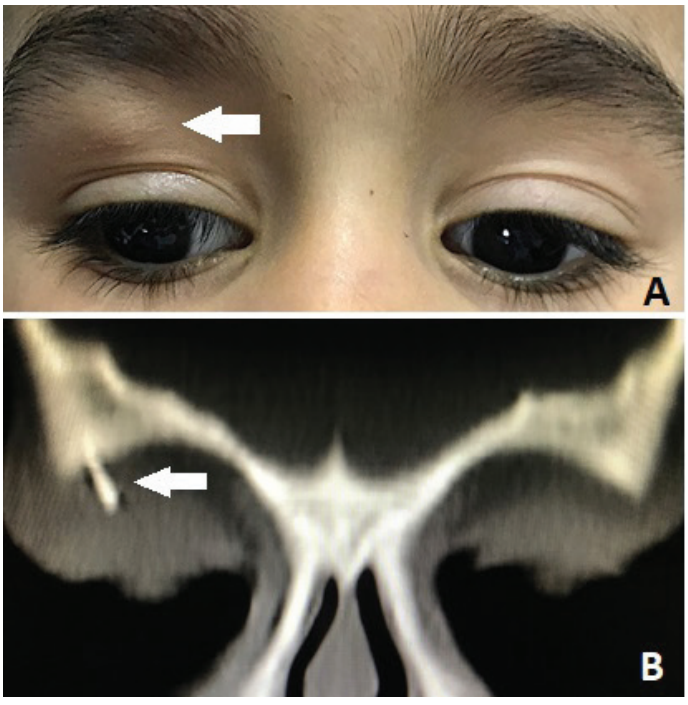


Figure 4: Case 3. A) A mass on his right upper eyelid B) Computed tomography image of case 3

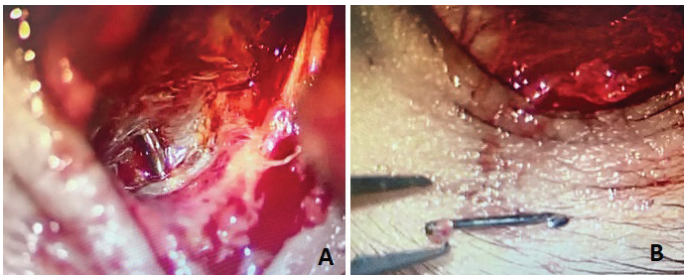


Figure 5: Case 3. A and B)Intraoperative images of the crochet needle head.

Figure 6: Case 4. Rounded mass on lower eyelid.

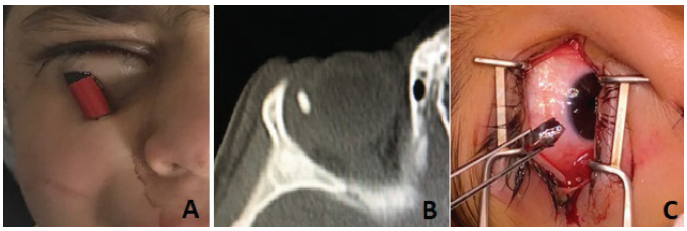


Figure 7: Case 5. A)Pencil in the lower eyelid B)Computed tomography image of the

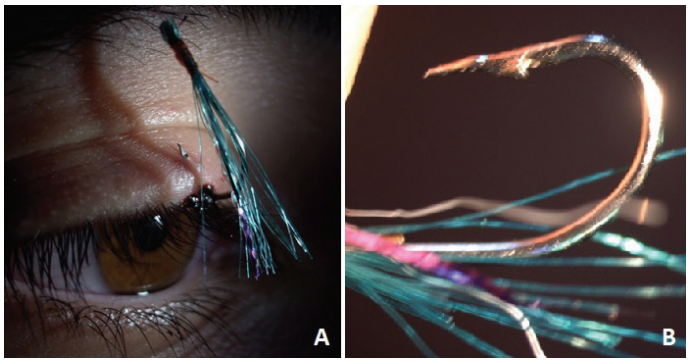


Figure 8: Case 6. A) Fish hook in upper eyelid B) Barbed structure of the fish hook.

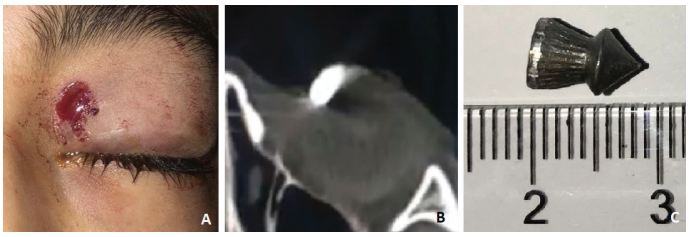


Figure 9: Case 7. A) Wound in the upper eyelid B) Computed Tomography image of the foreign body in the upper eyelid C) Air-gun pellet

pediatric patients had foreign bodies in their eyelids. Mean age of the children was 5,6±2.4 years. In all cases globe was intact but one who was injured with bullet. Five of 7 patients were injured outdoor. In 2 patients foreign bodies were organic. Only one patient, who had injury with bullet, had low vision; visual acuity was 20/20 in rest of the patients. Information about patients were given in Table 1. Five of the 7 patients were preschool-aged, 2 were school-aged children. The ages of the patients were 7 or under 7 in 6 patients.

Our first case was a 5 year-old male and he was complaining about redness, pain and discharge in his left eye (Figure 1). He had these symptoms for 2 months. His mother told that he felt down on a plantation area and after that day his complaints had started. They had visited different ophthalmology departments and topical antibiotics had been prescribed but no cure was obtained. In ophthalmic examination there were a periorbital redness and swelling and also mucopurulent discharge, membranes, ciliary injection in his left eye (Figure 1). Under biomicroscopic examination we found multiple organic foreign bodies, that were determined as oat seeds (Figure 2A and 2B). The seeds were removed and after 2 weeks all complaints and findings were resolved.

In second case, a 4 year-old female had a red growing mass on her left eye for 6 months and she had no other significant history (Figure 3A). She was referred to our department as pyogenic granuloma for surgery. She had a hyperemic mass on her temporal conjunctiva. After a carefully examination of her eyelid -double elevation- under biomicroscopy , an organic foreign body -oat seed- were found at the upper fornix and removed (Figure 3B). The patient was checked 1 week after removal and all symptoms were resolved.

Third case was three year-old male that was referred to our department with a mass on the right upper eyelid. His parents noticed a growing mass 1 week ago, he had no other significant history (Figure 4A). In computed tomography (CT) imaging it was noted that there was approximately a 1 cm wide hiperdense object in his right upper lid (Figure 4B), however; no obvious entrance wound was found in his ophthalmologic examination. After his CT scan, his mother declared that she had found a broken crochet needle at the home. In the operation room 0.8 mm broken crochet needle was found in upper lid through anterior orbit that was surrounded with an abscess (Figure 5A and 5B). Foreign body was removed, patient recovered with no sequelae.

In another case (case 4) a 6 year-old girl was complaining about a blueish mass on her right lower eyelid (Figure 6). She declared that she had felt down and got a trauma to her lower eyelid 6 months ago. Ecchymosis and edema had occurred at that time. She also expressed that sometimes the mass had bleeded. During ophthalmic examination a hard round shape mass was felt with palpation. Tomography imaging was planned for further investigation however the family did not accept imaging or detailed investigation. According to her examination and history, we presumed the mass was post traumatic capillary hemangioma. Because lack of consent we could not investigate and treat this patient.

Another 4 year-old female (case 5) was brought to emergency department with a pencil injury. In her history, she had felt down while a pencil was in his mount. Pencil tip was exposed under her right eyelid and the rest was felt under skin obliquely in her cheek with palpation.(Figure 7A) Computed tomography imaging showed a hyperdense object was in her right cheek under lower lid (Figure 7B) .However no globe injury was noticed. There was only conjunctival laceration. The pencil was removed surgically and lower lid retractor was repaired.(Figure 7C).

Our sixth case was a 7 year-old male. He was referred to Department of Ophthalmology with a fish hook in his right upper eyelid.(Figure 8A). The hook perforated his upper lid but fortunately the glob was intact. The hook then removed surgically. (Figure 8B). No post-operative complication was observed.

Our last case- 10 year-old child- was (case 7) referred to emergency department with loss of vision in his left eye, after he had been shot by his friend with air-gun. In his ophthalmic examination, there was a wound on his upper eyelid and a hard mass was felt with palpation (Figure 9A). His vision was hand motion, and on biomicroscopic examination subconjunctival bleeding and hypotonia was noticed. Retinal detachment and vitreous hemorrhage were also diagnosed in fundus examination. His computed tomography imaging revealed foreign body in the upper eyelid. (Figure 9B) In operation room a 9 mm air-gun pellet was removed from superior fornix (Figure 9C). Rupture of globe was also found under bleeding conjunc-

Table 1.General Features Of Eyelid Traumas

| Case | Age | Gender | Symptom | Findings | Imaging | Diagnose | Treatment |
|---|---|---|---|---|---|---|---|
| 1 | 5 | M | Conjunctival redness, Pain, Discharge | Mucopurulent Discharge ,Periorbital Redness, Swelling | None- organic foreign body | Multiple Oat Seed in Fornix | Mechanic removal |
| 2 | 4 | F | Conjunctival red mass | Conjunctival hyperemia | None- organic foreign body | Oat seed in Fornix | Mechanic removal |
| 3 | 3 | M | Growing painless mass upper eyelid for a week | Non mobile mass on upper lid | Metallic foreign body | Crochet needle | Surgical Removal |
| 4 | 6 | F | Round mass on lower lid for 6 months after trauma | Round shape mass on lower eyelid | N/A* | Post traumatic foreign body or capillary hemangioma | N/A* |
| 5 | 4 | F | Pencil injury in lower lid | Pencil was beneath under skin | Foreign body | Pencil injury | Surgical removal |
| 6 | 7 | M | Fish hook injury at upper lid | Fish hook found at upper lid | none | Fish hook injury | Surgical removal |
| 7 | 10 | M | Low vision and pain | Wound in upper eyelid, hypotonia, retinal detachment | Foreign body in the eyelid | Bullet | Surgical removal and globe repair |

*Parents did not accept imaging or surgery.

tiva and repaired. Retinal detachment and vitreous hemorrhage was deferred to secondary operation.

## Discussion

Ocular traumas are important and need to be treated quickly in childhood. Not only globe injuries but eyelids must be evaluated carefully. Many injuries with foreign bodies are underestimated. Because many foreign bodies may be hidden and cause recurrent inflammation that mimicking infections.(2-7) Trimmers et al reported that pediatric patients with foreign body injuries mostly referred with respiratory or gastrointestinal tracts foreign bodies. Ocular foreign bodies were found rare. (8) Although the rate of ocular foreign body was found low, it can lead devastating ocular morbidities. Because of this history taking and full ocular examinations are the crucial step in ophthalmic evaluation. In our 2 cases oat seeds were the causes of the injuries. Both injuries were happened after felt down on agriculture fields. Both patients were misdiagnosed previously. This kind of injuries are very rare and hard to recognize so history taking is of utmost importance. Similar symptoms can be seen in pediatric patients with foreign body in fornices without any trauma history.(2,4,7,9) Synthetic fibers from teddy bears, pillows, blankets, and cotton fibers, button batteries, toys, insect hairs (caterpillar) or leech and parasites may enter fornices accidently and may cause hyperemia, discharge, granuloma, swollen eyelid.(2-12) However in such cases there is lack of trauma or fall down history. Taylor et al. reported three children who applied to emergency with a painful and watering eye. Severe localized edema of the conjunctiva and inflammation was evident with conjunctival ves-

Table 2: Similar case presentations in the literature

| Authors | Year | Patient | | | Material | Source | Injury site |
|---|---|---|---|---|---|---|---|
| | | Count | Age | Sex | | | |
| Betharia et al. (19) | 1985 | 1 | 3 | male | organic | Bean seed | Eyelid, conjunctiva |
| Taylor et al. (3) | 2001 | 3 | 6,10,14 | All male | organic | Oat seed | Conjunctiva |
| Sakata et al (20) | 2007 | 1 | 3 | male | plastic | Toy | Eyelid, conjunctiva |
| Sen et al. (18) | 2011 | 1 | 5 | female | organic | Grass | Conjunctiva |
| Ogasawara et al. (4) | 2011 | 1 | 3 | female | metal | Button battery | Eyelid, conjunctiva |
| Ratnarajan et al. (17) | 2013 | 1 | 2 | female | metal | Button battery | Eyelid, conjunctiva |
| Khan et al.(5) | 2014 | 1 | 2 | female | metal | Button battery | Eyelid, conjunctiva |
| Subramaniam et al. (16) | 2015 | 1 | 11 | male | metal | Fish hook | Eyelid |
| Elghazi et al.(9) | 2016 | 1 | 7 | N/A | organic | Cactus thorn | Conjunctiva, globe |
| Jinagal et al.(13) | 2018 | 1 | 3 | female | organic | Vegetative material | Conjunctiva, cornea |
| El Kaddoumi et al. (14) | 2019 | 1 | 10 | female | metal | Jewelry | Eyelid, conjunctiva |
| Purtskhvanidze et al.(15) | 2019 | 3 | N/A | N/A | metal | Fish hook | Eyelid |

N/A: Not applicable

sel injection leading to bleeding, like chemical burn. Two of them appeared to have eyelash behind the lid, so emergency doctors tried to remove them but they could not. Eventually it was understood that seedpods had become embedded in the subconjunctival space.(3) Similar cases with other kinds of seeds, cactus torn, vegetative organisms, grass were previously published.(3,9,13,18) (Table 1)

When evaluating preschool children with ocular trauma, many reasons should be kept in mind. We presented a case with broken crochet needle injury. There were many case reports about intracranial, cardiac or hand perforation with crochet needle but eyelid perforation has not been reported previously (21)
Pencil trauma of the eyelid mostly seen in pediatric age groups In reported cases especially the tip of the pencil retained in the eyelid or orbita. (22,23) Pencil is made of a mixture of carbon, clay and animal fat and is surrounded by a wooden sheath. The main component, carbon, is known to usually remain inert in the eye. However sometimes it may mimick ocular melanoma or potential toxicity due to the other components especially when cornea is involved.(24,25) Stromal keratitis and even endophtalmitis were reported with pencil traumas.(26) Therefore pencil trauma must be considered and evaluated in a great detail. In our case the patient was quite lucky that neither cornea nor intra-ocular structures were injured with pencil. Eyelid structures should be repaired meticulously such as full thickness eyelid injuries.

In all general causes of traumatic eye injury, the ones with fishhooks can have devastating consequences especially if cornea is involved. (15, 27) Fortunately these are rare injuries, especially in childhood. Fishhooks are not easy to remove because of its barbed design so different removing techniques were described.(16) There are several cases with fisherman injuries in adults reported in literature (16,28), our case is one of the rare cases that was described in a child.

In pediatric eyelid injuries ocular examination is very important. Especially for foreign bodies in the fornix double elevation of the upper eyelid is crucial. Also, urgent surgical intervention and examination under general anesthesia should be kept in mind in pediatric cases. Previous traumas also should be asked to patients. Even it had been occurred long time ago, post traumatic changes in eye reveal itself as a recurrent inflammatory process or a silent hard mass. Pyogenic granulomas and post traumatic hemangiomas are rare entities which may show up various anatomic areas in body including hand, lips,nose. Similar cases on the hands were reported.(29) We diagnosed foreign body and hemangioma in one case however parents of the patient did not give consent neither for imaging nor forsurgical intervention.
Most of the eyelid traumas with air gun bullets may result with ocular injuries. Patients are generally young male teenagers. (30) Bowen et al reported 105 cases that injured with airgun pellet. Mean age was found as 14 years. (31) Visual acuities are generally low because most of the air gun injuries may cause open globe injuries additional to adnexial injuries. In this study our case was 10-year old child with eyelid injury, globe rupture and retinal detachment.

## Conclusion

Ocular traumas and foreign bodies should be kept in mind in patients with unexplained findings especially in preschool-aged children. Trimmers et al reported that pediatric patients under age 7 should be supervised carefully against foreign body injuries.(8) The ages of six children of 7 cases in this study were also under 8 year-old. All detailed ocular and systemic history should be taken and total ophthalmic examination must be done under general anesthesia if needed. Good prognosis and outcomes can be achieved when appropriate medical and surgical treatment is performed.

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MINI REVIEW

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# Pediatric Ocular Trauma

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## Introduction

Ocular trauma is the leading cause of monocular blindness in children.(1) 2.4 million eye injuries occur in the United States per year, with 35% of injuries in patients 17 years of age or less.(2) Every year, 160,000 to 280,000 children under the age of 15 require admission for ocular trauma.(3) Pediatric ocular trauma presents numerous complications over that in adults, representing a major concern for ophthalmologists. Delays in presentation, incomplete history, decreased cooperation during exams, and inaccurate visual acuity measurements may severely hinder an ophthalmologist's ability to correctly diagnose and manage pediatric ocular trauma.(4) The overall occurrence of pediatric ocular trauma has decreased by 17% from 1990-2009, in part due to implementation of eye protection for children.(5) However, there have been increases in the amount of ocular trauma associated with specific activities, namely firearm injuries. Since ocular trauma is a significant cause of childhood blindness worldwide, awareness and preventative measures are imperative to decrease this preventable loss of vision.

## Etiology of Pediatric Ocular Trauma

Common causes of pediatric ocular injuries include blunt and penetrating trauma secondary to traffic accidents and projectile injury.(4) Blunt trauma is the most common form of ocular trauma in pediatric cases, while 21-24% of cases are penetrating globe injuries.(3) The etiology of pediatric ocular trauma depends greatly on the age at presentation, mostly due to activities performed at various developmental stages. Ocular trauma is more common in children 9 years old or younger. The most common mechanism of injury is self-inflicted poking of the child's eye with a sharp object or trauma secondary to objects thrown at children.(6) In older children, there is an increased risk of sports-related injury, whereas younger children have a predisposition for injuries related to falling, household cleaners, desk supplies, and toys.(3) The most common location of injury is in the home, possibly due to decreased supervision in comparison to school and childcare environments.(6) There is a distinct male predominance of ocular trauma, with 65% of all eye injuries occurring in male patients, and males have a higher annual mean injury rate compared to females.(5)

Certain high-risk activities have been associated with increased risk of ocular trauma and deserve mention to increase awareness and preventative strategies. Increased exposure to firearms has led to a significant increase in firearm related ocular injuries in the pediatric

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population. From 2008 to 2014, 25% of all firearm-related ocular injuries occurred in pediatric patients, most commonly males ranging from 12-18 years old. These injuries occurred either in the home or outdoors. The most common form of ocular injury was open globe, followed by ocular adnexal injury, orbital injury, orbital fractures, and contusion of the eye.(7) Risk factors for ocular injury from firearms include absence of supervising adult, recreational gun use, large numbers of individuals using the weapon, and lack of safety glasses.(3)

Sports-related injuries account for about 27% of all pediatric ocular trauma requiring hospitalization, with increased incidence that correlates with an older age. The most common sporting activities resulting in ocular trauma include baseball, tennis, soccer, squash, and darts.(3)

Child abuse unfortunately remains a significant cause of pediatric ocular trauma and plays an equal role in visual impairment as accidental trauma. One of the most common examples of non-accidental head injury is shaken baby syndrome. This syndrome occurs mostly in children under 2 years old, and is characterized by retinal hemorrhages, subdural hematomas, and encephalopathy. It is imperative for healthcare professionals to recognize the unique pattern of retinal hemorrhages in order to protect the patient from further harm. Risk factors for inflicted injury include unknown paternal identity, low socioeconomic status, male sex, low birth weight, and medical co-morbidities.(3)

## Diagnosis

Children presenting with ocular trauma have a more complex clinical course than adults, largely due to delays in presentation, unclear mechanism of injury, and inability to cooperate with the ophthalmic exam. These factors make the initial assessment of pediatric ocular trauma difficult and less accurate, resulting in delays in triage and appropriate management. Therefore, it is imperative for ophthalmologists to obtain comprehensive history and exam and supplement with appropriate diagnostic testing.(4) Taking a complete history is crucial for initial assessment, and certain injuries should be suspected based upon the history. For instance, the potential presence of an intraocular foreign body must be considered with history of explosion, gunshot wound, or sharp object entering the eye.

Once a comprehensive history is obtained, the patient should undergo thorough ophthalmic exam. Ocular exam includes obtaining visual acuity, assessing for afferent pupillary defect, delineating confrontational visual fields, and determining degree of ocular motility. Slit lamp examination of the conjunctiva, sclera, cornea, anterior chamber, iris, angle and lens is performed to determine potential violation of the globe and identify any intraocular foreign body. Pediatric patients who are unable to cooperate with the exam often require examination under anesthesia to assess the severity of trauma and intervene immediately in cases of penetrating injury. An examination under anesthesia becomes even more critical in cases with history and initial ophthalmic assessment suggestive of open globe injury. Open globe trauma should be suspected if the ocular exam demonstrates hemorrhagic chemosis, intraocular pressure of <10mmHg, abnormally deep or shallow anterior chamber, or peaked pupil. Occult open globe injury may rarely present with nonspecific conjunctival injection and irritation.(8)

Diagnostic imaging may be conducted to further assess the presence of an intraocular foreign body and evaluate the extent of globe damage. The most common forms of imaging include CT scan and B-scan ultrasonography. CT scan has been shown to be 95% sensitive for intraocular foreign body detection, although it exposes patients to increased doses of radiation. B-scan ultrasonography is a rapid, cost-effective method for diagnosing retinal detachment and intraocular foreign body and may be chosen over CT scan due to decreased exposure to radiation. X-ray may be used to detect metallic foreign bodies and orbital fractures, and has advantages due to the rapidity, widespread availability, and low cost of testing. MRI is less commonly used for nonmetallic intraocular foreign bodies, usually in cases when CT scan is unable to differentiate hypodense foreign bodies from air. (8) MRI may require general anesthesia in younger patients.

## Management

Management of pediatric ocular trauma depends greatly on the mechanism of injury and the extent of globe damage. In cases of open globe injury, a rigid eye shield should be placed over the injured eye for immediate protection. Studies have also shown that administration of prophylactic broad-spectrum antibiotics decreases the risk of endophthalmitis. Analgesics and anti-emetics may also be administered for patient comfort and prevent emesis that may cause transient increase in intraocular pressure and risk uveal prolapse. Patients are ad-

vised to rest with limited activity until surgical repair.(8) The primary goal of surgical management in ocular trauma is to close penetrating wounds, reposition any prolapsed ocular contents, remove foreign bodies, and treat complications associated with injury in order to preserve final visual acuity.(8)

Prognosis after pediatric ocular trauma depends on a variety of factors, including presenting visual acuity, location of wound, presence of afferent pupillary defect, mechanism of injury, retinal detachment, and endophthalmitis.(9) Scoring systems have been developed to assist in triaging globe injury and predicting outcomes after appropriate management. Scoring systems further allow for efficient communication between emergency department physicians and consulting ophthalmologists. The ocular trauma score (OTS) has been validated in populations worldwide and is commonly used to predict final visual acuity and overall prognosis. The scoring system is based on four presenting characteristics of the ocular injury: type of injury, grade of injury, pupil, and zone of injury. Type of injury is defined by mechanism of injury. Studies have shown that blunt force injury results in ocular rupture and carries a poor prognosis compared to penetrating ocular injury which is associated with localized eye wall injury. Grade of injury is defined by the visual acuity in the injured eye on presentation. Pupil is defined by presence of relative afferent pupillary defect in the injured eye. Afferent pupillary defect is a gross measure of retinal and nerve function, and presence of the defect equates to significant damage to either structure. Grade and pupil have been shown as the most significant predictors of visual outcome. Lastly, zone of injury is defined by the relative anteroposterior extent of the injury. Injuries that are more posterior carry worse prognosis as there is a higher risk of involvement of the optic nerve and retina. In such cases, despite anatomic correction, post-operative visual acuity may remain limited.(9)

Although such scoring systems have assisted with triaging and determining prognosis of ocular injury in adults, certain criteria within the scoring system are notably hard to obtain in pediatric patients, including presenting visual acuity and relative afferent pupillary defect. Therefore, a pediatric ocular trauma score (POTS) was developed that includes variables such as age and location of injury to allow for accurate scoring without visual acuity and afferent pupillary defect. A retrospective study by Awidi and Kraus suggests that POTS may be superior to OTS in predicting final visual acuity in the pediatric population.(4)

## Complications

Pediatric patients are predisposed to certain complications over adults after management of ocular trauma, leading to significant reduction in visual acuity. The most common causes of loss of visual acuity in pediatric patients after ocular trauma are amblyopia, difficulty in follow-up examinations, effect of management, and outcome of perforating ocular injury.(6) Factors that contribute to loss of visual acuity after ocular trauma include young age at presentation, poor initial visual acuity, posterior location of injury, wound size, lens involvement, vitreous hemorrhage, retinal detachment, and endophthalmitis.(4)

Amblyopia is the most common cause of reduced visual acuity after pediatric ocular trauma.(4) Amblyopia occurs due to the length of visual rehabilitation and therapy after open globe repair in children. Patients should undergo aggressive prevention of amblyopia with patching as a gold standard.

Endophthalmitis is a severe complication of open globe injury associated with significantly worse visual acuity. The incidence of endophthalmitis is higher in children, 4.9-54.2%, compared to 0.9-18.4% in adults. Risk factors for development of endophthalmitis include intraocular foreign body, injury in rural setting, wound contamination with organic matter, delay in primary wound closure greater than 24 hours, and involvement of the lens capsule. Streptococcus is the most commonly isolated organism in pediatric patients, likely translocated from normal skin flora. Prophylactic antibiotics and aggressive management are critical in preventing endophthalmitis in the pediatric population.(8)

Other common complications associated with globe injury in the pediatric population are retinal detachment and vitreous hemorrhage. Retinal detachment is associated with a worse visual prognosis. Pars plana vitrectomy with silicone oil infusion has been shown to be more effective in the pediatric population as it provides a clear view without requiring face-down post-operative positions in comparison to gas tamponade, leading to greater compliance. Vitreous hemorrhage is often seen with posterior segment injuries and may present 2-3 weeks after initial injury. Although observation is the primary management of vitreous hemorrhage in a great majority

of cases, this should be balanced with the risk of developing amblyopia rapidly in young patients.(8)

## Conclusion

Ocular trauma remains the leading cause of monocular blindness in children. Blindness has been shown to have a significant impact in the pediatric population, as children who have experienced loss of vision score lower on quality-of-life questionnaires than their peers.(7) Pediatric ocular trauma is further associated with certain complications, including amblyopia and endophthalmitis, that significantly impact prognosis of visual outcome. These aspects highlight the need for increased awareness and prevention strategies to mitigate vision loss in the pediatric population. Education of caretakers and children, accessibility to eye protection, and decreased exposure to certain high-risk activities may serve to significantly decrease the incidence of pediatric ocular trauma.

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CASE REPORT

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# Foldable Capsular Vitreous Body Implant For Post-Traumatic Phthisical Eye

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## Abstract

Purpose: To analyze the outcomes of foldable capsular vitreous body injected in a post-traumatic phthysical eye.

Case presentation: A 19 year-old male patient presented to the ophthalmology department with left post-traumatic phthisical eye , who had previously undergone corneoscleral tear repair due to a penetrating trauma to his left eye one year ago. On ocular examination , there is a corneo scleral scar mark, aniridia , aphakia and retina incarcerated in the scar. He was injected with a foldable capsular vitreous body.

Conclusion: Our case report of foldable capsular vitreous body gives an excellent cosmesis for the phthisical eye.

## Introduction

Vitreous is a transparent, gelatinoid structure occupying major bulk of eye. Vitreous cortex is a thin membrane like structure and extends from the ora serrata to the posterior pole. The function of vitreous body is to support the posterior segment also provide an excellent refractive medium, transports oxygen and inhibits cells migration from retina to the vitreous cavity.(1)The disfigurement associated with the loss of an eye may cause significant physical and emotional problems. Loss of an eye may occur due to malignancies, congenital defects, irreparable traumas, the presence of a painful blind eye, and sympathetic ophthalmia. Depending on the severity of the involvement, the surgical operation in these patients may involve evisceration, enucleation, and exenteration (2). Here we present a case of foldable capsular vitreous body which is injected in the posterior segment of a post traumatic phthisical eye to give an excellent results in terms of cosmesis and maintenance of eye ball.

## Case presentation

A 19 year old male, unmarried, student by occupation presented in out-patient department of ophthalmology with the complaints of sunken and shriveled left eye ball. His complaints started after he had undergone corneo-scleral tear repair for a trauma. One year ago he received a blunt trauma to his left eye resulting in corneo-scleral rupture and uveal prolapse, he went to the emergency department and got his primary repair done, due to the severity of trauma his vision was no light perception (NLP) and later on started shrinking. This unsightly look of a shriveled eye made him consult for any further cosmetic treatment. On slit examination of his left eye there was a leucomatous corneal scar mark in a paracentral area going beyond the limbus, irregular anterior chamber depth, aniridia and aphakia, fundus details were hazy for which B- scan was performed and is shown (Figure 1). Some part of retina was found in-

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carcerated in the corneal scar. Examination of the right eye revealed 6/6 vision and both anterior, posterior segments within normal confines.

We planned to inject a foldable capsular vitreous body (FCVB) in this case, as a volume replacement and to protect the eye ball form further shrinking. Procedure was done under general anesthesia and for which patients suitability for anesthesia was examined pre-operatively. Under the microscope; peritomy was done and full thickness entry of 3.5mm was created in the sclera 5 mm behind the limbus in the supero-temporal quadrant, with the help of an injector vitreous body was injected in the posterior segment (Figure 2A-F). Foldable capsular vitreous body is a foldable round body made up of biocompatible polymer, contains vitreous like sheet and is attached with a drain tube valve system. Body goes in the eye ball whereas the tube with valve stays out and once the body is in the posterior segment, adequate amount (checking digital IOP while injecting silicon oil) of silicon oil is injected in the FCVB which serves two purposes, maintains the volume and shape of the eye ball and also avoids silicon oil emulsification and displacement. After the surgery adequate volume replacement was observed and post-operative pictures are also shown. Since this is a cosmetic procedure, visual prognosis was already explained to the patients and remained the same at the 3rd month (Figure 3), IOP monitoring with applanation tonometry was done on subsequent follow-ups and it remained within normal limits.

## Discussion

Our study demonstrated that the FCVB injected with silicon oil as a vitreous substitute had good biocompatibility and retina support function in the vitreous cavity after a long-term tamponade. This revealed that the new approach of using FCVB combined with silicon oil may yield an ideal artificial vitreous substitute for long-term vitreous replacement. This new approach greatly improved stability of ocular structure and together with the silicon oil acting as an excellent vitreous substitute.

Foldable capsular vitreous body is made from a biocompatible polymer and contains a vitreous like capsule and tube drain system. Its major roles are to support retina and maintain the shape of eyeball and avoid silicon oil emulsification and displacement. They have the best comfort level for the patient and depends upon the axial length and antero-posterior diameter. Recommended silicon oil volume for different axial lengths are shown in the table 1 as recommended by the manufacturers.

An ideal vitreous substitute should mimic the native human vitreous in both form and function. It should have similar viscoelastic properties to the native vitreous in order to maintain a physiologic-range intraocular pressure and support the retina in a proper position (3). The substitute should also be clear and transparent. It should be stable, permanent, and biocompatible, without any toxic reactions during long-term use (4). Meanwhile, the ideal substitute would be easily manipulable during surgery and injectable through a small syringe (5).

Currently, only silicone oil is accepted as a long-term vitreous replacement. However, silicone oil has many disadvantages as a vitreous substitute, such as secondary glaucoma, cataract formation, hyperopic shift, oil emulsification, keratopathy, and in cases of non-effective tamponade, the inferior retina breaks (6-11). Short-term persistence of a vitreous substitute in a vitreous cavity will not be sufficient efficacy in the treatment of complicated retinal detachments or retinal detachments with proliferative vitreoretinopathy. Therefore, researchers have been trying to find an ideal alternative material that may be left safely in the vitreous cavity as a long-term tamponade. The hydrogels (e.g., PVA, PAA) can closely mimic the light transmittance of the natural vitreous humour, as well as its physical and mechanical properties, and may therefore be the best candidates for vitreous substitution (12,13). However, to our knowledge, they have the primary drawbacks of a short residence time and biodegradation in vivo.

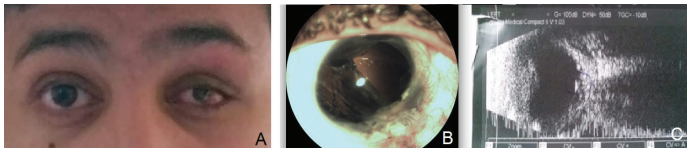


Figure 1Preoperative photos and B-scan ultrasound image of patient

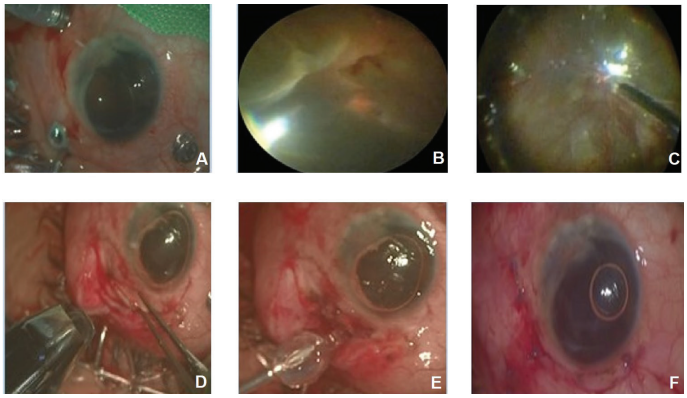


Figure 2 (A-F) Peroperative photos of Foldable Capsular Vitreous Body implantation

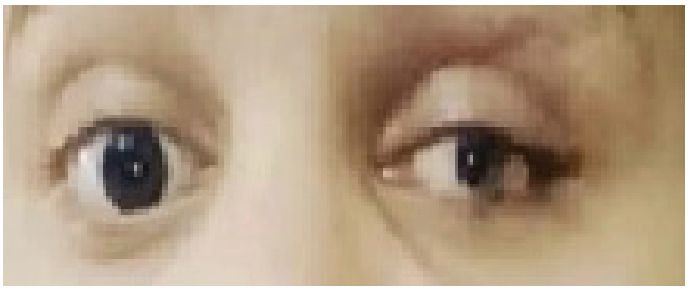

Figure 3 Photo of the patient at postoperative 3rd month

The PVA hydrogel is deemed to be one of the most promising candidates for vitreous substitution due to its optical properties, rheological features, and long-term biocompatibility (13). In previous studies (14-16), the PVA hydrogel has been confirmed to have excellent optical properties and safety in vitro or in vivo, but further studies need to be performed in order to show their retention time, mechanical properties, and ability to reattach the retina within the eye.

In this case, we are reporting that for a pthisical post-traumatic eye foldable capsular vitreous body(FCVB) is an excellent cosmetic hope. It gives a good volume shape to the eye ball and complications associated with silicon oil are minimized to much extent ,providing a better shape and maintain a volume for longer term is a new hope for psychologically suppressed patients with phthisis. One study demonstrated that the FCVB had cellular barrier function and could avoid silicone oil emulsification and migration. Therefore, the FCVB could serve as an isolator in order to avoid PVA hydrogel biodegradation or absorption and displayed better all-round retina support.

We followed the patient for 3 months and is associated with very few complications and gives good shape to the eye ball . The results were similar to many of previous research project.(19,20)

For application during vitrectomy, the hydrogel should be injectable through a needle. During injection, the molecular chains of the polymer will be subjected to an external shear stress, which may result in the massive mechanical breakage of the crosslinks, inducing a significant loss of elasticity (G′ decreases), causing the hydrogel to become more fluid-like and viscous. Our rheologic experiments showed that after their injection through a 19-gauge needle, the storage modulus G′ and the loss modulus G″ of the 3% PVA hydrogel were approximately equivalent to those before injection. This indicated that the injection did not affect the network structure of the 3% PVA hydrogel and that it had similar rheological behavior before and after injection.

Table 1 Recommended silicon oil volume for different axial lengths by the manufacturers.

| Sr. no. | Axial length | Silicon oil volume |
|---|---|---|
| 1 | 16-19.9 | 0.7-0.9 |
| 2 | 20-21.4 | 1.4-1.7 |
| 3 | 21.5-22.9 | 1.8-2.2 |
| 4 | 23-24.9 | 3.5-4.0 |
| 5 | 25-28 | 4.0-5.0 |

Previous studies showed that the fragmentation of a PVA hydrogel in the vitreous cavity and the resulting muddiness of the vitreous cavity occurred after the implantation of the PVA hydrogel.(20)

In one of the previous study (17), it is established that most of FCVB-implanted eyes developed cataracts after a long-term tamponade. In order to better observe fundus, we had to perform lensectomy which lead to secondary lesion. Therefore, in this study, lensectomy was performed during vitrectomy in the PVA + FCVB -treated eyes.

In another study no significant changes in IOP were observed after 7, 14, 30, 60, and 90 days, but there was an increasing IOP at 3 days after PVA hydrogel and BSS implantation, which may have resulted from anterior chamber inflammation after the operation. In contrast, the IOP in the PVA + FCVB group decreased at 3 days after operation. This may have been due to a leakage of the aqueous humor at the incision for the FCVB implantation. Meanwhile, a significant decrease in IOP was observed at 180 days after PVA hydrogel direct implantation, which may have occurred because of hydrogel degradation and absorption.(22)

In the PVA + FCVB-implanted eyes, a histopathologic examination showed that the structure of retina was intact without obvious pathological changes on postoperative 90 days. However, retinal disorder and proliferation were observed at 180 days after implantation, which may have been caused by a long-term FCVB capsule-induced mechanical pressure to the retina.(23)

In conclusion, the FCVB tamponade with silicon oil seems to have good stability and transparency in the vitreous cavity. The FCVB can safely prolong its retention time and effectively improve its stability performance in the vitreous cavity. Also this novel approach may indicate that the FCVB is suitable for other hydrogels (e.g. PVP, PAA) tamponade. Moreover, many nanometer-wide

apertures exist in the FCVB, and drugs can be released from the FCVB (21-24) , so a drug may be added to the hydrogels, providing clinicians with a slow-release drug device. Therefore, this novel approach may develop into a new ideal vitreous substitute and open new options for the prevention and treatment of vitreous retinal diseases.

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CASE REPORT

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# Chorioretinal Folds in a Patient with Macula Sparing Malign Hypertensive Retinopathy

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## Abstract

To report a case about chorioretinal folds in a patient with malign hypertensive retinopathy. Chorioretinal folds are associated with several pathologies, especially with papilledema or similar situations. Persistant folds usually occur with longstanding pathologies. However, as seen in this case, these chorioretinal folds do not need permanent and long standing changes.

## Introduction

Choroidal folds are the fundus appearance of striations in the posterior pole and may be horizontal, vertical, or oblique, and rarely ever extend beyond the equator. (1) Choroidal folds can be seen in association with orbital inflammation, orbital infections, dysthyroid eye disease, hypermetropia, and following scleral buckling, a non-specific sign of orbital tumours, hypotony, papilloedema, intracranial hypertension, microgravity space flight or hyperopia. (2-7)

These folds develop when the forces are applied to the choroid and retinal layers, which are compliant substrate. (8) Although the pathophysiology of optic nerve head (ONH) swelling in several pathologies differ, the volumetric swelling of the ONH is a common structural entity.

In our report, we demonstrate chorioretinal folds in a patient with macula sparing malign hypertensive retinopathy.

## Case

A forty- eight years old male patient was referred to our clinic with complaint of visual loss. His visual acuities were 20/20 on the right eye (+1,50) and 20/20 left eye (+2,00). Intraocular pressures were 14 mmHg in right eye and 13 mmHg in the left eye. Anterior segment were bilaterally normal. On fundus examination, bilaterally optic disc head swelling, cotton wool spots, hard exudates and macular wrinkles were present. (Figure 1) On the spectral domain optical coherence tomography (SD-OCT) evaluation choroiretinal folds were seen at bilateral macular section. (Figure 2)

Cardiologic examination of this patient revealed acute malignant hypertensive crisis with 240/130 mmHg blood pressure. Antihypertensive therapy was initiated. At patient's 3. month control, the visual acuities were same and the optic disc swelling and cotton wool spots disappeared however macular chorioretinal folds were present on both fundus examination and SD-OCT images. (Figure 3,4)

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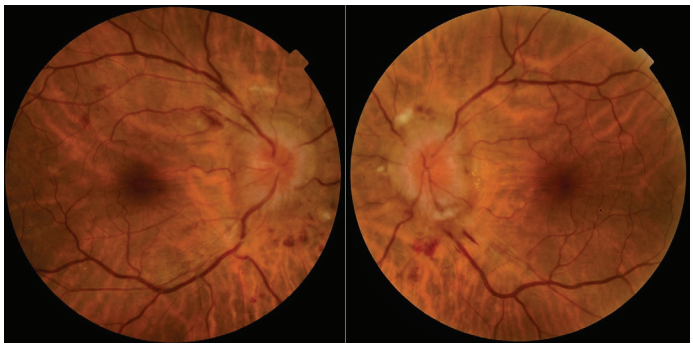

Figure 1: Color Fundus Photograph of right and left eye at the first evaluation.

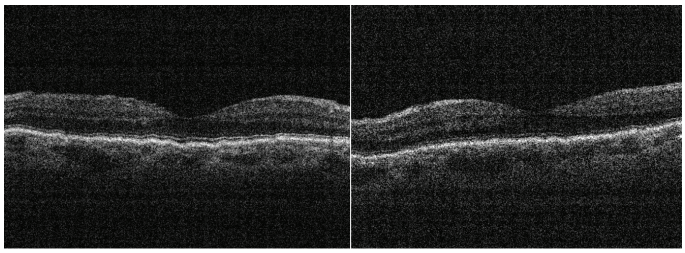

Figure 2: Spectral domain optical coherence tomography image of macula of right and lefte ye at the first evaluation.

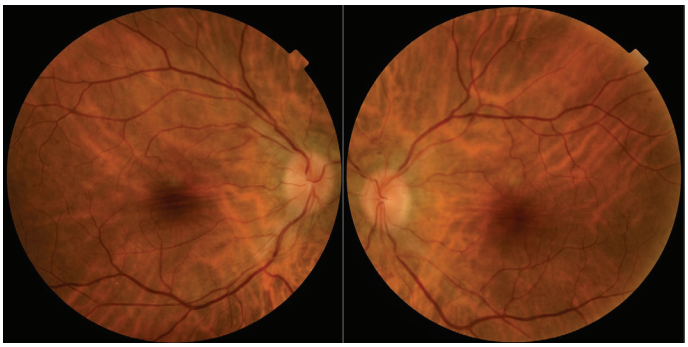

Figure 3: Color Fundus Photograph of right and left eye at last evaluation.

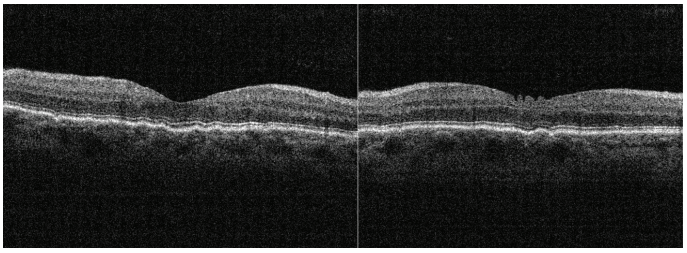

Figure 4: Spectral domain optical coherence tomography image of macula of right and left eye at last evaluation.

## Discussion

In this report, we presented persistent chorioretinal folds after macular sparing malign hypertensive retinopathy. As described previously, chorioretinal folds are associated with several pathologies. (2-7) Although most of the acquired chorioretinal folds and hyperopia usually regress in orbital mass patients after successful tumor removal, some of these patients and the other pathologies persist. (9,10)

Mechanism of choroioretinal folds associated with the papilledema is suggested as transmission of increased cerebrospinal fluid pressure from sunarachnoid space of the optic nerve to the posterior ocular wall. (11) The persistence of the choroidal folds has been attributed to scleral remodelling after long-standing compression. (12)

A hypertensive emergency is defined as a sudden increase in systolic and diastolic blood pressure associated with end organ damage of the central nevre system, the heart, or the kidneys. (13) Result of this arterial tension increase lead to retinal hemorhhages, hard exudates, cotton wool spots and optic disc swelling. (14)

In our case, although macular exudates as star formation were not seen, chorioretinal folds and acquired hyperopia were present and vision was not effected. After the regression fo the optic nerve swelling, exudates and cotton wool spots, chorioretinal folds were persistant. The importance of this case is, persistance of the chorioretinal folds is not dependent on a long period of uncontrolled hypertension.

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