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Original Article

Endothelial corneal transplants: indications, clinical profile and surgical outcomes in a tertiary care hospital

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ABSTRACT

Background: Endothelial keratoplasties have become the surgical procedure of choice over full thickness penetrating keratoplasty for corneal decompensation because of endothelial dysfunction.

Methods: A retrospective data review was performed from February 2016 to April 2017 for all the patients who underwent endothelial keratoplasty in a tertiary care center for Indian Armed Forces.

Results: A total of 161 corneal transplants were performed; endothelial keratoplasties accounted for 34 (21.1%) transplants. Most common indication was pseudophakic/aphakic bullous keratopathy followed by Ahmed glaucoma valve–related corneal decompensation and Fuchs' corneal dystrophy, respectively. Mean preoperative corneal thickness was 845.96 ± 106.9 microns. Mean lenticule thickness was 131.55 ± 42.47 microns with microkeratome for descemet stripping automated endothelial keratoplasty (DSAEK) and 174 ± 70.4 microns manually for descemet stripping endothelial keratoplasty (DSEK). Mean preoperative best-corrected visual acuity (BCVA) was 1.65 LogMAR (Snellen equivalent in meters 2/60 approx) which significantly improved to 0.82 LogMAR (Snellen equivalent in meters 6/36 approx) after surgery. In the DSAEK group, BCVA improved from 1.61 to 0.7 LogMAR, whereas in the DSEK group, the visual acuity improved from 1.7 to 0.94 LogMAR at one-month postoperative period. Postoperatively, two patients had graft detachment and had to undergo repeat DSAEK.

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Conclusion: Study results suggest the similar trends in our tertiary care hospital as in other most advanced ophthalmic centers around the world for adoption of newer techniques of lamellar corneal transplants and their outcomes.

Introduction

Lamellar keratoplasty has emerged as an alternative to full thickness penetrating keratoplasty (PKP) in recent years because of technological advancements in corneal imaging and newer surgical equipment and are guided by the location of corneal pathology.[1] Diseases involving corneal endothelium can now be managed by selective replacement of the affected part by newer endothelial keratoplasty procedures such as descemet stripping automated–endothelial keratoplasty (DSAEK), descemet stripping endothelial keratoplasty (DSEK), or descemet membrane endothelial keratoplasty (DMEK).

In most tertiary eye care centers around the world, more and more lamellar keratoplasties are being performed than PKP because of advantages of early visual rehabilitation, less graft rejection, less surgically induced astigmatism, and better patient comfort.[2–6] Endothelial keratoplasties, i.e., DSAEK, DSEK, and DMEK are being increasingly performed in our center for endothelial dysfunction, but no published data about indications, clinical profile, or surgical outcomes of endothelial keratoplasties are available in our setup. We describe the indications, donor lenticule characteristics, and surgical outcomes of endothelial keratoplasties among Armed Forces personnel and their relatives and compare these characteristics with the various studies published in the literature.

Materials and methods

A retrospective data review was performed from February 2016 to April 2017 for all the patients who underwent endothelial keratoplasty. Hospital ethical clearance was obtained to access the health data. Data were collected from the Out-patient department (OPD) record books of all the patients who were operated and followed up by the first author or coauthors. Data were collected about preoperative evaluation including uncorrected and best-corrected visual acuity (UCVA and BCVA), intraocular pressure (IOP), anterior segment optical coherence tomography (ASOCT), specular microscopy, and fundus evaluation. As per records, donor lenticule was prepared either manually (for DSEK) or using a microkeratome (for DSAEK). Manual preparation of donor lenticule was performed by mounting the donor cornea over artificial anterior chamber and making a deep partial depth incision near the periphery of the cornea. A dissection plane was established at an appropriate depth and smooth dissection was performed to remove the anterior stroma. The remaining lenticule was marked at the periphery with the marker, and 'S' mark was also made in the paracentral cornea on the stromal side for appropriate orientation of the lenticule in the anterior chamber after insertion. For DSAEK, donor lenticule was prepared using a microkeratome (SLc; Gebauer, Neuhausen, Germany) using different cutting heads varying from 350 microns to 500 microns, depending upon the donor corneal thickness as measured using intraoperative ultrasonic pachymetry. After the donor lenticule was prepared, the host corneal epithelium was debrided for clarity and side port entry was made at temporal aspect of the cornea. Host's descemet stripping was performed in the central cornea (7.5–8.0 mm) with a reverse sinskey hook, and the donor lenticule previously prepared and appropriately sized as per the host corneal diameter (usually 3 mm smaller than white-to-white diameter of the host cornea) was inserted from the nasal 3.2 mm incision. After ensuring appropriate orientation, anterior chamber was filled with air, and air tamponade was given for 20 min. All patients were maintained in the supine position over the next 24 h. All patients underwent UCVA and BCVA, ASOCT, and fundus evaluation at 1 week and 1 month postoperatively.

Sample size and power

Assuming improvement by lamellar technique of 0.5 logmar, correlation between premeasurement and postmeasurement as 0.4, standard deviation of 0.5, power of 90%, and alpha as 0.05, the sample size would be 15 in each group. However, sample size of 18 in the DSAEK group gives us power of 95%.

All analyses were carried out using statistical software STATA ver 13.1. Level of significance was taken as 0.05. Normality of the data was checked using the Shapiro–Wilk normality test.

Results

A total of 161 corneal transplants were performed between February 2016 and April 2017, and endothelial keratoplasty accounted for 34 (21.1%) of total corneal transplants. Frequency of various types of corneal transplants performed in our hospital is shown in Fig. 1. Of these 34 endothelial keratoplasties, 18 eyes underwent DSAEK, 15, DSEK, and one, DMEK. There were 18 female and 16 male patients in the study. Mean age of patients at the time of surgery was 63.2 ± 11.1 years.

Various characteristics of patients who underwent endothelial keratoplasty in our center are depicted in Table 1. The commonest indication in our study was pseudophakic/aphakic bullous keratoplasty (Fig. 2) followed by Ahmed glaucoma valve (AGV) (Fig. 3) related corneal decompensation

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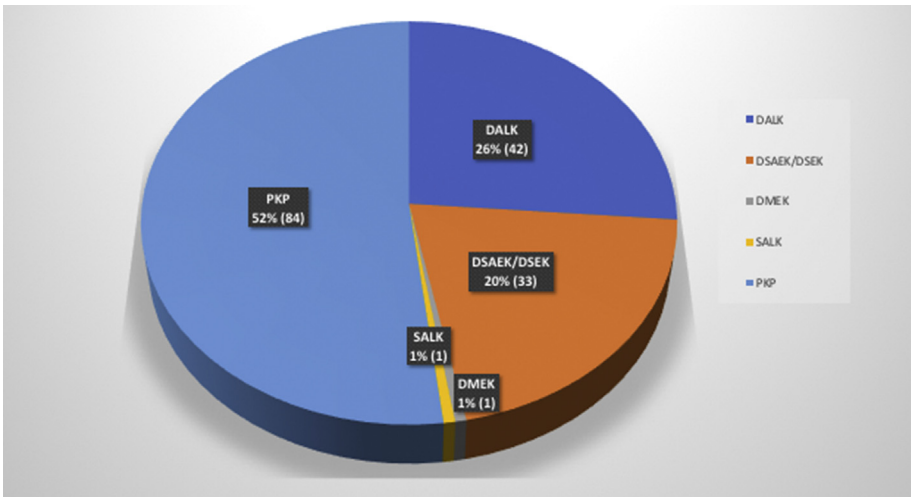

Fig. 1 – Procedure frequency of various types of corneal transplants. DSAEK, descemet stripping automated endothelial keratoplasty; DSEK, descemet stripping endothelial keratoplasty; PKP, penetrating keratoplasty; DMEK, descemet membrane endothelial keratoplasty; DALK, Deep anterior lamellar keratoplasty; SALK, Superficial anterior lamellar keratoplasty.

and Fuchs' (Fig. 4) endothelial dystrophy. Other indications included postpenetrating keratoplasty corneal decompensation in two cases (06%) (Fig. 5), repeat DSAEK in two cases (06%), and one case (03%) of postvitreoretinal surgery–related corneal decompensation.

Mean preoperative BCVA was 1.65 Log MAR (Snellen equivalent in meters 2/60 approx.) which significantly improved to 0.82 LogMAR (Snellen equivalent in meters 6/36 approx.) after surgery. In the DSAEK group, BCVA improved from 1.61 to 0.7 LogMAR, whereas in the DSEK group, the visual acuity improved from 1.7 to 0.94 LogMAR at one-month postoperative period, which is further likely to improve over the next 6 months to one year period because of tissue remodeling.

Mean corneal thickness before surgery was 845.9 ± 106.9 microns suggestive of the presence of marked corneal edema. Mean lenticule thickness achieved in all cases was 150.8 ± 59.9 microns, whereas in the DSAEK subgroup, it was 131.55 ± 42.47 microns compared with the DSEK subgroup where mean lenticule thickness was 174 ± 70.4 microns. Preoperative specular count was not recordable in all the patients.

All surgeries were uneventful. Postoperatively, two patients developed graft detachment. One patient developed graft detachment on day 2 after surgery, whereas the second

Table 1 – Characteristics of patients with lamellar keratoplasty[a].

S.no.	Characteristic	Total cases (n = 34)	DSAEK (n = 18)	DSEK (n = 15)	95% CI between DSAEK and DSEK
1	Sex#, F (%)	18 (52.94%)	11 (61.1%)	6 (40%)	
2	Age, mean (SD)	62.9 (11.06)	63.7 (11.2)	62.7 (11.4)	(–)7-9
3	Indications##				
	PBK/ABK	15 (44.1)	7 (38.9%)	8 (52.3%)	
	AGV-related corneal decomposition	7 (20.6)	5 (27.8%)	2 (13.3%)	
	Fuchs' endothelial dystrophy	6 (17.7)	3 (16.7%)	3 (20%)	
	Post-PKP corneal decompensation	2 (5.9)	2 (11.1%)	0	
	Re-DSAEK	2 (5.9)	0	2 (13.3%)	
	Post-vitreoretinal (VR) surgery	2 (5.9)	1 (5.6%)	0	
4	Preop corneal thickness	844.7 (105.5)	832.1 (107.1)	862.6 (108)	(–)107.1–46.2
5	BCVA logmar				
	Preop BCVA logmar, mean (SD)	1.6 (0.4)	1.6 (0.4)	1.7 (0.4)	(–)0.36–0.18
	Postop BCVA logmar, mean (SD)	0.8 (0.4)	0.7 (0.4)	0.9 (0.4)	(–)0.5–0.04
	95% CI for paired test		0.7–1.1	0.5–1.01	
6	Difference in logmar, mean (SD)	(–)0.8 (0.4)	(–)0.9 (0.4)	(–)0.8 (0.5)	(–)0.4–0.2
7	Lenticule thickness	147.1 (63)	131.6 (42.5)	174 (70.5)	(–)83-(–)2

F, female; DSAEK, descemet stripping automated endothelial keratoplasty; DSEK, descemet stripping endothelial keratoplasty; SD, standard deviation; CI, confidence interval; PKP, penetrating keratoplasty; AGV, Ahmed glaucoma valve; BCVA, best-corrected visual acuity; DMEK, descemet membrane endothelial keratoplasty.
#, ##p values 0.2 and 0.4 using the chi-square and Fisher's exact test, respectively.
[a] One female patient who underwent DMEK (descemet membrane endothelial keratoplasty) is not shown in table.

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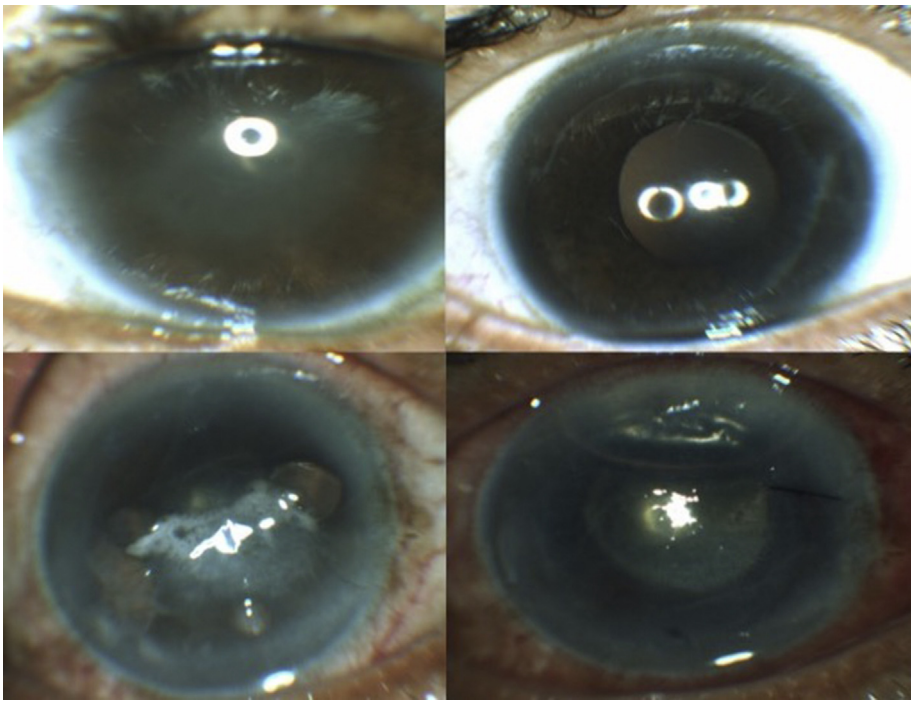

Fig. 2 – Preoperative and postoperative photographs of patients with PBK who underwent DSAEK. DSAEK, descemet stripping automated endothelial keratoplasty.

patient developed graft detachment after one month. In both these patients, air tamponade was tried but was not successful, and repeat DSAEK had to be performed. BCVA in the first patient improved to 6/36, whereas in the second patient, it improved to 6/24 at one month. Two patients also developed secondary graft failure and are on follow-up.

Discussion

Endothelial keratoplasties, i.e., DSAEK and DMEK, are relatively newer procedures and have become the preferred surgical procedures for management of endothelial dysfunction because of various causes leading to corneal decompensation.[7,10]

In our study, endothelial corneal transplants accounted for 20.5% of the total corneal transplants which is comparable with most ophthalmic centers of excellence. Rezaei et al.[8] concluded in their study in Iran that DSAEK accounted for 7.5% of all corneal transplants. In a study by Ryan et al.[9], at university of Toronto, endothelial keratoplasty (DSAEK and DMEK) accounted for 31.6% of all corneal transplants.

Park et al.[10] in their review of indications for keratoplasty, found that Fuchs' endothelial dystrophy was the commonest

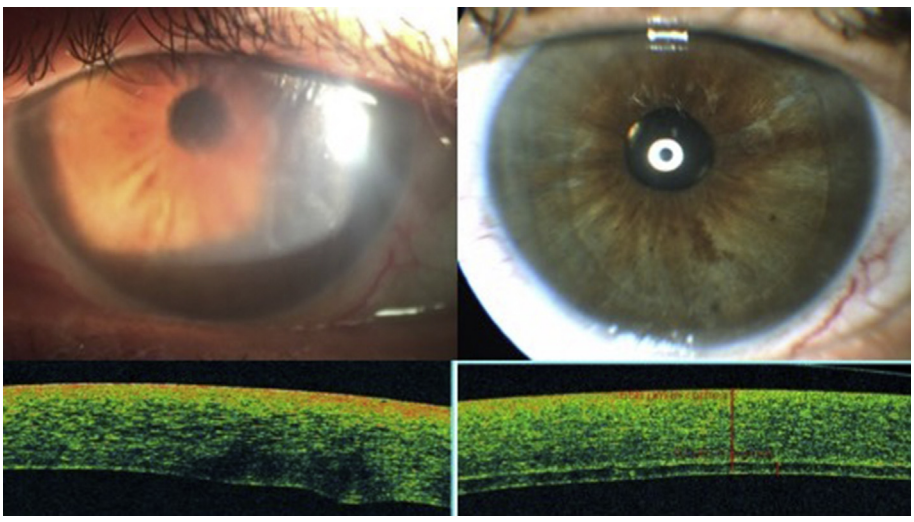

Fig. 3 – Preoperative and postoperative photographs of patients with Fuchs' corneal dystrophy who underwent DSAEK. DSAEK, descemet stripping automated endothelial keratoplasty.

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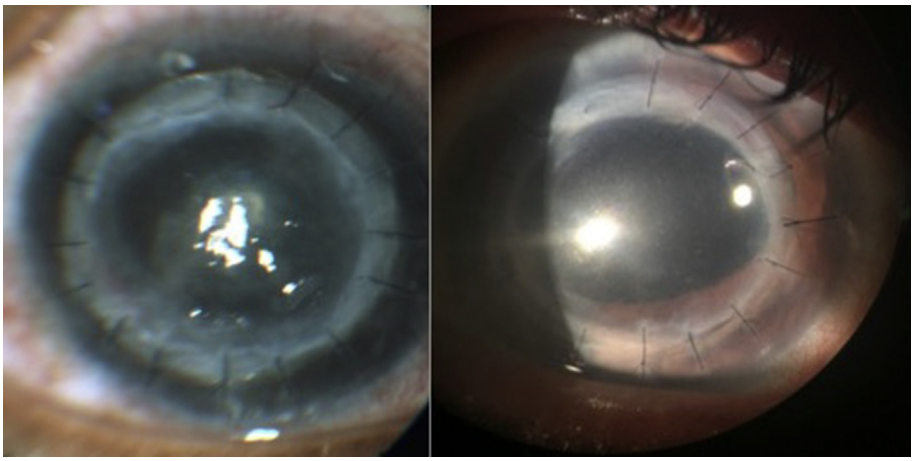

Fig. 4 – Preoperative and postoperative photographs of patients with post-PKP corneal decompensation who underwent DSAEK. DSAEK, descemet stripping automated endothelial keratoplasty.

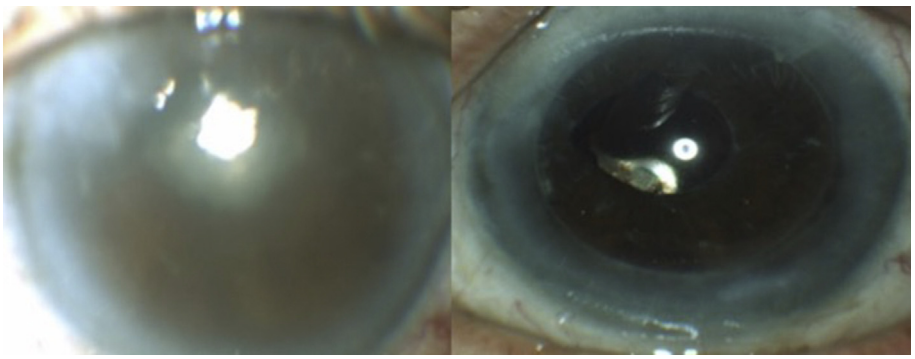

Fig. 5 – Preoperative and postoperative photographs of patients with AGV-related corneal decompensation who underwent DSAEK. DSAEK, descemet stripping automated endothelial keratoplasty; AGV, Ahmed glaucoma valve.

indication for DSAEK, accounting for 47.7% of cases (13817 patients) in 2014 in the United States, whereas pseudophakic bullous keratopathy (PBK)/aphakic bullous keratopathy (ABK) was found to be the second commonest cause (17.8% cases (5151 patients) in 2014 in the United States).[11,12] Ryan et al. also found Fuch's endothelial dystrophy (40%) as the commonest indication for DSAEK followed by PBK (33%). PBK/ABK as the commonest indication in our center could be because of large number of referrals of these patients from all service hospitals in our country because of non-availability of corneal transplant facility at most of these centers. AGV-related corneal decompensation was the second commonest indication owing to large number of AGV implantations performed over the past decade for the referred advanced glaucoma patients. Performing DSAEK in patients with AGV is a difficult situation, and surgery is guided by various factors including tube length in the anterior chamber, functional or non-functional AGV implant, and tube endothelial touch.[13,14]

Postoperative BCVA showed marked improvement in both the groups, with patients in the DSAEK group and DSEK group showing no significant difference in the final visual acuity, although there was thinner DSAEK lenticule cut with the microkeratome (131 vs 174 microns in our study) than manual dissection in the DSEK group. Many studies in the published literature have found microkeratome-assisted lenticule preparation better than manual preparation.[15] There were two cases with graft detachment postoperatively. One patient with post-PKP corneal decompensation developed graft detachment on day 2. Air tamponade with postoperative supine positioning was tried extensively, but reattachment could not be achieved, and patient had to undergo repeat DSAEK.[16] The second patient had AGV tube in the anterior chamber and developed late graft detachment at one month. In this patient also, air temponade failed, and repeat DSAEK was performed. Both these patients had good visual outcome. Endothelial keratoplasty with both these indications, i.e., postPKP corneal decompensation and AGV-related corneal decompensation have more graft detachment rates than normal endothelial keratoplasties.[17,18] There were no other intraoperative or postoperative complications. Long-term complication rates of endothelial keratoplasties have been found to be lesser than those of PKP. It has been extensively published in the literature.[19–22]

Conclusion

This is the first study about indications, clinical profile, and surgical outcomes of endothelial keratoplasties in the Indian

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Armed Forces personnel and their dependents and their comparison with the published literature. It is important to have data analysis from our setup to plan and distribute resources for better and early surgery for visual rehabilitation of our clientele. Study results suggest that although indications are slightly different compared with other published studies in the literature, the surgical outcome shows similar trends in our hospital as in other most advanced ophthalmic centers around the world for adoption of newer techniques of lamellar corneal endothelial transplants and their outcomes.

Conflicts of interest

All authors have none to declare.

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