ORIGINAL ARTICLE

Trans Scleral Diode Laser Cycloablation for Treatment of Refractory Glaucoma

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ABSTRACT

Aim: To determine the efficacy and safety profile of Diode laser cycloablation in treatment of patients with refractory glaucoma.

Methods: This retrospective observational study included 57 eyes of 57 patients with refractory glaucoma treated between December 2016 and September 2019 at Eye Department, Jinnah Hospital Lahore. Laser was applied at 1.5 mm posterior to limbus for the duration of 2 second with power between 1500- 2000 mw. The power was titrated until the researcher heard a popping sound and then decreased to just below that level. Decision on area to be lased depends on preoperative IOP. Burns were applied to 90-degree, 180 degree and 360 degree for IOP range from 21-25mmHg, 25-35mm Hg and more than 35mm Hg respectively. Follow up was done on 1st day ,1st week and 1st month. Retreatment was done only in those cases where IOP was ≥21mmHg after 1st month.

Results: The mean pre-operative IOP was 38.61±7.51 mmHg. The mean post-operative IOP at 1 day, 1 week and 1 month was 14.10±6.26 mmHg, 14.36±5.97 mmHg and 14.24±5.27 mmHg. Complications observed were anterior segment inflammation, pain and hyphema. None of the patient reported with hypotony or cataract.

Conclusion: Transscleral diode laser cycloablation is a reliable and well–tolerated procedure that significantly decreases the intraocular pressure with few complications.

Keyword: Diode Laser, Trans-Scleral, Cycloablation

INTRODUCTION

Glaucoma is the second major cause of global blindness.[1-4] According to a survey conducted by Pakistan Institute of Community ophthalmology, the prevalence of glaucoma in Pakistan is 7%.[5] The term refractory glaucoma is defined as the glaucoma which is resistant to conventional management.[6] This includes maximal tolerated antiglaucoma medications, glaucoma surgery, with or without augmentation, with antimetabolites, and in the case of neovascular glaucoma, cryotherapy or panretinal photocoagulation.

The more likely causes of refractory glaucoma are neovascular, post retinal surgery, inflammatory, post traumatic and congenital anterior chamber angle anomalies.

Cyclodestructive procedures have been used in the treatment of advanced glaucoma, particularly refractory glaucoma.[7-11] Diode laser is the preferred wavelength because of its better absorption leading to more targeted destruction and less inflammation which results in decrease in Intraocular Pressure (IOP)[12].

The main objective of this study is to determine the efficacy and safety profile of transscleral diode laser cycloablation in the cases of refractory glaucoma.

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PATIENTS AND METHODS

This retrospective observational study included 57 eyes of 57 patients with refractory glaucoma treated between December 2016 and September 2019 at Eye Department, Jinnah Hospital Lahore. Refractory glaucoma was defined as an entity in which no improvement in intraocular pressure is observed despite maximum medical, surgical and/or laser treatment procedures.

Informed consent was taken from all patients. Scio-demographic (name, age, sex, occupation) data was recorded.

Pre-operative assessment included complete ophthalmic history, best spectacle corrected visual acuity, slit lamp examination of the anterior segment, and posterior segment (with 90 diopter lens). Gonioscopy (with Goldmann triple mirror) and IOP (with Goldmann applanation tonometer) was done for every patient preoperatively. IOP was recorded postoperatively on 1st day, 1st week and 1st month.

Peribulbar or retrobulbar anesthesia was given with 3-4ml of 2% lignocaine injection. Trans-Scleral Diode laser cycloablation was performed with the Iridis Quantal laser machine using 810nm wavelength. Laser was applied for the duration of 2 second with power between 1500-2000 mw. The power was titrated until the researcher heard a popping sound and then decreased to just below that level. This Power was considered to be low enough to cause

complications, while reducing the IOP to a desirable level. Probe was placed and laser was applied 1.5mm posterior to the limbus. Decision for area to be lased depend on preoperative IOP. Laser burns were applied to 90-degree, 180 degree and 360 degree for IOP range from 21-25mm Hg, 25-35mm Hg and more than 35mm Hg respectively. Care was taken to avoid 3^{o} and 9^{o} clock position to prevent damage to the ciliary vessels and ciliary nerves.

Postoperative treatment was 0.1% dexamethasone eye drops six hourly, antiglaucoma eyedrops and oral NSAID. Topical dexamethasone was continued for four weeks, while antiglaucoma eye drops were tapered according to drop in intraocular pressure.

Follow up IOP was recorded on 1st day, 1st week and 1st month. Retreatment was done only in those cases where IOP was ≥21mm Hg after 1st month of laser application. The laser setting in cases of reapplication was 1500-2000mW power and 2 seconds duration. Postoperative management was unchanged. On each follow up, any complication like anterior segment inflammation, hypotony, pain and hyphema was noted.

The data were recorded in a predesigned performa and analyzed using SPSS, Quantitative variables were calculated as frequencies and whereas qualitative variables were analyzed in percentages with p≤ 0.05 considered as statistically significant.

RESULTS

There were 57 patients in the study with mean age 43.7±12.6 (range: 14-70) years and female to male ratio of 1:1.5. All 57 patients (100%) included in the study were using more than three antiglaucoma medications before the procedure. Neovascular glaucoma, silicon oil induced glaucoma, primary open angle glaucoma, uveitic glaucoma and post-traumatic secondary glaucoma were observed in 36.8%, 28.1%, 10.5%, 7.0% and 7% respectively. Sturge Weber syndrome was diagnosed in one patient (Table 1).

The mean pre-operative IOP was 38.61±7.51mmHg (range:26 mm -56 mmHg). The mean post-operative IOP at 1 day, 1 week and 1 month was 14.10± 6.26mmHg (range: 6 to 34mmHg), 14.36±5.97 mmHg (range: 4-30mmHg) and 14.24±5.27 mmHg (range:10-30mmHg) (Table 2).

Reduction in IOP on post-operative first day, first week and first month was 63.47%, 63.33% and 64.01% respectively (p-value:0.001) (Table 3).

Anterior segment inflammation, pain and hyphema were observed in 12.3%, 17.5% and 3.5% of patients respectively (Figure 1). None of the patients reported with hypotony or cataract.

Table 1: Glaucoma diagnosis

	Frequency	Percent
Hyphema	2	3.5
Misc	1	1.8
NVG	21	36.8
OAG	6	10.5
SE	16	28.1
SE/NVG	3	5.3
Trauma	4	7.0
Uveitis	4	7.0
Total	57	100.0

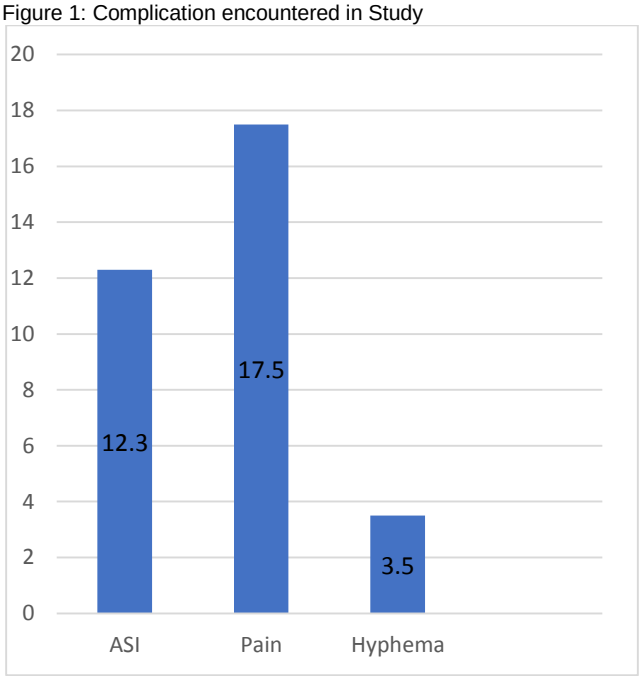
Table 2: Mean pre- and post-operative IOP

	Mean ± Std. Deviation	Range
Age	43.7 ± 12.6	14 – 70
Pre-Operative IOP	38.6 ± 7.5	26 – 56
First Day IOP	14.1 ± 6.3	6 – 34
One Week IOP	14.3 ± 6.0	4 – 30
One Month IOP	14.2±5.3	10 – 30

Table 3: Pre- and Post-Laser Intraocular Pressure

Intraocular Pressure (mmHg)	Mean ± Std. Deviation	P value
Preoperative IOP – First Day IOP	24.5 ± 6.3	.000
Preoperative IOP – One week IOP	24.2 ± 6.5	.000
Preoperative IOP – One Month IOP	24.3 ± 6.1	.000

Figure 1: Complication encountered in Study



DISCUSSION

This study was conducted to determine the efficacy and safety profile of transscleral diode laser cycloablation in cases of refractory glaucoma. Fifty-seven patients were observed in the study. The mean pre-operative IOP was 38.61mmHg, which dropped to 14.10 mmHg, 14.3 mmHg and 14.24 mmHg on 1st day, 1st week and 1st month respectively. Thus, mean IOP decrease on post-operative first day, first week and first month was 63.47%, 63.33% and 64.01% respectively (p-value:0.001). Anterior segment inflammation, pain and hyphema were observed in 12.3%, 17.5% and 3.5% of patients respectively.

Transscleral Diode laser cycloablation has become an increasingly popular minimally invasive treatment modality for refractory glaucoma[10,11,12] Initially, this modality was used only in eyes with advanced end stage glaucoma where little or no visual potential exist and where most other surgical and medical treatment had been tried but failed. This was because of traditional mistrust of earlier

cycloablation methods, such as cyclocryotherapy, that were associated with drastic complications, compared to DLCA. As confidence and experience of DLCA grows, it is now being safely tried as a primary surgical treatment in different types of glaucoma[13,14]. Complications observed after the treatment are now acceptable and most of studies reported minimal complication like pain and inflammation.[15]

There are no recommendations available about the energy settings in DLCA. Different energy settings which have been used, range from 1500 to 2500 milliwatts for 1-2 seconds.[16] We used a power of 1500 to 2000mW and titrated it with pop sound. Spencer and Vernon used a fixed setting and did not change it to hear the pop sound[17].

The mean decrease in IOP, in our study is 63.60%. Our results are comparable with the previous studies in which a decrease of 48% - 92% in mean IOP has been reported.

In our study decision for area to be lased depended on preoperative IOP. Burns were applied to 90 degree in cases of IOP range from 21-25mm Hg, 180 degree were applied with IOP from 25-35mm Hg, 360 burn were applied with IOP more than 35mm Hg. Khalid et al [18]and Butt JB[19] applied 270-degree laser irrespective to pre-operative IOP level. Similarly Gupta and Agerwal [20]applied 360 degree lasers to each patient. Most of studies applied laser to a fixed area. We did not find any literature that applied laser according to pre-operative IOP range.

In our study, retreatment of one session was done only in 4 patients (7.01%) where IOP was more than 21mmHg after four weeks of 1st session. No consensus is found in literature about the number of treatment sessions and the number of times for repeating the procedure.

Spencer and Vernon[17] repeated the procedure up to five times. Khalid et al repeated treatment in 44%, and the procedure was repeated in 3 sessions, in only 6% of patients. Brancato et al[21] and Bock et al[22] noted a retreatment rate of 65% and 70% respectively. Noureddin et al[16] recommend that a high-power setting results in better IOP control and lesser need for retreatment.

The mean IOP decrease in IOP on post-operative first day, first week and first month was 63.47%, 63.33% and 64.01% respectively (p value:0.001).Thus the mean IOP drop was 63.60% .Results in literature vary from 48% – 92%.[23,20,17,14] On literature review , better success rate is seen with higher power settings and increased number of treatment sessions. Egbert et al[14] reported a success rate of 48%. Their power settings were low and only 20% cases received more than one treatment session.

They recommended that higher power settings and repeated treatment sessions would improve success. Highest success rate in literature is that of Gupta and Agarwal[20] which is 92%. The main reason for their high success rate was that they treated 360 degrees instead of 270 degrees.

Most serious adverse effects of this procedure are hypotony, phthisis and cataract. In our study, we did not find any patient with this drastic complication. Minor complications like anterior segment inflammation, pain and hyphema were observed in 12.3%, 17.5% and 3.5% of patients respectively.

In our study, 64.9% of patients were either had siliconized eyes or neovascular glaucoma. They were successfully treated with DLCA and with minimal complications. Thus, our study of Trans-scleral Diode Laser Cycloablation revealed that this treatment was quick and relatively simple to apply. Patient acceptance of treatment was excellent and patients found the procedure less frightening than trabeculectomy. The procedure seems safe as no major complications were observed.

CONCLUSION

The results show that DLCA, if applied according to the pre-operative IOP is highly successful in achieving desirable intraocular pressure. The treatment, most of the time, is single, lasts longer and causes less complications.

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