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Original Article

Ophthalmology Section

Risk Factors for Descemet's Membrane Detachment Following Small Incision Cataract Surgery

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ABSTRACT

Introduction: Separation of Descemet's membrane and the endothelium from the stroma is called Descemet's detachment. The most common cause of Descemet's Membrane Detachment (DMD) is mechanical separation near the incision site by an instrument, fluid or viscoelastic substance. DMD is an important vision threatening complication after cataract surgery.

Aim: To evaluate the risk factors for DMD following manual Small Incision Cataract Surgery (SICS).

Materials and Methods: A retrospective, non-comparative clinical analysis of the risk factors causing DMD was performed using computerised database. All cases operated for cataract extraction and intraocular lens implantation by manual SICS, in which only blade was used for construction of the sclera-corneal tunnel (incision, tunnel and entry)-no crescent and no keratome technique, under community outreach department between January 1st, 2013 and December 31st, 2013, were analysed. We analysed the preoperative, intraoperative and postoperative records of all the patients who suffered with a DMD. We compared the surgeon's experience, ocular risk factors and the DMD.

Results: The mean age of patients having DMD was 64.89 years. Male to female ratio was found to be 0.54:1. The incidence of DMD was found to be 0.15% (57 patients out of 36,898). Dense cataract, shallow anterior chamber, Pseudoexfoliation (PXF), corneal opacities, steep cornea were found associated with DMD. Incidence of DMD was higher among final year trainees than the first year trainees. All DMDs were re-attached on first postoperative day.

Conclusion: DMD is a surgeon induced preventable cause for postoperative corneal oedema and low vision. Gentle instrumentation, early detection, judicious management may reduce the incidence and outcome of DMD especially in dense cataract, PXF, steep cornea and corneal opacities.

Keywords: PXF/Post operative low vision/ corneal oedema/ scleral tunnel

INTRODUCTION

Descemet's membrane is a basement membrane which is 8-10 μm thick in adults [1] and composed of collagen (Type IV). It consists of a simple squamous or low cuboidal monolayer of mitochondria-rich cells that are responsible for regulating fluid and solute transport between the aqueous and corneal stromal compartments [2]. Separation of Descemet's membrane and the endothelium from the stroma is called Descemet's detachment. It was first reported in 1928 by Bernard Samuels, and since then it has been reported most often after cataract surgery [3].

The most common cause of DMD is mechanical separation near the incision site by an instrument, fluid or viscoelastic substance [4-6]. In addition, non-surgical detachments have been reported in birth injury, blunt or sharp trauma, congenital glaucoma and keratoconus. Some patients may be anatomically predisposed to DMD possibly because of an abnormality in the fibrillary stromal attachment to Descemet's membrane [7].

In our setup, with a large volume of cataract surgeries under community outreach department, we found that most important cause of postoperative low vision was corneal oedema. A significant number of cases of corneal oedema were due to DMD and number of cases posted for re surgery (air injection) on first post-operative day was high. These events triggered us to analyse the incidence and risk factors for DMD following SICS.

MATERIALS AND METHODS

A retrospective, non-comparative clinical analysis of the incidence and risk factors causing DMD was performed using computerised database. All cases operated for cataract extraction and intraocular lens implantation by SICS under community outreach department between January 1st, 2013 and December 31st, 2013 were analysed using preoperative, intraoperative and postoperative records. Case sheets of patients with low vision (<6/60) on first postoperative day, were taken and complete analysis of pre, intra-op and pos*-op data analysed.

Preoperative Records

In our institute, all cases posted for cataract surgeries, were clinically evaluated for:

Uncorrected Visual Acuity (UCVA),

Intraocular Pressure (IOP) by Non-Contact Tonometer (NCT),

Slit lamp biomicroscopic examination,

Dilated fundus evaluation using +90D lens and indirect ophthalmoscopy.

Ultra sound B-scan was done in cases where fundus details were not clear, Automated keratometry was done and Intraocular Lens (IOL) power calculation using a SRK-T formula with a A-constant 118.5 was used.

Intraoperative Procedure

All the surgeries were performed by residents and consultants. All patients underwent SICS. Tropicamide 0.8% and phenylephrine 5% and flurbiprofen 0.03% was instilled 2 to 3 times before ocular anaesthesia to achieve adequate mydriasis. Ocular anaesthesia was administered by peribulbar injection of xylocaine and hyaluronidase.

Under all aseptic precautions, peritomy was done and Razar blade - sharp edge of this blade was cut using blade breaker.

Tunnel construction: A 6-7 mm partial thickness scleral incision was made at the limbus. Sclero-corneal tunnel was made using same blade and entry into the anterior chamber was made using blade. Section was extended under viscoelastic (OVD) cover using blade. Crescent and keratomes were not used for tunnel construction which is unique mode of constructing scleral tunnel in Manual Small Incision Cataract Surgery (MSICS). This method is economical and reduces financial burden in performing around 40,000 surgeries per year. The method is faster and hence saves time.

A circular curvilinear capsulorrhexis was made and hydrodissection done using a 26G air needle cannula. The nucleus was prolapsed into anterior chamber and viscoelastic was injected both above and below the nucleus to cushion the site and avoid trauma to the corneal endothelium, underlying iris and posterior capsule during delivery by sandwich technique. Irrigation and aspiration was done to remove the cortex and epinucleus using a 22G Symcoe cannula. Viscoelastic was injected into the bag and a polymethyl methacrylate (PMMA) IOL (single-piece, optic diameter 5.5 or 6.0 mm, modified C loop with 10°) was placed in the bag. OVD was washed out of the anterior chamber with the Symcoe's cannula and the anterior chamber was formed using a 26 G 11/2 inch air cannula attached to a 5cc syringe by hydrating the section. Antibiotic eye drops were instilled before patching the eye.

Postoperative Evaluation

In our institute, all postoperative patients are examined under the slit lamp on postoperative day one and findings are recorded in the case sheet, patients requiring re-surgery are posted on the same day and are discharged next day. Since DMD is a vision threatening complication (0.15%), the number of cases posted for resurgery due to DMD was significant.

The records of the patients who underwent resurgery for air injection, were retrieved from our computer database and analysed the pre existing risk factors for DMD like presence or absence of corneal opacities, PXF, and glaucoma were noted.

The preoperative findings were compared with the incidence of DMDs. We also evaluated the surgeons experience and the incidence of DMD.

Patient with dense striate keratopathy were carefully examined with a thin slit beam under the slit lamp, location and extend of DMD was noted. In case dense corneal oedema, topical anhydrous glycerine was used to dehydrate the cornea to delineate the extend of DMD. On the first postop day visit in all cases of low vision, the surgical video was reviewed by the senior surgeon and the cause of DMD was noted in the case records.

Method of air Tamponade

Under aseptic precautions, sideport has been made opposite to site of DMD and air is injected using 26 guage needles beneath the detached flap to attach the DM.

Statistical analysis was performed by using Descriptive Analysis.

RESULTS

The incidence of DMD was found to be 0.15% (57 patients out of 36,898). The mean age of patients having DMD was 64.89 years. Male to female ratio was found to be 0.54:1.

The preoperative anterior segment findings from the records in cases with DMD were: shallow anterior chamber depth in 5 cases of DMD, pre- existing corneal opacity in 10 cases of DMD, steep K (>47D) 11 cases of DMDs, PXF in 8 cases of DMDs, dense cataract in 21, very deep socket in 6 cases of DMDs, 17 patients of DMD no significant anterior segment findings was mentioned other than cataract [Table/Fig-1].

The type of cataract and DMD showed the following results: Nuclear sclerosis 2&3 with DMD accounted for 21.05% cases (12 patients) while brown cataract (Nuclear grade 4) (LOCS-2) accounted for 78.95% (45 patients) cases.

We recorded all intraoperative complications in the case sheets, as per the protocol. In the 57 case records with DMD, only ten surgeons have noted the cause of DMD during surgery. In 7 cases, DMD was noted after nucleus delivery, while in two cases DMD was noted at the step of entry into anterior chamber and in one case it was at anterior chamber reformation [Table/Fig-2].

On evaluation of the surgeons experience and the incidence of DMD, it was found that incidence of DMD was higher among final year trainees [Table/Fig-3].

Shallow AC-5	5
Corneal opacity	10
Steep K	11
PXF	8
Dense cataract	21
Deep socket	6
None	17

[Table/Fig-1]: Anterior chamber comorbidities.

Cause of DMD	
AC entry	36.84%
OVD insertion	3.5%
Nucleus delivery	12.28%
Cortex aspiration	3.5%
AC reformation	43.85%

[Table/Fig-2]: Causes of descemets membrane detachment.

Year of training	
First year residents	12.28%
Second year residents	31.57%
Third year residents	42.10%
Consultants	14.03%

[Table/Fig-3]: Risk of DMD versus years of training.

DISCUSSION

DMD is remediable but a potentially blinding cause of postoperative corneal oedema. DMD is neither rare, nor always a benign problem with a wide range of aetiologies [8]. During cataract surgery localized detachment at the site of incision which can progress during subsequent steps if not recognised early [9,10] and hence we carried out this analysis to find out the risk factors for DMD.

Planar detachments are likely to resolve spontaneously and non-planar should be repaired early [4,5]. There is a higher chance of DMDs with clear corneal incisions [10]. Anterior chamber entry and section extension leading to DMD and is a well-known risk factor [4-6]. More than half of described cases of DMD were detected during surgery, spontaneous re-attachment of extensive DMD is rare. Early recognition is necessary to prevent further complication. Time interval between day of surgery and DM re-attachment was up to 1 year. Cases have been reported with large DMD successfully repaired by expansible gases but the majority of surgical repositions were performed with air or viscoelastic, a penetrating keratoplasty should be the last choice.

In our case series, maximum DMDs (43.85%) occurred during anterior chamber reformation. In most cases, an initial localised DMD occurred during AC entry which inadvertently progressed to a large planar DMD during section extension, subsequent steps and mainly AC reformation. Early intraoperative detection is thus imperative to avoid rapid progression. Inadequate section size leading to a difficult

nucleus delivery by sandwich technique especially for dense, large brown cataracts contributed to 12.28% of DMDs. Inadvertent viscoelastic injection and saline injection during irrigation and cortex aspiration were also identified as intraoperative risk factors for DMD. The patients with pre-existing corneal opacities, high astigmatism or corneal pathologies like corneal degenerations (climatic droplet dystrophy) suffered more incidences of detachments than normal subjects. PXF was identified as a significant preoperative risk factor for DMD. The incidence of DMD was found maximum with brown cataracts. This could be attributed to the large, hard nucleus posing difficulties in nucleus delivery. Kumar DA et al., have noted that early intervention in DMDs involving central cornea reduces the scarring induced visual loss [11].

Literature reports a strong association between pseudo exfoliation and nuclear cataract [12]. Grade 3-4 nuclear sclerosis and pre-existing endothelial disease are the common cause of DMD in their study [13]. Together they increase the likelihood of surgical complications. Almost 8.5% of DMDs occur in patients with a shallow anterior chamber. Axial anterior chamber depth of less than 2.5 mm increases the risk of surgical complications five-fold [14].

First year surgeons contributed less than expected to the incidence of DMD. Since, first year residents operate on patients with no anterior segment comorbidities with softer cataracts, there were lesser complications. The maximum incidence occurred in the hands of final year residents. As final year residents operate on denser cataracts and with ocular comorbidities, number of complications was higher. This however, alerts adoption for a more careful attitude and cautious approach after mastering the art of SICS. Several factors should be borne in mind to help minimise the risk of DMD. These include minimal and gentle instrumentation and avoidance of blunt blades. The incision's inner corneal aspect should be greater than the incision's outer scleral aspect to prevent undue trauma during insertion and removal of irrigation/aspiration devices or nucleus delivery. In our case series all the DMD were successfully attached using air.

LIMITATION

Since we have done a retrospective study, we could analyse only DMDs which caused low vision and required re-surgery, but number of DMDs which was noted by surgeon on table and treated with air injection could not be analysed hence incidence of DMDs could have been even more than what we obtained.

Since it's a retrospective study, we couldn't get complete intraoperative notes to assess most common step where DMD occurs. Since we followed up the patients in camp site after one month, best corrected visual acuity was not done hence any small impact on visual acuity could not be assessed; but it has not caused major impact on visual acuity since we have uncorrected visual acuity of more than 6/18. Hence, we need a prospective follow up study to support these data.

CONCLUSION

DMD is a surgeon induced preventable cause for postoperative corneal oedema and low vision.

Gentle instrumentation, early detection, judicious management may reduce the incidence and outcome of DMD especially in dense cataract, pseudoexfoliation, steep cornea and corneal opacities.

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