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Original research

Factors associated with surface epithelial keratopathy after optical penetrating keratoplasty

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Abstract

Purpose: The aim of the study was to evaluate the various donor and recipient factors associated with short-term prevalence of surface epithelial keratopathy after optical penetrating keratoplasty (OPK).

Methods: Preoperative and postoperative data of 91 eyes of 91 patients were reviewed retrospectively who had undergone OPK from March 2013 to February 2016. Donor and recipient data were analyzed for age and sex of the donor, cause of death, death to enucleation time (DET), death to preservation time (DPT), enucleation to utilisation time (EUT) and total time (TT), age and sex of recipient, indications of penetrating keratoplasty (PK), associated glaucoma and recipient size (RS). The presence of various epitheliopathies were recorded at various postoperative visits.

Results: The range of age of recipient in this study was 10–83 yrs (mean 49.19 ± 19.35 yrs). The donor age ranged in between 17 and 95 years (70.27 ± 15.11 years). Age and preoperative diagnosis of host showed significant influence on epitheliopathy till two weeks and one month post-PK ($P = 0.032$ and 0.05), respectively. Donor's age and gender showed significant impact on surface keratopathy (SK) till two weeks follow-up with P value of 0.04 and 0.004, respectively. DET, DPT, EUT, and TT affected the surface epithelium significantly with P value of 0.007, 0.001, 0.05, and 0.03, respectively. On first postoperative day 33 (36.26%) eyes developed epithelial defect involving >1/2 of cornea.

Conclusion: Various donor and recipient factors showed influence on various epithelial abnormalities of surface epithelium in early postoperative period.

Keywords: Penetrating keratoplasty; Donor factors; Surface keratopathy

Introduction

Various factors affect graft survival and the visual rehabilitation of the recipient. Although endothelial rejection, infection and high astigmatism are commonly considered the primary causes of physiologic or functional graft failure after penetrating keratoplasty (PK), corneal surface dysfunction can cause significant morbidity due to poor refractive surface, delay in visual rehabilitation and discomfort to the patients.[1]

Any compromise in the integrity of the corneal epithelium after PK acts as precursor of infection and escalates the damage to the graft. It is estimated that surface dysfunction constitutes failure of 25% of grafts.[2] Surface of the graft undergoes total replacement of the donor epithelium by the recipient in initial weeks after PK by mitosis, migration and transformation of the host stem cell population. Epithelium migrates over preformed basement membrane and gets adhered to it by hemidesmosomes. In a native cornea, this whole process requires several weeks.[3]

After PK, epithelisation becomes difficult due to additional insults of denervation of the cornea, frequent exposure of toxic topical medications, poor wettability of surface and an altered anatomical relationship between adnexa and cornea.[4] Delayed

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or incomplete epithelial healing after one week damages bowman's membrane which can lead to superficial scarring, haze and further delay can lead to infection, rejection, stromal thinning, melting or perforation of the graft. The critical period for stabilization of most surface problems is in the first 3 months.[4] Aggressive treatment of epithelial defects is mandatory to avoid vision threatening complications which are critical for serious delay in visual rehabilitation and survival of the graft.[4] Donor parameters such as age, cause of death, local and systemic diseases, traumatic damage, surgical procedures, storage methods and death to preservation time (DPT) can influence the final quality of the corneas.[5–8] Healthy epithelium post-PK may reduce the likelihood of postoperative epitheliopathy which is only one of the plethora of factors that influence graft clarity which potentially improve the visual outcome and longevity for corneal grafts. The purpose of the study was to analyse the donor and recipient factors which influence the clinical profile of graft surface epithelium post optical penetrating keratoplasty (OPK).

Methods

This retrospective observational study was approved by institutional research ethical committee and was in accordance to the tenets set forth in Declaration of Helsinki. The present study was conducted at Department of Ophthalmology at Himalayan Institute of Medical Sciences. Data were reviewed retrospectively for the patients who had undergone OPK from March 2013 to February 2016.

Patients with preoperative diagnosis of adherent leucoma, pseudophakic bullous keratopathy (PBK), corneal opacity or scarring, graft failure, anterior staphyloma, and corneal dystrophy were included in the study.

All the patients having preoperative adnexal abnormalities like lid pathologies, ocular surface disorders and severe dry eye were excluded from the study. Patients with postoperative complications such as infectious keratitis, wound leak requiring the application of a contact lens, or lack of sufficient donor data and lost for complete follow-up were also excluded from the study.

Procurement, surgical technique and postoperative care were consistent regimens. Donor tissue collection was according to the guidelines of Eye Bank Association of America (EBAA)[9] and rejected if any infectious or structural contraindications or foreign material on slit-lamp examination and rarely by serologic testing.[2]

In situ, corneoscleral rim excision was done for all eye donations and donor tissues were collected in McCarey-Kaufmann (MK) medium with all aseptic precautions. Grading of the tissues was done according to grading chart by National Eye Bank as Grade A, B+, B, B−, C and D.[10] Donor tissues graded A, B+ were used for OPK.

Preoperatively, complete ophthalmological examination was reviewed for the recipients, which included measurement of uncorrected visual acuity (UCVA), manifest refraction (if possible), best corrected visual acuity (BCVA) with fully corrective glasses using a Snellen chart, slit-lamp biomicroscopy, applanation tonometry by Tonopen TM, dilated fundus examination or B scan if fundus was not visible. All observations were made by single observer to avoid bias.

Surgical technique

All the OPK's were performed by one surgeon (First author) under peribulbar anaesthesia or general anaesthesia for specific indications of pediatric age group, uncooperative patients, and regrafts with distorted ocular anatomy. Standard technique of PK with donor grafts 0.5 mm larger than the recipient was followed in all cases. Full thickness grafts were used after manual trephination of both donor and recipient corneas. Both interrupted and continuous suturing were done depending upon the indications and vascularity.

The epithelium was not removed at the time of surgery, and the epithelium of all the grafts were coated with viscoelastic before bandage at end of surgery. Histopathological examination of both recipient button and donor corneoscleral rim were done for all cases. All of the recipient histology showed fibrosis and scarring except in two buttons which showed evidence of herpetic keratitis scar. Postoperative medication consisted of topical prednisolone 1% combined with preservative free topical antibiotics and lubricants, cycloplegics and antiglaucoma, if required. After one month, topical antibiotics were stopped, but steroids tapered off till 3 months. Preservative free lubricants continued till last included follow-up in all cases.

Data were analyzed for donor cornea which included the age and sex of the donor, cause of death, death to enucleation time (DET), DPT, enucleation to utilisation time (EUT) and total time (TT) in hours. Donor epithelial status evaluation was graded as intact and sloughing. The donor stroma status was assigned as clear or cloudy (Table 1).

Retrospective data from patients' records were gathered for the epithelial surface abnormalities on first postoperative day (Ist POD) then at least two separate visits till 2 weeks (considered as 2 weeks follow-up), 1 month and 3 months for all cases. After Ist POD follow-up, 2 weeks follow-up was considered the next follow-up because of the fact that the epithelium was examined twice or thrice after Ist POD, but its status was considered on 2 weeks to justify the definition of persistent epithelial defect (PED) which is considered non-healing epithelial defect up to two weeks. Graft clarity was grade 4 if iris details were clearly visible, grade 2–3 without good view of iris details and grade 1-0 for opaque graft with no or poor view of anterior chamber details.[11] Graft clarity was recorded at last follow-up only. Recipient records were reviewed for age, sex, indications of PK, associated glaucoma and recipient size (RS) (Table 2). Histological and microbiological data of recipient and donor cornea were recorded for all cases. Intraocular pressure (IOP) was measured at each visit using a Tonopen TM, and if pressure was elevated (>21 mmHg), medical management was initiated. The presence of superficial punctate keratopathy (SPK), epithelial defects at graft host junction (GHJ), epithelial defects ($\leq$1/2 and >1/2 of the graft), PED, microcystic epithelial edema,