Is endocylophotocoagulation (ECP) effective after failed glaucoma drainage device (GDD) surgery? The Malaysian experience

Teh Swee Sew[1], Jemaima Che-Hamzah[2]

[1]Ophthalmology Clinic, Hospital Selayang, 68100 Batu Caves, Selangor, Malaysia
[2]Department of Ophthalmology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Ya'acob Latif, Bandar Tun Razak, 56000 Cheras, Kuala Lumpur, Malaysia

Purpose: To investigate the efficacy, survival time and safety profile of endoscopic cyclophotocoagulation (ECP) in patients with failed primary glaucoma drainage device (GDD).
Material and methods: A retrospective case review of ten patients with primary GDD implantation who underwent ECP from July 2013 to April 2018. Ten eyes of 10 patients were included. Indication of ECP was failure to achieve target IOP with maximal tolerated medical therapy despite the GDD implantation. ECP were performed by a single surgeon over at least 270 degrees and the subjects were followed up to 1 year. Main outcome measures were mean reduction in IOP and anti-glaucoma medications at 1, 3, 6 and 12 months. The visual acuity and complications were also documented.
Results: Mean IOP at baseline, 1, 3, 6 and 12 months were 17.7 + 3.74 mmHg, 18.1 + 8.1 mmHg, 18.1 + 6.1 mmHg, 16.5 + 5.9 mmHg, and 15.2 + 4.8 mmHg respectively. Although the IOP post ECP was in the downwards trend, it was not statistically significant (p=0.916). Mean difference in number of anti-glaucoma medications were 1.40, 1.44, 1.38, and 1.5 at baseline, 1, 3, 6 and 12 months respectively, which was statistically significant up to 6 months (p=0.036). One patient required repeat ECP due to uncontrolled high IOP and another had recurrent rhegmatogenous retinal detachment. No other complications encountered.
Conclusion: ECP is a useful and safe surgery in managing refractory glaucoma with inadequate IOP control post primary GDD implantation.
Conflict of Interest: There is no conflicting relationship exists for any author.
Key words: Endocyclophotocoagulation, ECP, Tube-shunt, Glaucoma drainage device, GDD, failed GDD
EyeSEA 2019;14(1):36-42
Full text. https://www.tci-thaijo.org/index.php/eyesea/index

Introduction

Glaucoma drainage device (GDD) has increasingly gained its popularity to treat refractory glaucoma or when other modalities of treatments have failed. The results of tube versus trabeculectomy (TVT) study showed that GDD was found to have a higher success rate and lower reoperation rate at 5 years supporting the use of GDD in the management of complex glaucoma.[1] However, when GDD failure occurs or GDD failed to control the intraocular pressure (IOP) within target levels despite maximal tolerated medical therapy, the next step of

Correspondence to:
Jemaima Che Hamzah. *Department of Ophthalmology, Faculty of Medicine,* Universiti Kebangsaan Malaysia.E-mail : jemaima@ppukm.ukm.edu.my
Received : 26 December 2018
Accepted: 25 May 2019
Published: 30 June 2019

intervention is still debatable. Revising the GDD, implanting a second GDD, performing a trabeculectomy, or transcleral cyclophotocoagulation (TSCPC) have been used to control IOP in such situation but each was associated with significant risks of complications.

Among these interventions, TSCPC was shown to have less post-operative complications compared to implanting a second GDD.[2] However, there is paucity of data regarding endoscopic cyclophotocoagulation (ECP) as a second intervention after GDD failure. ECP is a minimally invasive glaucoma surgery (MIGS) that uses laser to produce a controlled and titrable ablation of ciliary process under direct visualisation through an endoscopy developed by Uram in 1992.[3] The efficacy and sustainability of ECP in reducing IOP have been widely studied either as single procedure or in combination with cataract surgeries. The results have shown to be promising, as reported by many investigators.[4,5]

In Malaysia, our center is the only center which is equipped with ECP and serves as the referral center for the whole country. We conducted a study to investigate the efficacy, survival time and safety profile of ECP among our local population.

Methods

A retrospective case series of all patients with previous GDD implantation who underwent ECP from July 2013 to April 2018 were done. All ECP were performed by the same surgeon (JCH) under subtenon anaesthesia. A single clear corneal incision was made with 2.75mm keratome at 11-12 o'clock position. A high molecular weight viscoelastic (Healon GV, Advanced Medical Optics [AMO], Santa Ana, CA) was used to inflate the ciliary sulcus. Diode laser (Iridex OcuLight SL, Mountain View, California, USA) was delivered using the curved endoscopic probe (Endo Optiks, Little Silver, USA) starting at 150 mW in continuous mode. The ciliary processes and spaces between the processes were treated for at least 270 degrees. The endpoint of treatment was whitening and shrinkage of the processes. Viscoelastic was then removed using either automated or manual irrigation-aspiration (IA). At the end of the procedure, subconjunctival gentamicin 20 mg and dexamethasone 1% 2 mg was injected. All patients received standardised post-operative therapy: guttae ciprofloxacin 0.3% and guttae pred forte 1% every 2 hours tapering dose for 4-6 weeks depending on level of inflammation. Patients were also advised to continue their usual preoperative anti-glaucoma medications.

Data was collected at baseline, 1 month, 3 month, 6 month and 1 year post-operatively. Visual acuity measured with Snellen chart, intraocular pressure (IOP) measured with Goldmann applanation tonometry, number of anti-glaucoma medications and presence of complications were recorded.

Data were recorded in an Excel spreadsheet (Microsoft Office 2007; Microsoft Corporation) and then transferred to SPSS 25 (IBM SPSS Statistics 25, Armonk, NY). The data were analysed for VA, IOP and number of medication used at each time point. Mean IOP and drop use were calculated together with their 95% CIs. Multiple comparisons of VA, IOP and number of anti-glaucoma medications at all-time points were undertaken using repeated measures analysis of variance (ANOVA). Bonferroni's multiple comparison post-test was undertaken to compare pre-treatment IOP with IOP at each subsequent time point. The mean differences in IOP with 95% CIs were given. p values <0.05 were considered statistically significant throughout.

Results

Nine ECP cases were performed as a single procedure and one case was a combined

procedure with phacoemulsification. Mean age of the subjects was 39.0 + 21.0 years old, ranging from 13 to 75 years. There were 5 females and 5 males. Six of them were Chinese, the rest were Malays. The breakdown of the types of glaucoma is shown in Table 1. Seven (70%) of patients had Baerveldt glaucoma implant while three patients (30%) had Ahmed glaucoma implant. None had GDD on both eyes.

All ten eyes from 10 patients were recruited in the study. Eight patients completed six months follow up and subsequently six patients completed one year follow up. The characteristics of patients who underwent ECP are shown in Table 2.

Mean baseline IOP was 17.7 + 3.74 mmHg. The mean IOP initially went up to 18.1 + 8.1 mmHg at 1 month but slowly reduced to 18.1 + 6.1 mmHg, 16.5 + 5.9 mmHg, and 15.2 + 4.8 mmHg at 3, 6 and 12 months respectively. The difference in IOP before and after ECP at all time-points was not statistically significant (p=0.916) using repeated measure ANOVA and pairwise comparison between baseline and time points are shown in Table 3.

Mean number of medications at baseline was 4.1 (Table 4). Mean number of medications were reduced at all follow up visits; 2.7, 2.6, 2.5 and 2.5 at 1, 3, 6 and 12 months respectively. The difference in anti-glaucoma medications before and after ECP at all time-points was statistically significant (p=0.03) using repeated measure ANOVA and pairwise comparison between baseline and time points are shown in Table 4. However, the mean reduction of number of medications post ECP were statistically significant only up to 6 months.

Table 1: Types of glaucoma in the case series

Types of glaucoma	Number of patients (%)
POAG	2 (20)
JOAG	1 (10)
CACG	1 (1)
Secondary	
Post corneal transplant	1 (10)
Post trauma	1 (10)
Post rhegmatougenous RD	1 (10)
Steroid induced	2 (20)
Necrotising scleritis	1 (10)

POAG: Primary open angle glaucoma; JOAG: Juvenile onset open angle glaucoma; CACG: Chronic angle closure glaucoma; RD: Retinal detachment

Study	Baseline				1 Months				3 Months				6 Months				1 Year			
ID	VA^0	IOP^0	Meds^0	CX^0	VA^1	IOP^1	Meds^1	CX^1	VA^2	IOP^2	Meds^2	CX^2	VA^3	IOP^3	Meds^3	CX^3	VA^4	IOP^4	Meds^4	CX^4
1	2.30	16	5	-	2.30	22	4	-	2.30	32	5	RPT	-	-	-	-	-	-	-	-
2	1.30	16	4	-	1.30	12	2	-	1.30	14	2	-	1.30	10	2	-	1.48	7	0	-
3	0.60	17	4	-	0.60	13	1	#	0.60	16	1	-	0.60	12	2	-	0.60	16	4	-
4	0.18	17	4	-	0.18	8	2	-	0.18	16	2	-	0.18	24	3	-	-	-	-	-
5	0.60	26	3	-	0.48	24	3	-	0.60	20	4	-	0.60	20	4	-	-	-	-	-
6	1.78	16	5	-	2.30	24	3	RRD		-	-	-	-	-	-	-	-	-	-	-
7	0.48	16	4	-	0.48	20	3	^	0.48	14	3	-	0.60	16	3	-	0.60	14	3	-
8	0.18	23	4	-	0.18	10	2	-	0.48	20	2	-	0.48	22	2	-	0.48	20	4	-
9	0.48	16	4	-	0.60	14	4	-	0.60	20	4	-	0.60	20	4	-	0.60	20	4	-
10	1.80	14	4	-	1.80	34	3	-	1.80	11	0	-	1.8	8	0	-	0.60	14	0	-

*VA, visual acuity; IOP, Intraocular pressure; Meds, number of medications; CX, complications; rpt, repeat; RRD, rhegmatogenous retinal detachment, # hyphaema; ^hypotony

Table 4: Distribution of number of medication at baseline, 1 month, 3 month, 6 month and 1 year post ECP

Time points	Number of patients	Mean + SD and range (mm Hg)	Difference in number of medications compared to baseline [95% CI]**	p value
Baseline	10	4.1 + 0.6 3.0 - 5.0	-	
1 month	10	2.7 + 0.9 1.0 - 4.0	-1.40 + 0.97 (-2.01 to -0.71)	0.001
3 month	9	2.6 + 1.6 0 - 5.0	-1.4 4 + 1.59 (-2.67 to -0.22)	0.026
6 month	8	2.5 + 1.3 (0 - 4.0)	-1.38 + 1.50 (-2.63 to -0.12)	0.036
1 yesr	6	2.5 + 2.0 (0 - 4.0)	-1.50 + 1.98 (-3.57,0.57)	0.122

*ECP: endoscopic cyclophotocoagulation

The visual acuity at baseline, 1-month, 3-month, 6-month and 1 year post ECP were shown in Table 1. Analysis of visual acuity showed that 3 patients had decrease of Snellen vision of 1 line (1 was due to worsening of corneal decompensation, 2 were due to ocular surface problems) and 1 had decrease of 2 lines of vision (due to cataract progression).

The complications post ECP were minimal (Table 2). Transient self-limiting hyphaema was seen in one patient. Another patient developed hypotony with choroidal effusion on day 1 post-operative but hypotony resolved within 1 week. Uncontrolled IOP was seen in one patient post ECP and was subjected to another ECP five months after the first ECP. Another patient needed surgery for recurrent rhegmatogenous retinal detachment (RRD) two months after ECP procedure. No excessive anterior chamber inflammation or other complications were reported.

Discussion

Management following primary GDD failure remains a challenge. TSCPC has been one of the successful methods used but it is a blind treatment without direct visualisation of the ciliary bodies. With the invention of ECP, precise and accurate ablation of ciliary body is possible to reduce the aqueous outflow, thus, reducing the IOP with comparative minimal complications. Our study showed that ECP was able to reduce the IOP and number of anti-glaucoma medications post procedure with mild and transient complications.

Studies have shown the potential of ECP in controlling IOP, either in combination with cataract surgery or as rescue procedure after failed initial glaucoma surgery, with relatively low risk of complications.[6] Francis et al reported a success rate of 88% using ECP in the management of failed prior tube shunt from 6 months up to 2-year follow up with no serious complications. Both mean IOP and number of medications were reduced significantly post ECP.[6] While, a review by Murakami et al found that both ECP and implantation of a second GDD were equally effective in lowering IOP (p= 0.52) and number of anti-glaucoma medications (p=0.50) at 2 years follow up for patients with refractive glaucoma that has failed a prior GDD.[7]

ECP was also compared to Ahmed valve in the management of patients with failed trabeculectomy, with the IOP of > 35mmHg. The study showed that the success rate at two years for both groups were similar, 71% for the Ahmed group and 74% with ECP.[8]

Although the IOP reduction post ECP in our study was not statistically significant, the number of medications were significantly reduced up to 6 months. The differences in these findings compared to other studies might be attributed to the fact that, at baseline, our patients were on higher number of medications leading to a lower mean IOP. In cases where patients were on systemic anti-glaucoma agents, we managed to discontinue the systemic anti-glaucoma agents with an acceptable IOP post ECP.

However, this is a retrospective study and subject to non-response and recall bias. Some patients were followed up and managed by the referring hospital after ECP. Thus, there was lack of standardisation in terms of post-op management. The treatment of ciliary processes was only 270 degrees in our study compared to some studies where more aggressive approach of treating more than 270 degrees[10] or near to 360 degrees[6] were applied. This needs to be studied to determine its additional benefits compared to the risks of complications such as hypotony and pthisis bulbi.

In view of minimally invasive nature of ECP, less complicated post-op care and good safety profile, ECP offers an alternative in managing failed primary GDD in glaucoma patients if facilities are available. A prospective study with a bigger sample size and longer follow up period may offer a better assessment of efficacy and safety profile of ECP in our population.

References

1. Gedde SJ, Schiffman JC, Feuer WJ, Herndon LW, Brandt JD, Budenz DL, Tube Versus Trabeculectomy Study Group. Treatment Outcomes in the Tube Versus Trabeculectomy (TVT) Study After Five Years of Follow-Up. Am J Ophthalmic. 2012;153:789-803.

2. Wang MY, Patel K, Blieden LS, Chuang AZ, Baker LA, Bell NP, et al. Comparison of Efficacy and Complications of Cyclophotocoagulation and Second Glaucoma Drainage Device After Initial Glaucoma Drainage Device Failure. J Glaucoma. 2017 Nov;26(11):1010-8.

3. UramM. Endoscopic cyclophotocoagulation in glaucoma management. Curr Opin Ophthalmol. 1995;6(2):19-29.

4. Lindfield D, Ritchie RW, Griffiths MF. Phaco-ECP: combined endoscopic cyclophotocoagulation and cataract surgery to augment medical control of glaucoma. BMJ Open. 2012;2:1-6.

5. Siegel MJ. Combined endoscopic cyclophotocoagulation and phacoemulsification versus phacoemulsification alone in the treatment of mild to moderate glaucoma. Clin Exp Ophthalmic. 2015;43:531-9

6. Francis BA, Kawji AS, Vo NT, Dustin L, Chopra V. Endoscopic cyclophotocoagulation (ECP) in the management of uncontrolled glaucoma with prior aqueous tube shunt. J Glaucoma 2011;20:523-7.

7. Murakami Y, Akil H, Chahal J, Dustin L, Tan J, Chopra V, et al. Endoscopic cyclophotocoagulation versus second glaucoma drainage device after prior aqueous tube shunt surgery. Clin Exp Ophthalmol. 2017 Apr, 45(3):241-6.

8. Lima FE, Magacho L, Carvalho DM, Susanna RJ, Avila MP. A prospective, comparative study between endoscopic cyclophotocoagulation and the Ahmed drainage implant in refractory glaucoma. J Glaucoma. 2004;13:233-7.

9. Gayton JL, VanDer KM, Sanders V. Combined cataract and glaucoma surgery: trabeculectomy versus endoscopic laser cycloablation. J Cataract Refract Surg. 2000;26;330-6.

10. Clement C. Combining phacoemulsification with endoscopic cyclophotocoagulation to manage cataract and glaucoma. Clin Exp Ophthalmic. 2013;41:546-661