Demography, Indications and Outcome of Descemet Stripping Automated Endothelial Keratoplasty in Nepal

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ABSTRACT

Introduction: Descemet stripping automated endothelial keratoplasty (DSAEK) is performed for corneal endothelial pathology. It had gained popularity over penetrating keratoplasty (PK) because of better outcomes.

Materials and methods: A retrospective data was collected from records of patients who underwent DSAEK from 2005 to 2019. Demography, indications and post-operative complications of DSAEK were analyzed. Outcome was measured in terms of graft clarity and vision.

Results: Ninety-three eyes of 86 patients had undergone DSAEK in the study period of 15 years. Average age of the patients was 61.0 years. 55.9% were female. The common indications for DSAEK were cataract surgery related bullous keratopathy (n=47, 50.5%), Fuchs dystrophy (n=22, 23.6%) and failed graft (n=11, 11.8%). Eight cases (8.6%) had graft detachment and five (5.3%) had pupillary block in the early post-operative period. Outcome analysis was done for cases (n=80) which had follow-up duration of at least two months (range: 2 months to 11 years; average=28.5 months). Endothelial rejection occurred in eight cases (10.0%), five of which regained graft clarity after treatment. At the last follow-up visit, 23.8% (n=19) of grafts had failed, which was mostly due to endothelial failure (n=16); three grafts failed due to infective keratitis. Post-operatively, 42.5% (n=34) acquired best corrected vision of 6/18 or better with average astigmatic error of 1.6 diopter cylinder by refraction.

Conclusion: DSAEK showed good outcome with our results comparable to other studies. It had replaced traditional penetrating keratoplasty in our institute for endothelial dysfunction. Surgeons in the country should be encouraged and trained to do the procedure.

Key words: Descemet stripping automated endothelial keratoplasty, DSAEK.

Financial Interest : Nil
Conflict of Interest : Nil

Received : 04.10.2021
Accepted : 01.05.2022

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Access this article online
Website: www.nepjol.info/index.php/NEPJOPH
DOI: https://doi.org/10.3126/nepjoph.v14i2.40248

ISSN: 2072-6805, **E-ISSN:** 2091-0320

INTRODUCTION

Descemet Stripping Automated Endothelial Keratoplasty (DSAEK) is the type of endothelial keratoplasty (EK) where descemet membrane (DM) and endothelium are removed; donor corneal endothelium with some posterior stroma is dissected by the use of automated microkeratome and transplanted to the recipient cornea (Melles, 2006; Price & Price 2007). It is the choice of treatment for endothelial dysfunction such as Fuchs dystrophy, pseudophakic or aphakic bullous keratopathy (BK), posterior polymorphous dystrophy, iridocorneal endothelial (ICE) syndrome, endothelial decompensation from trauma and failed penetrating graft. DSAEK can be performed through a self-sealing limbal or sclera tunnel incision without the need of suture. In comparison to penetrating keratoplasty (PK), DSAEK has advantages like faster wound healing and visual recovery, lower risk for endothelial rejection, minimal astigmatic change , retention of the cornea's tectonic strength and absence of problems related to suture (Melles, 2006; Price & Price, 2007).

EK has evolved significantly in the past few decades. The first technique was deep lamellar endothelial keratoplasty (DLEK), replaced later by Descemet stripping endothelial keratoplasty (DSEK) and then by DSAEK. Lately, Descemet membrane endothelial keratoplasty (DMEK), which involves selective transplantation of DM and endothelium through a small corneal incision is getting popular due to having better outcome than previous types of EK (Melles 2006; Price & Price 2007). In Nepal, a developing country, the major type of keratoplasty performed is therapeutic or optical PK, which is done mostly for active or healed infective keratitis (Bajracharya et al, 2013). EK (DSAEK) was started in Nepal in 2005. In the initial years, DSAEK used to cover 3% of total keratoplasty performed in tertiary referral centers, in Kathmandu, Nepal (Bajracharya et al, 2013). The number of DSAEK is expected to have increased as more surgeons got trained and as Nepal Eye Bank (NEB) started to process precut tissue. The current study intends to find out the demography, indications and outcome of DSAEK being performed in a developing country.

MATERIALS AND METHODS

It was a retrospective study of DSAEKs performed in 15 years' time from 2005 to 2019 at Tilganga Institute of Ophthalmology, Nepal. Pre-operative data collected from the records were demography and indications for DSAEK (pseudophakic bullous keratopathy, Fuchs dystrophy, failed graft and others.) Intraoperatively, records were collected about the type of surgery undergone and any additional procedures undertaken (like cataract extraction, intraocular lens implantation, anterior vitrectomy). Post-operative complications like graft detachment, primary endothelial failure (PEF), glaucoma, non-healing epithelial defect and post-operative inflammation were recorded. For outcome analysis, those patients who had a follow up period of less than two months were excluded. Outcome of the surgery was evaluated in terms of graft clarity, occurrence of graft rejection, causes of graft failure and best corrected visual acuity (BCVA) in the last follow-up.

Donor tissue: Good quality tissue preferably below 60 years with endothelial count >2200 cells/ mm^2 and with 2mm scleral rim were chosen. Surgeons prepared the tissue in the operating room on the day of surgery with an automated microkeratome (with 350 micron microkeratome head). Since 2018, precut tissues have been prepared by NEB and provided to surgeons. The tissues were stored either in McCarey-Kaufman or Cornisol media.

Surgical procedure: Procedure was performed under peribulbar block. For children, general anesthesia was given. Corneal epithelium was scraped. A ring mark of 7.5 to 8.5 mm diameter was made on the recipient corneal surface. Five millimeter wide corneal or corneo-scleral tunnel was created. Anterior chamber (AC) was entered. Dye (tryphan blue 0.06%) was injected into the AC and was washed. Viscoelastics (hydroxypropyl methylcellulose) was injected. Side port was made, one on either side of the main incision. The DM was stripped using a reverse Sinsky hook. The donor cornea was trephined the same size as the ring mark. AC was washed to remove viscoelastics. The donor posterior lenticule was inserted into the AC using forceps, needle or Busin glide, depending on surgeons' preference. Once the lenticule was unfolded and centered, from the side port, air was injected below the lenticule to press it up against the stroma. Atropine eye drop was instilled to prevent pupillary block. Patient was kept in a supine position. After 30 minutes, part of the air bubble was removed, filling only one third of the AC volume. In combined surgery, cataract extraction either manually or by phacoemulsification was done first. Anterior vitrectomy, whenever needed, was performed prior to inserting the graft.

Postoperatively, patients received topical 1% prednisolone acetate 6 times for 2 weeks then reduced to 4 times for 8 weeks. Topical antibiotic was given 4 times a day for 6 weeks. Topical steroid was tapered to one drop daily over 6 to 8 months, thereafter topical steroid was reduced to alternate day. The steroid was stopped after 12-18 months. Approval for the study was taken from the Institutional Research Committee of TIO. Being a retrospective study, consent from patients is not applicable.

RESULTS

Ninety-three eyes of 86 patients were operated in the study period. Seven patients had undergone DSAEK in both eyes. Average age of the patients was 61.0 years (Figure 1). 55.9%

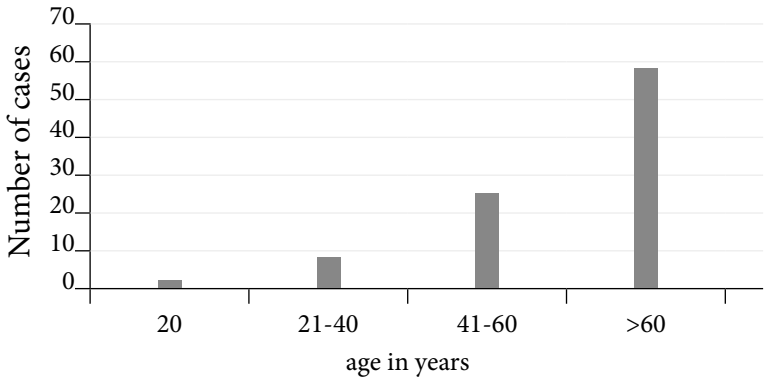

Figure 1 : Age distribution of patients undergoing DSAEK.

Table 1: Indications for DSAEK.

Indications	Number (%)
Bullous keratopathy	47 (50.5%)
Aphakic bullous keratopathy	(4)
Pseudophakic bullous keratopathy	(43)
Fuchs dystrophy	22 (23.6%)
Fuchs dystrophy associated pseudophakic bullous keratopathy	(7)
Fuchs dystrophy without cataract surgery	(15)
Failed graft	11 (11.8%)
Glaucoma	2 (2.2%)
Trauma	2 (2.2%)
Toxic	2 (2.2%)
CHED*	1 (1.1%)
Iridocorneal endothelial syndrome	1 (1.1%)
Unknown	5 (5.4%)
Total	93 (100%)

*Congenital hereditary endothelial dystrophy

were female. 48.4% of the patients were from Kathmandu valley (urban area).

The main indications for DSAEK were BK related to cataract surgery (n=47, 50.5%), Fuchs dystrophy (n=22, 23.6%) and failed graft (n=11, 11.8%) (Table 1). DSAEK was combined with cataract extraction and posterior chamber intraocular lens implantation in 23.7% of cases.

Early post-operative course: Partial graft detachment was seen in 8 (8.6 %) cases in the first week, all of which underwent successful re-centering and re-attachment by air tamponade. Other early complications were anterior segment toxic syndrome (4 cases), pupillary block glaucoma (5 cases), non-healing epithelial defect (4 cases) and malignant glaucoma (1 case).

Outcome of DSAEK: 80 cases had follow-up duration of 2 months or more with an average of 28.5 months (range 2 months to 11 years).The remaining 13 cases with follow-up duration of less than 2 months were excluded for outcome analysis.

Out of 80 cases, endothelial rejection occurred in 8 cases (10.0%). The rejection episodes happened between 6 months to 5 years. In 5 cases, graft clarity regained after treatment. Sixty-one out of 80 (76.3%) cases had clear

Table 2: Best corrected vision at the last follow-up visit.

Best corrected vision	No of cases (%)
6/6 to 6/18	34 (42.5%)
6/24 to 6/60	17 (21.3%)
5/60 to 3/60	11 (13.7%)
<3/60	18 (22.5%)
Total	**80 (100%)**

graft and the remaining 19 (23.7%) were hazy. Causes of hazy graft (graft failure) were mostly due to endothelial failure which were due to PEF (n=6), rejection (n=3), glaucoma (n=3) and late endothelial decompensation (n=4). In 3 cases, the cause of failure was infective keratitis (one fungal and two viral). Viral keratitis had occurred in DSAEK surgeries which had been done for failed PK grafts, the primary indication of which had been viral scar.

Table 2 shows that 42.5% (n=34) had BCVA of 6/18 or better. The average astigmatism (by refraction) in cases with clear graft was 1.6 diopter cylinder (DC). 36.2% (n=29) had vision less than 6/60 which was due to failed graft (n=19), cystoid macular edema (n=3), secondary glaucoma (n=5), primary open angle glaucoma (n=2).

DISCUSSION

Mean age of subjects in our study was 61.0 years, compared to 41.7 years which was the overall average age of patients who had undergone different types of keratoplasty in our institute (Bajracharya et al, 2013). In India, the mean age of patients undergoing EK was 54 to 58 years (Basak, 2008; Mohamed et al, 2014) but in China and New York it was around 72 years (Young et al, 2014; Wu et al, 2012). Older age was obviously because of patients with BK related to cataract surgery and Fuchs dystrophy, which occur in middle-aged groups (Elhalis et al, 2010). In a study done in India by Mohamed et al (2014), the patients treated for congenital hereditary endothelial dystrophy (CHED), failed prior EK or PK and ICE syndrome tended to be younger than the patients treated for other indications. Similarly in our study, average age patients with BK, Fuchs and others (failed graft, ICE, CHED, toxic, trauma) were 67.2, 58.5 and 51.7 years respectively. So it can be inferred that average age depends on the proportion of specific types of endothelial problem.

In our study, male: female ratio was 0.78:1. The ratio was lesser in Italy and Thailand, 0.65:1 to 0.7:1 (Medi et al, 2019; Lekhanont et al, 2017). In China, male and female patients were almost in equal proportion (Young et al 2014). But in India, male patients were 1.5 to 1.58 times more than females (Basak, 2008; Mohamed et al, 2014). Since Fuchs occur mostly in women (Elhalis et al, 2010), the sex ratio of patients undergoing DSAEK depends on the proportion of patients with Fuchs dystrophy.

In our study endothelial dysfunction due to BK (50.5%), Fuchs dystrophy (23.6%) and regraft

(11.8%) were three major indications (Table 1). Similar pattern was seen in our neighboring countries, China and India (Basak, 2008; Young et al, 2014). But in Thailand, New York and Italy the common indications were Fuchs (38.8 to 61.5%) followed by BK (Wu et al, 2012; Medi et al, 2019; Lekhanont et al 2017). In China and India, like in our study, Fuchs accounted for 18 to 22.7 % (Basak, 2008; Young et al, 2014). Variation of indication is because prevalence of Fuchs is different in different populations (Elhalis et al, 2010).

In our study 23.7% underwent combined DSAEK and cataract surgery. In studies done in China and India, 22.7% had undergone combined surgery (Basak, 2008; Young et al, 2014). But 41.2% had combined surgery in Thailand, probably because they do more Fuchs cases (Lekhanont et al, 2017).

In our study graft detachment was seen in 8 (8.6%), similar to that (8%) reported by Basak (2008). It was reported as 4.5% in China (Young et al, 2014), but quite high (23%) in the study of Suh et al (2008). Rebubbling with air was successful in all of our detached grafts. Some centers used iso expansile sulfur hexafluoride gas for reattachment of the graft (Young et al, 2014; Suh et al, 2008).

In our study, graft rejection occurred in 10% of cases (n=8) within 6 months to 5 years with reversal of graft clarity in 5(62.5%) after treatment. In the study done in New York, 8.5% of grafts were rejected which occurred between 0.8 to 34 months with recovery of 73.3% (Wu et al 2012). In the study by Young et al (2014), 9.1% were rejected at 6 months follow up and all rejected grafts failed. Sharma et al (2017) mentioned an average rejection rate of 10% with follow-up ranging from 3 months to 2 years.

In our study, 61 out of 80 (76.3%) cases had clear graft at average follow-up of 28 months. Basak (2008) mentioned graft clarity of 98.6% at 3 months and BCVA of 20/60 or better in 82.7%. In our study, BCVA of 6/18 or better was achieved in 42.5% (Table 2). At 47.4 months' follow-up, BCVA was ≥20/70 in 40.9% in the study done in China by Young et al (2014). 97% of the eyes had a vision of 20/40 or better at 6 months in a study by Chen et al (2008). Our study as well as that done by Young et al (2014) had longer follow-up duration than that of Basak (2008) and Chen et al (2008).This could be the reason for better vision in their study (Chen et al, 2008; Basak, 2008) than in our study and in that of Young et al (2014). The average astigmatism in refraction of cases with clear graft was 1.6 DC in our study, compared to 1.16 DC reported by Basak (2008) at 3 months. Sharma et al (2017) mentioned the average astigmatism after DSAEK from various studies was 1.5 D.

The correlation between graft thickness and gain in visual acuity could not be evaluated in our study due its retrospective nature. Terry et al (2012) found no correlation with visual outcome when graft thickness of 100-200 micrometers were used but Dickman et al (2013) reported negative correlation between graft thickness and gain in visual acuity.

In our study graft failure (23.8%, n=19) was mostly due to endothelial failure (n=16). Suh et al (2008) had reported graft failure of 17.7%. In our study, 7.5% of total grafts had PEF. It was 5 % in the study of Suh et al (2008) but no PEF

in the study of Basak (2008).Various studies showed PEF rates from 0% to 29%, with an average rate of 1% (Sharma et al, 2017).

In our study, the pupillary block reported was 6.25%. It was 2 to 2.7% reported by Basak (2008) and Suh et al (2008). Pupillary block is a rare but serious immediate postoperative complication, with a reported incidence of 0%–10% in different studies (Chen et al, 2008).

Besides being retrospective in nature, other limitations of our study were that it had a wide range of follow-up, lacked information about the endothelial cell counts of the donor cornea, intraoperative details and post-operative cell count. Further studies are needed for more detailed information on these factors.

CONCLUSION

DSAEK is an effective procedure for corneal endothelial dysfunction. Most of our results were similar to studies done in other regions. Preparation of precut tissue by NEB has eased the surgical procedure and has become popular in centers with limited resources.

Recommendation:

In developing countries, a large number of therapeutic penetrating keratoplasties (TPK) are performed for active infective keratitis, which has high endothelial failure rate post operatively

(Bajracharya et al, 2015). Failed grafts in such cases are likely to have anterior segment abnormalities like synechia, iris defects, complicated cataract, aphakia, and eccentric primary graft. Although various studies have shown that DMEK surgery has better outcome than DSAEK for pseudophakic BK and Fuchs, (Woo et al, 2019; Pavlovic et al, 2017) a comparative study by Einan-Lifshitz et al (2019) of DSAEK and DMEK performed for failed PK graft showed that graft detachment occur significantly more in DMEK than in DSAEK. This study (Einan-Lifshitz et al, 2019) did not conclude benefit of DMEK over DSAEK for failed PK. So in developing countries, despite transition of DSAEK to DMEK for other indications, (Singh et al, 2019) DSAEK can be an important procedure for treating endothelial failure especially due to failed TPK graft with challenging anterior segment situation.

REFERENCES

Bajracharya L, Gurung R, Demarchis EH, et al (2013). Indications for keratoplasty in Nepal: 2005–2010. Nepal J Ophthalmol; 5(2):207–14.

Bajracharya L, Gurung R (2015). Outcome of therapeutic penetrating keratoplasty in a tertiary eye care center in Nepal. Clin Ophthalmol; 9:2299-304.

Basak SK (2008). Descemet stripping and endothelial keratoplasty in endothelial dysfunctions: Three-month results in 75 eyes. Indian J Ophthalmol; 56(4): 291–96.

Chen ES, Terry MA, Shamie N, et al (2008). Descemet-stripping automated endothelial keratoplasty: Six-month results in a prospective study of 100 eyes. Cornea; 27:514-20.

Dickman MM, Cheng YYY, Berendschot TTJM, et al (2013). Effects of graft thickness and symmetry on visual gain and aberrations after descemet stripping automated endothelial keratoplasty. JAMA Ophthalmol; 131(6):737-44.

Einan-Lifshitz A, Mednick Z, Belkin A, et al (2019). Comparison of Descemet Stripping Automated Endothelial Keratoplasty and Descemet Membrane Endothelial Keratoplasty in the Treatment of Failed Penetrating Keratoplasty. Cornea; 38(9):1077-82.

Elhalis H, Azizi B, Jurkunas UV (2010). Fuchs endothelial corneal dystrophy. Ocul Surf; 8:173Y184.

Lekhanont K, Vanikieti K, Nimvorapun N, et al (2017). Outcomes of descemet stripping automated endothelial keratoplasty using imported donor corneas. BMC Ophthalmol; 17(1):41.doi: 10.1186/s12886-017-0436-0.

Madi S, Leon P, Nahum Y, et al (2019). Five-Year Outcomes of Ultrathin Descemet Stripping Automated Endothelial Keratoplasty. Cornea; 38(9):1192-7.

Melles GR (2006): Posterior lamellar keratoplasty: DLEK to DSEK to DMEK. Cornea; 25(8):879-81.

Mohamed A, Chaurasia S, Murthy SI, et al (2014). Endothelial Keratoplasty: A Review of Indications at a Tertiary Eye Care Centre in South India. Asia Pac J Ophthalmol (Phila); 3(4):207-10.

Pavlovic I, Shajari M, Herrmann E, et al (2017). Meta-Analysis of Postoperative Outcome Parameters Comparing Descemet Membrane Endothelial Keratoplasty Versus Descemet Stripping Automated Endothelial Keratoplasty. Cornea; 36(12):1445-51.

Price MO, Price FW (2007): Descemet stripping automated endothelial keratoplasty: Curr Opin Ophthalmol; 18:290-4.

Sharma N, Maharana PK, Singhi S, et al (2017). Descemet stripping automated endothelial keratoplasty. Indian J Ophthalmol; 65(3):198-209.

Singh SK, Sitaula S (2019). Visual Outcome of Descemet Membrane Endothelial Keratoplasty during the Learning Curve in Initial Fifty Cases. J Ophthalmol: 5921846. doi: 10.1155/2019/5921846.

Suh LH, Yoo SH, Deobhakta A, et al (2008). Complications of Descemet's stripping with automated endothelial keratoplasty: survey of 118 eyes at One Institute. Ophthalmology; 115(9):1517-24.

Terry MA, Straiko MD, Goshe JM, et al (2012). Descemet stripping automated endothelial keratoplasty: the tenous relationship between donor thickness and postoperative vision. Ophthalmology; 119(10):1988-96.

Woo JH, Ang M, Htoon HM, et al (2019). Descemet Membrane Endothelial Keratoplasty Versus Descemet Stripping Automated Endothelial Keratoplasty and Penetrating Keratoplasty. Am J Ophthalmol; 207:288-303.

Wu El, Ritterband DC, Yu G, et al (2012). Graft rejection following descemet stripping automated endothelial keratoplasty: features, risk factors, and outcomes. Am J Ophthalmol ; 153(5):949-57.

Young AL, Kwok RP, Jhanji V, et al (2014). Long-term outcomes of endothelial keratoplasty in Chinese eyes at a University Hospital. Eye Vis (Lond). Dec 1;1:8. doi: 10.1186/s40662-014-0008-9.