

Ab-externo cyclodialysis enhanced trabeculectomy for intractable post-penetrating keratoplasty glaucoma

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Abstract

Purpose To evaluate the efficacy of cyclodialysis-enhanced Mitomycin c (MMC) trabeculectomy in post-keratoplasty glaucoma.

Design Prospective, non-comparative, interventional case series.

Methods A total of 45 eyes of 45 consecutive patients with refractory glaucoma after penetrating glaucoma underwent a cyclodialysis-augmented trabeculectomy with MMC. The visual acuity, intraocular pressure (IOP), corneal clarity, and graft failure were evaluated over a minimum follow-up of 2 years.

Results The mean age of the patients was 55.4 ± 9.4 years. The cyclodialysis-augmented MMC trabeculectomy procedure resulted in a mean reduction of IOP from 38.9 ± 3.9 mm Hg (95% confidence interval (CI) 35.9–42.2) at baseline to 11.3 ± 2.8 mm Hg (95% CI 9.5–12.9), at final follow up ($P = 0.002$). Blebs were avascular, diffuse, and extended posteriorly. Postoperative UBMs revealed the presence of a cyclodialysis with a small associated suprachoroidal effusion and a subconjunctival filtering bleb in all cases.

Conclusions Cyclodialysis-augmented MMC trabeculectomy provides a safe and effective method of lowering IOP in intractable glaucoma following penetrating keratoplasty, without compromising the corneal graft survival and clarity.

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Introduction

The incidence of glaucoma after penetrating keratoplasty reportedly varies from 9 to 31% in the early and from 18 to 35% in the late postoperative period.¹ Conventional trabeculectomy has a low success rate in lowering intraocular pressure (IOP), with antimetabolite use causing frequent graft failure.^{2–4} Graft failure rates are high after all kinds of glaucoma surgery.^{5–8}

Patients and methods

Consecutive adult patients having refractory glaucoma for ≥ 3 months after a penetrating keratoplasty underwent ab-externo cyclodialysis enhanced Mitomycin C (MMC) trabeculectomy. Data of patients with ≥ 24 months of follow-up were analysed.

All patients were counselled and an informed consent was taken. The study was approved by our Institutional ethics committee.

Age, gender, particulars of penetrating keratoplasty, baseline and final IOP (pneumotometry/applanation), graft status, and complications were noted.

Patients who had no perception of light were excluded from the study.

Surgical procedure

A limbus-based conjunctival flap was raised and a partial thickness rectangular scleral flap 5×4 mm was dissected. MMC (0.04%) was applied intrasclerally for 3 min. The

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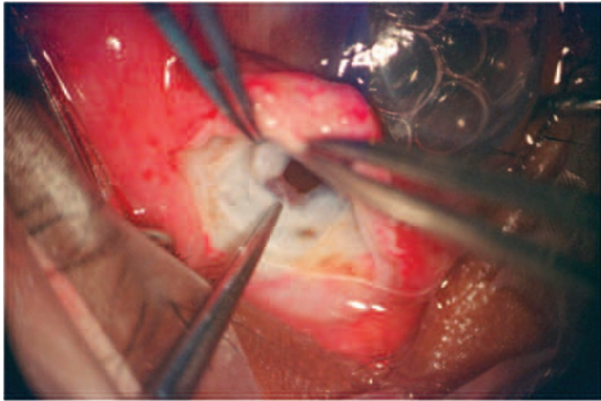


Figure 1 Surgical photograph showing the cyclodialysis with trabeculectomy.

Table 1 Baseline data of eyes that underwent ab-externo cyclodialysis enhanced trabeculectomy

Variable	Number of eyes
<i>Corneal diagnosis</i>	
Pseudophakic bullous keratopathy	12
Aphakic bullous keratopathy	11
Healed corneal ulcer	20
Macular corneal dystrophy	2
<i>Previous surgery^a</i>	
Combined penetrating keratoplasty + cataract	35
<i>Cataract surgery</i>	
Posterior chamber IOL	23
Anterior chamber IOL	7
Aphakia	5
Re-penetrating keratoplasty	7
Trabeculectomy	15
Diode laser cyclophotocoagulation	15
<i>Pathogenesis of glaucoma^a</i>	
Peripheral synechial angle closure	39
Synechiae at the graft–host junction	35
Chronic uveitis	31
Secondary open angle glaucoma	4

^aTotal numbers do not add up to 45, as some patients underwent more than one previous surgery and some eyes had more than one cause for raised IOP.

scleral spur was identified as the junction between the blue–grey transition zone of the limbus and the white sclera. A 3-mm long, circumferential, deeper corneoscleral block was excised, to include sclera 1 mm in front and 1 mm behind the scleral spur. This revealed a millimetre of the ciliary body posteriorly, recognised by its lighter colour and vascularity of the ciliary body surface (Figure 1). A peripheral iridectomy was performed anteriorly and the scleral flap and conjunctiva were sutured. Postoperative therapy included topical steroids, cycloplegics, and antibiotics for 6 weeks.

Success was defined as an IOP between 6 and 20 mm Hg, without the use of additional antiglaucoma medication/laser/surgery at the last follow-up, with no drop of vision.

Wilcoxon signed-rank test was used to compare the variables. Two-tailed probability values of <0.05 were regarded as statistically significant.

Results

The mean age of the 45 patients was 55.4 ± 9.4 years. There were 28 males and 17 females, *P* = 0.3, with a mean follow-up of 28.1 ± 2.0 months (95% CI 24.7–33.2).

The baseline clinical data are presented in Table 1. The glaucoma was multifactorial with peripheral synechial angle closure, synechiae at the graft–host junction, and chronic uveitis seen in these eyes.

The baseline mean IOP was 38.9 ± 3.9 mm Hg (95% CI 35.9–42.2), and at final follow-up after cyclodialysis enhanced MMC trabeculectomy, it was 11.3 ± 2.8 mm Hg (95% CI 9.5–12.9), (*P* = 0.002). One patient had an IOP of 28 mm Hg at 1 month, another 20 mm Hg at 1 year.

Blebs were avascular, diffuse, and extended posteriorly (Figures 2a and b).

All eyes showed either an improvement in visual acuity or remained stable (Table 2).

One patient developed an endothelial rejection 2 years later. Postoperatively, complications such as graft failure, severe postoperative hypotony, blebitis, or suprachoroidal bleeding were not seen in any case.

A postoperative ultrasound biomicroscopy revealed the presence of a cyclodialysis with minimal suprachoroidal effusion, underlying a subconjunctival filtering bleb in all cases. (Figure 3).

Discussion

Post-keratoplasty glaucoma is difficult to manage, with the necessity for a consistent decrease of IOP and maintenance of corneal graft clarity.^{2–8}

Cyclodialysis, as practiced earlier, used a cyclodialysis spatula passed under the scleral lip to mechanically depress the ciliary body, attempting to thereby separate the ciliary body from the scleral spur. The spatula was further swept without direct observation from side to side to allow disinsertion over ≥2 clock hours. The procedure was fraught with unpredictability and complications, especially hypotony and haemorrhage.^{9,10} However, the efficacy of a cyclodialysis was reconfirmed by Johnson *et al*¹¹ who performed a conventional cyclodialysis in rats after experimental

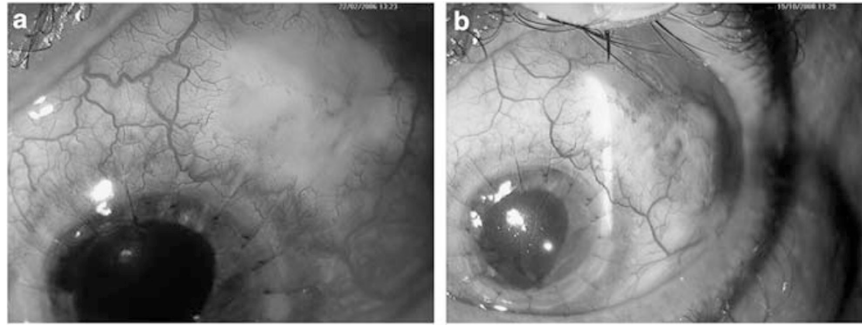


Figure 2 Clinical photograph of the functioning bleb with clear corneal graft after cyclodialysis enhanced trabeculectomy. (a) After 1 year there is a large, posterior, diffusely avascular bleb. (b) After 3 years, subsequent to an episode of endothelial rejection, the bleb is still mildly elevated as evidenced by the configuration of the slit, diffuse, avascular, and functioning.

Table 2 Preoperative and postoperative data of eyes that underwent ab-externo cyclodialysis enhanced trabeculectomy

Variable	Baseline	Final follow-up
IOP (mm Hg)	39.6 ± 3.9	11.3 ± 2.8
Vision (Snellens acuity)		
20/200–20/40	18	No change (n = 18)
<20/200	27	Improved to 20/200 (n = 8) Stable/no change (n = 19)
Graft clarity (grade 1–4)	Grade 1 n = 5 Grade 2 n = 12 Grade 3 n = 16 Grade 4 n = 12	Improved (n = 24) Stable (n = 21)
Antiglaucoma medications	45 (Maximal medical therapy)	43 eyes: Nil 1 eye: 2 topical medications 1 eye: 1 topical medication
Graft failure	27	27
Follow-up period	—	28.1 ± 2.0 months (95% CI 24.7–33.2)

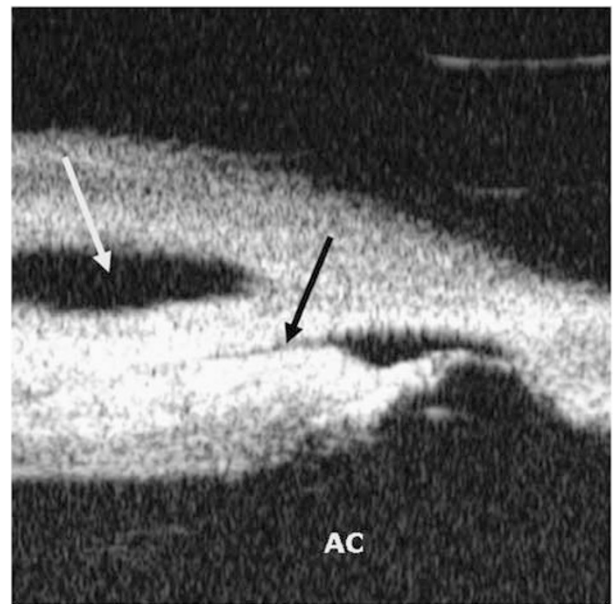


Figure 3 Ultrasound biometry of the bleb showing subconjunctival drainage (white arrow) and an underlying suprachoroidal cyclodialysis cleft (black arrow).

Table 3 Review of post-keratoplasty glaucoma studies

Author/year	Procedure	Number of eyes	Mean duration of follow-up (months)	IOP control (%)	Graft failure occurring subsequent to intervention (%)
Gilvarry et al ² (1989)	Trabeculectomy	35	36	50.5	51
Ayyala et al ⁷ (1998)	Trabeculectomy with MMC	17	23 ± 13	77	11.7
Figuerido et al ¹³ (1996)	Trabeculectomy with MMC	9	16	NA	22.2
Ishioka M et al ³ (2000)	Trabeculectomy with MMC	34	22.3 ± 10.3	73	30.8
	Trabeculectomy without MMC		22.3 ± 10.3	25	62.5
Wu Dunn D ⁴ (1999)	Combined PK + trabeculectomy with MMC	24	24	50	25
Kwon et al ⁵ (2001)	GDD	55	34 (8–74)	82	61.8
Alvarenga et al ¹⁴ (2004)	GDD	40	December 1986–September 2002	63.1	74.2
Shah P et al ¹⁶ (2001)	Cyclodiode	28	30.5(18–38)	79	16-opacification, 37-failure/rejection
This study 2009	Cyclodialysis enhanced trabeculectomy	45	28.1 ± 2.0	95.6	0

IOP elevation, and showed a 40% reduction in IOP.

We evaluated a limited ab-externo cyclodialysis performed under direct vision as part of an MMC trabeculectomy. Disinsertion of the ciliary body from its scleral attachment opens up the potential suprachoroidal space, exploiting the resorptive capacity of the choroid. UBM pictures show drainage from both the subconjunctival and suprachoroidal pathways. In our series, the IOP was maintained below 15 mm Hg in all but two patients, without any antiglaucoma medications. The blebs were relatively avascular, diffuse, and extended posteriorly. In our study, there was no decrease in graft clarity and no graft failure after the surgery in any eye for up to 2 years. This could be because the corneoscleral block was well away from the graft edge, and the bleb was positioned more posteriorly.

In literature, post-keratoplasty patients have responded poorly to all surgeries, both in terms of IOP control, as well as graft failure, due to extensive peripheral anterior synechiae, limbal vascularisation, uveitis, and extremely shallow anterior chambers (Table 3).^{1–5,7,12–18}

The limitation of our study was the absence of a control group, however, 30 of the 45 eyes had previous, failed glaucoma procedures.

In conclusion, an ab-externo cyclodialysis enhanced MMC trabeculectomy maintained or improved graft clarity besides achieving the long-term, low 'target' IOP necessary to control refractory post-penetrating keratoplasty glaucoma.

Summary

What was known before

- Cyclodialysis was effective but was unpredictable and prone to complications.

What this study adds

- Limited cyclodialysis as part of an augmented trabeculectomy provides significant lowering of IOP without the complications.

Conflict of interest

The authors declare no conflict of interest.

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