

Descemet's Membrane Detachment

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Descemet's membrane detachment (DMD) is an uncommon but serious complication of intraocular surgery¹. It occurs when fluid enters the corneal stroma through a break in Descemet's membrane (DM) or an area of separation between the DM and the corneal stroma. Acute loss of vision from severe corneal edema can be the first sign and may also be the cause of a delayed diagnosis².

In 1928, soon after the advent of slit-lamp biomicroscopy, the first systematic description of DMD in the American literature was made by Bernard Samuels³. Samuels reported three patients with DMD after iridectomy, but he failed to realize its significance. Indeed, the subsequent literature reflected little interest in this entity until 1964, when Scheie⁴ realized the potentially serious nature of this surgical complication in his report of three patients who did poorly with DMD after cataract extraction.

A review of literature revealed that only one report has determined the incidence of DMD. It was found to be 2.8% for extracapsular cataract extraction (ECCE) and 0.5% for phacoemulsification⁵. The presence of DM flaps or scrolls along the interior lip of the sclera-corneal incision have been noted, with an incidence determined by gonioscopy to be 11% to 42%^{6,7}.

There is no clarity in the existing literature regarding the need for surgical reattachment⁸⁻¹¹ and the efficacy of various substances used as tamponade, such as 100% air, viscoelastic material, 14% isoexpansile perfluoropropane (C3F8) and 20% sulfur-hexafluoride¹². Potter and Zalatio¹³ have reported air to be the most efficacious tamponade for descemetopexy.

Predisposing Factors

- Shallow anterior chamber
- Complicated or repeated surgeries
- Inadvertent insertion of instruments between the corneal stroma and descemet's membrane
- Anterior and shelved incisions
- Blunt blades
- Engaging the descemet's membrane during intraocular lens implantation or with the irrigation/aspiration device (when mistaken as an anterior capsular remnant).

Causes of Descemet's Membrane Detachment

Surgical

1. Complicated / uncomplicated Cataract surgery – Phacoemulsification, SICS, ECCE
2. Glaucoma surgery – Viscoanalostomy, Deep sclerectomy, Trabeculectomy, Iridectomy, holmium laser sclerostomy

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3. Inadvertent intracorneal injections- Viscoelastics, Balanced salt solution, Adrenaline, Antibiotics
4. Penetrating keratoplasty
5. Pars plana vitrectomy

Non- surgical- Birth injury, Trauma- blunt/sharp, Congenital glaucoma, Corneal ectasia- keratoconus, Anatomical predisposition

The most common cause of descemet's membrane detachment is mechanical separation near the incision site by an instrument, fluid or viscoelastic substance.^{15,16,17}

Classification

- **Mackool and Holtz Classification** based on clinical presentation - Classification by Mackool and Holtz helps in determining the prognosis of DMD. Planar detachments are likely to resolve spontaneously and non-planar should be repaired early. Iradier MT and Moreono E used this classification in studying the late spontaneous resolution of a massive detachment of Descemet's membrane after phacoemulsification.^{14,15}
- Planar (<1mm separation from the stroma)
- Peripheral detachment only
- Combined peripheral & central detachment
- Non- Planar (>1mm separation from the stroma)
- Peripheral detachment only
- Combined peripheral & central detachment

Dr Jacob's Classification based on etio-pathogenesis¹⁷

- Stripped descemet's membrane detachment
- Taut descemet's membrane detachment

Stripped descemet's membrane detachment - Stripped descemet's membrane detachment is generally induced during viscoelastic injection or during insertion of blunt instruments or intraocular lens.

Taut descemet's membrane detachment - A long-standing stripped descemet's membrane detachment could sometimes adhere to intraocular contents with secondary fibrosis, thus turning into a taut descemet's membrane detachment. It could be due to inflammation involving the descemet's membrane secondary incarceration of the descemet's membrane in an inflammatory process, eg, in peripheral anterior synechiae or within the graft host junction; or secondary incarceration in a wound/suture with subsequent contraction.

Morphological classification¹⁸

- DMD with non- scrolled edges
- DMD with scrolled edges

Role of Imaging Technology

Diffuse corneal edema can obscure the slit-lamp view into the anterior chamber, making the diagnosis and subsequent surgical planning difficult. Ultrasonographic biomicroscopy (UBM) has been advocated as a

means of imaging DMD through an opaque cornea, but this procedure requires a skilled technician, a cooperative patient, and substantial time investment.¹⁹

Anterior segment OCT may be superior alternative to UBM because of the speed and ease of image acquisition, the ability to acquire images without direct corneal contact, and the ability to image patients in the upright position.²⁰ It determines the extent of detachment (planar or non-planar) and degree of tautness. A stripped descemet's membrane detachment is seen as an undulating linear hyper-reflective echo in the anterior chamber whereas a taut descemet's membrane detachment is seen as a straight, taut line between two points of attachment.¹⁷

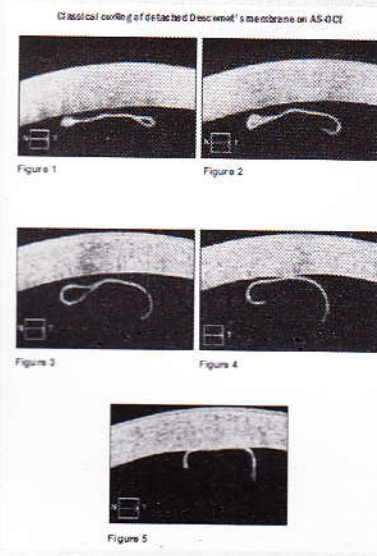


Fig. Classical curling of DMD on AS-OCT

Management

Conservative Approach: Planar DMDs are visually insignificant and resolve spontaneously (reattachment) within few weeks to few months. Conservative approach including medical treatment in the form of topical steroids and hyperosmotic agents is indicated with a close follow-up.

Reattachment: Spontaneous resolution of descemet's membrane detachment has been reported within days to 3 months. The actual nature of this reattachment is unclear. It has been hypothesized that the persistent pumping action of the healthy endothelium might exert an appositional force to appose detached corneal descemet's membrane. Fortunately, the viability of the endothelial cells is maintained, and they function well even after months of descemet's membrane separation. The descemet's ridges present following reattachment are usually visually insignificant.²¹

Intentional Approach: Non-planar DMDs may cause vision loss because of subsequent corneal decompensation. Swift action in nonplanar DMD is essential.

Intraoperative tamponade : One should be vigilant enough to notice even a small DMD intra-operatively, immediately on its occurrence. If stripping of descemet's membrane is recognised at the time of surgery attempt may be made to reposit the same using an iris repositor. Sterile air should be injected at the end of surgery. Due to its short life, air is reserved for small incision detachments. If anterior chamber gas injection cannot be carried out at the end of the surgery, it must be done on the first day after the surgery.

Descemetopexy: Intracameral injection with either iso-expansile sulfur hexafluoride (SF6) or iso-expansile perfluoropropane (C3F8) gas has gained increasing acceptance as an efficient and effective treatment option for descemet's membrane detachments. SF6 (20%) is the best option for the endothelium.²² In addition, this procedure can be performed at the slit-lamp and may be repeated if necessary. It may also be combined with transcorneal laser. DMD is very large or having scrolled edges.

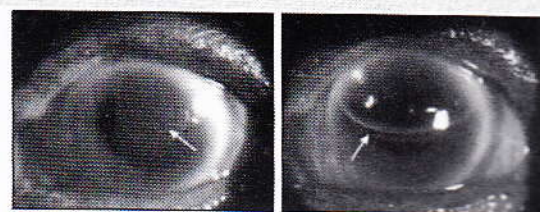


Figure 1- Slit-lamp examination image with postoperative severe corneal edema

Figure 2- Slit-lamp examination image with C3F8 bubble in anterior chamber and attached Descemet's membrane. Day 3

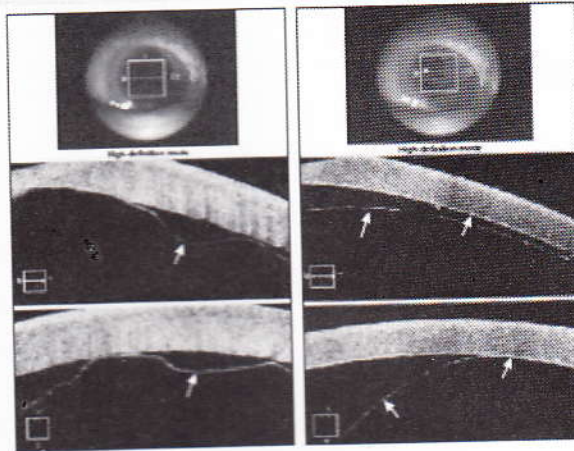


Figure 3- High-resolution cornea scanning with anterior segment optical coherence tomogram revealing central Descemet's membrane detachment

Figure 4- Post C3FB injection gas bubble with attached Descemet's membrane and clear cornea on anterior segment optical coherence tomogram

Case 1. Management of DMD by Descemetopexy



Figure 1- High-resolution cornea scanning with anterior segment optical coherence tomogram revealing central Descemet's membrane detachment

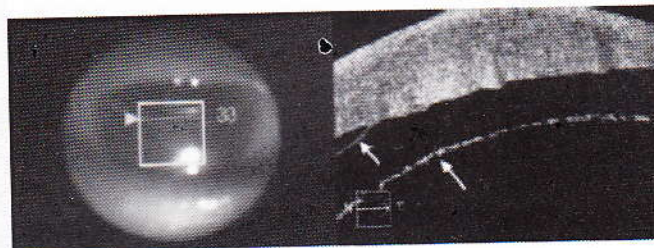


Figure 2- Post air injection gas bubble with detached Descemet's membrane on day 3 on anterior segment optical coherence tomogram

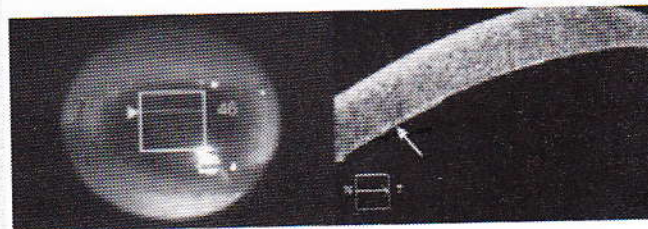


Figure 3- Re-descemetopexy- Post C3FB injection with attached Descemet's membrane at 1 month on anterior segment optical coherence tomogram

Case 2. Management of DMD- Re-Descemetopexy an option

Complications of descemetopexy

- Raised intraocular pressure due to pupillary block due to large gas bubble or because of movement of the gas bubble behind the iris. A simple paracentesis will relieve the pupillary block.
- Endothelial fallout may occur due to increased instrumentation associated with descemetopexy
- Despite successful reattachment, a horizontal opacity, or descemet's membrane haze may remain at the location of the original detachment.
- Irregular astigmatism may result owing to the formation of wrinkles in descemet's membrane.

Prevention

Descemet's membrane detachment is a remediable but potentially blinding cause of postoperative corneal oedema. Several factors should be borne in mind to help minimise the risk of DMD:

- Instrumentation should be gentle and minimal,
- Use of Blunt keratomes and blades should be avoided,
- Early intraoperative detection is imperative to avoid rapid progression,
- The incision's inner corneal aspect should be equal to, or slightly greater than, the incision's outer scleral aspect to prevent undue trauma during insertion and removal of phaco probes or irrigation/aspiration devices with irrigating sleeves.

Conclusion

A careful slit-lamp examination augmented by an anterior segment OCT if needed, can diagnose descemet's membrane detachment in cases of corneal oedema following cataract surgery, especially if the procedure has been uneventful. AS-OCT guided, endoilluminator assisted intracameral injection of sulphur hexafluoride (SF6) gas is the best way of management of DMD as compared to intracameral injection of air and perfluoropropane (C3F8) gas²³. Descemetopexy should be undertaken even if detection of DMD is as late as 2 months postoperatively.

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