DESCEMET STRIPPING AUTOMATED ENDOTHELIAL KERATOPLASTY (DSAEK), VENTING VERSUS NON-VENTING INCISION - A REVIEW OF 21 CASES

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ABSTRACT

Objective: The purpose of this was study to analyze the advantages/disadvantages of venting versus non-venting incision in descemet stripping automated endothelial keratoplasty (DSAEK).

Material and Methods: This study was performed in the department of Ophthalmology, Khyber Teaching Hospital Peshawar, Pakistan from 1st Jan 2017 to April 2019. The charts of all patients were reviewed retrospectively. DSAEK was performed by a single surgeon, using a similar technique. Any complication either intra- or post-operative which happened, was recorded and managed either medically or by appropriate surgical means. At the end of the study the data was compiled and analyzed.

Results: Total 21 patients, 5 (23.80%) males and 16 (76.20%) females were included in this study. The mean age of the patients was 52.62±7.64 years. All patients had pseudophakic corneal edema/bullous keratopathy. Twenty (95.23%) out the total had posterior chamber intraocular lens and only 1 (4.7%) had anterior chamber intraocular lens. All patients had visual acuity of less than 5/60 (0.08). Mean value before DSAEK procedure was 0.0381 ± 0.01721. Best corrected visual acuity (BCVA) after DSAEK in venting cases was 6/24 (0.25) in one case (4.76%), 6/36 (0.16) in one case (4.76%), 6/60 (0.1) in four cases (19.04%) and 3/60 (0.05) in four cases (19.04%). Mean values after DSAEK in venting cases was 0.2810±0.19393 (p-value 0.004). BCVA after DSAEK in non-venting was 6/12 (0.5) in one case (4.76%), 6/18 (0.32) in one case (4.76%), 6/24 (0.25) in four cases (19.04%), 6/36 (0.16) in one case (4.76%) and 6/60 (0.1) in four cases (19.04%). Mean value after DSAEK in non-venting cases were 0.2164±0.12372 (p-value 0.001). P-values after DSAEK in venting versus non-venting cases were 0.001. Donor dislocation was seen in 4.76%, air induced pupillary glaucoma in 9.52% and partial donor non-attachment in 4.76% in the venting cases. Air induced pupillary glaucoma 4.76% and partial donor non-attachment in 4.76% are the only early post operative complication in non-venting cases.

Conclusion: DSAEK is a promising procedure for decompensated cornea which has damaged endothelium. The complications are more in venting than the non venting cases and similarly best corrected visual acuity remain good in non-venting cases.

Key-words: DSAEK (Descemet stripping automated endothelial keratoplasty), DSEK (descemet stripping endothelial keratoplasty), CME (cystoid macular edema), PKP (penetrating keratoplasty), PGF (primary graft failure).

This article may be cited as: Shah Z, Hussain I, Samar B. Descemet Stripping Automated Endothelial Keratoplasty (DSAEK), Venting Versus Non-Venting Incision - A Review of 21 Cases. J Med Sci 2020 July;28(3):292-297

INTRODUCTION

Descemet stripping automated endothelial keratoplasty (DSAEK) is the procedure of choice for corneal decompensation due to endothelial dysfunction, as alternative to penetrating keratoplasty (PKP). In DSAEK, the disease endothelium is replaced with healthy donor endothelium, descemet membrane and part of the thin posterior corneal tissue[1].

One of the reports of American Academy of Ophthalmology 2009 states that DSAEK appears similar to PKP in term of graft clarity, visual acuity, surgical risk, complications rate and endothelial cell loss. However, it seems to be superior to PKP in term of early visual recovery, refractive stability, post-operative astigmatism, wound and suture related complications and intra-operative risk[2].

Some surgeons are using automated micro keratome for the preparation of donor endothelial graft, mounted on artificial anterior chamber. The procedure is known as DSAEK. Other surgeons

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Date received: 26-01-2020
Date revised: 0?-05-2020
Date accepted: 2?-05-2020

are still using manual dissection for preparation of donor tissue mounted on artificial anterior chamber and the procedure is termed as DSEK (Descemet stripping endothelial keratoplasty)[3].

Donor tissue complications that have been reported include inability to separate newly prepared donor tissue from the anterior layer, excessively thickened donor posterior lenticule, donor tissue perforation and inadvertent slipping of the tissue inside of the eye [2,3,4]. Price et al showed that the most frequent complication encountered in DSAEK is donor lenticule dislocation which can be resolved with repositioning of the graft and re-bubbling. The proposed causes of graft detachment include patient eye rubbing and poor donor tissue dissection technique[5]. There are reports on air induced pupillary block, primary graft failure and interface infection in early post operative period 6,7,8,9. In the late post operative period, the most important reported complications are secondary glaucoma and graft rejection[10,11,12,13].

The purpose of this study is to document the advantage and disadvantage of venting and non-venting incision in DSAEK procedure.

MATERIAL AND METHODS

This retrospective chart review was performed in the department of Ophthalmology, Khyber Teaching Hospital Peshawar, Pakistan from 1st Jan 2017 to April 2019. All these 21 cases of DSAEK were performed by a single surgeon. Informed written consent was obtained from all patients. Ethical approval of the study obtained from institutional review board (IRB) of Khyber Medical College, in accordance with the declaration of Helsinki. All patients who underwent DSAEK in our department were included in this study.

All the DSAEK procedures were performed using the similar technique. We received the precut DSAEK tissue and then endoglide was used to insert the donor tissue into anterior chamber. The unfolding of the donor tissue was performed by preplaced anterior chamber maintainer using balance salt solution.

Intra operative complications were those that happened during surgery in relation to DSAEK procedure. Early post-operative complications were defined as those that happened within 2 months of after surgery and late complications were those that happened after 2 months of surgery. Any complication either intra-operative or post-operative, which happened, was managed either medically, or by appropriate surgical means. SPSS version 17 was used to analyze the data. Categorical variables were represented in percentages and numeric variables as means with standard deviation. Patients having bullous keratopathy with posterior or anterior chamber intra-ocular lens implants as well as those with Fusch's endothelial dystrophies with cataract were included in this study. The patients having bullous keratopathy with posterior or anterior lens implants with stromal scaring were excluded from the study. Moreover, cases with excessive synechia and glaucoma vale implants or any active disease were also excluded.

RESULTS

Twenty-one patients were included in the study, which comprised 5 males (23.8%) and 16 females (76.2%). The mean age of these patients was 52.62+7.64 (table 1). All 21 patients had pseudophakic corneal edema/bullous keratopathy. 20 (95.23%) out the total had posterior chamber intraocular lens and only 1 (4.7%) had anterior chamber intraocular lens. Table 2 shows the record of visual acuity before and after DSAEK procedure. All 21 patients had VA less than 5/60 (0.08) with most of the patients having VA of CF-1m (0.04). The average VA before surgery was CF-1m (0.04). Mean value before DSAEK procedure was 0.0381 ± 0.01721. Best corrected visual acuity (BCVA) after DSAEK in venting cases was 6/24 (0.25) in one case (4.76%), 6/36 (0.16) in one case (4.76%), 6/60 (0.1) in four cases (19.04%) and 3/60 (0.05) in four cases (19.04%). Mean value after DSAEK in venting cases was 0.2810±0.19393 (p-value 0.004). BCVA after DSAEK in non-venting was 6/12 (0.5) in one case (4.76%), 6/18 (0.32) in one case (4.76%), 6/24 (0.25) in four cases (19.04%), 6/36 (0.16) in one case (4.76%) and 6/60 (0.1) in four cases (19.04%). Mean value after DSAEK in non-venting cases was 0.2164±0.12372 (p-value 0.001).

Table 3 shows a comparison of early complications in venting versus non-venting cases. Donor dislocation happened in one (4.76%) in venting and none in non-venting cases. Air-induced pupillary glaucoma in two (9.52%) in venting and one (4.76%) in non-venting cases. Partial donor non-attachment occurred in one (4.76%) in both venting and non-venting cases. Blood in interface and decentration happened in one (4.76%) in venting while no such complication has been recorded in non-venting cases. Epithelial ingrowth has not been occurred in any of the case.

A comparison of late complications in venting versus non-venting cases is shown in table 4. Edema and non-attachment after rebubbling in donor

dislocation happened in one (4.76%) venting case while no such complication was there in non-venting cases. Late secondary glaucoma occured only in one (4.76%) non-venting case. Cystoid macular edema and interface opacification occurred in venting cases in one (4.76%) and two (9.52%) respectively, while no such complications occurred in non-venting cases. Figure 1 shows loss of the endothelial cells at 27 months both in venting and non-venting cases which were 23.2%.

DISCUSSION

The DSAEK offers an effective and efficient alternation to traditional PKP for the treatment of cor-

Table 1: Age & Gender distribution

Gender	Number	Age (range) in years	Mean in years
Male	5 (23.80%)	40-65	52.62 ± 7.64
Female	16 (76.20%)	40-65	
Total	21 (100%)		

Table 2: Record of Visual Acuity in DSAEK before and after surgery Total 21 cases

		Visual Parameters													
		PL+ 0	HM 0	CF/1m 0.04	3/60 0.05	4/60 0.06	5/60 0.08	6/60 0.1	6/36 0.16	6/24 0.25	6/18 0.32	6/12 0.5	6/9	6/6	Mean in decimal
No of Patients	Before DSAEK	1 4.76%	2 9.52%	12 57.12%	4 19.04%	2 9.52%	0	0	0	0	0	0	0	0	0.0381±0.01721
	After DSAEK + BCVA in Venting cases	0	0	0	4 19.04%	0	0	4	1 4.76%	1 4.76%	0	0	0	0	0.2810±0.19393
	After DSAEK + BCVA in Non-venting cases	0	0	0	0	0	0	4 19.04%	1	4 19.04%	1 4.76%	1 4.76%			0.2164±0.12372
P-values before DSAEK/after DSAEK in Venting case										0.004					
P-values before DSAEK/after DSAEK in Non-Venting case										0.001					
P-value after DSAEK in venting/non-venting cases										0.001					

Table 3: Comparative early post operative complications in venting versus non-venting Total cases 21

Complications	Venting cases	Non-venting
Donor Dislocation	1 (4.76%)	0
Air induced Pupillary glaucoma	2 (9.52%)	1(4.76%)
Partial donor non-attachment	1 (4.76%)	1 (4.76%)
Blood in interface	1 (4.76%)	0
Decentration	1 (4.76%)	0
Epithelial ingrowth	0	0

Table 4: Comparative Late Post-operative complications in venting versus non-venting Total cases 21

Complications	Venting cases	Non-venting
Edema and non attachment after rebubbling in donor dislocation	1 (4.76%)	0
Late secondary glaucoma	0	1 (4.76%)
Cystoid macular edema	1 (4.76%)	0
Interface opacification	2 (9.52%)	0
Decentration	1 (4.76%)	0
Epithelial ingrowth	0	0

neal endothelial dysfunctions. The different complications of DSAEK are described in literature include pupillary block by air, donor dislocation, graft failure, secondary glaucoma and graft rejection. The potential causes of donor dislocation include the presence of interface viscous fluid or air, patient squeezing and eye rubbing[2-8]. There are complications with preparation, handling and insertion of donor lamellar tissue into the anterior chamber of the recipient [2,3]. Most of the reported complications are with automated dissection of the donor tissue but evidence is lacking about management of these complications.

Pupillary block by air is an important complication of DSAEK procedure. Infact, the reported incidence of pupillary block varies between 0.5% and 13% in different series [5,16,17,18,19]. This is due to the displacement of an excessively large air bubble. In our series, the air induced papillary glaucoma in venting was 9.52% and was 4.76% in non-venting

cases. Fewer glaucoma cases in non-venting cases show the overall good results of the non-venting cases. This complication can be prevented by placing a freely mobile air bubble and putting a drop of cycloplegic at the end of surgery as recommended by terry et al[13].

Donor dislocation is another complication and the rate varies from 0% to 82%, with an average dislocation rate of 14.5% 2. The graft dislocation may represent either fluid in the interface of an otherwise well positioned graft or complete dislocation into the anterior chamber [14]. In our series, the donor dislocation happened in 4.76% in venting cases while no such complication was there in non-venting case. It is interesting to note that the incidence of this complication is reduced with experience. Price reported a dislocation rate of 50% on the first 10 eyes undergoing DSAEK, which was reduced to 13% in the next 126 cases after changing the procedure to include face up position after surgery and smoothening of the corneal surface[5]. Other authors have shown the similar results that, with experience and time, the dislocation rate is reduced[10,12,13]. The results of dislocation management are also satisfactory with a success rate of 72.3% that is comparable with other published series [20].

The published studies showed rate of primary graft failure (PGF) from 0% to 29%, with an average PGF rate of 5% [2,19,21,22,23]. PGF has been linked with poor surgical technique and excessive iatrogenic intraoperative manipulation of DSAEK graft. In fact, some studies refer to this entity as iatrogenic PGF [10,13]. In our series, no case of PGF was recorded both in venting and non-venting cases.

Published reports on secondary glaucoma after DSAEK are between 0% and 15%, with an average of 3% [2,24]. In our series, the incident of secondary glaucoma was 4.76% in non-venting cases while no such complication was recorded in venting cases and the commonest cause of this late secondary glaucoma was topical corticosteroid.

Endothelial rejection is another long term complication which was 0% in our series up to the follow up period of 27 months. In different studies the endothelial rejection rate varies from 0% to 45%,average 10% in a follow up period ranging from 3 months to 24 months [12,18,28,29,30].

Epithelial ingrowths and interface hemorrhage are less common complications in our series and these are comparable with reported studies [3,35,36] while interface opacification occurred in 9.52% venting cases and no such complication was there in non-venting cases which are not comparable with the reported studies [3,35,36]. Among these, interface opacity is one of the important reasons for repeat endothelial keratoplasty as reported by Letko et al, following 1050 consecutive DSAEK cases in 5 years [37]. Interface fibrosis was also described histopathologically in failed DSAEK cases where PKP procedure was performed later on [38].

The incomplete stripping of DM as a cause of partial graft detachment in DSAEK has been reported [39]. In our series, partial donor detachment happened in 4.76% both in venting and non-venting cases and with time they attached completely. In both cases the graft was initially attached in more than two third areas.

Post operative cystoids macular edema developed in 4.76% venting cases and 0% in non-venting cases, which resolved with topical non-steroidal anti-inflammatory agent and sub-tenon triamcinolone acetonide injection. This is again comparable with the previous reports [3].

Late secondary donor failure due to chronic endothelial cell loss is a question in DSAEK procedure. The reported late graft failure varies between 0 and 45 % after 01 year with an average of 6% in first year [2]. In our series the study duration was up to 27 months and the endothelial cell loss was 23.2% both in venting and non-venting cases. Late graft failure was more in pseudophakic eye with AC IOLs than with PC IOL (11.7% versus 2.4%)[43]. Previous studies have also shown that endothelial cell loss (ECL) in DSAEK in Pseudophakic eyes with AC IOLs was higher and the graft failure was 16% up to 30 months follow up [43]. Therefore, DSAEK surgery in venting and non-venting cases with AC IOL remains controversial, considering the outcomes from different studies [44]. As the published report of DSAEK beyond 5 years are few in number, so long term graft clarity with DSAEK is yet to be determined [36,39,40].

The infection following DSAEK procedure, either in the form of interface kerititis and endophthalmitis in early post operative period or delayed kerititis after 3 months is always serious and has already been reported in literature [22,45,46]. In our study, at the end of 27 months follow up, not a single case of infection was seen in both venting and non venting cases.

CONCLUSION

DSAEK is a promising alternate procedure to the traditional PKP. Like other corneal transplantation surgeries, the learning curve is steep and the potential for complications are significant in venting cases. Non-venting cases has less complication

rate and good best corrected visual acuity. However, long term follow up of more cases is needed for better understanding.

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CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE: NIL

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Shah Z: Study idea, concept, design and drafting

Hussain I: Study supervision and critical revision

Samar B : Data analysis and writing

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.