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Traumatic wound dehiscence after penetrating keratoplasty: Clinical features and outcome in 53 cases in Yemen

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Abstract:

AIMS: Penetrating keratoplasty (PKP) carries the risk of developing wound dehiscence, which can lead to vision loss. The main aim of this study is to analyze the management and outcome of surgery for traumatic wound dehiscence occurring in patients who had PKP.

SUBJECTS AND METHODS: This retrospective study included post-PKP patients who sustained traumatic wound dehiscence at the Cornea Unit in Yemen Magrabi Eye Hospital between 2008 and 2016. Fifty-three eyes with a history of wound dehiscence were treated with primary wound closure. Patient files were reviewed for type and time of injury, distance visual acuity (VA), and outcome.

RESULTS: Ruptured globe with dehiscence of wound occurred on average 2.4 years (3 months to 13 years) after PKP. The mean age at wound dehiscence was 22.27 years and males accounted for 77.4% (41). All patients were managed with primary closure of the wound. Lensectomy of traumatic or dislocated lens was the most frequent additional surgical procedure (14, 26.4%), followed by anterior vitrectomy (6, 11.3%). In the end, 43 (81.1%) grafts remained clear. In the last follow-up, 34 eyes (64.1%) had best-corrected VA of 20/200 or better and two eyes had no perception of light.

CONCLUSION: Rupture globe and wound dehiscence occurs after PKP at the graft-host junction. Wound dehiscence is a lifelong risk after PKP and wound weakness persisted for a long period after PKP. Visual outcome and graft survival are generally poor after the injury, and the restoration of a satisfactory visual result is possible if treated early.

Keywords:

Graft survival, ocular trauma, penetrating keratoplasty, traumatic wound dehiscence

Introduction

Blindness and visual impairment due to corneal diseases is a significant public health problem in Yemen^[1] and worldwide.^[2] PKP is the most common organ transplantation, and there is an increase in the number of corneal transplantation worldwide.^[3] Corneal graft outcome generally is measured in terms of graft survival and final visual acuity (VA).^[4,5]

The eye is the third most frequently affected organ by trauma after the hands and feet.^[6] Eye trauma is one of the main causes of unilateral and bilateral blindness in Yemen^[1,7,8] and worldwide^[9] and makes eye trauma a significant cause of unilateral ocular morbidity. Globe rupture may occur in any eye that sustains trauma and tends to occur at the weakest points.

From the literature, the incidence of traumatic globe rupture after penetrating keratoplasty (PKP) is higher than after extracapsular cataract surgery (ECCE) with

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reports of 0.6%–5.8% after PKP^[10-13] and 0.4%–1.4% after ECCE.^[14] Therefore, PKP is more prone to traumatic globe ruptures than other type of eye surgery because surgical wound after PKP makes the cornea susceptible to damage through even minor trauma than nonoperated cornea due to the decreased strength of graft–host junction and the surgical wound may never regain tensile strength.^[10,11]

Compared with wound healing in other tissues, corneal transplants carry a prolonged susceptibility to wound dehiscence due to the tensile strength of corneal scars after penetrating wound repair is unlikely to reach the original preinjury level. The avascular nature of corneal scars which prevents effective wound healing and remodeling, creates continued weakness at the graft–host junction, even long after the wound appears well healed clinically.^[7,8,15] Furthermore, the frequent use of steroids to control immune/inflammatory responses post-PKP delays the wound healing process, further weakening the graft–host junction. PKP exposes patients to a higher risk of globe rupture following trauma because of the above factors.^[12,16]

Corneal wound dehiscence is a well-known potential complication after PKP.^[17] Wound dehiscence is a serious concern for all patients after PKP because it can result in severe damage to the ocular structures and permanent decrease in VA.^[12,13] Corneal wound dehiscence can result from uncontrollable causative factors, such as trauma or spontaneously after suture removal. These eyes can be severely injured by only minor insult, which may result in globe rupture at the graft–host junction.^[12,15] Increasing evidence indicates that wound dehiscence is a lasting risk that all patients undergoing PKP face, regardless of their age, indication for surgery, and time since transplant.

The Cornea Unit in Yemen Magrabi Eye Hospital in the capital city, Sana'a is the main cornea service provider in Yemen and has a large corneal transplantation database for PKP cases done in Yemen and abroad. This study retrospectively investigates and analyzes the characteristics, risk factors, and visual outcome of traumatic globe rupture after PKP and wound dehiscence repair.

Subjects and Methods

All eyes with a history of PKP and wound dehiscence repair between January 1, 2008, and December 31, 2016, and followed up at the Cornea Unit at Yemen Magrabi Eye Hospital were retrospectively analyzed. These case series included 53 eyes of 53 patients who had undergone a PKP procedure, followed by traumatic wound dehiscence. Some of the patients had their corneal graft done in our hospital, and others were done outside Yemen. Only patients who had surgical repair of an open

wound dehiscence were included in this study. Patients with trauma to the eye and no aqueous leak were not included in this study.

Patients were identified through a search of the electronic health records of our private practice using the diagnosis and billing codes for ruptured globe, wound dehiscence, and their repairs. Records of the selected patients were reviewed and data collected included patient age and gender, indication for PKP, time between PKP and wound dehiscence, causative events for wound dehiscence, size of dehiscence, associated ocular complications and history, pre- and post-repair lens status, postdehiscence anterior and posterior complications, intraocular pressure-related complications, postrepair graft clarity, and VA outcomes. Any further interventions were recorded. Statistical analysis was performed using SPSS software for Windows version 21.0 (IBM, Chicago, USA).

After first-aid management in the emergency room, all cases were referred to the operation room for wound repair. The wound was sutured with 10-0 nylon and if needed cataract extraction or lensectomy, anterior vitrectomy and iris repositioning were performed. Included patients were recalled for the final follow-up visit. Complete ophthalmic examination was done, and the final best spectacle-corrected VA was measured.

All of these surgeries were performed by three expert surgeons using well-adjusted buried–interrupted sutures. Patients were followed up regularly, and all patients were instructed to visit the hospital, day or night, even during weekend as soon as they experience any unusual complaint without prior appointment (open and free access system). Patients were also educated on graft rejection and the risk of late presentation.

The study was approved by the Research and Ethics committee of Yemen Magrabi Eye Hospital, and the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional), and with the Helsinki Declaration of 1975, as revised in 2000. The risk of the surgery was fully explained to the patients in accordance with the Helsinki Declaration, and verbal informed consent was obtained.

Results

Among the 53 eyes, all had trauma-induced dehiscence. The mean age at wound dehiscence was 22.27 years with ages ranging from 4 to 65 years. Males accounted for 77.4% (41/53) and females accounted for 22.6% (12/53), and male-to-female ratio was 3.4:1. Ruptured globe with dehiscence of wound occurred on average

2.4 years (3 months to 13 years) after PKP. Number of patients under the age of 17 years was 9 (17.0%).

Majority of corneal grafts were done in our hospital (33/53, 62.3%) and the remaining (20/53, 37.7%) were done outside Yemen. Most PKP cases done abroad were done in Jordan, Egypt, India, and Saudi Arabia.

The main indication of PKP was keratoconus (40/53, 75.5%). Other common indications were pseudophakic or aphakic bullous keratopathy (PBK) (4/53, 7.5%), corneal dystrophy (3/53, 5.7%), traumatic corneal opacity (3/53, 5.7%), tectonic graft for perforated corneal ulcer (2/53, 3.8%), and herpetic corneal opacity (1/53, 1.8%) [Table 1].

The major cause of trauma was blunt trauma by various objects, especially hand or finger. Other causes of trauma were major blunt trauma, falling, and intentional assault. Number of clock hours of wound dehiscence ranged from 3 h to 8 h. In all cases, the corneal ruptures occurred at the host-graft junction. In 62.3% of patients (33/53), the extent of dehiscence was >6 clock hours.

Associated anterior segment complications were traumatic cataract at presentation in six eyes, loss of crystalline lens in five eyes, and 20 developed cataracts later during follow-up. Of the 53 eyes, five were pseudophakic; two had either loss of implants or dislocation of intraocular lens. Posterior segment complications included vitreous hemorrhage in one eye, and two eyes had retinal detachment on presentation.

Table 1: Preoperative diagnoses of 53 eyes that had postpenetrating keratoplasty wound dehiscence

Corneal graft indication	Male	Female	Total number, n (%)
Keratoconus	31	9	40 (75.5)
Bullous keratopathy	3	1	4 (7.5)
Granular/macular corneal dystrophy	2	1	3 (5.7)
Traumatic corneal opacity	3	0	3 (5.7)
Therapeutic graft	1	1	2 (3.8)
Herpetic corneal opacity	1	0	1 (1.8)
Total	41	12	53 (100)

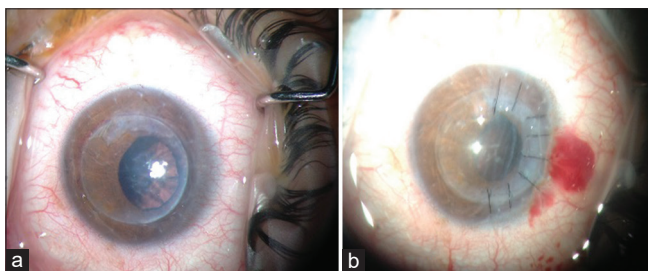


Figure 1: (a and b) Ruptured globe of a penetrating keratoplasty patient with loss of the crystalline lens (pre- and post-operative)

All the patients were managed with primary closure of the wound. Figures 1 and 2 show the intraoperative and postoperative appearance of the postrupture PKP with loss of crystalline lens and with traumatic cataract, respectively. Lensectomy of traumatic or dislocated lens was the most frequent additional surgical procedure (14/53, 26.4%), followed by anterior vitrectomy (6/53, 11.3%).

At the final visit, 43 (81.1%) grafts remained clear. Of the ten grafts (18.9%) that became opaque, two eyes (3.8%) atrophied. In the last follow-up, 34 eyes (64.1%) had best-corrected VA of 20/200 or better and two eyes had no perception of light. Eyes showing lens damage were associated with poorer VA than eyes with no lens damage.

Discussion

Rupture globe can occur if sufficient force affects a weak region in the eye such as insertions of extraocular muscles, the corneoscleral limbus,^[6] or a previous corneal scar or surgery.^[11] After PKP, there is a full-thickness 360° surgical wound (graft-host junction), and it creates a permanent weakness in the eyeball throughout patients' lives.^[11,12,15] Wound dehiscence is a lifelong risk after PKP regardless of the age, indication for corneal transplant, and time since transplant.

Despite the low incidence of traumatic wound dehiscence following PKP [Table 2], the potentially serious complications with poor outcomes make the growing number of such cases a concern. Furthermore, the outcomes of wound dehiscence treatment post-PKP have been difficult to predict, owing to many factors including predehiscence vision, corneal wound healing, lens status, and the extent of anterior and/or posterior damage.^[12,13,18]

It is very important to understand the pathogenesis and clinical development of wound dehiscence in patients undergoing corneal transplant. It is usually important to analyze the causative factors, clinical features, patient characteristics, and outcomes of wound dehiscence; hence, preventive and therapeutic measures can be

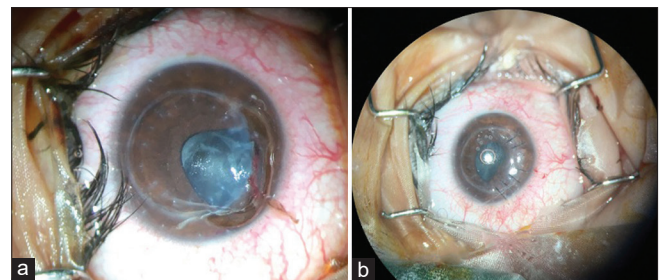


Figure 2: (a and b) Ruptured globe of a penetrating keratoplasty patient with traumatic cataract (pre- and post-operative)

Table 2: Traumatic wound dehiscence after corneal transplantation in different countries

Country	Number of cases	Mean age
The USA	31	56
Turkish	26	40.7
Turkish	34	31.5
Iran	32	38.1
The UK	19	53
The USA	51	69.5
France	26	50

taken to reduce the risks and consequences of PKP wound dehiscence. Globe rupture after PKP occurred more frequently in active young and elderly patients in a previous study.^[12] Posterior segment damage has been reported to be associated with poor visual outcome.^[6,7,9,13] This complication leads to delayed visual rehabilitation and increased risk of graft failure.^[10-13,19]

The graft–host junction remains vulnerable and weak after PKP and is a potential area for wound dehiscence even years after keratoplasty, despite the appearance of having healed.^[16,17] Graft wound dehiscence can occur due to many reasons after PKP due to trauma, infectious keratitis, suture failure, or spontaneous wound separation. Traumatic rupture globe after PKP has been evaluated in many studies, but this is the first time to be studied in Yemen.

Resuturing may have to be performed more commonly after PKP, and major indications for resuturing are wound dehiscence and loose or broken sutures.^[20] In a study done in our hospital, 8.9% of PKP patients were readmitted and their corneal graft resutured,^[20] and this is higher compared to other studies where the incidence of resuturing was 0.6%–5.8%.^[12,16,21]

In this study, the group of patients included was done in our hospital and also outside Yemen and so we cannot give the incidence, and a separate study should be done to find the incidence of wound dehiscence post-PKP for cases done only in our hospital.

The mean age at the time of trauma was 22.27 years, and the most common indication for keratoplasty was keratoconus. This highlights that young age and keratoconus as major risk factors for wound dehiscence in our group of patients. Usually, patients with keratoconus are younger than subjects with other keratoplasty indications.^[12,21] The most common indication of keratoplasty in Yemen is keratoconus.^[5,20] Other studies found greater susceptibility to ocular trauma in older patients.^[18]

The corneal wound never achieves its original strength, even years after keratoplasty.^[19] In the literature, the

mean interval between PKP and traumatic wound dehiscence has varied from 18 weeks to 7.5 years.^[10,11,12,15] In this study, the mean interval between PKP and traumatic wound dehiscence was 2.4 years (range, 3 months–13 years). Majority of wound dehiscence was in the first 3 years. Most series^[10,11,12,15] have described that most of wound dehiscence occur in the first 2 years following PKP, but later, occurrences have also been reported.^[19] The higher prevalence of wound dehiscence in the early period after keratoplasty could be related to wound weakness, visual rehabilitation following keratoplasty, and increased physical activity of the patient.

Many studies confirmed that there is no correlation between suturing technique and wound dehiscence.^[19] Majority of patients who had PKP had interrupted sutures and few had combined interrupted and continuous. It was difficult to compare the two suturing techniques because the combined number of cases was few. In two studies, globe rupture was more frequent when sutures were placed in an interrupted fashion.^[10,16]

Our analyses revealed a range of outcomes associated with corneal wound dehiscence, including the complications and visual impacts that are often permanent and difficult to treat.

Various useful articles are available that are associated with “traumatic wound dehiscence after corneal keratoplasty,” but very few of them have discussed a large case series of 53 cases in a young age population (mean age 22.3). None of the articles published were from the Middle East Arab countries and African region.

Conclusion

Rupture globe and wound dehiscence occurs after PKP at the graft–host junction, and wound dehiscence is a lifelong risk after PKP. Younger patients are more prone to such injury and should be warned against getting involved in any type of fight. Visual outcome and graft survival are generally poor after the injury; the restoration of a satisfactory visual result is possible if treated early. In patients without major complications such as posterior segment damage, visual outcomes and graft survival can be favorable. Intractable glaucoma and phthisis bulbi are the main causes of poor outcome.

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Nil.

Conflicts of interest

The authors declare that there are no conflicts of interests of this paper.

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