Original Article

Long-Term Follow-up of Corneal and Sclero-Corneal Grafting in Severe Eye Perforations

Qasim Mansoor, Roa Rashad Qamar, S. Biswas, H.P. Adhikary

Pak J Ophthalmol 2006, Vol. 22 No.2

See end of article for authors affiliations

Corrrespondence to:
Qasim Mansoor
12-Bluestone Drive
Heaton Mersey
Stockport, Cheshire
UK

Received for publication
August' 2005

Purpose: The objective of the present study was to assess the prognosis of grossly perforated eyeballs due to pathological condition by attempting a repair with corneal or corneo-scleral graft with anterior segment reconstruction.

Material and Method: A retrospective analysis of 26 eyes of 23 patients who underwent free-hand corneal or sclero-corneal graft for perforated eyeballs over a period of 15 years was performed. The minimum follow up period was 3 years, except one patient who died after 4 months from an unrelated cause. The causes of perforations included corneal melt associated with rheumatoid arthritis, chronic non-specific corneal ulcer, rupture of acute hydrops of keratoconus (Down's syndrome), Herpes zoster keratitis, trauma in a buphthalmic eye, sloughing of the cornea due to Strep. pneumoniae infection and chronic ulcer due to chemical injury.

Results: All the patients were able to keep their eyes with a variable amount of vision, except one eye that became phthisical after three months. The patients who did not develop better vision were for various reasons, e.g., pre-existing poor vision, retinal problems and cataract still to be dealt with.

Conclusion: The long-term psychological benefits of retaining the eye, preserving a modicum of ocular motility, avoiding enophthalmos which might occur post-enucleation, and in the case of children, facilitation of orbital development make free-hand corneal graft worth considering even in grossly perforated eyeballs due to pathological condition. There is also an uncertain but distinct possibility of restoring a partial degree of vision that might be extremely useful to the patient.

The management of grossly perforated eyeballs due to a pathological condition is a very difficult task. The choices of management are evisceration and enucleation or an attempt at corneal repair with or without anterior segment reconstruction, using a corneal or corneo-scleral graft. The major principles of penetrating keratoplasty in pathologically ruptured globe or perforated cornea are excision of devitalised and infected tissue, anterior chamber reconstruction including anterior vitrectomy if needed, cataract extraction if indicated, medical control of raised intraocular pressure or prophylaxis by filtering surgery and careful follow-up to control postoperative complications[1]. Various adjunctive procedures like tarsorrhaphy, conjunctival flap, cyanoacrylate glue and amniotic membrane grafting have also been tried.

Although there is a high risk of not being able to save the eye in gross perforations, it might be worth availing of the small chance of preserving globe integrity, if not visual acuity, by attempting a repair and reconstruction instead of a primary evisceration or enucleation. Corneal or corneo-scleral grafting in a perforated eyeball due to pathological condition is a daunting task to perform. The preparation of recipient bed, with the usual technique of trephination is neither safe nor possible, due to the collapse of globe. Moreover, it is difficult to ascertain the exact extent of the pathological process in order to make a viable bed with minimum tissue loss; hence the graft is not always circular. So in these circumstances the only choice on many occasions is to consider a free hand corneal graft or corneo-scleral graft.

There have been reports of free hand lamellar graft for marginal corneal degeneration[2,3] penetrating graft in epithelial down growth[4], or in otherwise healthy perforated cornea[5]. To our knowledge there are few reports on free hand graft in such grossly perforated eyeballs due to pathological conditions.

MATERIAL AND METHODS

This is a retrospective analysis of 26 eyes of 23 patients who underwent penetrating keratoplasty or sclero-corneal graft along with anterior segment reconstruction for perforated eyeballs over a period of 15 years from January 1984 to December 1999. Of the 23 patients, 9 were male and 14 female. Their age range was 13 years to 87 years, the mean age being 63 years. The pathological conditions leading to these perforations are shown in (Fig. 1)**.** All these patients had very soft eyeball and all the patients were conservatively managed by medical treatment prior to their referral for corneal graft, except the one with trauma in a buphthalmic eye that also had posterior synechae and seclusio-pupil. He had been receiving Argon laser treatment for corneal and iris vessel, prior to planned corneal graft with triple procedure. He received a blunt injury leading to a rupture of the globe.

Corneal grafting was performed in 15 eyes. In another 11 eyes, along with corneal grafting various other associated procedures were performed as shown in (Fig. 2). A single surgeon operated all the patients, as an urgent case. Extensive corneal disease and perforation of the cornea needed free hand corneal grafting. For descriptive purposes, these patients were divided into two groups.

In Group I there were 15 eyes, whose associated pathological conditions are shown in (Table 1). In this group it was possible to make a free hand circular bed on the recipient cornea. So it was not necessary for free hand cutting of the donor corneal disc, with the usual circular trephination being performed for watertight closure of the wound. The donor corneal disc was trephined through endothelial surface.

In Group II there were eleven eyes whose donor cornea needed to be cut by free hand. The associated pathological conditions in this group are shown in (Table 2). In these cases due to uncertainty and the extent of pathological condition, it was necessary for free hand cutting of both the recipient and donor's disc for water tight closure of the wound. Trephines were used to mark the area to be excised and the cornea dissected free hand, in view of the softness of the globe, to avoid the risk of collapse and excess tissue loss. An oversized donor button was trephined or fashioned to allow for adequate wound closure. Viscoelastic substance (sodium hyalunorate) was used to reform the anterior chamber and delaminate the iris from the lens; part of it was left to reduce the risk of synechiae formation. The graft was sutured, using continuous 10/0 nylon. Along with corneal grafting various other procedures were also carried out in some cases at the same sitting.

The average follow up period of all the patients was 3 years (range 4 months to 4 years). The short follow-up period of 4 months was due to death of a patient from an unrelated cause.

RESULTS

All the patients were able to keep their eyes with variable amount of vision, as shown in Fig. 3. The patients who did not develop better vision were for various reasons, such as pre-existing poor vision, retinal problems and cataract still to be dealt with. The patients with corneal melt associated with rheumatoid arthritis were all above eighty years, except one.

Summary of the complicated cases with highly unfavorable outcome is given below:

Case I: A sixty-seven years old female patient with poorly controlled rheumatoid arthritis presented with simultaneous bilateral melting of the cornea except in the areas of calcification, in her aphakic eyes. She had a free hand corneo-scleral graft, anterior vitrectomy and iris supported secondary implants**.** Two years

later the same pathology started in both eyes together and a similar surgical procedure, involving anterior vitrectomy, was carried out. However, within three months one eye became phthisical while the other eye regained an unaided vision of 6/60. (Fig. 4-5)

Case II: A patient who had severe atrophy of the upper eyelid in the affected eye, following herpes zoster ophthalmicus, and presented with perforation of the cornea due to exposure keratitis. She had to have multiple procedures like corneal graft, cataract extraction and intra ocular lens implants, pupilloplasty and reconstruction of upper eyelid. She regained an unaided vision of 6/36. This patient died after four months from an unrelated cause.

Two of the 3 patients with Down's syndrome, who had hydrops of cornea, were severely mentally challenged. One patient also suffered from severe psoriasis of the eyelids, which was successfully managed by the dermatologists.

Table I: Group I: Free hand cutting of recipient bed only. (Associated pathological conditions leading to perforation) n (%)

Corneal melt associated with Rheumatoid Arthritis	5 (33.3)
Herpes zoster ophthalmicus	2 (13.3)
Trauma on buphthalmic eye	1 (6.7)
Non-specific corneal ulcer	5 (33.3)
Keratoconus	1 (6.7)
Infective corneal ulcer	1 (6.7)
Total	15 (100)

Table 2: Group II: Free hand cutting of both donor and recipient beds (associated pathological conditions leading to perforation) n (%)

Corneal melt associated with Rheumatoid Arthritis	5 (45.5)
Acute hydrops of ruptured keratoconus	3 (27.3)
Sloughing of cornea due to Strep. Pneumoniae	2 (18.2)
Chemical injury	1 (9.1)
Total	11 (100)

DISCUSSION

The major causes of destruction of corneal tissue are infections, dry eye syndrome, chronic exposure keratitis, trophic ulcerations, melting syndromes and trauma.

The primary goal of therapeutic penetrating keratoplasty is to excise devitalised and infected tissue and to restore structural integrity[1].

Corneal grafts undertaken in disorganized eyes are at risk of failure. Kirkness et al[6] in an analysis of the relative success and complications of penetrating keratoplasty in perforated eyes found no significant difference between sterile perforated eyes and infected perforated eyes, suggesting that perforation itself is a major risk factor. They recommend that when perforation is imminent, it is better to proceed to a penetrating keratoplasty as the angle may be better protected from peripheral anterior synechiae formation. The risk is increased by the presence of anterior synchiae that may exert traction at the site of attachment, and may perhaps expose the donor endothelium to blood vessels and increase the risk of rejection[7]. It has been shown that after anterior segment reconstruction and restoration of anatomical integrity, there is reduction of postoperative corneal oedema and also improvement of visual acuity[8].

Corneal perforations due to herpetic keratitis and rheumatoid arthritis have been treated with temporising measures such as tissue adhesives provided the perforation is small, to be followed by therapeutic keratoplasty as soon as donor tissue is available[9,13-15]. In both these conditions, melting and perforations are associated with increased corneal collagenase activity. Intensive topical steroid are widely used post-operatively to reduce anterior chamber inflammation, with an umbrella of antiviral coverage in herpetic infections[9]. The systemic immune mediated inflammation in the late stages of rheumatoid arthritis can cause a melting of host-graft junction, which might necessitate even systemic immunosuppression. It has also been suggested that an unstable corneal epithelium might trigger collagenase activity; hence tear supplements are helpful to stabilise the epithelium in these patients[10,16,17].

Patients with Down's syndrome have a poorer outcome following keratoplasty, as there is less ability of patients with Down's syndrome to report graft reactions and infections, their tendency to self-traumatise and their increased susceptibility to

infections. Post-operative results depend on severity of the disease itself, tendency of eye rubbing and self-traumatization[11,12]. However, careful post-operative follow-up with care provided by an attendant can improve outcomes as was also borne out by our study.

In all of the cases presented here, it was possible to retain the eye following surgery. In addition to the psychological benefits gained in retaining the eye,

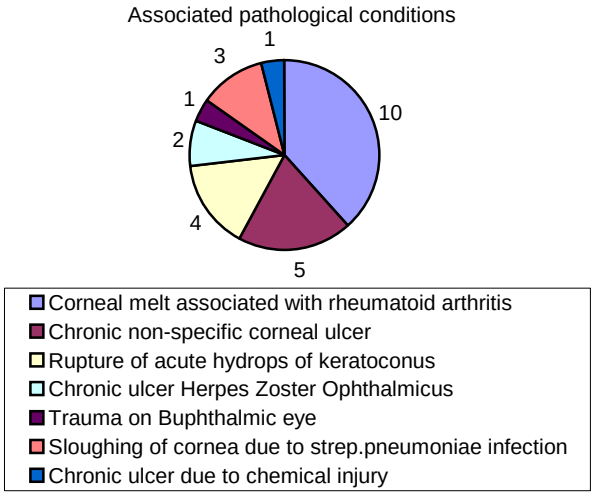

Fig. 1: Associated pathological conditions of the perforated eyeballs.

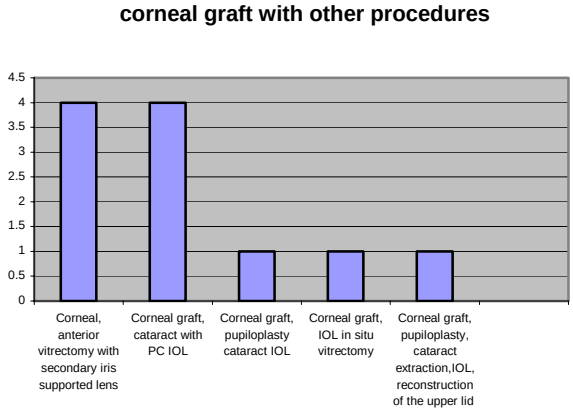

Fig. 2: Corneal graft performed with other associated surgical procedures.

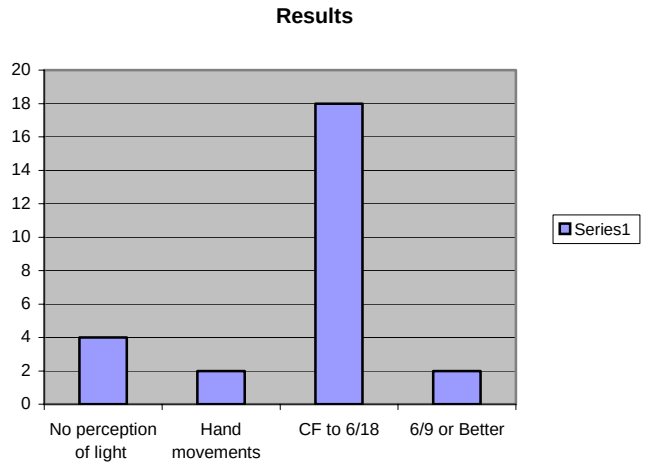

Fig. 3:

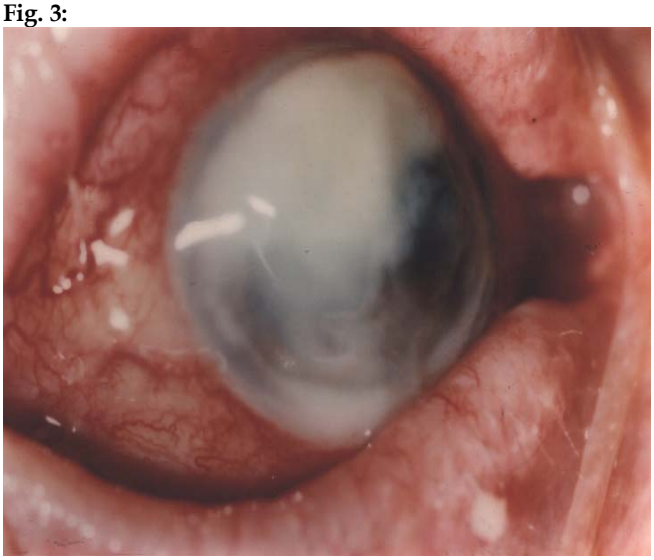

Fig. 4: Corneal melt and perforation associated with Rheumatoid arthritis preoperative appearance of the right eye (the left eye having the same condition had a similar appearance).

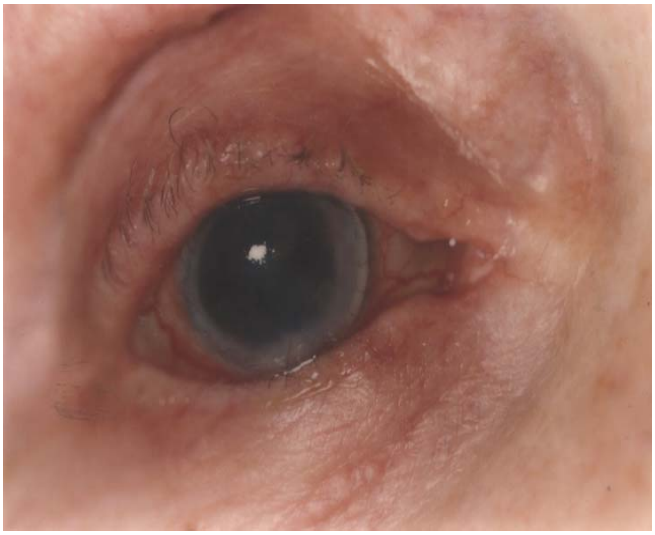

Fig. 5: Postoperative appearance of the same eye after the first reconstructive keratoplasty with an unaided vision of 6/60 six months after the operation.

ocular motility is preserved, thus avoiding enophthalmos, which may occur post-enucleation. In the case of children, retention of the globe may have an advantageous effect on future orbital development.

CONCLUSION

Surgical repair of a perforated eyeball with a free-hand corneal or corneo-scleral graft is a difficult proposition even in the best of circumstances. However, the possibility of retention of the eyeball, if not useful vision, makes repair and reconstruction a worthwhile first line of approach in preference to removal of the remnants of the globe.

Free-hand corneal or corneo-scleral graft with anterior segment reconstruction, even in cases with poor visual prognosis, is perhaps the desired procedure in perforated eyeballs due to pathological conditions, despite the sometimes small chance of retaining the eyeball. In addition to retaining the eye, there is also the prospect of restoring partial vision in a miniscule proportion of patients, which might still make a significant difference for them. There is always the option of removal of the eye at a later date if required. However, by attempting reconstruction and restoration of the normal anatomy as a first step, there is a possibility of a favourable outcome even in an apparently futile scenario.

Author's affiliation

Dr. Qasim Mansoor
12-Bluestone Drive
Heaton Mersey
Stockport, Cheshire
UK

Roa Rashad Qamar
Assistant Professor
Bahawal Victoria Hospital
Bahawalpur

S. Biswas
12-Bluestone Drive
Heaton Mersey
Stockport, Cheshire
UK

H.P Adhikary
12-Bluestone Drive
Heaton Mersey
Stockport, Cheshire
UK

REFERENCES

1. **Taylor DM, Stern A L.** Reconstructive keratoplasty in the management of conditions leading to corneal destruction. Ophthalmology. 1980; 87: 892-902.
2. **Pettit TH.** Corneo-scleral free hand lamellar keratoplasty in Terrien's marginal degeneration of the cornea long-term results. Refract Corneal Surg. 1991; 7: 28-32.
3. **Brown AC, Rao GN, Aquavella JV.** Peripheral corneal graft in Terrien's Marginal Degeneration. Ophthalmic surg. 1983: 14: 931-4.
4. **Friedman AH.** Radical anterior segment surgery for epithelial invasion of anterior chamber: Report on three cases. Trans. Am Aca Ophthalmol Otolaryngol. 1997; 83: 216-223.
5. **Kramer SG.** Simplified technique for freehand corneal grafting in traumatic cases. Arch. Ophthalmol. 1971; 86: 182-5.
6. **Collin M, Kirkness, Linda A, et al:** the role of penetrating keratoplasty in the management of Microbial keratitis. Eye 1991; 425-431.
7. **Keneyon KR, Strack T, Hersch PS.** Penetrating keratoplasty and anterior segment reconstruction for severe ocular trauma. Ophthalmology. 1992; 396-402.
8. **Waring III, Keneyon KR, Gemmil MD.** Results of anterior segment Reconstruction for Aphakic and Pseudophakic Corneal Oedema. Ophthalmology. 1988: 836-41.
9. **James T, Patten, Cavanagh D**. Penetrating keratoplasty in acute herpetic corneal perforations. Annals of Ophthalmology. 1976.
10. **Bernauer W, Ficker LA.** The management of corneal perforation associated with rheumatoid arthritis. Ophthalmology. 1995; 102.
11. **Joanathan M, Frantz, Micheal S, et al.** Penetrating Keratoplasty for keratoconus in Down's Syndrome. Am J Ophthalmol. 1990, 109:143-7.
12. **Akova YA, Dabil H, Kavalcioglu O, et al.** Clinical features and keratoplasty results in keratoconus complicated by acute hydrops. Ocul Immunol Inflamm 2000; 8: 101-9.

13. **Reed JW, Joyner SJ, Knauer WJ 3rd.** Penetrating keratoplasty for herpes zoster keratopathy. Am J Ophthalmol. 1989 15; 107: 257-61.
14. **Claerhout I, Beele H, Abeele KVD, et al.** Therapeutic Penetrating Keratoplasty, Clinical Outcome and Evolution of Endothelial Cell Density. Cornea. 2002; 21: 637-42.
15. **Killlingsworth DW, Stern GA, Driebe WT, et al.** Results of Therapeutic penetrating keratoplasty. Ophthalmology. 1993; 100: 534-41.
16. **Palay DA, Stulting RD, Waring GO.** Penetrating keratoplasty in patients with rheumatoid arthritis. Ophthalmology. 1992; 99: 622-7.
17. **Vanathi M, Sharma N, Jeevan S, et al.** Vajpayee. Tectonic Grafts for Corneal Thinning and Perforations. Cornea. 2002; 21: 792-7.