

Traumatic Wound Dehiscence following Corneal Transplantation

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Purpose: To investigate the incidence, mechanisms, characteristics, and visual outcomes of traumatic wound dehiscence following keratoplasty.

Methods: Medical records of 32 consecutive patients with traumatic globe rupture following keratoplasty who had been treated at our center from 2001 to 2009 were retrospectively reviewed.

Results: The study population consisted of 32 eyes of 32 patients including 25 men and 7 women with history of corneal transplantation who had sustained eye trauma leading to globe rupture. Mean patient age was 38.1 (range, 8 to 87) years and median interval between keratoplasty and the traumatic event was 9 months (range, 30 days to 20 years). Associated anterior segment findings included iris prolapse in 71.9%, lens extrusion in 34.4%, and hyphema in 40.6% of eyes. Posterior segment complications included vitreous prolapse (56%), vitreous hemorrhage (28%) and retinal detachment (18%). Eyes which had undergone deep anterior lamellar keratoplasty (DALK; 5 cases, 15.6%) tended to have less severe presentation and better final visual acuity. There was no correlation between the time interval from keratoplasty to the traumatic event, and final visual outcomes.

Conclusion: The host-graft interface demonstrates decreased stability long after surgery and the visual prognosis of traumatic wound dehiscence is poor in many cases. An intact Descemet's membrane in DALK may mitigate the severity of ocular injuries, but even in these cases, the visual outcome of globe rupture is not good and prevention of ocular trauma should be emphasized to all patients undergoing any kind of keratoplasty.

Keywords: Corneal Transplantation; Complications; Surgical Wound Dehiscence

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INTRODUCTION

Globe rupture may occur in any eye that sustains trauma and tends to occur at the weakest points. Keratoplasty exposes patients to a higher risk of globe rupture following trauma because the surgical wound may never regain the strength and stability of an intact cornea.¹⁻³

These eyes can be severely injured by only minor insult, which may result in globe rupture at the host-graft junction.⁴ Multiple factors have been proposed to be associated with weak host-graft junctions, such as inappropriate wound apposition, avascularity of the interface, prolonged treatment with topical steroids, and suture complications.⁵

In this study we evaluated the mechanisms, incidence, characteristics and visual outcomes of traumatic globe rupture following keratoplasty.

METHODS

This retrospective study includes 32 eyes of 32 patients who sustained ocular trauma following keratoplasty from 2001 to 2009. During this period, 1,083 eyes had undergone keratoplasty at our center. Records of all patients were reviewed and those with globe rupture were selected. Cases with inadequate follow-up were excluded from the study. Records were reviewed in terms of describing the injury and therapeutic measurements. After appropriate management in the emergency room, all cases were referred to the operation room for secondary repair. In all cases, the ruptured wound was sutured with 10-0 nylon and if needed, anterior vitrectomy and iris repositioning was performed. The mean duration of follow up after repair was 23 (range, 2 to 98) months.

RESULTS

Thirty-two eyes of 32 patients that had sustained ocular trauma following keratoplasty were studied. Indications for corneal transplantation included pseudophakic bullous keratopathy (PBK) in 7 cases, keratoconus in 18, herpetic corneal opacity in two cases, one case of congenital hereditary endothelial dystrophy (CHED), two cases of macular corneal dystrophy, one case of corneal melting due to herpes simplex keratitis, and one case of old corneal opacity due to corneal laceration repair. The type of keratoplasty was penetrating keratoplasty (PKP) in 26 eyes (81.3%), deep anterior lamellar keratoplasty (DALK) in 5 eyes (15.6%), and tectonic graft in one eye (3.1%).

Mean age at the time of trauma was 38.1 ± 18.7 (range, 8 to 87) years and mean interval between keratoplasty and traumatic wound dehiscence was 44.1 months (range, 1-350). Dehiscence occurred during the first 3 years following operation in 24 cases (75%) which included 13 cases (40.6%) in the first year, 4 cases in the second (12.5%) and 7 cases (21.8%) in the third.

All patients included herein had sustained blunt ocular trauma and none had worn protective eyewear following keratoplasty. The cause of trauma included being hit accidentally in 13 cases, intentional assault in 10, minor trauma such as finger pokes in 3 cases, and falling either due to loss of consciousness or accidents in 6 cases (Table 1).

Traumatic globe rupture occurred at the host-graft junction in all cases. The suturing technique was interrupted in 21 cases and running in 11 cases. The extent of the wound dehiscence was one quarter in 16 cases (50%), two quarters in 13 cases (40.6%), and three quarters in 3 cases (9.4%). Wound dehiscence was more frequently located superiorly and inferotemporally (12 cases; 37.5%). The dehiscence was superonasal in 10 cases (31.3%), and superotemporal and inferonasal in 5 cases each (15.6%). In keratoconus cases, the location of wound dehiscence was inferotemporal in 8 cases (44.4%) and inferonasal in 4 (22.2%). The type of initial suturing had been combined in 14 cases and interrupted in 18.

Associated injuries included iris prolapse in 23 cases (71.9%), hyphema in 13 eyes (40.6%), lens expulsion in 11 eyes (34.4%), and flat anterior chambers in 7 subjects (21.9%). Posterior segment injuries, such as vitreous hemorrhage and retinal detachment, were observed in 15 eyes (46.8%). Six of the posterior segment injuries were cases of retinal detachment and all occurred within the first 7 months after trauma. All cases of retinal detachment underwent vitreoretinal surgery and anatomical results were satisfactory in 5 eyes. Three patients underwent vitreoretinal surgery because of persistent vitreous hemorrhage. One case underwent Ahmed glaucoma valve implantation because of poor intraocular pressure control, and endophthalmitis complicated one case 7 days after the traumatic event.

Final visual acuity (VA) was 1/10 or better in 7 (21.8%), better than hand motions to 1/10 in 11 (34.3%), hand motions or light perception in 10 (31.2%) and no light perception in 4 (12.5%) eyes. DALK patients were more likely to have better final visual acuity ($P = 0.037$) than PKP patients. In addition, they were less

Table 1. Characteristics of traumatic wound dehiscence following keratoplasty

Case	Indication for keratoplasty	Type of keratoplasty	Age at time of trauma	Cause of trauma	Interval between trauma and keratoplasty (months)	Final visual acuity
1	PBK	PKP	51	Fall	80	CF 2m
2	PBK	PKP	52	Fall	15	HM
3	Keratoconus	PKP	25	Finger poke	5	CF 2m
4	PBK	PKP	65	Fall	3	LP
5	Keratoconus	DALK	26	Punch	11	3/10
6	PBK	PKP	80	Fall	36	NLP
7	Keratoconus	PKP	18	Punch	5	4/10
8	Keratoconus	DALK	28	Struck by door	15	3/10
9	Macular corneal dystrophy	PBK	12	Struck by hand	5	8/10
10	Keratoconus	DALK	36	Struck by hand	1	2/10
11	Corneal melting due to herpetic keratitis	Tectonic graft	51	Punch	36	NLP
12	Keratoconus	PKP	23	Punch	36	CF 1m
13	Opacity due to corneal laceration repair	PKP	14	Struck by hand	8	CF 3m
14	Keratoconus	DALK	40	Struck by own hand	4	2/10
15	Keratoconus	PKP	35	Punch	28	HM
16	Keratoconus	DALK	40	Punch	8	HM
17	Old herpetic corneal opacity	PKP	41	Punch	43	HM
18	PBK	PKP	78	Struck by hand	15	CF 2m
19	Macular corneal dystrophy	PKP	11	Struck by hand	26	CF 2m
20	Keratoconus	PKP	29	Punch	34	HM
21	Keratoconus	DALK	40	Struck by hand	14	HM
22	Old herpetic corneal opacity	PKP	47	Struck by hand	35	HM
23	Keratoconus	PKP	35	Punch	12	NLP
24	CHED	PKP	8	Struck by door	24	CF 5
25	PBK	PKP	60	Fall	237	CF 20cm
26	Keratoconus	PKP	41	Fall	240	LP
27	Keratoconus	PKP	25	Finger poke	24	CF 1m
28	Keratoconus	PKP	44	Struck by car door	240	HM
29	PBK	PKP	57	Finger poke	16	2/10
30	Keratoconus	PKP	46	Punch	110	CF 0.5m
31	Keratoconus	PKP	30	Struck by hand	100	NLP
32	Keratoconus	PKP	28	Struck by toy	30	CF 1m

PBK, pseudophakic bullous keratopathy; CHED, congenital hereditary endothelial dystrophy; PKP, penetrating keratoplasty DALK, deep anterior lamellar keratoplasty; CF, counting fingers; HM, hand motion; LP, light perception NLP, no light perception

likely to experience iris prolapse ($P = 0.020$) or hyphema ($P = 0.052$), or require vitreoretinal surgery ($P = 0.920$). Although DALK patients had a smaller area of wound dehiscence as compared to PKP cases, the difference did not reach statistical significance ($P = 0.601$).

DISCUSSION

Traumatic wound dehiscence following keratoplasty has been evaluated in many studies and associations between final visual acuity on one hand and age, sex, type of trauma, interval

from keratoplasty to trauma, and indications for keratoplasty on the other have been investigated. Wound dehiscence following keratoplasty has an unfavorable prognosis⁵ and the burden of this problem has not been adequately determined in Iran.

The incidence of traumatic wound dehiscence following keratoplasty in this study was 2.9%. The incidence of rupture reported from other countries varies from 0.6% to 5.8%.⁵

Rehany and Rumelt⁶ reported traumatic wound dehiscence to be more common in younger individuals and also in those who had

undergone keratoplasty for keratoconus. These two factors are inter-dependent since patients with keratoconus are younger than subjects with other keratoplasty indications. Foroutan et al⁷ also found greater susceptibility in younger subjects and reported keratoconus as the most common indication. In contrast to these studies, Tseng et al⁸ found greater susceptibility to ocular trauma in older patients. In our study, mean patient age at the time of trauma was 38.1 years and the most common indication for keratoplasty was keratoconus. This confirms young age and keratoconus as risk factors for wound dehiscence. In contrast to these findings, traumatic wound dehiscence was not associated with younger age or keratoconus in the studies by Tseng et al⁸ and Raber et al⁹.

Binder et al¹⁰ found no correlation between suturing technique and wound dehiscence. In our study, globe rupture was more frequent when sutures were placed in an interrupted fashion which is in good agreement with other studies that have found continuous sutures to be superior to interrupted sutures in preserving globe integrity; this is the reason why we observed less globe rupture with this technique in comparison to interrupted one.^{6,11}

The mean interval between keratoplasty and traumatic wound dehiscence has varied from 18 weeks to 7.5 years in the literature.^{6,8,11-13} In our study, the mean interval between keratoplasty and traumatic wound dehiscence was 44.1 (range, 1 to 350) months and dehiscence frequently occurred during the first 3 years in the majority (75%) of cases. Wound dehiscence was more prevalent in the first and third years, which could be explained by the fact that at our center, sutures are removed 2 years after keratoplasty and the second peak of wound dehiscence in the third year may be due to weakened wound integrity after suture removal. Other series^{7,9,12} have demonstrated higher frequencies of wound dehiscence in the first two years following keratoplasty, but later occurrences have also been reported.⁸ The corneal wound never achieves its original strength, even years after keratoplasty.¹ 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.⁶

Traumatic globe rupture following keratoplasty may lead to severe ocular complications including iris prolapse, extrusion of the crystalline lens (or intraocular lens), vitreous loss, and early or late retinal detachment.^{6,7,11,14} Anatomical complications in our study were as follows: iris prolapse in 23 cases (71.9%), hyphema in 13 (40.6%), lens expulsion in 11 cases (34.4%), and flat anterior chamber in 7 (21.9%). As in previously reported series,^{4,6,8,17} posterior segment injuries, such as retinal detachment and vitreous hemorrhage, were associated with poor prognosis and were an important cause of complete loss of vision in our study.

Patients who had undergone DALK tended to have better final visual acuity ($P = 0.037$) and also less extensive wound dehiscence although the difference with PKP was not statistically significant (60% of DALK eyes versus 50% of PKP cases had one quadrant of wound dehiscence). This may be due to better preserved corneal structure in DALK in comparison with PKP. Because younger patients have a more active lifestyle and are therefore more susceptible to ocular trauma, whenever possible, lamellar keratoplasty is the procedure of choice in this population, which in addition to decreased rate of rejection, offers better structural integrity.⁷ In older subjects who require keratoplasty for endothelial decompensation one can perform an endothelial graft which avoids post-PKP wound problems.¹⁵ In the case of PKP, new techniques such as the femtosecond laser technology are under evaluation for achieving a lamellar host-graft junction configuration which may offer a better wound profile.^{16,17}

Most studies report poor visual outcomes for ocular trauma following keratoplasty.⁶⁻⁹ In the current study, 14 patients (43.7%) had final visual acuity of hand motions or less.

None of the patients in this case series wore protective glasses. Several authors have suggested using eye protection during the vulnerable period^{5,12}, but as shown in this study, ocular trauma may occur during a large and variable time period after surgery, and it

would be better to inform the patients of such complications and constantly remind them of such risks at each follow up visit.

Conflicts of Interest

None.

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