Original Article

Descemet membrane detachment after ocular chemical burns: case series and review of literature

Sohini Mandal[1], Hemant Jhajharia[1], Prafulla Kumar Maharana[1]
Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi, India.

Abstract

Background: Descemet's membrane detachment (DMD) is a rare complication after ocular chemical injury and its pathogenesis remains unclear. In this study, we reported three cases of DMD with traction demonstrated on Anterior segment optical coherence tomography (ASOCT).

Case presentation: Two patients sustained ocular chemical injury with 50% sodium hydroxide and one patient with hydrochloric acid 10%. ASOCT revealed detached Descemet's membrane in the inferior quadrant at 40 days, 36 days and 30 days after the injury respectively. Apart from receiving conservative treatment, the first case received intracameral tamponade with 12% C3F8 gas and the third case underwent amniotic membrane transplantation with symblepharon ring. However, DMD persisted in all the cases.

Conclusions: The atypical features of DMD on anterior segment optical coherence tomography in our cases suggested the presence of an inflammatory component caused adhesions and traction to Descemet's membrane and prevented reattachment of DMD even with gas tamponade.

Delhi J Ophthalmol 2022; 32; 44-47; Doi http://dx.doi.org/10.7869/djo.766
Keywords: *Descemet's Membrane Detachment, Ocular Alkali Burn, Ocular Acid Burn*

Introduction

Most of the reports of DMD in chemical injury has been described following alkali injury. Deeper ocular penetration following an acid injury is considered rare in view of the coagulative necrosis induced by acids. However, this case highlights that severe form of acid injury can cause damage to the deeper structures of the eye and a DMD.

Descemet's membrane detachment (DMD) is a known complication of various intraocular surgeries such as cataract surgery, trabeculectomy, corneal transplantation, iridectomy etc. with incidence rates being reported at 2.5% and 0.044–0.5% during extracapsular cataract extraction and phacoemulsification, respectively.[1-3] DMD is a relatively rare untoward event following ocular chemical injury. Several authors have reported DMD in cases of chemical injury (mostly alkaline in nature) in around seven cases.[4,5] The most common site of DMD is the inferior half of cornea due to gravitation of inflammatory cells and fibrinous exudates in the inferior anterior chamber with onset being 3 days to 4 months. Few proposed mechanisms include massive cellular damage at stromal and endothelial level leading to development of an inflammatory retrocorneal membrane thereby pulling the DM or retrocorneal membrane might develop neovascularization that can rupture and fill the pre-descemetic space leading to hemorrhagic DMD. However, in literature there has been no reports of Pre-descemet's/ Dua's layer (PDL) detachment in cases of ocular chemical burns.

Case presentation

Case 1

A 44-year-old male was referred to our hospital 40 days after an accidental chemical injury in his left eye with 50% sodium hydroxide solution. The patient irrigated his left eye with tap water immediately after the injury and was subsequently treated at a local clinic. At the time of presentation to our hospital, his visual acuity was hand movements in the left eye and 20/20 in the right eye. Slit-lamp examination revealed an inferior corneal epithelial defect involving 2 clock hours along with diffuse corneal epithelial and stromal edema (Figure 1a). The patient was treated with 0.3% ofloxacin four times a day, 0.1% prednisolone acetate eye drops four times a day, 1% atropine sulfate eye drops twice daily and oral 2000 mg vitamin C per day. The epithelial defect resolved at one week follow up and the best-corrected visual acuity (BCVA) improved to 20/400. Six weeks after the initial injury, DMD was noted in the inferonasal quadrant on slit-lamp examination (Figure 1b) and the BCVA was 20/ 200. AS-OCT confirmed a localized DMD in the inferior quadrant. The detached Descemet membrane was thick and adherent to the underlying iris tissue. The iris was pulled anteriorly (Figure 1c-f). Confocal scanning microscopy failed to detect the corneal endothelium. On the following day, 0.1 ml of 12% perfluoropropane (C3F8) gas was injected into the anterior chamber. However, the detached Descemet's membrane persisted postoperatively (Figure 1g and h). The central cornea clarity improved gradually and the BCVA of the left eye recovered to 20/100 and 20/50 at two and four months after the initial injury

Case 2

A 28-year-old male presented to our hospital 36 days after ocular chemical injury with 50% sodium hydroxide. The patient irrigated his eyes with tap water immediately after the injury and presented an hour later to our hospital. At the time of presentation, the BCVA was 20/40 in the right eye and 20/200 in the left eye. There was extensive corneal edema along with limbal ischaemia (Figure 2a). Treatment was commenced in the form of topical levofloxacin 0.5% four times a day, topical atropine 1% gel nocte and oral vitamin C 2000 mg per day. Five weeks later, slit lamp examination revealed a DMD, which had not been present during the initial examination. AS-OCT showed a localized DMD in the inferior quadrant. Similar to the first case, the detached Descemet membrane was thick, adherent to the underlying iris tissue and pulled the iris anteriorly (Figure 2c-f). Topical prednisolone acetate 1% eye drops

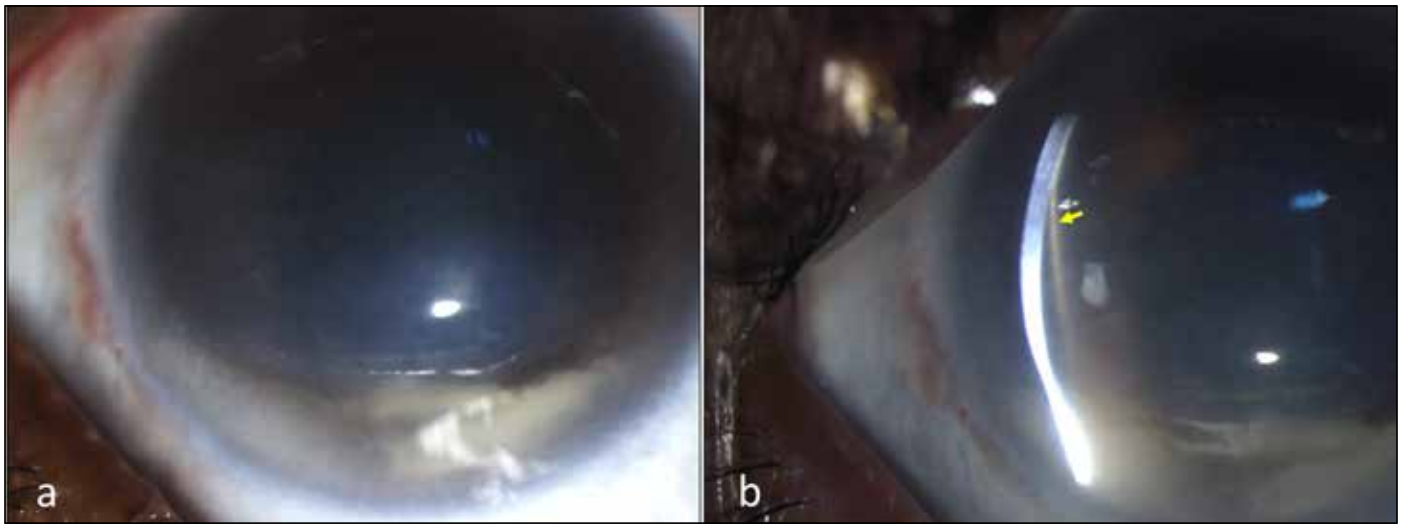

Figure 1: *(a)- Right eye slit lamp image (diffuse illumination mode) shows 12 clock hours of limbal ischaemia, inferior corneal epithelial defect and diffuse corneal stromal edema; (b)- on making slit, Descemet membrane detachment (yellow arrow) with pre-descemetic sterile exudate collection of 2mm in the inferior half of cornea can be noted.*

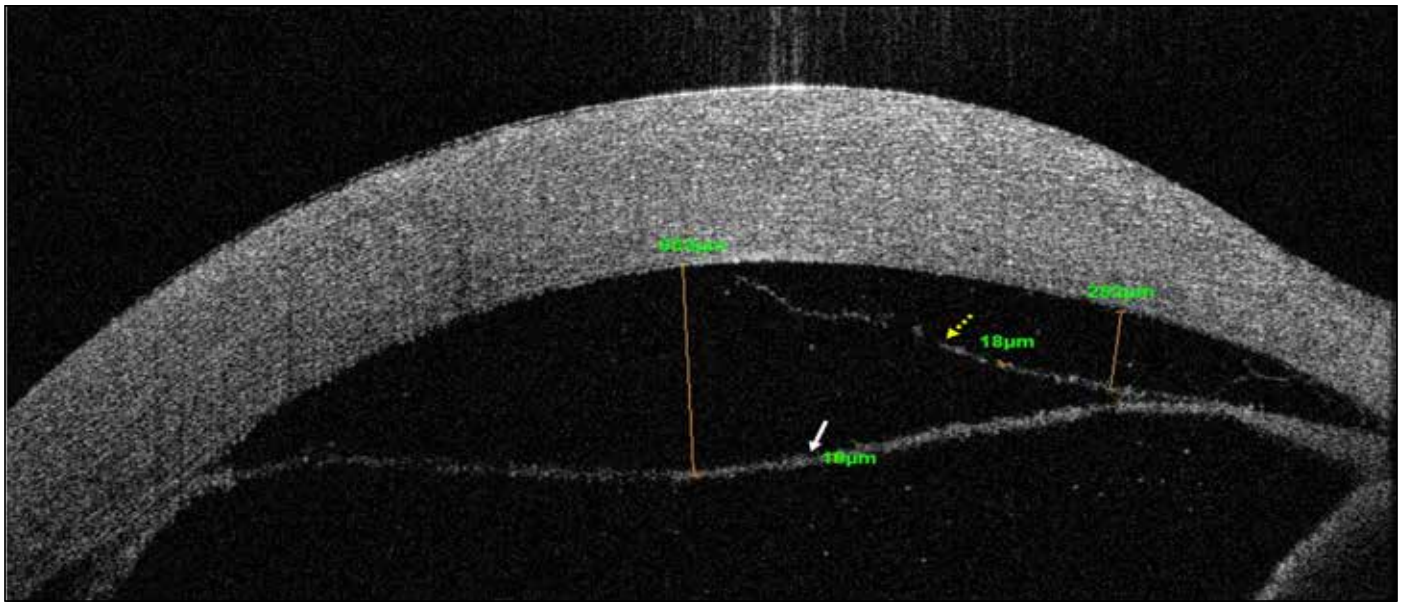

Figure 2: *Anterior segment optical coherence tomography shows an anterior hyperreflective band representing the pre-descemet layer (yellow dotted arrow) and a posterior undulating band (white solid arrow) corresponding to the detached descemet membrane; the maximum height of PDL detachment being 252 µ and that of DM detachment being 663 µ.*

and sodium chloride 5% eye drops were administered every 2 h; however, the DMD persisted at the end of one week and one month (Figure 2g and h). There was severe corneal neovascularization (Figure 2b) and the BCVA of left eye dropped to hand movements at one-year follow-up visit. He received penetrating keratoplasty at another institute and the BCVA improved to 20/200 postoperatively.

Case 3

A 54-year-old male was referred to our hospital 30 days after an accidental chemical injury in his right eye with toilet cleaner (constituent including 10% hydrochloric acid). Patient irrigated his right eye with tap water instantly following injury and was later treated at a local eye hospital the same day. At presentation, visual acuity was hand movements OD and 20/40 OS. Slit-lamp examination of right eye revealed entropion of upper eyelid and 360-degree scleral thinning. Corneal epithelial defect involving 3 clock hours inferiorly and 12 clock hours of limbal ischaemia along with diffuse corneal stromal edema was also present (Figure 1a). Additionally, descemet membrane detachment (DMD) with pre-descemetic sterile exudate collection of 2mm was noted in the inferior half of cornea.(Figure 1b) ASOCT (Visante, Carl Zeiss Meditec AG) OD confirmed a mixed form of DMD,[6] an anterior hyperreflective band of 18 µ thickness representing the PDL (long arrow) and a posterior undulating band (short arrow) of same thickness representing the DM; the maximum height of PDL detachment being 252 µ and that of DMD being 663 µ. (Figure 2) The patient was treated with preservative free 0.5% moxifloxacin four times a day, 2% homatropine eye drops four times daily, preservative free lubricants 2 hourly and oral 2000 mg vitamin C per day.

Right eye amniotic membrane transplantation (AMT) with symblepharon ring was performed under local anaesthesia. All the preoperative medications alongwith topical steroid were continued in the postoperative period. The epithelial defect resolved at one week follow up and the height of exudates gradually decreased with persistence of DMD and corneal edema.

Differential diagnosis

The Descemet membrane detachment was present in the inferior half of cornea with pre-descemetic exudate collection. On careful slit lamp examination, we could not find any corneal infiltrate or any sign that would have pointed towards an infective etiology. Besides, literature has several reports on tractional Descemet membrane detachment following ocular alkali burn and our patient's clinical picture corroborated with those.

The second diagnostic dilemma was to identify the type of detachment as per the classification system recently proposed by Dua et al.[6] Mixed DMD was defined by Dua et al. as the anterior taut hyperreflective line like a chord of a circle representing the Pre-descemet layer separated from posterior stroma, and another posterior straight or undulating double contour line representing the DM, with the latter also separated from the former. This was also corroborating to our case as the posterior undulating hyper-reflective membrane was extending to periphery unlike the anterior hyper-reflective line; and was partially adherent to iris tissue inferiorly.

Discussion

Various intraoperative factors such as clear corneal incisions, use of blunt blades, inadvertent insertion of instrument between stroma and DM, entry into anterior chamber in a soft globe and improper shelved or oblique incisions predispose to iatrogenic DMD. DMD following chemical burn has been described previously by several authors. Cases of Descemet's membrane detachment after ocular chemical injuries in literature and our study are summarised in Table 1.

As reported by Najjar et al.[5] and Hua et al.[4], DMD occurred 1–4 months after the initial injury. Najjar et al.[5] hypothesized two possible mechanisms: 1) an inflammatory retrocorneal membrane with an organizing hyphema that caused tractional DMD; 2) collection of blood between corneal stroma and DM due to rupture of neovascularization on the retrocorneal membrane. Our case also presented with DMD at 30 days after initial insult, similar to the cases reported by Najjar et al. However, hyphema was not noted in our case.

Recently Dua et al. have described three types of DMD.[6] Type 1 includes cases where the PDL and DM were detached together. In Type 2, only the DM was detached. In mixed form, the PDL and DM both were detached and separated from each other. Based on this classification our case 3 falls into mixed type of DMD.[6]

In the cases reported by Yuen et al.[7] gas bubble was detected in the pre-descemetic space, thus hypothesizing that hydrogen peroxide produces gas, that pushes the DM away from the corneal stroma actively. AS-OCT showed that the detached PDL and Descemet's membrane was thick and taut and partially adherent to the iris in the inferior half. Therefore, based on the clinical presentation and AS-OCT features, following hypothesis given by Zhang et al.[8] holds good: inflammatory cells and fibrinous exudates incited by chemical burn, gravitate down inferiorly in the anterior chamber causing iris and Descemet's membrane adhesions; contraction of the fibrinous adhesion caused DMD.

There is lack of knowledge regarding management for DMD after chemical injury in literature due to small number of cases published. In early onset cases of post-chemical injury DMD resolution has been reported with 20% SF6 intracameral injection or spontaneously. The DMD fails to reattach even after intracameral gas tamponade in late onset cases[5] due to traction force of the underlying iris tissue.

Most of the reports of DMD in chemical injury has been described following alkali injury. Deeper ocular penetration

Table 1: Summary of cases of Descemet's membrane detachment after ocular chemical injuries in literature and our study

Article	Yuen HK 2004[7]	Zhang B 2012[8]	Najjar DM 2000[45]	Najjar DM 2004[5]	Hua MT 2010[4]	Case report
Age	40	19	49	45	26	54
Gender	Male	Male	Male	Female	Male	Male
Chemical	Hydrogen peroxide	Sodium cyanide	Sodium hydroxide	Unknown	Ammonia	Hydrochloric acid 10%
Location	inferior	extensive	inferior	inferior	Inferior	inferior
Exam	Slit lamp	UBM	Slit lamp	Slit lamp	Slit lamp	Slit lamp, ASOCT
Initial VA	HM	20/800	20/80	20/800	HM	HM
Hyphema	No	No	Yes	Yes	Yes	No
Management	Intracameral 20% SF6 injection	1% prednisolone and 0.5% levofloxacin eye drops	Intracameral 18% SF6 injection	unknown	Intracameral air bubble injection	Amniotic membrane transplant with symblepharon ring; 0.5% moxifloxacin, 1% prednisolone acetate, 2% homatropine eye drops, preservative free lubricants, oral 2000 mg vitamin C
Outcome	reattached	reattached	unresponsive	unknown	unknown	unknown

following an acid injury is considered rare in view of the coagulative necrosis induced by acids.
coherence tomography

References

1. Li YH, Shi JM, Fan F, et al. Descemet membrane detachment after trabeculectomy. Int J Ophthalmol. 2012;5(4):527–9.
2. Mulhern M, Barry P, Condon P. A case of Descemet's membrane detachment during phacoemulsification surgery. Br J Ophthalmol. 1996;80(2):185–6.
3. Ti SE, Chee SP, Tan DT, et al. Descemet membrane detachment after phacoemulsification surgery: risk factors and success of air bubble tamponade. Cornea. 2013;32(4):454–9.
4. Hua MT, Betz P. Descemet membrane detachment after alkali ocular surface burn. Bull Soc Belge Ophtalmol. 2010;(316):85-6
5. Najjar DM, Rapuano CJ, Cohen EJ. Descemet membrane detachment with hemorrhage after alkali burn to the cornea. Am J Ophthalmol. 2004;137(1):185-7
6. Dua HS, Sinha R, D'Souza S, et al. "Descemet Membrane Detachment": A Novel Concept in Diagnosis and Classification. Am J Ophthalmol. 2020 Oct;218:84-98.
7. Yuen HK, Yeung BY, Wong TH, et al. Descemet membrane detachment caused by hydrogen peroxide injury. Cornea. 2004;23(4):409–11.
8. Zhang X, Jhanji V, Chen H. Tractional Descemet's membrane detachment after ocular alkali burns: case reports and review of literature. BMC Ophthalmol. 2018 Sep 24;18(1):256.

Cite This Article as: Sohini Mandal, Hemant Jhajharia, Prafulla Kumar Maharana. Descemet membrane detachment after ocular chemical burns: case series and review of literature Delhi J Ophthalmol 2022;32; (4) 44- 47.

Acknowledgments: Department of General Medicine

Conflict of interest: None declared

Source of Funding: None

Date of Submission: 20 May 2022
Date of Acceptance: 22 June 2022

Address for correspondence

Prafulla Kumar Maharana, MD
Associate Professor of Ophthalmology
Cornea, Cataract and Refractive Surgery Services
Dr. Rajendra Prasad Centre for
Ophthalmic Sciences,
AIIMS, New Delhi, India.
Email: drpraful13@gmail.com

Quick Response Code