



Research Article

Incidence of Descemet Membrane Detachment after Phacoemulsification Cataract Surgery in a Sample of Iraqi Patients at Ibn Al-Haitham Teaching Eye Hospital

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Abstract

Background: Descemet's membrane detachment (DMD) is a common complication following phacoemulsification surgery that can have a significant impact on the visual prognosis of patients undergoing surgery. **Objective:** Determine the incidence of DMD following phacoemulsification cataract surgery and identify potential risk factors for detaching. **Methods:** A prospective study was undertaken at Ibn Al-Haitham Eye Teaching Hospital between October 1st, 2022, and September 1st, 2023. Patients who underwent cataract surgery were clinically evaluated for DMD. Cataract density is ranked from 1 to 4 based on density and hardness. The conventional phacoemulsification surgery was performed without the use of systemic acetazolamide prior to the procedure. **Results:** The study included 253 participants, ranging in age from 10 to 89 years. One case indicated central detachment, while seven showed peripheral detachment. The stability of the Descemet membrane was found to be significantly associated with patients under the age of 65. Non-diabetics demonstrated a significant association with the lack of DMD. We discovered a statistically significant link between surgical operations lasting less than 30 minutes and a lack of separation. The single usage of a keratome was strongly related to the lack of detachment. **Conclusions:** DMD incidence is significantly associated with elderly people (≥ 65 years). We discovered a strong relationship between the lack of DMD and non-diabetic people who had a single keratome treatment lasting less than 30 minutes.

Keywords: Descemet membrane detachment, Cataract surgery, Visual impairment, Endothelial diseases, Incidence.

معدل حدوث انفصال غشاء ديسميه بعد جراحة الساد باستخدام تقنية استحلاب العدسة في عينة من المرضى العراقيين في مستشفى ابن الهيثم التعليمي للعيون
الخلاصة

الخلفية: انفصال غشاء ديسميه (DMD) هو أحد المضاعفات البارزة التي تحدث بعد جراحة استحلاب العدسة وقد يكون له تأثير كبير على التشخيص البصري للأفراد الذين يخضعون لعمليات جراحية. **الهدف:** تحديد معدل حدوث انفصال غشاء ديسميه بعد جراحة إعتام عدسة العين باستحلاب العدسة وتحديد عوامل الخطر المحتملة المرتبطة بالانفصال. **الطرق:** أجريت دراسة مستقبلية خلال الفترة من 1 أكتوبر 2022 إلى 1 سبتمبر 2023 في مستشفى ابن الهيثم التعليمي للعيون. **النتائج:** شملت الدراسة ما مجموعه 253 فرداً، تراوحت أعمارهم من 10 إلى 89 عاماً. لوحظ الانفصال المركزي في حالة واحدة فقط، ولكن لوحظ الانفصال الطرفي في 7 حالات. كان هناك ارتباط كبير بين المرضى الذين تقل أعمارهم عن 65 عاماً مع عدم وجود انفصال. كان هناك ارتباط ملحوظ بين عدم وجود DMD والأفراد غير المصابين بالسكري. كما تم العثور على ارتباط ذي دلالة إحصائية بين الإجراءات الجراحية التي تستغرق أقل من 30 دقيقة وعدم الانفصال. وكان الاستخدام الفردي للكيراتوم مرتبطاً بشكل كبير بغياب الانفصال. **الاستنتاج:** كان هناك ارتباط كبير بين حدوث DMD والمرضى المسنين الذين تبلغ أعمارهم 65 عاماً أو أكثر. وقد تبين أن الأفراد غير المصابين بالسكري الذين خضعوا لإجراء كيراتوم واحد وكانت مدة الجراحة أقل من 30 دقيقة لديهم ارتباط كبير بغياب DMD.

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INTRODUCTION

One of the most prevalent postoperative complications associated with phacoemulsification is DMD. It presents as persistent corneal edema after surgery, which may lead to corneal endothelial decompensation in severe cases and influence the prognosis of vision in surgical

patients. The corneal endothelium and its basement membrane (8-10 μ m thick) work together to preserve corneal transparency [1-3]. Weve first described Descemet's membrane detachment in 1927, and Bernard Samuels expanded upon it in 1928. Scheie acknowledged it as a potentially severe complication to visual function in 1964. Studies have demonstrated that

DMD manifests between one month and 30 years following surgery. [3,4]. When there is a problem with the Descemet stromal interface (DSI) or the fibrillary stromal attachment to the DM, and the TGF- β -induced gene is changed, it makes the keratoepithelin protein less effective. Consequently, this leads to diminished adhesions between the DM and the posterior corneal stroma. Minimal external force can easily separate this loose attachment between the DM and the posterior stromal layer [5]. A slit lamp can reveal the presence of localized corneal edema, one of the clinical manifestations of DMD. This edema is characterized by a demarcation line that separates the swollen cornea from the unaffected clear cornea. Additionally, one can observe the creation of a double anterior chamber (AC) and the appearance of a narrow-slit lamp beam on the edges of DMD [6]. Several preoperative patient-related factors may increase the likelihood of developing DMD, including being older than 65 years, having underlying endothelium diseases such as Fuchs dystrophy, and having intrinsic DSI abnormalities. Mature or dense cataracts, an uncooperative patient, insufficient anesthesia, or a prior history of ocular trauma are all potential risk factors [1,3]. Clear corneal incisions during cataract surgery can increase the risk of Descemet's membrane detachment (DMD) by creating lateral traction, which can lead to the separation of the loosely attached Descemet's membrane. Additionally, the use of blunt blades for incisions and accidental insertion of instruments between the stroma and Descemet's membrane can also contribute to this risk. There are genetic and familial factors that can make it hard for DM to stick to the posterior corneal stroma, which can lead to DMD after surgery, no matter what kind of incision or procedure is used for cataract removal [5,7]. Advancements in technology, like anterior segment optical coherence tomography (AS-OCT), significantly contribute to the clinical diagnosis and treatment of DMD, categorized into three types: simple, symmetric, and complete detachment [1, 8]. Peripheral detachments often recover on their own; however, massive and central detachments, if not appropriately treated, may lead to corneal decompensation and opacification. Recently, Kumar *et al.* developed the HELP (Height, extent, length, and pupil) algorithm to categorize and allocate therapy for DMD. This approach relies on the dimensions of the DMD, as determined by AS-OCT [9,10]. DMD is a somewhat prevalent condition, affecting up to 43% of cataract surgeries [11]. The majority of these conditions are minor peripheral detachments, which typically occur near the location of corneal incisions. They have little clinical significance and often resolve on their own without requiring any further treatment. Only 0.5% of cases are considered significant and impact the core cornea. Out of these, up to 8% will eventually need a corneal transplant in order to restore clarity to the cornea. Research on the incidence of DMD in Iraq is

inadequate. The aim of this study is to determine the incidence of DMD after phacoemulsification cataract surgery in a sample of Iraqi patients and to identify possible risk factors and categorize the separation according to clinical manifestations.

METHODS

Study design and settings

An observational study was carried out from October 1, 2022, to September 1, 2023, at Ibn Al-Haitham Eye Teaching Hospital. During the data collection period, patients who fulfilled the inclusion criteria had phacoemulsification cataract surgery performed by the same surgeon at the Ibn Al-Haitham Eye Teaching Hospital. This occurred on the first day after the operation.

Sample collection

A total of 253 cataract surgery patients were clinically evaluated for evidence of descending membrane detachment. AS-OCT was used to examine detachment on the first day after surgery and again one week later if detachment was detected.

Inclusion criteria

The sample consisted of patients who satisfied the inclusion criteria, which included individuals with visually significant cataract who were suitable for phacoemulsification surgery from any age group.

Exclusion criteria

Noncompliant individuals that decline to participate in this research project. Individuals who have already had eye injuries or undergone eye surgery. Complications that may arise during surgery include posterior capsular rupture, as well as any previous refractive surgery. Additional persistent eye conditions include glaucoma and uveitis.

Descemet's membrane detachment classification

In 2016, Samarawickrama *et al.* categorized DMD into peripheral and central DMD based on the extent of visual axis involvement. They also suggested therapeutic strategies based on this classification [12].

Surgical technique

Cataract density is graded from one to four according to its density and hardness. A standard phacoemulsification surgery was performed without the use of systemic acetazolamide before the operation. Postoperatively, dexamethasone and ciprofloxacin

drops were given, and the eye was dressed as necessary. Surgeries are done by using the constellation vision system ALCON model VMC212-1.

Surgical procedures

The operator first entered the patient's personal information into the device's control interface. After that, the examiner tied their head to the support to prevent any movement. The examiner then adjusted the chin's position, both horizontally and vertically, until the measuring eye aligned properly with the probe. The examiner then made the appropriate modifications to both the front and back of the probe to achieve the best possible focus. The gadget's capture button was clicked, causing photographs of various resolutions to be automatically collected and saved. These graphics depicted multiple levels of corneal morphology in an intuitive way. The RTVue model-RT100 CAM system, version 6.2, produced by Optovue Inc. in Fremont, CA, USA, was utilized.

Ethical Approval

Approval was granted from the Arab medical specialization committee and scientific department of the Ibn Al-Haitham teaching eye hospital. All patients provided informed consent before enrollment.

Statistics analysis

Data input and analysis were conducted with Microsoft Excel 2021 and SPSS version 26. The Shapiro-Wilk test was used to confirm the normality of the distribution. The quantitative data were characterized using the range (minimum and maximum values), mean, and standard deviation (SD). Quantitative data is represented in numerical values and proportions. The homogeneity was tested using the Chi-square test and Fisher exact test. A P value less than 0.05 was considered to be statistically significant.

RESULTS

The investigation involved a total of 253 patients, each of whom contributed one eye. The average age of the patients was 54.87 ± 11.78 years, with a range of 10 to 89 years. The age of the majority of patients, 233 (92.1%), was less than 65 years. The distribution of eyes was 123 (48.6%) right eyes and 130 (51.4%) left eyes, with 164 (64.8%) of the 253 patients being male. The study included 59 patients who were smokers (23.3%) and 40 diabetic patients (15.8%) (Table 1). The majority of cases, 250 (98.85%), demonstrated normal endothelial health, while 238 (94.1%) had normal iris. Third-grade cataracts were identified in 113 cases (44.7%). The incision was made by a single-use keratome in the majority of cases, 247 (97.6%).

Table 1: Sociodemographic characteristics of the sample

Variables		n(%)
Age group	< 65	233(92.1)
	≥ 65	20(7.9)
Sex	Male	164(64.8)
	Female	89 (35.2)
Eye Side	Right	123(48.6)
	Left	130(51.4)
Smoking	Yes	59(23.3)
	No	194(76.7)
Diabetes mellitus	Yes	40(15.8)
	No	213(84.2)
Total		253(100)

Table 2 indicates that the operation was completed in less than half an hour in 238 (94.1%) of the cases. Descemet's membrane detachment was absent in 245 cases (96.8%). Figure 1 illustrates that peripheral detachment was observed in seven cases (2.8%), while central detachment was observed in only one case (0.4%).

Table 2: Clinical and Intraoperative characteristics of the sample

Variables		n(%)
Endothelial health	Normal	250(98.8)
	Low	3(1.2)
Iris status	Normal	238(94.1)
	PXF	15(5.9)
Grades of cataract	First and second	73(28.9)
	Third	113(44.7)
	Fourth	67(26.5)
Keratome	Once	247(97.6)
	Twice	6(2.4)
Surgery duration/min	≤ 30 min.	238 (94.1)
	> 30 min.	15 (5.9)
Total		253 (100)

PXF: Pseudoexfoliation Syndrome.

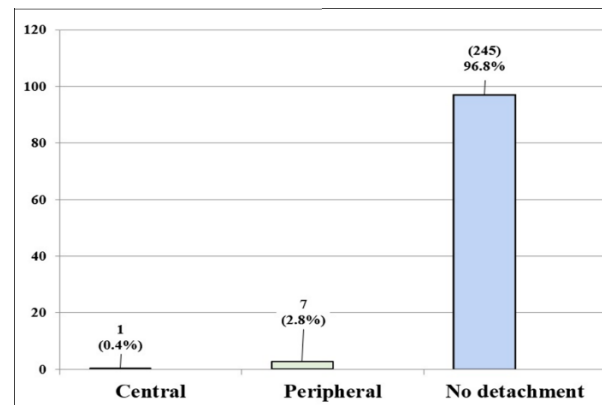


Figure 1: Descemet's membrane status.

Eight (3.2%) of the 253 patients had DMD. Approximately five (62.5%) of these patients were males under the age of 65. Among the diabetic patients, four (50%) were classified as such, with five (62.5%) undertaking procedures in less than 30 minutes. The majority of the patients had fourth-grade cataracts, while half of them had third-grade cataracts. Six (75.0%) of the patients documented the sole use of a keratome. The following information is provided in Table 3.

Table 3: The distribution of possible risk factors associated with the Descemet’s membrane among patients with detachment (n=8)

Age (year)	Sex	DM	Smoking	Eye side	Keratome single used or reused	Surgery duration	Detachment	Age (year)	Sex
57	Female	Yes	No	OS	First	35	central	0.9 mm length, 0.5mm high	0.5mm length
41	Male	No	No	OD	First	20	Peripheral	less than 1 mm	No detachment
68	Male	Yes	Yes	OD	Second	20	Peripheral	less than 1 mm	No detachment
70	Female	No	No	OS	First	20	Peripheral	less than 1 mm	No detachment
78	Male	No	Yes	OD	First	30	Peripheral	less than 1 mm	No detachment
60	Female	Yes	No	OD	First	20	Peripheral	less than 1 mm	No detachment
58	Male	Yes	Yes	OS	Second	30	Peripheral	less than 1 mm	No detachment
62	Male	No	No	OD	First	20	Peripheral	less than 1 mm	No detachment

The absence of detachment was significantly associated with patients under the age of 65 ($p=0.018$), while there was no significant association between sex and Descemet’s membrane detachment ($p=0.57$). The absence of Descemet’s membrane detachment was significantly associated with non-diabetic patients ($p=0.024$). The absence of detachment was significantly

associated with interventions lasting less than half an hour ($p=0.008$). Cataract grades did not exhibit a statistically significant correlation with detachment ($p=0.125$). Table 4 indicates that the absence of detachment was significantly associated with the sole use of keratome ($p=0.012$).

Table 4: The distribution of possible risk factors associated with the Descemet’s membrane detachment (n=253)

Variables	Detachment	No detachment	Total	p-value
Age group (year)	< 65	5(2.1)	228(97.9)	0.018**
	≥ 65	3(15.0)	17(85.0)	
Sex	Female	3(3.4)	86(96.6)	0.579**
	Male	5(3.0)	159(97.0)	
Diabetes mellitus	No	4(1.9)	209(98.1)	0.024**
	Yes	4(10.0)	36(90.0)	
Surgery duration (min)	≤ 30 min.	5(2.1)	233(97.9)	0.008**
	> 30 min.	3(20.0)	12(80.0)	
Cataract grades	1 st and 2 nd	0(0.0)	73(100.0)	0.125*
	Third	4(3.5)	109(96.5)	
	Fourth	4(6.0)	63(94.0)	
Keratome	Once	6(2.4)	241(97.6)	0.012**
	Twice	2(33.3)	4(66.7)	

Values are presented as number and percentage. *Chi-Square test; **Fisher’s Exact test.

DISCUSSION

Descemet’s membrane detachment is often seen in elderly patients after phacoemulsification cataract surgery (age is seen as a significant determinant). Sex difference does not seem to have a substantial impact on the incidence of DMD after phacoemulsification. This illness might have an equal impact on both males and females [13]. The present research included 253 individuals, with each patient providing one eye for investigation. The mean age of these individuals was 54.87±11.78 years. Out of the group of patients, 65% were males, and 51.4% had left eye involvement. These findings were consistent with previous research done by Odayappan *et al.* in India in 2018. The research included patients with a mean age of 66.47±8.46 years, and men made up about 45% of the participants [4]. This study found that cases of DMD represented 3.2% of the total incidences after phacoemulsification. Peripheral detachment was reported in around 2.8% of cases, but core detachment was seen in just 0.4% of cases. Conversely, research conducted by Joshi *et al.* in India in 2023 found that the rate of incidence of Duchenne muscular dystrophy (DMD) following phacoemulsification (both central and peripheral) was around 0.5% [14]. The variation in the prevalence of

DMD may be explained by the significant discrepancy in the number of participants, with the research reporting DMD in just 4 out of 1008 cases. The current study found that 23.3% of the patients recruited were smokers. The scientific literature lacks sufficient documentation on the association between smoking and DMD after phacoemulsification cataract surgery, and there may be few studies specifically addressing the aforementioned issue. Smoking might hinder the body’s capacity to recover and elevate the likelihood of postoperative problems [15]. Unmanaged diabetes might heighten the likelihood of problems after undergoing eye procedures, such as cataract surgery [16]. In this study, 5.9% of the patients were found to have pseudoexfoliation on the pupillary margin and anterior lens capsule. This finding is consistent with a study conducted in India in 2020 by Das *et al.* [17], which observed pseudoexfoliation in 14.2% of the 49 patients. The elevated risk of DMD may be attributed to the abnormal thickening of the Descemet’s membrane and the focal buildup of the pseudoexfoliation material. Due to these factors, Descemet’s membrane (DM) might get separated from the posterior stroma after cataract surgery. Furthermore, the presence of pseudoexfoliation might cause corneal endotheliopathy, which may result in endothelial decompensation after cataract surgery [18]. Within this

research, 44.7% of the cases were classified as third-grade cataracts, which is in opposition to the findings of Sharma *et al.* in their 2015 study done in India, when 58% of patients were identified as second-grade cataracts [19]. The risk of Descemet's membrane detachment is greater in cases of more advanced cataracts (higher grades) due to factors such as increased surgical manipulation and the need for more phacoemulsification power during cataract surgery [20]. However, it should be noted that DMD can occur in any grade of cataract, and the surgeon's skill and technique are crucial in preventing and managing this complication. The present investigation discovered a notable correlation between patients under the age of 65 and the lack of detachment in 228 cases (97.9%), with a *p*-value of 0.018. In contrast, a study done by Sharma *et al.* in India showed that age was not a significant factor in relation to DMD, with a *P*-value of 0.51 [19]. Elderly adults often exhibit thicker and more delicate Descemet's membranes, rendering them more susceptible to a detached during surgical procedures. This research demonstrated a strong correlation between non-diabetic patients (84.2% of the patients) and the lack of Descemet's membrane detachment (98.1% of cases), with a statistically significant *p*-value of 0.024. The increased corneal thickness seen in diabetics may be attributed to heightened corneal hydration. It is possible to hypothesize that an aberrant function of the corneal endothelium might be a potential explanation. The increased thickness of the cornea seems to be evident at an early stage of the illness and may thus be one of the first observable alterations in the diabetic eye. This indicates that those without diabetes had a lower risk of problems after undergoing eye procedures, such as cataract surgery [21]. A significant correlation was found between surgeries that lasted less than 30 minutes and the absence of detachment in 233 cases (97.9%), with a statistically significant *p*-value of 0.008. In terms of operation duration, 94.1% of procedures in this study were completed in under 30 minutes. It is worth noting that the longer a cataract surgery takes, the greater the likelihood of requiring more intraocular manipulation. Excessive manipulation in the front part of the eye may lead to further harm, which in turn raises the likelihood of problems, such as Descemet's membrane detachment. Reduced operating times often result in less manipulation, hence lowering this risk. The use of a single keratome was found to be significantly associated with a lower incidence of detachment compared to other methods. In 97.6% of cases, a single-use keratome was used for the corneal incision. This is likely due to the sharpness and precision of the instrument, which reduces damage. The main factors driving the use of single-use keratomes are their disposable nature and the fact that their tip does not penetrate the Descemet's membrane. However, there is a risk that the tip may still push into the anterior chamber and cause the Descemet's membrane to tear. A surgeon that has the ability to do

the treatment expeditiously is often highly trained and skilled, which may help reduce the likelihood of complications, such as DMD.

Study limitations

This study includes several limitations. One limitation is the small sample size, which may restrict the generalizability and reliability of the findings. The research is limited by the short period of follow-up. The research did not take into consideration any confounding variables that may have an impact on the outcome of DMD.

Conclusion

The incidence of Descemet's membrane detachment was strongly linked with elderly individuals aged 65 years or older. There was a substantial association between the absence of DMD and the following factors: non-diabetic patients, the use of keratome just once, and a surgical duration of less than half an hour.

Recommendations

Close monitoring is necessary for patients who are elderly or have additional risk factors, such as pseudoexfoliation, diabetes, protracted operation duration, or excessive manipulation. It is imperative to exercise caution when operating the keratome in order to prevent any collateral injury. Perform an immediate follow-up to identify any detachments and administer anterior chamber optical coherence tomography (AC-OCT) to all patients who experience persistent corneal edema subsequent to eye surgery.

Conflict of interests

No conflict of interests was declared by the authors.

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Data sharing statement

Supplementary data can be shared based on a reasonable request.

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