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Spontaneous resolution of Descemet membrane detachment following big-bubble deep anterior lamellar keratoplasty

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PURPOSE. *To report 2 cases of delayed spontaneous Descemet membrane (DM) reattachment following big-bubble deep anterior lamellar keratoplasty (DALK).*
METHODS. *A 21-year-old man with keratoconus and a 36-year-old woman with corneal macular dystrophy underwent big-bubble DALK. No injury to DM was noted intraoperatively or postoperatively. Postoperatively, the patients developed central DM detachment with double anterior chamber formation. A nonsurgical conservative approach (waiting technique) was adopted.*
RESULTS. *Three weeks postoperatively, the double anterior chamber resolved spontaneously with complete DM reattachment and a clear donor cornea.*
CONCLUSIONS. *DM detachment and double anterior chamber following big-bubble DALK may resolve spontaneously. (Eur J Ophthalmol 2009; 19: 1079-81)*

KEY WORDS. *Deep anterior lamellar keratoplasty, Descemet membrane detachment, Double anterior chamber*

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INTRODUCTION

Deep anterior lamellar keratoplasty (DALK) using the big-bubble technique has recently become a widespread alternative to penetrating keratoplasty (PK) (1). One possible immediate postoperative complication of this technique is Descemet membrane (DM) detachment and formation of a double anterior chamber (2). Various treatment methods have included anterior chamber filling with air, perfluoropropane gas (C_3F_8), and sulfur hexafluoride gas (SF_6) (2, 3).
We report 2 patients who developed a DM detachment and double anterior chamber following big-bubble DALK. Using the conservative waiting technique resulted in spontaneous secondary anterior chamber resolution and DM reattachment.

Case 1

A 21-year-old man with keratoconus had preoperative visual acuities (VA) of 0.5 meters count fingers in the right eye (OD) and 20/100 in the left eye (OS). The patient underwent uneventful big-bubble DALK (1) in the right eye. After performing 8.0-mm-diameter partial thickness trephination of the recipient cornea, a 30-gauge bent needle was introduced bevel down into the central cornea, and a big bubble was produced. A limbal paracentesis peripheral to the edge of the air bubble was performed. Excision of the cornea to the level of DM was carried out. No ophthalmic viscosurgical device (OVD) was used and no visible perforation of DM under the bubble was noted. The 8.0-mm donor cornea button was stripped of DM and sutured to the recipient with partial thickness combined interrupted and

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continuous 10-0 nylon sutures. There was no air injection into anterior chamber at the end of the procedure. Topical Dexamycin solution (dexamethasone 0.1%, neomycin 0.5%, Teva) and Synthomycine ointment (chloramphenicol 5%, Rekah) were used postoperatively. On the first postoperative day, a double anterior chamber was noted resulting from a detachment between edematous donor cornea and recipient DM–endothelium layer. No intervention was done. The double anterior chamber persisted through the first postoperative week and resolved spontaneously at the beginning of the second postoperative week. Corneal edema subsequently resolved as well. Intraocular pressure remained within normal limits. Endothelial specular microscopy was performed after the DM reattachment and showed normal endothelial cell density and morphology. One month after the surgery, the patient's best-corrected visual acuity was 20/40.

Case 2

A 36-year-old woman with corneal macular dystrophy who had previously undergone penetrating keratoplasty OS was scheduled for keratoplasty OD. Preoperative VA was 20/400 OD and 20/200 OS. She underwent an uneventful big-bubble DALK with slight modification. After achieving a big bubble, a limbal paracentesis peripheral to the edge of the air bubble was performed. OVD (Biolon, Lapidot) was used to fill the pre-DM bubble in order to facilitate stromal removal. No visible perforation of DM was noted under the bubble. After copious irrigation and complete removal of OVD, the 8.0-mm donor cornea button was stripped of DM and sutured onto the 7.75-mm recipient bed with partial thickness combined interrupted and continuous 10-0 nylon sutures. There was no air injection into anterior chamber at the end of the procedure. Topical Sterodex (dexamethasone 0.1%, Fisher), Oflox (ofloxacin 0.3%, Allergan), and Synthomycine ointment (chloramphenicol 5%, Rekah) were used postoperatively.

On the first postoperative day, a detachment was noted between edematous donor cornea and recipient DM resulting in a double anterior chamber. No surgical intervention was carried out.

The corneal edema and double anterior chamber persisted through the first postoperative week and started to resolve spontaneously during the second week. By the third postoperative week, the double chamber disappeared and corneal graft was clear. Intraocular pressure remained normal. Endothelial specular microscopy was performed after the DM reattachment and showed multiple guttata and normal endothelial cell morphology and density (1714 cells/mm2). At the 1-month postoperative visit, the patient's best-corrected VA was 20/60.

DISCUSSION

DM detachment presenting as a double chamber following otherwise uneventful big-bubble DALK may cause both patient dissatisfaction and surgeon anxiety.

In most cases, this complication follows direct instrument perforation of DM during the dissection phase. Spontaneous reattachment of surgically injured DM has been described previously (3, 4). This process usually takes several months, the period of time presumably needed for repairing the defect in DM (3). Interestingly, such a detachment may be seen even in cases when the surgeon is convinced that DM under the graft is intact. Reviewing our cases, we did not discover any accidental perforation of the DM.

Several theories may explain postoperative development of a double chamber with intact DM. One possible explanation for such a phenomenon is temporary endothelial shock, which briefly halts endothelial pumping activity. Factors that influence function of endothelial pumping activity include oxygen, glucose, and carbohydrate metabolism and sodium-potassium adenosine triphosphatase pumps (5). Transendothelial movement of water is secondary to ion complex transporting. Active transport of sodium and potassium ions and bicarbonate ions also play a role (5). It is possible that traumatic manipulation of the DM endothelium layer induces temporary endothelial dysfunction leading to temporary shutdown of active ionic transport. In vitro, it has been shown that cooling of an enucleated eye causes corneal thickening through loss of the deturgescent effect of the endothelium (6). Warming appears to restore corneal clearness. This finding has been explained by a temporary stop in active ionic transport through endothelium. Postoperatively, return of normal pumping produces a pressure gradient between the 2 chambers, pumping fluid from the interface of secondary chamber to the main anterior chamber. This in turn promotes reattachment.

Delayed DM reattachment after performing DALK using OVD has been described previously (3). Some OVD remnants trapped in the interface between the host DM and donor stroma may impede endothelial pumping activity. Thus, degradation and disappearance of OVD may be es-

sential for DM reattachment. OVD was used in Case 2 although it was thoroughly removed. Case 1 was OVD free and this might be an explanation for faster double chamber resolution compared to Case 2.

Additionally, another possible mechanism of double chamber formation is the stretching of junctional endothelial intercellular complexes. Although less efficient when compared to epithelium, endothelium serves as a semipermeable membrane, creating a barrier to the diffusion of electrolytes and the flow of water (6). Gap junctions bridge the intercellular space at the apical end of the endothelial cells (5). Mechanical stretching of the endothelium during surgery may jeopardize the integrity and barrier properties of the endothelial layer. In this situation, endothelial pumping may not be able to build sufficient negative sucking pressure in the secondary chamber because of substantial reverse influx from the anterior chamber. Once the endothelial cells restore these junctional complexes and layer integrity, pump and barrier functions return. Subsequently, this eliminates the double chamber and aides in reattaching the endothelial-Descemet and stromal layers.

With anatomically intact DM, spontaneous resolution of secondary chamber may be anticipated and we refer to this approach as the waiting technique. Attempts at active reattachment of DM with gas tamponade without properly functioning endothelium are apparently prone to failure (3). The time required for reattachment most likely depends on the underlying detachment mechanism. Although corneal endothelium may maintain its viability and resume function after prolonged detachment from the stromal bed (4), the waiting approach should be used appropriately, as this viable period is not yet well-defined. Furthermore, this approach is different from one with grossly damaged or folded DM when early interventional repair to prevent DM stiffening may be needed.

In summary, DM reattachment following big-bubble DALK may occur spontaneously and the waiting technique may be appropriate, especially in cases with undamaged DM under the bubble. Further controlled studies may be needed.

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