Outcomes & Complications of Descemets Membrane Endothelial Keratoplasty without Routine Peripheral Iridotomy

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Introduction

- **Graft detachment** is one of the most frequent complications and challenges with Descemet's membrane endothelial keratoplasty (DMEK).
- **Tamponade** with air or gas to ensure graft attachment can result in **pupillary block** - most feared complication
- **Prophylactic peripheral iridotomy (PI)**, either pre-operatively using Nd-YAG laser or intra-operatively using scissors / cutter is usually performed to prevent pupillary block. But despite this, air or gas often has to be released.
- Potential **concerns** with PI:
  - **Pre-operative** (extra visit, cost, visibility)
  - **Intra-operative** (risk of bleeding, fibrin release – may hamper graft attachment)
  - **Complications**: glare, diplopia, photophobia, damage to lens zonules
- Authors routinely perform **DMEK without prophylactic PI**

Aim: To report clinical outcomes and complications of DMEK performed without PI in patients with Fuch's endothelial dystrophy (FED)

Materials and Methods

- **Retrospective case series** conducted as clinical audit in a tertiary care eye hospital
- **Inclusion Criteria**:
  - All patients with FED undergoing DMEK or DMEK in combination with phacoemulsification surgery (DMEK triple)
  - Either performed or supervised by a single surgeon (MN)
  - Using standardized surgical technique and post-operative care
- **Exclusion Criteria**:
  - Previous glaucoma surgery which required a PI
  - Previous Nd-YAG laser PI
  - Aphakic eyes
  - Complicated pseudophakia – IOL not in bag, pseudophakic bullous keratopathy
- **Primary outcome**: incidence **of pupillary block** *
- **Secondary outcomes**: **graft detachment**, **re-bubbling rates**, **visual acuity**, **endothelial cell loss** at **6 months**

* Pupillary block classified as
- **Type I or primary pupillary block**: bubble pushing the pupil against the lens restricting any aqueous movement through the pupil)
- **Type II or secondary angle closure**: bubble misdirection resulting in mechanical angle closure)

** **Graft detachment** recorded as **mild** (involving < 1/3rd peripheral graft area) or **significant** (involving > 1/3rd graft area or any detachment involving central visual axis).

Standard Protocol

Intra-operative

- **Graft preparation**: surgeon; modified manual dissection technique.
- **Tamponade**: air or 50% sulphur hexafluoride (SF6)
- Main incision and two paracenteses **sutured** using 10,0 monofilament nylon
- **5'o clock paracentesis** incision made for aqueous and air/gas release on slit lamp

Post-operative

- **Day 0**: Patients reviewed 1-2 hours after surgery - some air or gas released to ensure that AC depth returned to normal with bubble in front of pupil & approximately 80-85% of AC volume.
- **Day 1**: aqueous +/- air or gas released - bubble occupying approximately 70-80% of AC, and to prevent deepening of AC due to anteroposterior expansion of gas bubble
- Both procedures performed at slit-lamp under topical anaesthesia and standard aseptic precautions (G. Proxymetacaine 0.5% and G. Povidone-iodine).
- Patients advised to lie supine, when possible, for first 3 days; strict positioning not advocated

List of transplants for last five years under a single surgeon - data for DMEK retrieved

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Data collected from notes and local EMR software (MediSoft)

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Recorded on spreadsheet (Microsoft Excel 2021)

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Data analysed using Statplus mac software (Version 7.7.11, AnalystSoft Inc.)

Results

- Total **113** DMEK surgeries analysed, of which **nine excluded** (previous PIs or glaucoma surgery, complicated pseudophakia with PBK) → total eyes included – **104 of 72 patients**

Baseline parameters	Average (range)
Age (years)	71.12 ± 10.41 (44 to 88)
Gender	Male: 34; Female: 38
Uncorrected logMAR visual acuity	0.58 ± 0.36 (2 to 0.10)
Best corrected logMAR visual acuity	0.42 ± 0.35 (2 to 0.10)
Intraocular pressure (mm Hg)	15.26 ± 3.56 (8.0 to 23.6)
Donor endothelial cell density (per sq. mm)	2629 ± 159 (2300 to 3100)
Preoperative lens Status	Phakic = 77 (73%); Pseudophakic = 27 (27%)
Surgery performed	DMEK triple = 77 (73%); DMEK = 27 (27%)
Surgeon grade	Consultant = 64 (61%); Fellow = 40 (39%)
Tamponade agent	Air = 27 (26%); SF6 = 77 (74%)

Results: Pupillary Block

- Incidence: **3.8%** (n=4) developed pupillary block (PB)
- True PB: Less than 1% (n=1)
- No difference between two different grades of the surgeon (p=0.44), type of surgery (p=0.14) or tamponade (p=0.80)
- Step-wise regression analysis: higher logMAR BCDVA value or poorer BCDVA at 1 month, but no difference at 6 months

Case	Surgery	Description	Outcome
1: Type I	DMEK triple; air	No air release on day 0; PB on **day 1**; relieved by releasing air & aqueous from inferior paracentesis along with inferior laser PI	Mild inferior graft detachment (GD), settled conservatively; **BCDVA 6/9** at 6 months
2: Type II	DMEK triple; SF6	SF6 released on day 0, no aqueous/SF6 released on day 1; PB noted at **day 7**, requiring laser PI and further AC reformation in theatre on day 12	Post-operative cystoid macular oedema (pre-operative ERM); **BCDVA 6/12** at 6 months
3: Type II	DMEK; SF6	PB noted at **day 4**; managed by release of SF6 gas and aqueous through inferior paracentesis	Uneventful further course; **BCDVA of 6/5** at 6 months
4: Type II	DMEK triple; SF6	PB noted at **day 7**; managed by release of SF6 gas and aqueous through inferior paracentesis	Uneventful further course; **BCDVA of 6/7.5** at 6 months

Results: Secondary Outcomes

Outcomes	Results	Variation
Graft Detachment (GD)	**Significant**: **6.6%** (n=7) → Rebubbled in theatre (n=4); shallow central GDs settled with SL air injection (n=3) **Mild**: **36.5%** (n=38) → Inferior GDs settled conservatively (n=10); SL air injection (n=28) **Overall**: **42.8%** (n=45)	Did not vary with the grade of surgeon (p=0.06), type of surgery (p=0.41) or type of tamponade (P=0.33); though more eyes had non-significant GD with air (13 out of 27) than gas (25 out of 77)
Rebubbling	Theatre rebubbling : **3.8%** (n=4) Top up injection at slit lamp: **26.6%** (n= 28) Overall: **30.4%** (n=32)	No difference in overall or theatre rebubbling rates for surgeon (p=0.09 and 0.57), surgery (p=0.10 and 0.96) or tamponade (p=0.38 and 0.96)
Average LogMAR Visual Acuity	UCDVA at 1 month: 0.61 ± 0.56 (range: 3 to 0) BCDVA at 1 month: 0.43 ± 0.61 (range: 3 to -0.12) UCDVA at 6 months: 0.29 ± 0.31 (range: 2 to -0.12) BCDVA at 6 months: 0.20 ± 0.28 (range: 2 to -0.12)	No difference with tamponade Worse in eyes with GD and rebubbling No difference in eyes with or without pupillary block
Endothelial Cell Loss	40.46 ± 20.36% at 6 months (1.87 to 79.17%).	No difference for surgery (P=0.14), GD (P=0.28), rebubbling (P=0.26) or surgeon (P=0.05).

How we compare?

Parameter	Our results	Reported results
Pupillary Block	3.8%	0 - 15.4%
Graft Detachment	6.6% (*42.8%)	4 - 56%
Rebubbling	3.8% (*30.4%)	0 - 52%
Dislocation	0.9%	1.8 - 4.4%
BCDVA at 6 months (logMAR)	0.20 ± 0.28	0.15 ± 0.13; 0.07 ± 0.11; 0.22 ± 0.13
ECL at 6 months (%)	40.46 ± 20.36	13 to 46%

Discussion

- **Only one paper in literature** reporting results of DMEK without PI : study included 31 eyes and reported zero cases of pupillary block with graft detachment: 32%; rebubbling: 16%; BCDVA at 6 months: 0.18 ± 0.14 ; ECL at 6 months: 49 ± 20%
- Our study reports **real-world data** of outcomes of **PI less DMEK** performed using a standard protocol by surgeons of varying levels of experience at a tertiary care eye hospital
- **Limitations** of our study: Retrospective design, only FED cases included, no eyes with phakic DMEK in our study and hence results cannot be extrapolated

To conclude, our results of PI less DMEK using a standardized protocol have similar incidence of pupillary block, graft detachment, rebubbling, with comparable visual acuity and endothelial cell loss as previously reported

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