Surgical Technique

Preserving posterior capsular integrity in post-endothelial keratoplasty posterior capsular opacification

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Endothelial keratoplasty (EK) with pseudophakia often presents with late-onset proliferative after-cataract with posterior capsule distension. We performed a modified technique of capsular bag lavage in 11 eyes with late-onset PCO after EK (4 cases: post-DSAEK, 7 cases: post-DMEK). Anterior capsular rim was separated from the underlying IOL optic using MVR blade. Circumferential relaxing radial nicks were made on the capsular rim to create space for the passage of irrigation-aspiration (IA) probes behind the IOL. Bimanual IA of the flocculent cortical material was performed without damaging the posterior capsule. Air was injected at end of surgery to ensure graft apposition. All cases gained 1-3 lines of Snellen's acuity and no case developed graft failure, rejection, or endothelial decompensation. An intact posterior capsule is associated with better outcomes post a repeat graft, if required. Our technique helps avoid complications related to a disturbed anterior hyaloid phase and minimizes postoperative inflammation.

Key words: After cataract, capsular bag lavage, endothelial keratoplasty, posterior capsular opacification

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Endothelial keratoplasty (EK) is the surgical modality of choice in cases with endothelial dysfunction as observed in Fuchs' endothelial corneal dystrophy (FECD) and pseudophakic corneal decompensation, owing to the more physiological selective replacement of diseased corneal layers, faster visual rehabilitation, and decreased incidence of postoperative complications as compared with full-thickness keratoplasty including graft rejection and failure.[1,2]

Post-EK cases are mostly pseudophakic, either as a part of the primary etiology such as in pseudophakic bullous keratopathy, or due to the need for concomitant phacoemulsification (triple procedure) and a posterior capsule opacification (PCO) is commonly observed in these cases during follow-up.[3,4] Conventional management of PCO focuses on creating an opening in the opacified posterior capsule using either a Nd: YAG laser, surgically via membranectomy or posterior capsulorhexis.[5,6] The management of PCO is challenging in post-EK cases, as a loss of integrity of the posterior capsule has a detrimental impact on graft survival and jeopardizes the success of a repeat EK as well. A posterior capsule defect is associated with potential risks of persistent inflammation, vitreous disturbances, and increased intraocular pressure which may predispose to failure or rejection of the endothelial graft.

Late-onset PCO is often associated with capsular bag distension and proliferation of flocculent cortical material beneath the IOL. We herein present a modified technique of management of proliferative PCO in post-EK cases to achieve optimal visual outcomes while maintaining the anatomical integrity of the IOL-bag complex.

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We performed our modified technique of capsular bag lavage in eleven eyes of endothelial keratoplasty with late-onset PCO [Video 1, Fig. 1a-h]. Written informed consent was obtained from all patients, and the study adhered to the tenets of the Declaration of Helsinki.

We included consecutive cases of pseudophakia with PCO, who had undergone prior endothelial keratoplasty, either Descemet's stripping automated endothelial keratoplasty (DSAEK) or Descemet's membrane endothelial keratoplasty (DMEK). Only cases with primary indication for surgery as pseudophakic bullous keratopathy or Fuchs' endothelial corneal dystrophy were included. All cases had a foldable IOL implanted in the capsular bag. Cases with proliferative type of PCO (characterized by Elschnig pearls)

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or liquified after-cataract with capsular bag distension were included, and cases with fibrotic PCO were excluded. Cases with a prior episode of graft rejection, re-graft, failed graft, or visual loss disproportionate to the amount of PCO were excluded. Cases with ocular comorbidities including glaucoma, uveitis, retinal detachment, vitreous hemorrhage, and cystoid macular edema were excluded. Preoperatively, a comprehensive ocular assessment was performed, including visual acuity, slit-lamp examination, intraocular pressure, fundus examination, anterior segment and macular optical coherence tomography (ASOCT), and specular microscopy. Central corneal and donor lenticule thickness were assessed. The type of PCO (Elschnig pearls/liquefied after-cataract with capsular-bag distension) was assessed on slit-lamp examination. An objective assessment of posterior capsule distension and proliferation of flocculent material beneath the IOL was performed using ASOCT and on-table intraoperative OCT (iOCT). The duration between primary EK surgery and onset of PCO was noted.

All cases were performed by a single surgeon (JST). The surgeon performed the technique from the temporal aspect and made two side port entries at 90° and 240° with a 20-G microvitreoretinal (MVR) blade (Alcon Laboratories Inc.). A dispersive ophthalmic viscosurgical device (OVD) (Viscoat, Alcon Laboratories, Belgium, Europe) was injected in the anterior chamber in order to protect the donor endothelium followed by a cohesive OVD (Healon, Abbott, Illinois, USA) underneath the dispersive shell. The anterior capsulorhexis rim was gently separated from the IOL optic by sweeping with a blunt 27-G cannula. In cases with a firmly adherent anterior capsulorhexis-IOL complex, MVR blade was used to release the adhesion in one quadrant opposite to the side port entry [Fig. 1c]. A 27-G cannula was inserted through this gap and swept circumferentially to release the remaining adhesions. Six to eight equally spaced radial nicks were made in the anterior capsular rim circumferentially with 23-G intravitreal scissors (Grieshaber DSP), extending from the rhexis edge to beyond IOL optic edge [Fig. 1d]. Capsular bag was filled with a cohesive OVD beneath the IOL with a 27-G cannula to create space for the bimanual irrigation-aspiration (IA) cannulas. The flocculent proliferative after-cataract beneath the IOL was aspirated using bimanual IA and the posterior capsule was polished with the sandblasted IA tip, taking care to avoid an inadvertent PC tear [Fig. 1e, f]. A posterior curvilinear capsulorhexis (PCCC) was avoided. An air-bubble was injected into the anterior chamber (AC) towards the end of surgery to completely fill the AC. The air tamponade was maintained for 3–5 min and iOCT was used to assess DSAEK/DMEK graft apposition. A partial replacement of the air bubble was performed with a balanced salt solution and the paracentesis incisions were hydrated.

Postoperatively, the patients were prescribed topical antibiotics and steroids (tapering dose) for 1 month and topical cycloplegics for 1 week. Topical steroids in once-daily dose were continued after one month.

Results

Our technique was successfully performed in 11 eyes of 10 patients with late-onset PCO, including 4 cases of operated DSAEK and 7 cases of operated DMEK. The mean age of the patients was 65.6 ± 6.9 years.

The duration between primary EK surgery and onset of visually significant PCO ranged from 2–5 years. Seven cases had liquefied after cataract with capsular bag distension and four cases had proliferative PCO in the visual axis characterized by Elschnig pearls. The anterior capsulorhexis was well centered, circular with 360° IOL coverage in 7 cases, whereas it was eccentric and slightly decentered in 4 cases. Preoperative endothelial cell count was 1646.3 ± 322.6 cells/mm^2. The corrected visual acuity ranged from 6/60 to 6/18 and the mean IOP was 15.2 ± 2.6 mmHg.

Intraoperative complications such as hyphema, capsular bag dialysis, extension of radial cuts, IOL decentration, and posterior capsular tear with vitreous prolapse were not observed in any case. The visual axis was clear in all cases with an intact posterior capsule [Fig. 2a]. The corrected visual acuity ranged from 6/18 to 6/6, and an improvement of 1-3 lines on the Snellen's chart was observed in all cases. The mean IOP was 15.9 ± 3.3 mmHg. The mean postoperative endothelial cell count was 1447.1 ± 288.9 cells/mm^2. The central macular thickness was 259.3 ± 22.5 μm. No case developed excessive inflammation, increased IOP, cystoid macular edema, or endophthalmitis. Postoperative corneal edema and loss of graft clarity were not observed in the immediate postoperative period in any case [Fig. 2b]. No case developed graft rejection or failure, and the visual axis was clear with no recurrence of posterior capsule opacification in any case till 1 year of follow-up.

Discussion

A majority of post-endothelial keratoplasty cases are pseudophakic, with cataract surgery performed either preoperatively or concomitantly with EK. Posterior capsular opacification is one of the most common visually significant complications following cataract surgeries with an incidence ranging from less than 5% to 50%.[6-8] Rodríguez *et al*. reported a 0.8% incidence of PCO at 6-month follow-up in 500 cases undergoing DMEK.[4] Baydoun *et al*. reported 10-year follow-up results of a case with bilaterally operated DMEK, and reported PCO formation requiring Nd: YAG laser capsulotomy at 4–5 years after DMEK with a progressive endothelial cell loss of 68–72% at 10 years.[9] The long-term incidence of PCO in post-EK patients has not been comprehensively evaluated and there is a paucity of literature on the outcomes of conventional management strategies for PCO in these patients.

Conventionally, Nd:YAG laser capsulotomy is preferred for management of PCO.[5] Capsular bag lavage with posterior continuous curvilinear capsulorhexis (PCCC) has been described for the management of liquefied after-cataract with capsular bag distension which avoids the dissemination of the liquefied fluid into the vitreous cavity, minimizes postoperative inflammation, and prevents recurrence.[10] Both these techniques are associated with a loss of the integrity of the posterior capsule, which may not be preferable in cases that have undergone prior DSAEK or DMEK. We described our modified technique of capsular bag lavage in post-EK cases with proliferative PCO while preserving the integrity of the posterior capsule. We observed optimal visual and anatomical outcomes with restoration of the clarity of the visual axis and no recurrence of PCO in all cases. There was minimal endothelial

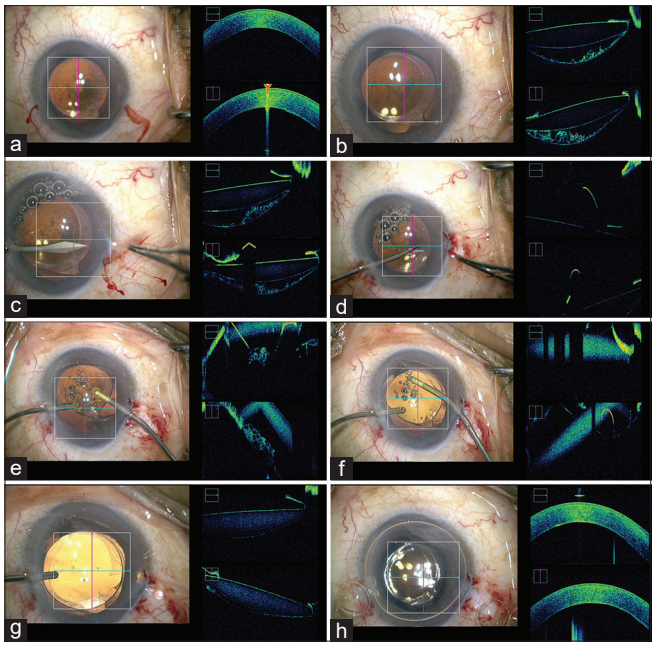

Figure 1: Management of proliferative PCO after DMEK. a. Proliferative PCO in a case of DMEK. iOCT image on the right side shows a well-attached DMEK graft. b. iOCT showing proliferative PCO with flocculent cortical matter beneath the IOL and distension of the posterior capsule. c. MVR used to separate the anterior capsular rim from the IOL optic. d. Microscissors used to create radial nicks along the circumference of the anterior capsular rim. e, f. Bimanual irrigation-aspiration of flocculent cortical material. g. Complete clearance of proliferative PCO observed on iOCT with intact posterior capsule. h. Well-attached DMEK graft on iOCT at end of surgery

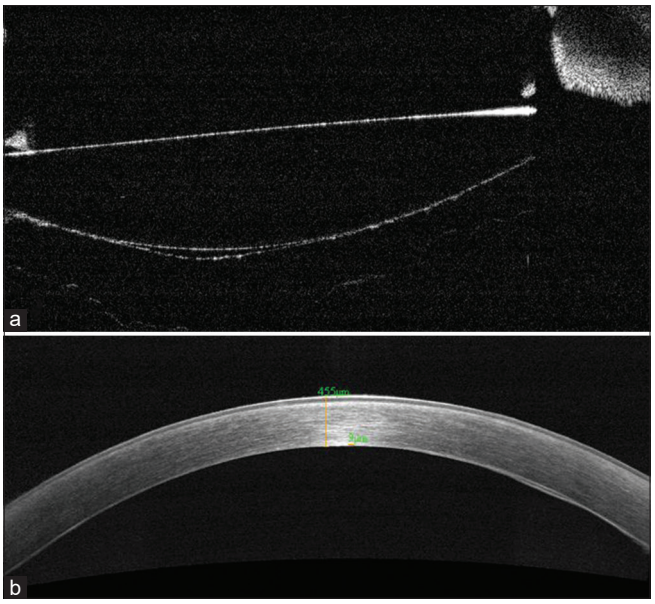

Figure 2: Postoperative day 1 ASOCT of cornea and IOL. a. ASOCT image of lens showing a stable intraocular lens, intact posterior capsule, and clear visual axis. b. ASOCT image showing a well-attached DMEK graft of 9 μm thickness with total corneal thickness of 455 μm

cell loss due to the surgical intervention, and postoperative graft clarity was maintained in all cases. Though capsular bag lavage is an intraocular procedure with its attendant risks, we did not observe any complications including graft rejection in our cases over 1 year of follow-up.

The benefits of our technique of capsular bag lavage with safeguarding of the posterior capsule in post-EK cases are manifold. First, an intact posterior capsule avoids the complications related to a disturbed anterior hyaloid phase such as vitreous prolapse and traction which may adversely impact the stability of the IOL and lead to progressive endothelial decompensation. A repeat graft is one of the most frequent indications of keratoplasty, and a re-graft may be required in 5% to 10.5% of cases after EK.[11,12] A defective posterior capsule increases the incidence of intraoperative complications during a repeat keratoplasty, including vitreous prolapse, IOL dislocation, and extrusion which adversely impacts graft survival. In addition, a loss of posterior capsule integrity will lead to difficulties in ensuring adequate air tamponade in anterior chamber during a repeat surgery, with high likelihood of migration of air posteriorly and subsequent graft dislocation.

Second, cystoid macular edema (CME) is a well-known complication following endothelial keratoplasty with an incidence ranging from 8% to 15%.[13-16] Laser capsulotomy in PCO is in itself associated with the development of CME and secondary glaucoma in 1.23% and 1.34% cases, respectively.[17] Postoperative inflammation induced by Nd:YAG laser capsulotomies in post-EK cases may be associated with further increase in the incidence of CME and secondary glaucoma in these cases.

Last, the majority of our cases had liquefied after cataract with capsular bag distension, and avoidance of laser capsulotomy in these cases helps to minimize postoperative inflammation. PCCC in the presence of fibrosed IOL-bag complex holds the potential risk of posterior capsulorhexis extension with subsequent vitreous prolapse into the anterior chamber and IOL instability.

Our technique is not useful for the fibrotic type of PCO and Nd:YAG laser capsulotomy or membranectomy via the pars plana route may be required in these variants of PCO.

Conclusion

The modified technique of preserving the posterior capsule with capsular lavage is safe and effective for the management of PCO (proliferative and liquefied after cataract) in post endothelial keratoplasty patients with optimal visual and anatomical outcomes. Keeping in view the potential need for a repeat keratoplasty, we recommend this technique as the modality of choice in cases of post-EK late-onset PCO.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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