

Causes and Management of Descemet's Membrane Detachment Associated with Cataract Surgery—Not Always a Benign Problem

C Y W Khng,*^{MBBS, M Med (Ophth), FRCS (Edin)}, L W Voon,**^{MBBS, M Med (Ophth), FRCS (Edin)}, K T Yeo,***^{MBBS, FRCS (Edin), FRCOphth}

Abstract

Introduction: Detachments of Descemet's membrane (DM) occur with not uncommon frequency during cataract surgery. The figure for extracapsular cataract extraction (ECCE) is 2.6%, and that for phacoemulsification is 0.5%. Most detachments are small and of little visual consequence. Large detachments are rare but can lead to loss of vision. Early recognition and appropriate management is the key to a favourable outcome. This review provides cataract surgeons with guidelines to the management of this problem. **Methods:** A review of reported studies on the subject was made using a MEDLINE search. A summary of the reviewed data is presented. **Results:** The problem is fairly widespread, given the number of cataract operations done today. The important points with regard to aetiology, classification, recognition and appropriate management are presented in this article. **Conclusion:** DM detachment should not be taken lightly because of the potential for serious visual outcome. It may be avoided in a large majority of cases. Appropriate and prompt management may prevent the patient from suffering visual loss should it occur.

Ann Acad Med Singapore 2001; 30:532-5

Key words: Corneal decompensation, Descemet stripping, Extracapsular cataract extraction, Penetrating keratoplasty, Phacoemulsification

Introduction

It is well known that stripping of Descemet's membrane (DM) occurs not infrequently during cataract surgery. In 1928, Samuels described frequent DM detachments of small dimensions during cataract extraction of minor consequence.¹ It has also been reported after penetrating keratoplasty, surgical iridectomy and trabeculectomy. Descemet's detachments of large extent associated with cataract surgery are, however, a rare occurrence,¹⁻⁴ and have been described as early as 1964 by Scheie.²

The incidence of DM detachments associated with cataract surgery has been reported as 2.6% for extracapsular cataract extraction (ECCE) and 0.5% for phacoemulsification.⁵ No statistics are available for extensive DM detachments that threaten vision. Detachment of DM may be detected intraoperatively or sometimes in the days or weeks after surgery. Following extensive detachment, corneal oedema occurs, with increased corneal thickness, loss of corneal transparency and bullous keratopathy, which can be difficult to treat. This paper aims to review the possible prevention, recognition and management of this unique problem.

Classification

MacKool and Holtz⁶ have mentioned the therapeutic and prognostic implications of classifying DM detachments based on the extent of detachment as measured by the distance between the flap of detached DM and corneal stroma.

Planar detachments are described as those where the greatest distance of the DM detachment is less than 1 mm away from the overlying corneal stroma.

Non-planar detachments are those where more than 1 mm separates DM from stroma.

So far, no classification system has attempted to divide the severity of the detachment based on the area of detached DM. Obviously, such a classification system would have prognostic value.

Detachments may also be described as peripheral if it is located within 3 mm from the limbus, or combined peripheral plus central if it also involves central cornea.⁶

No formal study of the natural history of untreated DM detachments has been made but anecdotally, the factor associated with favourable outcome appears to be the

* Registrar

*** Senior Consultant

Singapore National Eye Centre

** Registrar

Department of Ophthalmology

Tan Tock Seng Hospital

Address for Reprints: Dr Christopher Y W Khng, Singapore National Eye Centre, 11 Third Hospital Avenue, Singapore 168751.

amount of separation of DM from the stroma, with a higher incidence of planar separations spontaneously reattaching and ending in a good outcome.

Mechanism of DM Detachments

The exact pathogenesis for extensive Descemet's detachment is still unclear. In some cases, the mechanism is obvious e.g., injecting viscoelastic into deep cornea and delaminating a leaf of Descemet's,^{7,8} or trauma from the entry of surgical instruments as they are introduced without due care into the anterior chamber.

In several cases, however, the cause for DM detachment is unknown, with the detachment being discovered postoperatively after uncomplicated surgery. In some cases even, detachment was spontaneous, occurring weeks after uneventful surgery,⁹ or in rare cases, not associated with any surgery or mechanical trauma.¹⁰⁻¹² Unusually, DM detachment has been reported to occur in the fellow eye following cataract surgery.¹³ Breaks within DM may also be noted in congenital glaucoma, birth (forceps) injury and other blunt trauma, keratoconus and Terrien's marginal degeneration.

It has been recognised that small focal areas of DM separation may occur following cataract surgery but these rarely lead to any serious sequelae.^{9,14-17} It is therefore proposed that those eyes, in which extensive stripping of DM occurs, have some underlying predisposing factor that leads to detachment of DM.² An anatomical predisposition may be suggested by its occurrence in bilateral cases. Sparks¹³ described 2 cases in which bilateral cases of DM detachment occurred. Morrison et al⁹ found that DM is thickened in the fellow eye of subjects in which stripping of DM occurred. These eyes were probably abnormal to begin with, and DM thickening and/or reduced attachment of DM to corneal stroma may in some way have contributed to the occurrence of this problem.

If this was an adhesion problem, then one would expect it to be relatively more common in patients with diabetes mellitus, as this group of patients is well known to have decreased cell adhesion to basement membranes and an increased risk of recurrent corneal erosions. However, a review of the literature does not show a greater incidence of diabetes among patients with DM detachments.

Prevention of DM Detachments

Prevention of DM detachments should be by careful attention to the following:

1. The entry of the knife/keratome or irrigation/aspiration (I/A) instrument should be in the proper plane.
2. Avoid reusable keratomes/blades as a dull knife will increase the likelihood of detachment.

3. Intraocular lens implantation should be gentle with careful manipulation of the haptic/optic as it is introduced into the anterior chamber.
4. I/A should be gentle, and with the least possible number of excursions into and out of the anterior chamber.
5. Instruments introduced into the anterior chamber e.g., I/A apparatus, should be as thin as possible and with no abrupt changes in diameter to abrade against the edge of DM at the wound edge.
6. Any pressure applied by the instruments on the wound edge should be to the posterior (scleral) lip of the wound.
7. During injection of balanced salt solution or viscoelastic, the surgeon should be careful that the tip of the needle/cannula is within the anterior chamber, not anterior to DM.
8. More relevant to phacoemulsification, the incision's inner corneal aspect should be greater than or equal to the outer scleral aspect to prevent undue trauma during insertion and removal of the I/A device and phacoemulsification probe.

Recognition of DM Detachments

Recognition of the fact that the DM has detached is best made intraoperatively at primary surgery when any corrective action has its highest chance of success. However, in some cases, it is only recognised the day following cataract surgery, and in the occasional case, only weeks after, with persistent corneal oedema and striate keratopathy providing the clue.

Intraoperatively, it is often seen as a transparent membrane that is commonly mistaken for a capsular remnant. A horizontal line may be seen where the membrane is still attached. If this is not recognised, aspiration of this membrane will lead to its increase in size when its origins will be appreciated. Therefore, any membrane-like structure, especially when seen in the vicinity of the cataract wound, should arouse the suspicion that it might be DM. In some cases, the membrane, discovered after making the corneal incision, will be seen to move when the edge of the wound is lifted, again betraying the fact that the detached membrane is indeed Descemet's. If recognised, care must be taken not to aspirate it or further detach it.

Postoperatively, if the cornea is clear enough, again a horizontal line may be appreciated and the margins of the denuded area made out. Sometimes a transparent membrane may be seen, usually with overlying corneal oedema. In some cases, the patient may present with non-clearing corneal oedema after surgery. If the oedema is interfering with visualisation, and a DM detachment is suspected, the cornea may be cleared with hypertonic saline or topical glycerine and a detachment may then become obvious.

Management of DM Detachments

The presence of a healthy corneal endothelium is fundamental to the maintenance of corneal clarity and to resist corneal swelling. Every effort should be made in cases of extensive DM detachments to reappose stripped endothelium and Descemet's to corneal stroma. Management may be conservative (with observation, topical hypertonic agents) if the detachment is limited, or surgical if it is more extensive, scrolled, long-standing or has failed conservative treatment (Fig. 1).

Small planar detachments may initially be observed with the hope of spontaneous reattachment.^{3,7,15} The observation period is usually a few weeks. If no spontaneous reattachment occurs, then surgical intervention is indicated. If the detachment is scrolled, it is unlikely to spontaneously unroll and reattach; so surgical intervention seems justified in such cases. Excellent visual results after repositioning of DM, where indicated, suggest that prompt surgical management of the detachment has merit.^{2,6,13,18} One report¹⁹ states that delaying repair does not compromise outcome. However, Walland et al²⁰ reported that earlier surgery may prevent the membrane becoming rigid and therefore making anatomical reattachment more difficult.

Surgical intervention is reserved for large, scrolled, non-planar detachments or when a trial of conservative management fails in detachments of smaller dimensions.

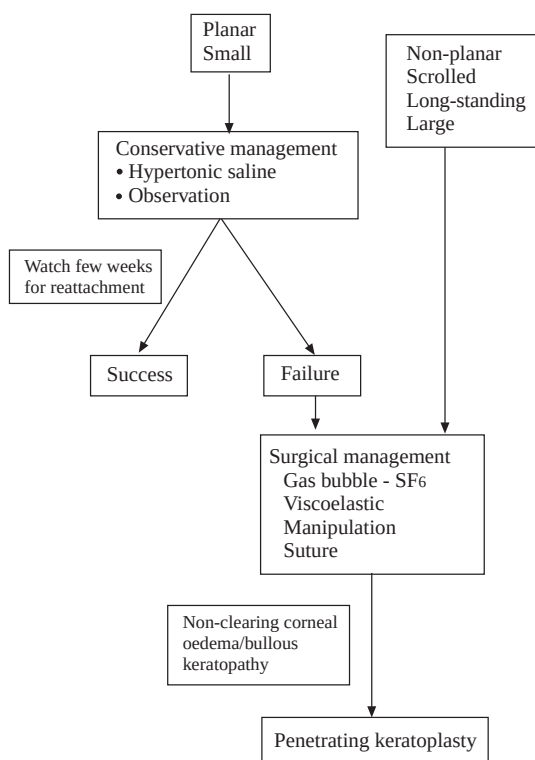


Fig. 1. Schema for management of Descemet's detachments.

With these management principles, it is our belief that the success of treatment is dependent on:

1. Early recognition that DM detachment has occurred, at primary surgery where possible.
2. Early anatomical repositioning of DM to stroma.
3. Maintaining this apposition till reattachment occurs, via gas or viscoelastic tamponade. Corneal sutures may be required in difficult cases.

Surgical Options for the Repair of Stripped DM

Descemetopexy can be achieved by a variety of means. The least traumatic form that successfully reapposes DM should be used:

1. Introduction of air, sulphur hexafluoride (SF_6) or other longer acting gases to unscroll DM and then left in as a gas bubble tamponade, keeping the reapposed membrane in contact with the stroma to allow reattachment to take place. The gas is introduced on the endothelial side of the stripped membrane via a paracentesis, allowing the enlarging bubble as it is injected to "steam-roll" and flatten the detached membrane. This is started from where it is still attached and proceeding towards its free edge. Posturing can modify the tamponading effect of gas. Air is convenient but its short duration of action of about 1 to 2 days may not be effective for many cases of extensive DM detachments. In this respect, SF_6 , lasting about 1 week may be a better choice.⁸ Animal studies have shown that SF_6 is non-toxic to corneal endothelium. Perfluoropropane (C_3F_8), however, may not be as safe as there is a risk of corneal endothelial damage and subsequent bullous keratopathy.^{21,22} Thus, SF_6 at a concentration of 20% up to 25% would be our agent of first choice.
2. Injection of viscoelastic to unscroll the detached DM back into place. A postoperative intraocular pressure rise and the possibility of the viscoelastic agent coming in between DM and corneal stroma, interfering with reattachment, may complicate the case. Furthermore, there is no benefit from posturing.
3. Mechanical manipulation of stripped DM into place e.g., with a cyclodialysis spatula. This is not generally recommended unless the membrane is already very rigid and cannot be unrolled by other means. This method, however, can result in further endothelial cell loss.
4. Usage of full-thickness corneal fixation sutures to hold the reapposed DM. This is reserved for those cases where the DM cannot be approximated by other means. In particular, it may be the only method suitable for semi-rigid scrolls, where it should be used in conjunction with SF_6 and supine posturing to flatten the DM against stroma. This is after unrolling the scroll with a

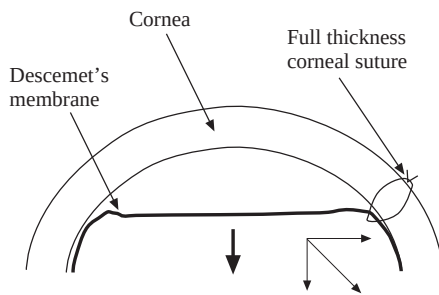


Fig. 2a. Force induced by corneal suture and posterior vector tending to detach Descemet's membrane.

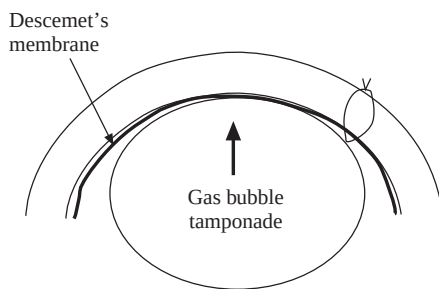


Fig. 2b. Tamponade effect of gas/viscoelastic holding Descemet's membrane attached despite force induced by corneal suture.

viscoelastic or after gentle mechanical manipulation. Sutures alone are not recommended, as the posterior vector of forces would tend to detach the DM (Figs. 2a and 2b).

5. Penetrating keratoplasty is a final resort when the above measures fail and intractable corneal oedema and bullous keratopathy results.

Conclusion

Cataract surgery is the most common intraocular procedure performed today. DM detachment is an association that should not be taken lightly because of the potential for serious sequelae. With a good understanding of the causes of Descemet's detachment and meticulous attention to careful surgical technique, it may be avoided. Despite this, should the unfortunate happen, early recognition and proper management can prevent serious visual consequences.

REFERENCES

1. Samuels B. Detachment of Descemet's membrane. *Trans Am Ophthalmol Soc* 1928; 26:427-37.
2. Scheie H G. Stripping of Descemet's membrane in cataract extraction. *Trans Am Ophthalmol Soc* 1964; 62:140-52.
3. Sugar H S. Prognosis in stripping of Descemet's membrane. *Am J Ophthalmol* 1967; 63:140-3.
4. Weve H. Separation of the membrane of Descemet after extraction of the lens. *Ned Tijdschr Geneesk* 1927; 2:398-400.
5. Anderson C J. Gonioscopy in no-stitch cataract incisions. *J Cataract Refract Surg* 1993; 19:620-1.
6. MacKool R J, Holtz J. Descemet membrane detachment. *Arch Ophthalmol* 1977; 95:459-63.
7. Hoover D L, Giangiacoimo J, Benson R L. Descemet's membrane detachment by sodium hyaluronate. *Arch Ophthalmol* 1985; 103: 805-8.
8. Zusman N B, Waring G O, Najarian L V, Wilson L A. Sulfur hexafluoride gas in the repair of intractable Descemet's membrane detachment. *Am J Ophthalmol* 1987; 104:660-2.
9. Morrison L K, Talley T W, Waltman S R. Spontaneous detachment of Descemet's membrane; case report and literature review. *Cornea* 1989; 8:303-5.
10. Tucker D P. Blue sclerotic syndrome simulating buphthalmos. *Am J Ophthalmol* 1959; 47:345-8.
11. McGrand J C. Hyaline ridges on the posterior cornea. *Br J Ophthalmol* 1968; 52:257-61.
12. Ruiz R S. Spontaneous Descemet's membrane tear and detachment. *Arch Ophthalmol* 1991; 109:20-1.
13. Sparks G M. Descemetopexy: surgical reattachment of stripped Descemet's membrane. *Arch Ophthalmol* 1967; 78:31-4.
14. Merrick C. Descemet's membrane detachment treated by penetrating keratoplasty. *Ophthalmic Surg* 1991; 22:753-5.
15. Theodore F H. Complications after cataract surgery. *Int Ophthalmol Clin* 1964; 4:913-48.
16. Jaffe N S. Detachment of Descemet's membrane in cataract surgery and its complications. St Louis: CV Mosby, 1984:627-36.
17. Cogan D G, Kuwabara T. Growth and regeneration potential of Descemet's membrane. *Trans Ophthalmol Soc UK* 1971; 91:875-94.
18. Greenhut J. Descemetopexy: A report of 2 cases. *Ann Ophthalmol* 1971; 3:1244-8.
19. Vastine D W, Weinberg R S, Sugar J, Binder P S. Stripping of Descemet's membrane associated with intraocular lens implantation. *Arch Ophthalmol* 1983; 101:1042-5.
20. Walland M J, Stevens J D, Steele A D. Repair of Descemet's membrane detachment after intraocular surgery. *J Cataract Refract Surg* 1995; 21:250-3.
21. Foulks G N. The effect of perfluoropropane on the cornea of rabbits and cats. *Arch Ophthalmol* 1987; 105:256-9.
22. Van Horn. In vivo effects of air and sulfur hexafluoride gas on rabbit corneal endothelium. *Invest Ophthalmol Vis Sci* 1972; 11:1028-36.