

**JOURNAL PUBLICATION AND CASE REPORT BOOK**  
**2005-2009**

**By**

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**Submitted in Partial Fulfillment of the Requirement for the**  
**Degree of Master of Medicine**  
**(OPHTHALMOLOGY)**



**UNIVERSITI SAINS MALAYSIA**

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**UNIVERSITI SAINS MALAYSIA**

**2009**

## ACKNOWLEDGEMENT

*(In the name of ALLAH, the Most Beneficent, and the Most Merciful)*

I would like to express my sincere thanks and deepest appreciation to my supervisor Dr Raja Azmi Mohd Noor, for his constant support and guidance without whom this publication and case reports would not have been completed.

I would also like to forward my special thanks to all lecturers in Ophthalmology Department, in particular Associated Professor Dr. Wan Hazabbah Wan Hitam, Head of Ophthalmology Department for his guidance, teaching and support throughout the program.

My special thanks to my parents and wife whose patience, encouragement and understanding have guided me throughout my course. To my lovely sons, Yusof and Ahmad, you were my inspiration.

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**PUBLICATION 1**

**A STAGED PENETRATING KERATOPLASTY FOLLOWING  
LIMBAL STEM CELLS ALLOGRAFT IN SEVERE CHEMICAL  
INJURY LEADING TO RESTORATION OF OCULAR SURFACE**

**ANATOMY**

**Published in International Journal of Ophthalmology, Vol 8,  
No. 1, Jan. 2008**



# A staged penetrating keratoplasty following limbal stem cells allograft in severe chemical injury leading to successful restoration of the ocular surface anatomy

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Received:2007-11-23 Accepted:2007-12-30

## Abstract

• A 62-year-old man presented with severe bilateral ocular surface chemical injury and history of failed penetrating keratoplasty of right eye in 1996. Visual acuity was hand movement in right eye and light perception in left eye. Staged procedures of limbal stem cells allograft followed by penetrating keratoplasty have been done and resulted in good ocular surface restoration and rehabilitation of vision in right eye.

• **KEYWORDS:** limbal stem cells transplantation; chemical injury; penetrating keratoplasty

Alashwal AH, Raja AMN, Ibrahim M. A staged penetrating keratoplasty following limbal stem cells allograft in severe chemical injury leading to successful restoration of the ocular surface anatomy.

*Int J Ophthalmol(Guji Yanke Zazhi)* 2008;8(1):26-28

## INTRODUCTION

The normal ocular surface is covered by corneal, limbal, and conjunctival epithelia, each of which has a distinct cellular phenotype. These three epithelia maintain the ocular surface integrity<sup>[1]</sup>. Limbal stem cells can be considered as the ultimate source of corneal epithelial regeneration. They support and maintain the corneal epithelial turnover since they have unlimited capacity for cells regeneration<sup>[2]</sup>. When these cells are in dysfunctional state due to any disorders or injuries, a unique pathologic state will invariably ensue and severe ocular surface insufficiency occurs characterized by persistent epithelial defects, vascularization, and conjunctivalization of the cornea with eventual loss of vision<sup>[1,3]</sup>.

Severe chemical injury results in limbal stem cells deficiency which was manifested clinically by conjunctivalization, scarring of the cornea secondary to destruction of the basement membrane, corneal neovascularization, chronic inflammation and fibrous ingrowth<sup>[4]</sup>. In such case, restoration of the corneal clarity and improving vision can be achieved only by

considering reconstruction of the ocular surface by limbal stem cells allograft accompanied with or followed by penetrating keratoplasty (PK). In our patient the corneal epithelium as well as conjunctival surface were severely injured, which resulted in a complete corneal conjunctivalization on both eyes. In order to repair the ocular surface and regain the functional vision in this patient, a two-step procedure of limbal stem cells allograft followed by PK was considered.

## CASE REPORT

A 62-year-old man, a known case of hypertension and diabetes mellitus on regular medication, presented with remarkably reduced vision following severe chemical injury in both eyes in 1993. He had severe ocular surface damage and eventually developed deep corneal stromal opacity and vascularization. He underwent PK in right eye in 1996. In 2003 extracapsular cataract extraction with posterior chamber intraocular lens (IOL) implantation had been performed in right eye. However, the visual acuity did not improve because the transplantation had failed and perhaps was attributable to the poor corneal re-epithelialization in view of severe limbal stem cell damage.

Ocular examination revealed that the visual acuity was hand movement in right eye with good light projection in all gazes and light perception in left eye. He had deep corneal opacification in the left eye (Figure 1). There was upper fornix symblepharon in the right eye and generalized diffuse corneal opacity with deep stromal vascularization 360° as shown in Figure 2,3. Right eye intraocular pressure (IOP) was 15mmHg and anterior chamber was formed but the details of the iris can not be visualized. Baseline hematological investigations, hepatic and renal parameters were obtained and repeated every 2-4 weeks.

An attempt to achieve normal ocular surface was considered first by releasing symblepharon and buccal mucosa grafting done in 2005. Right limbal stem cells allograft was performed on 16 September 2006. The limbal stem cells were obtained from a live donor who had severe proptosis blind eye due to neurofibromatosis type I and underwent enucleation. First the recipient bed was prepared. A lamellar dissection of the limbus and fibrovascular tissue was done. Then the limbal conjunctival graft was dissected 360° and advanced to the recipient bed. The donor tissue was sutured to the limbal side as well as to the surrounding conjunctival edge by interrupted 10-0 nylon sutures. At the end of surgery a bandage contact lens was placed.





**Figure 1 Severe limbal ischemia and dense stromal opacity in the left eye**

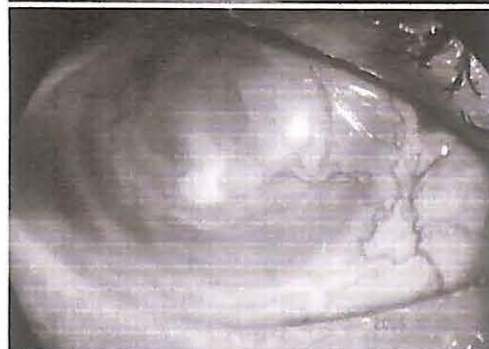
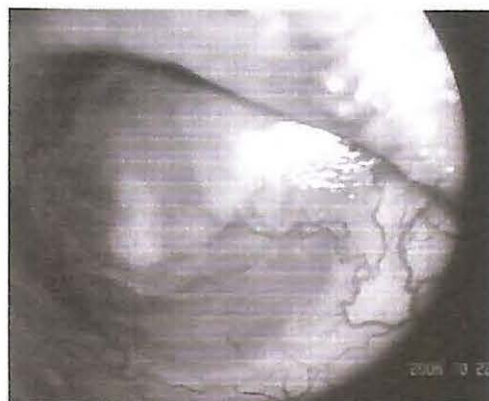
Postoperatively topical prednisolone acetate 10g/L was given every two hours, and then the dosage was tapered gradually. Topical ciprofloxacin every six hours and free preserved lubricants every two hours were given. Immunosuppressive therapy have been started postoperatively in the form of oral predinsolone 60mg once daily which tapered off weekly by 10mg. Oral cyclosporine 300mg once daily was started and its blood level was monitored regularly. A gap of four months after limbal stem cells transplantation was considered before proceeding to PK to allow the ocular surface to stabilize.

He underwent PK on 7<sup>th</sup> February 2007 with a standard surgical procedure for penetrating keratoplasty. A full-thickness corneal button with a diameter of 7.5mm was grafted by 10-0 nylon interrupted sutures. There was iatrogenic trauma to iris at around 4-5 o'clock intraoperatively. Visual acuity was 1/60 on the first day postoperatively and there was a small central epithelial defect in otherwise clear graft. This epithelial defect healed within the first week. Table 1 showed the events and operations that our patient had undergone since 1993.

Immunosuppressive therapy (cyclosporine 300mg once daily) was given with the postoperative medications in the form of topical prednisolone acetate 10g/L every two hours, topical chloramphenicol every four hours and free preservative lubricant every two hours. After five months the best corrected visual acuity has improved to 6/30, and cornea was clear with no signs of rejection noted (Figure 4). Cyclosporine blood level as well as renal and liver function parameters were within normal limit.

**DISCUSSION**

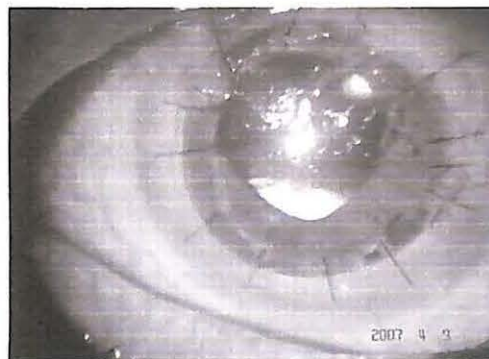
Severe chemical injury is a challenging disorder. It can cause destruction of limbal stem cells which represent the ultimate source of corneal epithelial cells replacement<sup>[5]</sup>. Also it can damage corneal tissue and lead to persistent epithelial defect and corneal scarring. In severe limbal stem cell deficiency, the ideal procedure will entail replacing the lost limbal stem cells through limbal stem cells transplantation (LST). However, the aim of surgery is not to restore vision but to replenish limbal stem cells and replace conjunctival phenotypic epithelium by corneal phenotypic epithelium, consequently maintaining a stable ocular surface. In 1989 Kenyon and Tseng were the first who applied LST clinically



**Figure 2, 3 Right eye after limbal stem cells transplantation; cornea has deep stromal vascularized scar**

**Table 1 Events in which patients had gone through since 1993**

Year	Events	V/A
1993	Chemical injury in both eyes	CF <sup>1/2</sup> m
1995	Right PK (failed)	6/9
1996	Corneal graft rejection	CF 1 m
2003	Right ECCE and PC IOL implantation	CF closed
2005	Right symblepharon release, mucosal graft	HM
2006	Right limbal allotransplant	HM
2007	Right PK	6/36



**Figures 4 Two months post PK; the stem cells stabilized the ocular surface; the cornea was clear with no signs of rejection; iatrogenic iridotomy at 4-5 o'clock**

and reported a favorable result. They transplanted a conjunctivolimbal tissue from a normal patient's healthy eye<sup>[6]</sup>. When both eyes are affected, allograft LST obtained from living relative or cadaveric donor must be used, which may be combined with or followed by PK. Once the limbal stem cells are successfully transplanted, they become the new

source of epithelium in which they support the corneal graft and cover it by epithelial cells, resulting in a good ocular surface reconstruction and favorable visual outcome. Unfortunately there is a high rate of immune reaction that may be expected due to the immunogenic stimulus of the transplanted limbal cells, which makes the judgment to use aggressive immunosuppressant agents necessary. Topical corticosteroid accompanied with oral cyclosporine has traditionally been the mainstay for preventing graft rejection. Recently a new immunosuppressive agent, FK-506, is used for at least 18 months after surgery. This agent shows similar activities and is more potent than cyclosporine.

The timing of the surgical procedures perhaps has a role in graft success. A period of at least three months between LST and PK allowing the inflammation to be diminished is preferred by many doctors<sup>[7-10]</sup>. Several studies now encourage staged operations rather than one stage operation. The first stage involves ocular surface reconstruction by transplantation of limbal stem cells and the second aims at restoration of vision by PK. Shimazaki *et al*<sup>[10]</sup> reported that they found that the eyes receiving PK several months after LST showed fewer complications than those with simultaneous PK and more than half of the cases in one-step operation developed immunologic rejection in the central graft, whereas the complication was not observed in the two-step procedure. Satisfactory visual rehabilitation is possible after PK following LST without compromising ocular surface stability<sup>[11]</sup>. However, Yao *et al* in his study demonstrated that a combination of autologous LST with deep lamellar keratoplasty as a one-stage surgical procedure simultaneously reconstructed the ocular surface and recovered corneal clarity in eyes with severe ocular surface disorders caused by late-stage chemical or thermal burns<sup>[12]</sup>. In our patient the failure of the first corneal graft was most likely attributable to the poor corneal re-epithelialization due to severe limbal stem cells deficiency occurring after injury. To minimize the risk of rejection and reduce postoperative complications, we consider the staged operation with 4-month gap between allograft IST and PK which was advocated recently by a lot of authors. Besides, the treatment of symblepharon before reconstruction of the ocular surface was performed. By using the immunosuppressive agents in high dose and long duration, staged procedures of LST followed by PK showed a remarkable progress in terms of ocular surface reconstruction and success of corneal epithelialization and clarity as well as improvement and rehabilitation of the vision. In conclusion, we believe that allograft LST is useful in stabilizing ocular surface in bilateral limbal stem cell deficiency, which renders PK success high and effective. This procedure has now become a widely accepted management for severe chemical ocular surface injury. It has showed good result for ocular surface reconstruction and visual rehabilitation as well. Based on our experience in this case, the ocular surface reconstruction prior to PK and the timing of

the surgical procedures has a significant role in graft success, minimizing immunologic rejection and improving the eventual visual outcome.

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#### 分期实施异体角膜缘干细胞移植与穿透性角膜移植术治疗严重化学伤

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#### 摘要

有1位于1996年实施右眼穿透性角膜移植术失败的双眼严重眼表化学伤的患者,62岁,右眼视力手动,左眼视力光感。于2006-09-16/2007-02-07分别对右眼实施了异体角膜缘干细胞移植术和穿透性角膜移植术,经过术后5m的药物治疗观察,最终获得了右眼最佳矫正视力为6/30,角膜移植片透明,眼表得以重建,并未发现明显排斥迹象的良好效果。

关键词:角膜缘干细胞移植术;化学伤;穿透性角膜移植术

**PUBLICATION 2**

**FIBRIN GLUE FOR SEALING EARLY BLEB LEAK**

**Published in International Journal of Ophthalmology, Vol 9,  
No. 5, May. 2009**



# Fibrin glue for sealing early bleb leak : a case report

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Received: 2009-02-01 Accepted: 2009-04-30

## Abstract

• A 63-year-old male presented with sudden diminution of vision, eye discomfort, redness and watering in his left eye. He had undergone glaucoma valve filtering surgery for refractive secondary glaucoma one week back. He also had a history of failed augmented trabeculectomy one year earlier in the same eye. Ocular examination showed best corrected visual acuity (BCVA) of 6/18 and there was a bleb leak, shallow anterior chamber and intraocular pressure (IOP) of 6mmHg. Successful sealing of bleb leak was performed using fibrin glue resulted in deepening of anterior chamber with IOP of 13mmHg. This case demonstrates that, fibrin glue is an effective method for management of early filtering bleb leak.

• **KEYWORDS:** fibrin glue; bleb leak; filtering surgery

DOI: 10.3969/j.issn.1672-5123.2009.05.007

Alashwal AH, Yaakub A, Noor RAM, Tajudin LSA. Fibrin glue for sealing early bleb leak; a case report. *Int J Ophthalmol (Guji Yanke Zazhi)* 2009;9(5):831-832

## INTRODUCTION

A leaking filtering bleb has been known as a common complication of glaucoma filtering surgery. It may be encountered in the early postoperative period or months to years after surgery. Its occurrence increases with the growing popularity use of antimetabolites in glaucoma surgery<sup>[1]</sup>. The bleb leak may be uncomplicated and self-limiting or may be associated with numerous ocular complications. These complications include shallow and flat anterior chamber, hypotony, cataract formation, choroidal detachment, hypotony maculopathy and bleb failure<sup>[2,3]</sup>. Furthermore, a leaking bleb may predispose the patient to vision-threatening infection such as endophthalmitis<sup>[4]</sup>. Nevertheless these complications can be avoided with appropriate management of the bleb leak. Fibrin glue is a group of blood products consists mainly of two components: fibrinogen and thrombin which leads to the formation of a fibrin clot at the site of application. The use of this material has increased in numerous ophthalmic surgeries including glaucoma surgery<sup>[5]</sup>.

## CASE REPORT

A 63-year-old male presented with sudden decrease in vision, eye discomfort, redness and watering in his left eye. He had undergone glaucoma valve filtering surgery for refractive uveitic glaucoma one week back. He also had a history of failed augmented trabeculectomy which was done one year earlier on the same eye. Eye examination showed best corrected visual acuity (BCVA) of 6/18 OS, shallow bleb, Seidel test was positive and leak was observed over the temporal part of the bleb. The anterior chamber was shallow and intraocular pressure (IOP) was 6mmHg. The patient was diagnosed to have an early bleb leak.

Conservative management of bleb leak with torpido eye padding, aqueous suppression and prophylactic topical antibiotics were attempted. Unfortunately this management was ineffective and conjunctival flap resuturing was performed. Although care was taken in handling the conjunctival tissue and meticulous suturing techniques was performed, however, on the second day bleb showed leakage again from the same site.

As the IOP was persistently less than 7mmHg and conservative and resuturing management were failed, sealing of the leak with fibrin glue was considered. The eye was cleaned with povidone iodine and few drops of topical anesthesia (benoxinate hydrochloride 4g/L) were instilled into the conjunctival sac. The fibrin glue (Tisseel) was prepared in advance according to the manufacture instructions. Small amount of the glue then injected to the bleb over the area of leakage using a 27-gauge needle and lifted about 5 minutes to dry. A fluorescein strip was placed over the leaking site to confirm that the bleb was successfully sealed. Eye examination on day one post procedure showed no sign of leakage, Seidel test was negative and anterior chamber was deepen with IOP 12mmHg (Figure 1). The BCVA was improved to 6/9 and the cornea was clear.

## DISCUSSION

The bleb leakage becomes more common ocular problem following trabeculectomy and more than ever with the use of concomitant antimetabolites in this surgery. Early postoperative bleb leak may be related to patent stitch tracts, inadequate wound closure, and surgical trauma to the conjunctiva causing conjunctival button holes<sup>[6]</sup>. A various conservative techniques have been described to address filtering bleb leak, including aqueous suppression, an eye patch, collagen shields or oversized contact lens, and subconjunctival injection of autologous blood<sup>[7,8]</sup>. However, these techniques are often inadequate to manage bleb leak and more invasive surgical methods are commonly required, such as free conjunctival patch grafts<sup>[9]</sup>, and scleral grafts<sup>[10]</sup>.

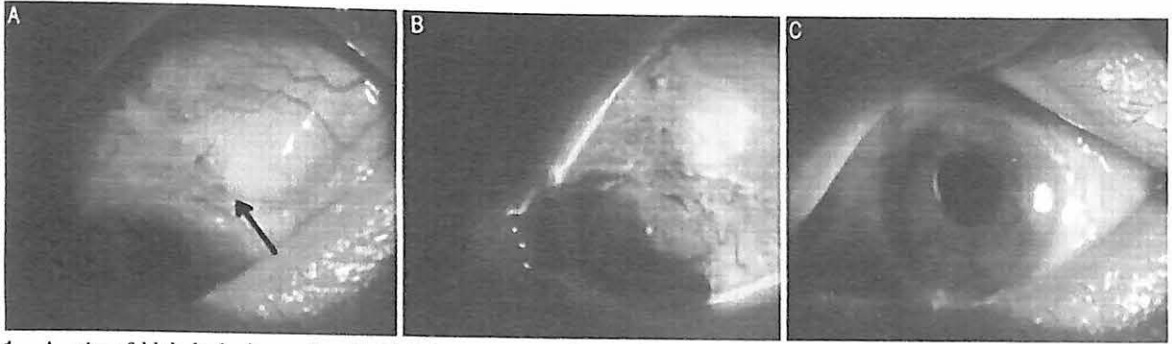


Figure 1 A: site of bleb leak (arrow) ; B: bleb intact post sealing with negative Seidel test; C: clear cornea and deep formed anterior chamber

Recently application of tissue adhesive such as fibrin glue grows to be widely accepted as sutures alternative in ophthalmic discipline. However, its use in glaucoma surgery and in bleb leak management is still a relatively novel concept. Asrani and Wilensky<sup>[11]</sup> reported the treatment of bleb leaks with autologous fibrin tissue glue. They found that, nine of the 12 bleb leaks were successfully healed. However, Seligsohn *et al*<sup>[12]</sup> concluded in their case series that, fibrin glue (Tisseel) may not be an effective treatment of leaking blebs and hypotony following trabeculectomy. On the other hand a recent study, Valimäki<sup>[13]</sup> investigated the use of fibrin glue to prevent leaks around silicone tube entry sites in glaucoma device implantation. They concluded that, the primary intraoperative use of fibrin glue was a good option for reducing peri-tubular leaks and preventing immediate postoperative hypotony after drainage device implantation. In this report we demonstrated the successful use of fibrin glue in sealing early bleb leak. We think that, fibrin glue is a valuable method to seal early bleb leak where the tissue still vascularized. On the other hand, it could be not of much help in late bleb leaks that occur years after surgery because they are often very avascular and no viable tissue left.

#### CONCLUSION

In conclusion, we have found that the fibrin glue is a safe and effective technique in management of an early bleb leak and also has advantages over the other methods. It can be placed quickly over the site of leak with potentially no risk of buttonholing of the conjunctiva. Furthermore, its use can simplified the procedure and cut down the time.

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#### 纤维蛋白胶封闭早期滤过泡漏 1 例

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#### 摘要

患者,男,63岁,以“左眼突发视力下降,眼部不适,眼红,流泪”主诉就诊。1wk前因继发性青光眼行青光眼阀植入术。同一眼1a前曾行扩大的小梁切除术,手术失效。眼科检查结果:最佳矫正视力为6/18,有滤过泡漏,前房浅,眼压6mmHg。应用纤维蛋白胶成功封闭滤过泡漏,前房加深,眼压升至13mmHg。此病例说明纤维蛋白胶是治疗早期滤过泡漏的有效方法。

关键词:纤维蛋白胶;滤过泡漏,滤过术

**CASE REPORT 1**

**MYCOTIC KERATITIS CAUSED BY *CURVULARIA SPP.***



## **Mycotic Keratitis Caused by *Curvularia Spp***

### **Abstract**

A 34-year-old Malay man presented with reduced vision right eye associated with redness, foreign body sensation and tearing. Ocular examination revealed visual acuity of 6/18 OD and 6/6 OS. There was presence of RE conjunctival injection and paracentral corneal ulcer. Examination of anterior chamber showed occasional cells with no hypopyon. He was diagnosed as right fungal corneal ulcer and topical and systemic antifungal therapy had been given.

### **Biodata**

Name : Mohamad Zaharina Mohd Yusof

Age : 34 years

IC : 730501036031

Gender : Male

Race : Malay

Occupation: Lorry driver

Registration number: B 335411

Date of presentation: 02/ June / 2007



## Case report

A 34-year-old Malay man presented with mild reduced vision RE associated with foreign body sensation, redness and tearing. The problem was started one week back with RE redness, irritation and tearing. Two days later he experienced mild reduced of vision and he noted white opacity over right cornea. He was using eye drops given by a pharmacist however the condition getting worse. The patient did not report any known ocular traumatic injury and there was no history of wearing contact lens. There was no history of previous similar attack and no medical illness had been known. Social history revealed that he is working as lorry driver for about 10 years.

Ocular examination revealed best corrected visual acuity of 6/18 OD and 6/6 OS. Right eye showed marked conjunctival injection, presence of para-central corneal ulcer measuring 3x2.8 mm. The margin was slightly elevated and ill defined. There was also deep stromal inflammatory infiltration (figure1). Staining the lesion with fluorescein stain revealed epithelial defect (figure1). Occasional cells were noted in the anterior chamber. There was no hypopyon. The intraocular pressure was 15 mm Hg. The lens was clear and fundus examination was uneventful. General physical examination and systemic work-up were normal.



Figure 1: Para-central corneal ulcer with ill define margin and stromal infiltration, no hypopyon

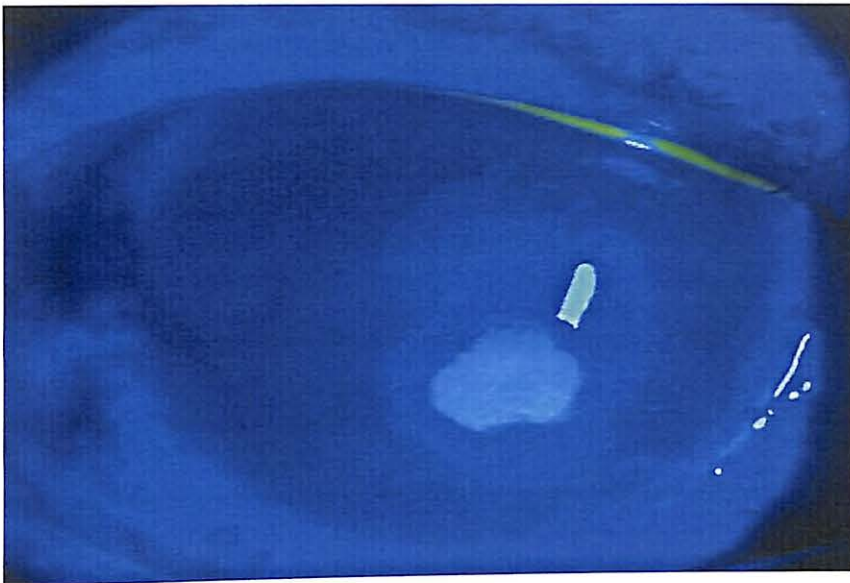


Figure 2: Epithelial defect stained with fluorescein

## **Provisional diagnosis**

This patient was diagnosed as right fungal corneal ulcer that was made based on clinical features.

## **Differential diagnosis and management**

RE bacterial ulcer was considered the first DD based on the history and clinical findings. The mode of presentation of reduced vision within one week without any history of trauma was suggesting the diagnosis of bacterial ulcer.

The patient was admitted to eye ward on 02/06/2007. Corneal smears and cultures were obtained aseptically from the base and edges of ulcer for bacteriological, viral and mycological examination. Intensive therapy of topical broad spectrum antibiotic (ciprofloxacin drops) every one hour and topical cycloplegic drops every eight hours was empirically started.

After two hours gram staining showed filamentous (hyphae) growth. Topical antifungal (fluconazole) was added hourly. Three days after admission culture result revealed fungal colonies of *Culvularia spp.* The ulcer showed minimal improvement after one week and its size remains same. Topical natamycin was added every one hour.

Unfortunately two days post natamycin instillation, a level of less than 1mm of hypopyon had developed (figure3). However there was no worsening of the ulcer size and its stromal infiltration. This reaction and hypopyon disappeared gradually over one week. We assumed that this reaction was due to natamycin hypersensitivity reaction. The corneal ulcer healed gradually over three weeks, patient was discharged with a small paracentral corneal scar and BCVA of 6/9 OD.

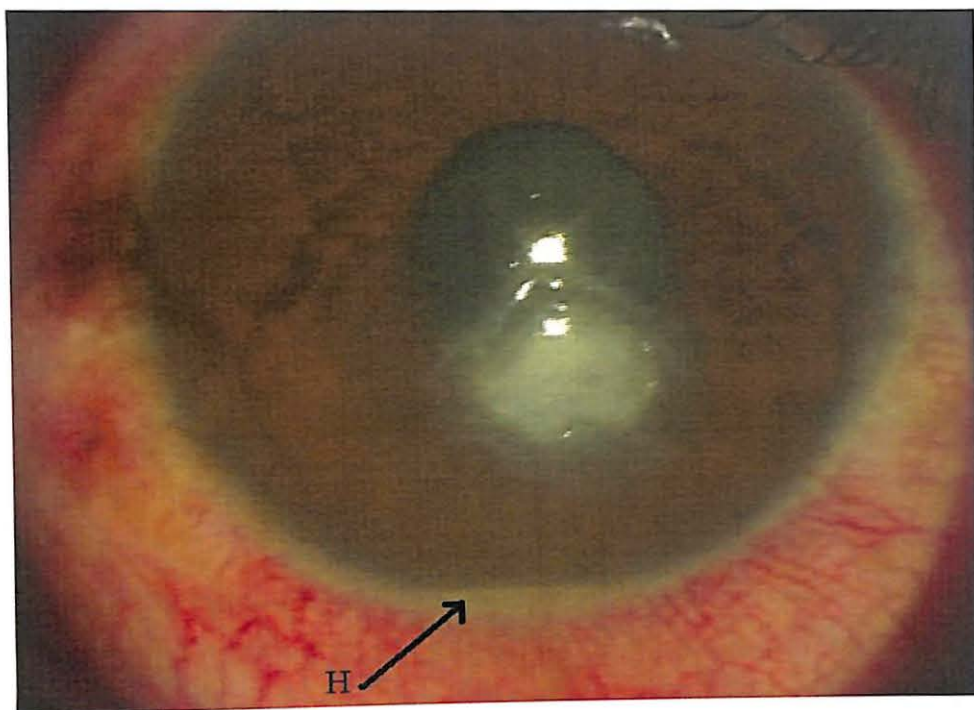


Figure 3: Presence of hypopyon (H) level less than 1mm after using Natamycin



## Discussion

The incidence of fungal keratitis has increased in the last two decades. This has been attributed by increase use and abuse of topical corticosteroids and contact lens wear. Trauma and ocular surface disorders also considered as other risk factor (1). Fungi that infect the cornea are broadly classified as yeast or molds. Yeasts are unicellular fungi characterised by an oval or round structure, the blastoconidium. Molds are organisms with filamentous structure (hyphae) and a tangled mass of hyphae which constitutes the mycelium.

There are about thirty-five fungal genera have been reported associated with mycotic keratitis. *Fusarium solani* is the most frequent etiologic agent and has been reported in up to 65% of cases. *Aspergillus species* and *Candida albicans* are also common causes. However infection with *Curvularia spp.* remains uncommon (2).

Fungi gain access into the corneal stroma through a defect in the epithelium, then it multiply causing tissue necrosis and an inflammatory reaction. This epithelial defect usually results from trauma (contact lens wear, foreign material and prior corneal surgery). The organisms can penetrate an intact Descemet membrane and gain access into the anterior chamber or the posterior segment. Mycotoxins and proteolytic enzymes augment the tissue damage. Trauma, contact lens wears, and topical steroid considered the main predisposing factors for fungal keratitis (1).

Fungal keratitis is a sight-threatening condition and remains a diagnostic and therapeutic challenge to ophthalmologist. It could be due to difficulties that related to establishing a clinical diagnosis, isolating the etiologic fungal organism and treating the keratitis effectively with topical antifungal agents. It results in a significant degree of ocular morbidity. Due to high incidence and poor responses to antifungal agents fungal keratitis has become an important cause of visual loss in many developing countries where a large number of the populations are farm workers (3 and 4). Early diagnosis and treatment are important in preventing this complication.

*Curvularia spp.* commonly occurs as contaminants and being saprophytic dematiaceous fungi. This genus of filamentous fungi colonizes soil and vegetation and spreads by airborne spores (5). With regard to keratitis caused by *Curvularia spp.* the role of trauma to the cornea and that of the initial topical use of steroids or broad-spectrum antibiotics are implicated in the development of this ulcer.

There are factors that could delay the healing of corneal ulcer in this case. First, our patient waited about a week before seeking proper care. Second, a delay in starting natamycin might prolong the length of therapy. However this case showed good response to topical antifungal (Natamycin), even though initially developed drug reaction, it showed dramatic improving. In short, the awareness of mycotic keratitis and early diagnosis is necessary for successful management of this sight threatening condition.

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**CASE REPORT 2**

**ACUTE UNILATERAL NEURO-RETINITIS IN  
UNCONTROLLED HYPERTENSIVE WOMEN**



## **Acute Unilateral Neuro-retinitis in Uncontrolled Hypertensive Women**

### **Abstract**

A 41-year-old Malay lady, a known case of diabetes mellitus, hypertension, and hyperlipidemia presented with mild reduced vision right eye associated with metamorphopsia and giddiness. The vision was 6/12, PH 6/9 OD and 6/6 OS with positive RAPD on RE. Slit- lamp examination of right eye revealed unremarkable anterior segment finding. There was optic disc swelling associated with peri-papillary flame shaped hemorrhages. Macula was involved with presence of macular star. Left eye examination was normal. Blood pressure was 160/90 mmHg and she was admitted for further investigations and management.

### **Biodata**

Name : Hasnah Daud

Age : 41 years

IC : 651002065692

Gender : Female

Race : Malay

Occupation: House- wife

Registration number: A039535

Date of presentation: 21/ June /2007

## Case report

A 41-year-old Malay lady, a known case of DM, hypertension and hyperlipidemia presented with mild reduced vision RE. The condition started one week prior to admission when she noticed mild blurring of vision associated with giddiness and metamorphopsia OD. There was no eye pain. She was to have BP of 185/119. She was treated with Tab captopril 50 mg BD. Pre-morbidity vision was good without history of similar previous attack. She had DM for more than 8 years and on oral hypoglycemic medications. She also had hypertension and hyperlipidemia on medications.

Ocular examination revealed visual acuity of 6/12 with BCVA of 6/9 OD and presence of RAPD. The anterior segment examination was normal. Fundoscopy examination showed right optic hyperemic disc swelling with surrounding retinal hemorrhages, hard exudates and presence of incomplete macular star (Figure1).

Optic nerve functions were affected with impaired color vision, saturation and light brightness. The left eye examination was showing normal findings and visual acuity of 6/6. She was alert, oriented and afebrile with blood pressure of 165/110. Other general physical examination, heart, abdomen and neurological examination were normal.

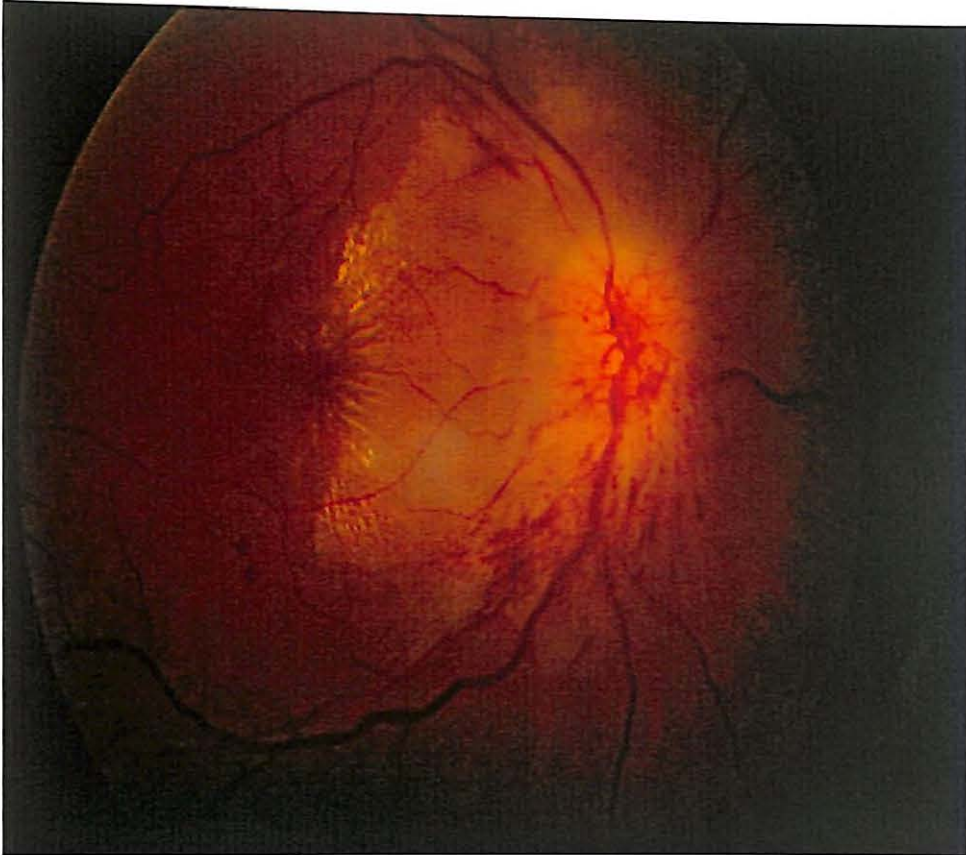


Figure 1: Right hyperemic swollen disc, retinal hemorrhages, hard exudates and incomplete macular star

## **Provisional diagnosis**

The provisional diagnosis of right neuro-retinitis was made based on the clinical features.

## **Differential diagnosis and management**

Fortunately the appearance of a macular star figure is helpful in narrowing the differential diagnosis. Few disorders are associated with lipid deposits with this particular pattern

- 1- Non arteritic anterior ischemic optic neuropathy (NAION) was considered the first DD based on the clinical findings including mild painless reduce of vision, positive RAPD and hyperemic optic disc. In addition the past medical history of DM and HPT which considered as risk factors for developing NAION.
- 2- Hypertensive retinopathy is another potential cause of such macular exudates and star. Although it initially might be considered in this patient, unilateral presentation was against this diagnosis. It is usually bilateral in most cases and associated with more widespread retinal exudates, hemorrhages, and cotton wool spots.
- 3- Disc swelling due to increase intra-cranial pressure (ICP) which is occasionally associated with a macular star, but typically it involves both optic discs and does not cause marked optic nerve dysfunction. Also there was no any symptom suggesting the presence of increase ICP such as nausea, vomiting or headache.