



Original research

Factors associated with surface epithelial keratopathy after optical penetrating keratoplasty

Anuradha Raj*, Renu Dhasmana, Harsh Bahadur

Department of Ophthalmology, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Jolly Grant, Dehradun, India

Received 18 July 2016; revised 3 January 2017; accepted 13 January 2017

Available online 12 February 2017

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.

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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

Financial support: None.

Conflict of interest: None declared.

* Corresponding author.

E-mail address: dranuradha_sagar@yahoo.com (A. Raj).

Peer review under responsibility of the Iranian Society of Ophthalmology.

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 (1st 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 1st 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 1st 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,

Table 1
Summarised donor related data.

Donor factors	N (%)
Age (years)	
≤60	21 (23.07)
>60	70 (76.92)
Gender	
Males	53 (58.24%)
Females	38 (41.75%)
Cause of death	
Cardiovascular diseases	44 (48.35)
Respiratory failure	38 (41.75)
Renal failure	9 (9.89)
DET (hrs)	
≤3	41 (45.05)
>3	50 (54.94)
DPT (hrs)	
≤4	45 (49.45)
>4	46 (50.54)
EUT (hrs)	
≤48	49 (53.84)
>48	42 (46.15)
TT (hrs)	
≤72	73 (80.21)
>72	18 (19.78)
Donor graft rating	
Epithelial defects (%)	56 (61.53)
No	23 (25.27)
≤30%	12 (13.18)
>30%	
Stromal clarity	81 (89.01)
Clear	
Cloudy	10 (10.98)

DET: Death to enucleation time.

DPT: Death to preservation time.

EUT: Enucleation to utilisation time.

TT: Total time.

filamentary keratitis and hurricane (vortex) keratopathy (HK) were recorded at each visit (Fig. 1a–d). SPK was defined as localized or diffuse punctate micro epithelial defects on graft surface. All these epithelial pathologies were considered as surface keratopathy (SK). Last postoperative follow-up was considered as last follow-up at three months.

Statistical analysis

Initially data were entered into an excel spreadsheet and then transferred to SPSS software (Statistical Package for Social Sciences, version 22, SPSS Inc, Chicago, IL) for analysis. The descriptive statistics was used to express data in terms of frequency and percentage. Statistical data were expressed in terms of means \pm standard deviations (mean \pm SD). For all surface abnormalities, a bivariate analysis was used to perform statistical analysis. At each visit, the abnormality was either present or absent. Independent T test was used to find the association of surface abnormalities at first POD, 2 weeks, 1 and 3 months postoperatively with various qualitative variables like DET, DPT, EUT, TT, RS, and IOP. Pearson Chi-square test was used to find out the association between categorical recipient variables like age, gender, indications of PK, glaucoma and categorical donor variables like age, gender and cause of death with

Table 2
Recipient related data.

Recipient factors	N (%)
Age (years)	
≤40	27 (29.67)
>40	64 (70.32)
Gender	
Males	64 (70.32%)
Females	27 (29.67%)
Indications	
Corneal opacity	44 (48.35)
PBK	22 (24.17)
Graft failure	17 (18.68)
Anterior staphyloma	6 (6.59)
Corneal dystrophy	2 (2.19)
Glaucoma	
With	30 (32.96)
Without	61 (67.03)
Recipient size	
<8 mm	43 (47.25)
≥8 mm	48 (52.74)

PBK: Pseudophakic bullous keratopathy.

surface abnormalities at first POD, 2 weeks, 1 and 3 months postoperatively. *P* value < 0.05 was considered statistically significant.

Results

In the present study data of 91 eyes of 91 patients were reviewed. A total of 472 documented visits were reviewed, and 5 patients were lost for the follow-up after two months so were also excluded from the study.

The recipient age at which PK's were done ranged from 10 to 83 (49.19 ± 19.35 years). The sex distribution amongst the recipient in this study was 64 (70.32%) males and 27 (29.67%) females. The left eye was involved in 53 (58.88%) cases. The donor age in this study ranged in between 17 and 95 (70.27 ± 15.11 years). Males and females donors were 53 (58.88%) and 38 (42.22%), respectively. The indications for PK were including adherent leucoma, PBK, corneal opacity or scarring, graft failure, anterior staphyloma, and corneal dystrophy in 44 (48.35%), 22 (24.17%), 17 (18.68%), 6 (6.59%) and 2 (2.19%), respectively. Various donor and recipients factors were analyzed for their impact on the epithelial surface abnormalities at various intervals of first POD, 2 weeks, 1 and 3 months postoperatively (Tables 3 and 4).

All the continuous and qualitative variables were divided into donor and recipient factors for analysis of their influence on surface epithelium of the graft.

Analysis of recipient factors affecting the epithelium

Age of recipient affected the epitheliopathy significantly at first POD and 1 week postoperatively (*P* = 0.002 and 0.032, respectively). The gender of recipient showed significant effect on SK at 2 weeks and 3 month postoperatively (*P* = 0.008 and 0.04, respectively). The indications of PK also affected SK significantly at first POD, 2 weeks and 1 month postoperative

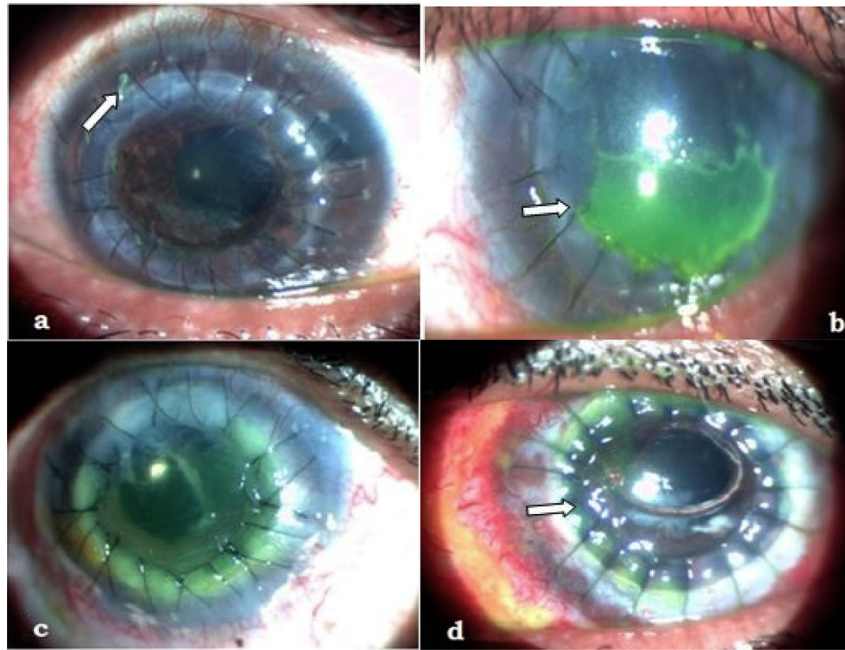


Fig. 1. **a**, Filamentary keratitis. **b**, Epithelial defect on 1/2 of the cornea. **c**, Epithelial defect involving whole of the cornea. **d**, Epithelial defect at graft host junction (GHJ).

time period ($P = 0.058$, 0.019 and 0.050 , respectively). IOP and RS showed no significant effect on epitheliopathy (Table 4). SK showed significant influence on the graft clarity at 3 months post-surgery ($P = 0.037$). Graft clarity was grade 2, 3 and 4 in 8 (8.7%), 18 (19.78%), and 65 (71.42%) eyes. Host factors like age and indications of PK account for the variability of the corneal epithelium immediately after transplant till 1 month postoperative follow-up (Table 3).

Analysis of donor factors affecting the epithelium

Donor age and gender affected the surface epithelium significantly on first POD and 2 weeks ($P = 0.05$, 0.04 and 0.017 , 0.004 , respectively). Cause of death showed significant effect on SK at 2 weeks postoperative period ($P = 0.05$). The other donor factors DET, DPT, EUT, and TT showed significant impact on epitheliopathy on first POD ($P = 0.007$, 0.001 , 0.05 , 0.03 , respectively), but after that period these factors had no influence on SK (Table 4). These results suggest that a longer time elapsed since surgery was associated with a lower prevalence of epithelial pathologies.

Distribution of various types of epitheliopathies at various postoperative intervals

Maximum patients 33 (36.26%) had epithelial defect involving $>1/2$ of the graft at first POD. At 2 weeks and 3 months postoperative follow-up, maximum patients 62 (68.13%) and 49 (53.84%) had no epithelial defects, respectively. Epithelial defects at GHJ and those involving $\leq 1/2$ of the graft at 2 weeks and 1 month follow-up were those epithelial defects which healed at normal postoperative time of

3–6 days but recurred. PED's were seen till 2 weeks post-PK follow-up. SPK's were seen in maximum patients 51 (56.04%) at 1 month follow-up. Filamentary keratitis and HK were seen only at 3 month post-PK (Table 5). All patients of HK belonged to the group of PED which healed later on by various interventions like bandage contact lens and tarsorrhaphy. 5 (5.49%) cases developed mild episodes of graft rejection at 3 month follow-up without any effect on graft clarity and all these cases belonged to younger donors. These rejections reversed with intravenous 1 gm of methyl prednisolone followed by tapering oral steroids.

Discussion

The current study demonstrated that the majority of patients had SPK's in the first month after PK. The present data also indicated that patients tended to have less SK as time after surgery elapsed. Maximum epitheliopathies were seen in recipients of age >40 years which formed 48 (81.35%) of total 59 patients of epitheliopathies. These results correlate well with other study in which it was postulated that postoperatively SK was correlated primarily with older recipient age.¹² Shimazaki et al studied the barrier function and stromal fluorescein uptake of the corneal epithelium after PK by using fluorophotometry as epitheliopathies post-PK reflects abnormal epithelial barrier function. They observed that the barrier function of the epithelial cells was significantly decreased and stromal fluorescein uptake was increased tenfold after PK compared to native corneas and direct relationship between recipient age and abnormal barrier function. These findings were consistent with our observation of increased SK in older patients. No relationship between postoperative time and the

Table 3
Significance of various recipient and donor qualitative variables on surface keratopathy (SK) at various postoperative follow-ups.

Recipient factors	Postoperative period							
	Ist POD		2 weeks		1 month		3 months	
	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal
Recipient age								
≤40	11	16	3	24	18	9	10	17
>40	48	16	21	43	46	18	32	32
<i>P</i> * value	0.002		0.032		0.619		0.257	
Gender								
Male	43	21	22	42	45	19	34	30
Female	16	11	2	25	19	8	8	19
<i>P</i> * value	0.469		0.008		0.99		0.04	
Indications								
Corneal opacity	28	16	9	35	35	9	19	25
PBK	15	7	4	18	12	10	11	11
Graft failure	14	3	10	7	13	4	8	9
Anterior staphyloma	2	4	1	5	4	2	4	2
Corneal dystrophy	0	2	0	2	0	2	0	2
<i>P</i> * value	0.058		0.019		0.050		0.55	
Glaucoma								
Without	37	24	19	42	43	18	27	34
With	22	8	5	25	21	9	15	15
<i>P</i> * value	0.23		0.14		0.96		0.60	
Donor factors								
Donor age								
≤60	10	11	2	19	14	7	8	13
>60	49	21	22	48	50	20	34	36
<i>P</i> * value	0.058		0.04		0.67		0.39	
Gender								
Male	29	24	8	45	37	16	23	30
Female	30	8	16	22	27	11	19	19
<i>P</i> * value	0.017		0.004		0.898		0.533	
Cause of death								
CVS diseases	29	15	10	34	32	12	18	26
Respiratory failure	25	13	14	24	26	12	20	18
Renal failure	5	4	0	9	6	3	4	5
<i>P</i> * value	0.828		0.05		0.885		0.566	

*P**: *P* value calculated by Pearson Chi square test.

Ist POD: First postoperative day.

PBK: Pseudophakic bullous keratopathy.

CVS: Cardio vascular system.

barrier function of the epithelium was validated,¹³ but SK decreased with time after surgery in this study. One explanation for this discrepancy is that Shimazaki measured barrier function with fluorophotometry which may be more sensitive in picking up small degrees of dye uptake than slit-lamp examination. In the present study the prevalence of HK was 12.08% of the total epitheliopathies and were seen at 3 month post-PK only which is consistent with 15% as reported by Feiz et al.¹⁴ Mathers and Lemp noted the prevalence of HK to be as high as 70% after PK and it resolved after suture removal¹⁵ which was quite high as compared to our results of HK. We observed all cases of PED developed HK after healing. Larger epithelial defects (>1/2 graft) were seen on first POD in 33.26%, and then none were seen till 3 month except PED's post-PK. Sugar et al reported that 26% of patients after PK had larger epithelial on first POD which is comparable to the present study.¹⁶ Time elapsed from surgery was associated with lower probability of epithelial defect. In the present study PED's represented

17.58% of SK on 2 weeks post-PK. Meyer et al found a direct relationship between the status of the donor epithelium and the length of time required for the healing of graft epithelium.¹⁷ In their study, the epithelium was checked daily after surgery and longest time for complete epithelial healing was 18 days. Our earliest recording of healing of epithelial defect was at 3 days postoperatively but more commonly at 6 days with maximum of 20 days. All the corneas in present study were stored in MK medium which was similar with the study conducted by Meyer et al. Kim and colleagues demonstrated that longer DPT were associated with epithelial defects 1 day after PK.¹⁸ Our data also showed significant relationship between SK and DET, DEP and EUT and TT and on first POD maximum patients 30 (32.96%) had epithelial defects involving >1/2 of the graft which can explained by the fact that SK on the first POD would be related to the donor epithelium and not the host. We noted filamentary keratitis in 5 (5.49%) patients at 3-month follow-up only which is quite less as compared to 14.2% as studied by

Table 4

The statistical analysis of the various continuous variables affecting the epitheliopathy at various postoperative (post op).

Variables	Ist POD				2 weeks Post Op			1 month Post Op			3 months Post Op		
	Epitheliopathy (Present/Absent)	N	Mean ± SD	P≠ value	N	Mean ± SD	P≠ value	N	Mean ± SD	P≠ value	N	Mean ± SD	P≠ value
DET	P	59	3.72 ± 1.67	0.007	24	3.75 ± 1.599	0.20	64	3.45 ± 1.65	0.57	42	3.70 ± 1.45	0.09
	A	32	2.79 ± 1.19		67	3.27 ± 1.57		27	3.25 ± 1.42		49	3.13 ± 1.65	
DPT	P	59	5.25 ± 2.82	0.001	24	4.82 ± 2.33	0.66	64	4.76 ± 2.86	0.42	42	4.91 ± 2.16	0.32
	A	32	3.45 ± 1.52		67	4.54 ± 2.68		27	4.28 ± 1.77		49	4.37 ± 2.90	
EUT	P	59	50.27 ± 16.71	0.05	24	46.29 ± 18.74	0.89	64	49.15 ± 21.24	0.10	42	50.54 ± 23.06	0.11
	A	32	47.75 ± 18.61		67	46.97 ± 22.23		27	41.18 ± 20.63		49	43.57 ± 19.25	
TT	P	59	58.08 ± 23.02	0.03	24	50.05 ± 19.49	0.96	64	52.65 ± 21.61	0.09	42	54.29 ± 23.44	0.09
	A	32	50.52 ± 18.66		67	50.30 ± 2.30		27	44.51 ± 20.44		49	46.75 ± 19.22	
RS	P	59	7.85 ± 0.61	0.88	24	7.91 ± 0.76	0.62	64	7.84 ± 0.64	0.65	42	7.92 ± 0.72	0.35
	A	32	7.87 ± 0.63		67	7.84 ± 0.56		27	7.90 ± 0.55		49	7.80 ± 0.508	
IOP	P	59	24.12 ± 11.21	0.42	24	20.08 ± 8.96	0.09	64	23.88 ± 11.45	0.55	42	24.50 ± 11.38	0.40
	A	32	22.13 ± 11.77		67	24.61 ± 11.97		27	22.33 ± 11.37		49	22.49 ± 11.42	

P≠ P value by independent T test.

Ist POD: First postoperative day.

DET: Death to enucleation time.

DPT: Death to preservation time.

EUT: Enucleation to utilisation time.

TT: Total time.

RS: Recipient size.

IOP: Intraocular pressure.

SD: Standard deviation.

Table 5

Clinical profile of various epithelial abnormalities at various interval of time post-PK.

Surface abnormalities	Ist POD N (%)	2 weeks N (%)	1 month N (%)	3 month N (%)
No epithelial defect	2 (2.19)	62 (68.13)	27 (29.67)	49 (53.84)
SPK			51 (56.04)	16 (17.58)
Epithelial defect at GHJ	30 (32.96)	5 (5.49)	3 (3.29)	
≤1/2 graft	33(36.26)	8 (8.79)		
>1/2 graft				
PED		16 (17.58)		
Epithelial edema			10 (10.98)	10 (10.98)
Filamentary keratitis				5 (5.49)
HK				11 (12.08)
	91	91	91	91

PK: Penetrating keratoplasty.

Ist POD: First postoperative day.

SPK: Superficial punctate keratitis.

GHJ: Graft host junction.

PED: Persistent epithelial defect.

HK: Hurricane keratopathy.

Feiz et al.¹⁴ The less incidence of filamentary keratitis in the present study can be due to the exclusion of the lid and ocular surface abnormalities and better lubricants usage.

Feizi et al revealed that longer DPT increased the incidence of graft epithelial sloughing, stromal edema and epithelial defects on first POD correlated significantly with DPT, which is consistent with our study which shows DPT affect the epithelium only during first POD.¹⁹

Van Meter et al suggested that an intact epithelium on Ist POD improves the chances of a clear graft and makes recipient's surface well maintained, but its long-term status is determined by multiple host factors.²⁰ Machado et al²¹ suggested that the

epithelial status on the Ist POD is not predictive of the status on third month after PK, because none of their patients had epithelial defects after 3 months which is true for the current study also. Borderie et al²² reported that in univariate analysis DPT, storage time and de-swelling time significantly influenced the graft reepithelialization. However in multiple regression, none of the donor parameter significantly affected the graft reepithelialization time. In the present study donor as well recipient age influenced the SK till 2 weeks post-PK.

Grabska-Liberek et al²³ found that the morphological rating of corneas suitable for PK depended mostly on DPT, donor's age, cause of death and EUT. The grading of tissues obtained

in 5 h after death was higher (excellent and very good) compared to corneas obtained 8–12 hrs after the donor's death. Stulting reported that donor age, ABO compatibility and other donor factors were not associated with graft rejection.²⁴ Graft rejection was independent of donor age and quality. This finding is consistent with the report by the Cornea Donor Study that showed no correlation between donor age and rejection occurrence.²⁵ On the contrary, younger donor age was a risk factor for graft rejection according to Inoue et al²⁶ which was true for current study also. Mannis et al concluded that higher donor age was significantly associated with lower graft success during longer follow-up period.²⁷

In the current study, this methodology was employed to standardize as much as possible the estimates of the severity of SK post-PK. Most ophthalmologists who perform PK are concerned about postoperative complications, including graft rejection and infection, but in this study, pure SK was observed. SK can escalate vision threatening complications. Therefore, this study was designed to highlight the clinical profile and extent of SK's commonly encountered post-PK.

In the literature various studies were conducted to demonstrate the effects of donor age, sex, cause of death, recipient age, indications of PK on various factors like graft success, survival, rejection but not on the surface epithelium of the recipient which is unique about this study.

This study has several limitations. The sample size was small. The effect of ocular surface disorders on epithelium could not be validated because we excluded the group with dry eye, lid abnormalities and ocular surface disorders. The corneal sensations of the subjects were not documented in the study. Keratometry or corneal topography and graft thickness were not recorded in relation to the epitheliopathy. BCVA of the subjects was not mentioned in results because till 3 months post-PK proper refractive status could not be validated because of sutures in place. The curvature difference and speed of epithelisation due to interrupted and running suture techniques could not be appreciated.

The histological findings of recipient central cornea and donor corneo-scleral rim were consistent showing fibrosis in almost all cases.

In conclusion, donor and eye bank variables affects the clinical profile of epitheliopathies of recipient corneas in early postoperative course. The present study concluded that the older age of recipient and donor both increased the probability of clinically significant SK till two weeks after PK. Various donor variables influenced the surface epithelium in immediate post-operative period. The indications of PK showed significant impact on the host's surface epithelium in early postoperative period of one month. Early recognition of these risk factors in advance will alert the surgeon for appropriate management to hasten the visual recovery and minimize the serious risks of incompetent surface. Other factors such as recipient age, tear film quality, ocular medications, and the immune status of the host are outside the control of the surgeon. Epithelial irregularities if managed early are less likely to cause aggressive problems. The eye banking community cannot do much about most donor variables and can control only few variables under

the jurisdiction of the procurement process. The data is expected to provide some basis for important factors influencing health and maintenance of the surface epithelium.

Acknowledgements

The authors thank Mr. Shubham Pandey, Assistant Professor of Statistics for Statistical analysis and Mr. Surendra Singh Bhandari, office assistant for technical support and photographic documentation.

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