Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2024.234154.2873 Volume 30, Issue 1.7, Oct. 2024, Supplement Issue
Manuscript ID: ZUMJ-2306-2815 (R1) Doi: 10.21608/ZUMJ.2023.219646.2815
ORIGINAL ARTICLE

Combined Continued Air Pumping And Descemetotomy In Post-Phacoemulsification Descemet´s Membrane Detachment

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Submit Date 23-06-2023
Revise Date 03-07-2023
Accept Date 08-07-2023

ABSTRACT

BACKGROUND: The aim of this work was to evaluate the efficacy of combined continued air pumping and descemetotomy in management of severe post- phacoemulsification Descemet membrane detachment (DMD).**Methods:** This study is an interventional study that included 7 eyes of 7 patients who presented with post phacoemulsification corneal edema due to Severe DMD.**Results**: The age of the patients at the time of surgery ranged from 61 to 73 years (mean age 66.7 ± 4.27 years). Best corrected visual acuity (BCVA) was improved from 0.076 ± 0.04 preoperatively to 0.53 ± 0.18 six months postoperatively. This difference was statistically significant (P value < 0.05). In all cases the Descemet membrane was completely attached all through the postoperative follow up period which ranged from 6 to 9 months (7.4 ± 1 months). The Central Corneal Thickness CCT was significantly reduced from 874.3 ± 101 um preoperatively to 543 ± 38.6 um six months postoperatively. No hypotony or endophthalmitis were reported.**Conclusion**: Combined continued air pumping and descemetotomy is an effective surgical technique in management of large post- phacoemulsification DMD.

Keywords: descemetotomy; air pumping; phacoemulsification; Descemet´s membrane, corneal edema.

INTRODUCTION

Descemet's membrane detachment (DMD) is considered one of the sight-threatening complications after cataract surgery. It is defined as separation of the Descemet's membrane (DM) from the posterior stroma with accumulation of fluid in the pre-Descemet's space which lead to stromal and epithelial edema. DMD after ECCE was 2.6% while it is 0.044% to 0.52% after phacoemulsification and 3.9% after femtolaser assisted cataract surgery (FLACS). [1-3]

Predisposing factors for DMD are DM anomalies, corneal endothelial disease, and shallowness of the anterior chamber. Many surgical maneuvers and risk factors were described especially in the hands of inexperienced surgeons as the use of blunt instruments or dull keratomes, excessively oblique anterior corneal incision, tight incisions that don't fit the phaco probe or instruments, and engagement of DM during

the irrigation/aspiration stage, intraocular lens or phaco probe insertion. Unexpected injection of saline or viscoelastic into the space between the deep stroma and DM is another risk factor.[3]

DMD is diagnosed clinically during the cataract surgery or in the post-operative period. The best tool for diagnosis is anterior segment ocular coherence tomography (AS-OCT) which helps to confirm the diagnosis and assesses the size of detached area. DMDs are commonly peripheral and resolve spontaneously but if large and central DMDs may lead to corneal decompensation and opacification if not appropriately managed. Many techniques for repositioning of the Descemet's by injecting air, viscoelastic, or gas were described. Manual repositioning and suturing of the DM to the corneal stroma were also published.[4]

In this work, we described a new technique for repositioning large DMD. The principle of this technique is to create a small opening in the DM near the area of the maximum intracorneal fluid collection away from the visual axis to allow for the escape of the fluid when air is injected into the AC (like the role of retinotomy in drainage of SRF in RD surgery). When air is then injected into the AC in presence of an opening in the DM, the intracorneal fluid will be squeezed into the AC through the hole in the DM rather than being trapped. This allows the DM to reattach completely to the stroma and the endothelial pump will keep the attachment and clear the cornea.

The aim of this work was to evaluate the efficacy of combined continued air pumping and descemetotomy in management of large post- phacoemulsification DMD.

METHODS

This study is an interventional study that included 7 eyes of 7 patients who presented with post-phacoemulsification corneal edema due to Severe DMDs (DMDs involving 50% of the cornea or involving the central cornea according to Jain classification (2013)[5]

Written informed consent was obtained from all participants, the study was approved by the research ethical committee of the Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Preoperative evaluation included visual acuity, slit lamp examination, Goldman applanation tonometry. Anterior segment OCT was also performed using Optovue (RTVue, Optovue Inc., Fremont, California, USA) to reveal pockets of fluid separating the Descemet´s membrane from the stroma corresponding to areas with significant corneal edema and to monitor changes in central corneal thickness postoperatively.

Preoperative preparation included antibiotic drops (Moxifloxacin 0.5%) but no mydriasis to avoid intraoperative air escape under the iris or the IOL.

Surgical technique: Fig (1)

Local anesthesia was performed in all cases using atenon block. Two to 4 ml of lidocaine 2%, (alone or mixed with an equal amount of bupivacaine 0.5%) was used After prepping with povidone Iodine 5% and proper draping a wire speculum was applied.

The surgical technique started with preparing the Descematome by reshaping a 27G insulin needle using a needle holder to make about 1 mm of the tip facing upward and angulating the shaft close to the hub at about 120 degrees

(figure 1). It was then mounted on an air-filled 3 ml syringe.

Due to corneal edema, it was difficult in most cases to view the exact position and extent of the detached Descemets membrane. An endoillumination light prop was connected to Stellaris PC (Bausch and Lomb, St. Louis, USA) and pressed against the limbus and the microscope light was turned off to allow for proper evaluation of the extent of DMDs using retro-illumination. This helps greatly to enhance the visualization and planning of the next steps. Also, the corneal epithelium was scrapped when needed, and viscoelastic was applied to cover the corneal surface.

Two Paracentesis were made in areas of clear cornea away from Descemet detachment using a 20 G MVR blade. After the optimal position for Descemetotomy was determined, an AC maintainer was inserted through the farther paracentesis and the Descemetome was inserted through the nearest paracentesis and pressed upwards towards the corneal stroma to make sure a hole was made in the DM. This hole allowed the fluid trapped in the pocket between DM and corneal stroma to escape into the anterior chamber when air was injected. After retracting the tip of the Descematome from the hole in the DM the syringe was rotated to make sure the tip of the Desematomewas no longer facing upwards towards DM, the BSS flow from AC maintainer was stopped and the air in the syringe was injected into the AC and the Descematome was carefully removed from the eye.

To allow for almost complete drainage of the intracorneal fluid, a continuous airflow to the anterior chamber was provided using the air pump of the vitrectomy machine which was connected to the Koch aspiration cannula (GUEDER, Hertzstr, Heidelberg, Germany) and inserted through the paracentesis. The air pressure in the machine was set to 30 mmHg. One more advantage of this aspiration cannula is that its port is facing upward allowing the surgeon to use the air current to gently massage the detached DM to milk the trapped fluid towards the area of Descemetotomy.

The Descemetome was then inserted under the iris to create an inferior iridotomy against the air cannula to safeguard against a pupillary block. While maintaining continuous air flow to the AC, the corneal surface was massaged with the light proper to allow for complete drainage of the intracorneal fluid surface till the Descemet becomes attached. The air in the AC was then replaced with a nonexpansile concentration 14% sulfur hexafluoride and both paracentesis were sutured with 10/0 nylon. Ten minutes later the gas fill was decreased to 80%.

Postoperative treatment included antibiotic drops (moxifloxacin 0.5%) five times daily, steroid drops (Prednisolone acetate 1%) five times daily, and cyclopentolate 1% drops three times daily. A combination of timolol maleate 0.5% and bromonidinetartrate drops was used if needed to control the intraocular pressure. The patients were checked after 6 hours, one day, three days, one week, and one month postoperatively. Postoperative follow-up included slit lamp evaluation, tonometry, and anterior segment OCT.

STATISTICAL ANALYSIS

Statistical Package for Social Sciences (SPSS) software version 14 (SPSS, Chicago, IL, USA) was used for analysis of data. Mean and standard deviation were used for Quantitative

data. Student's t-test compared the pre and post-operative data. A p value less than 0.05 was considered statistically significant.

RESULTS

The described technique was used in 7 cases, 4 males (57%) and 3 females (43%) suffered from post phacoemulsification corneal edema due to severe DMDs (DMDs involving 50% of the cornea or involving the central cornea). The age of the patients at the time of surgery ranged from 61 to 73 years (mean age 66.7 ± 4.27 years). Best corrected visual acuity (BCVA) improved from 0.076 ± 0.04 preoperatively to 0.53 ± 0.18 six months postoperatively. This difference was statistically significant (P value < 0.05). However, IOP did not reveal statistically significant change from preoperative level 17.57 ± 4.82 mmHg mmHg to 18.1± 3.9 mmHg after 6 months (P value >0.05). In all cases the DM was completely attached all through the postoperative follow up period which ranged from 6 to 9 months (7.4 ± 1 months). The CCT measured with anterior segment OCT was significantly reduced from 874.3 ± 101 um preoperatively to 543 ± 38.6 um six months postoperatively. (Fig 2) No hypotony or endophthalmitis were reported. (Table 1)

Table 1: Preoperative and postoperative characteristic data

Eye/patients	7/7
Mean age	66.7 ± 4.27 years
Male/Female	4/3
mean follow-up period	7.4 ± 1 months
Mean preoperative IOP (mmHg)	17.57 ± 4.82 mmHg
Mean postoperative IOP (mmHg)	18.1± 3.9 mmHg (P value 0.37)
Mean preoperative BCVA	0.076 ± 0.04
Mean postoperative BCVA	0.53 ± 0.18 (P value 0.00017.)
Mean preoperative CCT	874.3 ± 101 um
Mean postoperative CCT	543 ± 38.6 um (P value 0.00045)

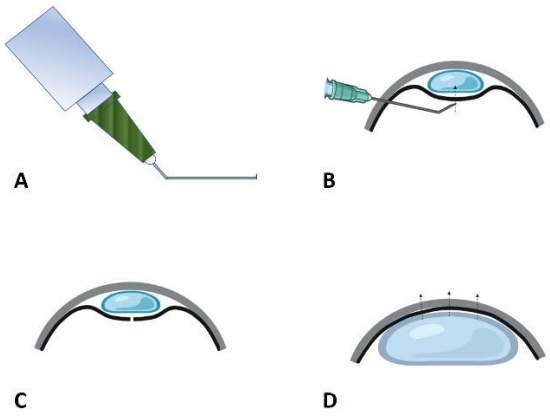

Figure 1: Illustrates the steps of the technique: **(A)** the Descematome design, **(B)** the Descematome is inserted into the anterior chamber to puncture the Descemets membrane in the area of maximum intracorneal entrapped fluid, **(C)** After creating an opening in the DM to allow the escape of the fluid into the anterior chamber and **(D)** finally after air injection to oppose the DM to the corneal stroma

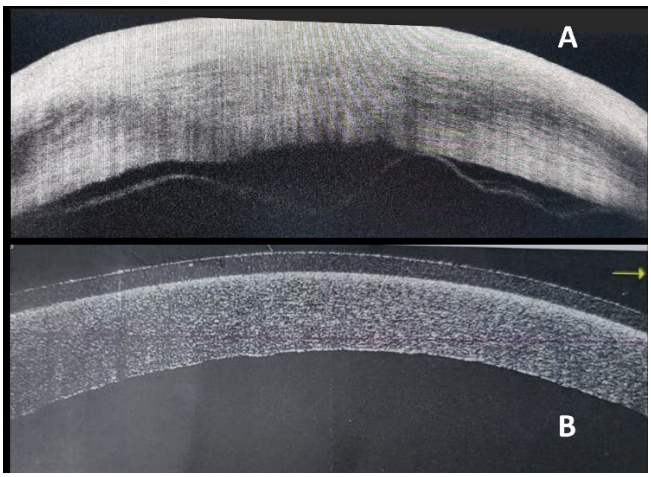

Figure 2: Shows anterior segment OCT **(A)** preoperative image showing severe DM detachment with marked increase in corneal thickness, **(B)** same patient one month after Descematopexy: DM attached to the corneal stroma with marked improvement of corneal edema

DISCUSSION

When air was injected to the AC, it pushed the DM towards the stroma but if there was no opening in the DM, the fluid would remain trapped and would be redistributed to induce shallower but wider DM detachment.

Chudzinski et al reported spontaneous improvement of two cases of a series of 9 cases of DMD. Four cases improved with air-bubble descemetopexy while the other three cases required keratoplasty. They concluded that poor outcomes are associated with late diagnosis and management[2].

Singhal et al found that conservative medical treatment might be beneficial in cases of small, peripheral, planar DMD with no scrolled edges. Surgical inference should be indicated in cases of no planar, central DMD, scrolled edges, and length >2 mm. They reported that descemetopexy is the surgical choice in DMD treatment[3].

Chow et al agreed with others in causes and management of DMD but the concluded that the time and the technique of surgery could not be defined[4]

Descematotomy procedure was described by Lowenstein and his colleges in 1993. It was done in cases of bullous DMD. Jacob and his colleges described the ab externo drainage of DMD using corneal incision. These procedures were done after failed pneumatodescmetopexy[6].

Djavamardi et al reported five cases diagnosed with hemorrhagic DMD after glaucoma surgery. The Hematoma was evacuated from the limbus or through the DM followed by air descmatopexy.[7]

Keye et al found that repeated air descmatopexy helped the treatment of refractory DMD and regained the clarity of the cornea.[8].

Das et al disagreed with previous studies, they concluded that suturing the DM is the surgery of choice in the managing of DMD especially in large recurrent DMD[9].

To our knowledge, it is the first time to use the continuous venting pressurized air flaw to drain the bullous DMD and flatten the Descemet´s membrane.

ETHICAL APPROVAL

The institutional review board approved the study (faculty of Medicine Zagazig University, IRB#:10725/16-4-2023). The Declaration of Helsinki tents were followed.

AVAILABILITY OF DATA

the data collected and analyzed in this study are included in this published article.

COMPETING OF INTEREST

The authors have no financial or non-financial interests

FUNDING DISCLOSURE

No fund was obtained

AUTHORS CONTRIBUTIONS

A.E. and A.L. selected the idea and designed the study. A.E.,A.G., and A.L. collected the data, submitted the manuscript, and analyzed the data

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Citation:

elsayed, A., Gad, A., lotfy, A. Combined Continued Air Pumping And Descemetotomy In Post-Phacoemulsification Descemet´s Membrane Detachment. *Zagazig University Medical Journal*, 2023; (4121-4126): -. doi: 10.21608/zumj.2023.219646.2815