Original Article

Transscleral Diode Laser Cyclophotocoagulation for the Treatment of Refractory Glaucoma

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Purpose: To study the efficacy and safety of diode laser cycloablation to achieve adequate IOP reduction and a comfortable eye.

Material and Methods: The study was conducted at the glaucoma unit of LRBT eye hospital Lahore. 102 eyes of 88 patients treated between August 2004 and January 2006 with a minimum follow up of 6 months were included in the study.

Results: The mean pre treatment IOP of 102 eyes (of 88 patients) was 41.79±9.50 mmHg. Mean IOP at 1, 3 and 6 months after treatment was 16.65±9.71 mmHg, 16.5±9.52 mmHg and 16.18±8.21 mmHg respectively. Complications encountered included uveitis, hyphema, hypotony and neurotrophic ulcer.

Conclusion: Transscleral diode laser cycloablation is highly effective in lowering intraocular pressure. High success and low complication rate combined with portability, durability and easy to learn technique makes diode laser cycloablation the treatment of choice for refractory and complex glaucoma.

Refractory glaucoma is the term used for glaucoma resistant to conventional management.[1] This includes maximally tolerated medical therapy, one or more than one glaucoma surgeries with or without antimetabolites and in cases of rubeotic glaucoma, panretinal photocoagulation or cryoablation.

Multiple factors contribute to the failure of intraocular pressure control during glaucoma management. Glaucoma more likely to become refractory includes neovascular, inflammatory, post retinal surgery, post traumatic and rare conditions like aniridia and congenital anterior chamber anomalies. Long term topical medical therapy for primary open angle glaucoma or primary angle closure glaucoma is a known factor compromising the outcome in glaucoma surgery.

Cyclodestructive procedures are used when glaucoma becomes resistant to conventional medical and surgical procedures. These procedures destroy the non pigmented and pigmented epithelium of the ciliary body leading to decrease in aqueous production and thus drop in intraocular pressure. Modalities tried for cyclodestruction are cryotherapy and laser photocoagulation of the ciliary body using energy of different wavelengths[2-7]. Of these cyclocryoablation and Nd: YAG laser cyclophoto-coagulation are more commonly used. Contact Diode laser cryoablation is emerging as the preferred treatment because these two methods are associated

with greater risk of hypotony and phthisis due to excessive ciliary body destruction[8-10].

Diode laser causes destruction of pigmented and non-pigmented ciliary epithelium and capillaries in the ciliary processes with pigment clumping, coagulative necrosis, and extensive destruction of ciliary muscle with moderate reduction in vascularity[11].

Main objective was to study the efficacy and safety of diode laser cycloablation and to achieve adequate IOP reduction and a comfortable eye.

MATERIALS AND METHODS

The study was conducted at the glaucoma unit of LRBT eye hospital Lahore. 102 eyes of 88 patients treated between August 2004 and January 2006 with a minimum follow up of 6 months were included in the study.

Glaucoma was labeled refractory if the IOP was above 21 mmHg despite all efforts using medical, surgical and laser treatment options.

Pre laser assessment included best corrected visual acuity, slit lamp biomicroscopy of the anterior and posterior segment, applanation tonometery using Goldman tonometer in adults and air puff non contact tonometery under sedation in children. Gonioscopy was also done in all patients except infants. Personal profile including age and gender was also recorded.

Transscleral Diode Laser Cyclophotocoagulation ("cyclodiode") was performed using the Iridis Quantal Medical Diode laser with a wavelength of 810 nm.

Local anesthesia in the form of peribulbar injection using 3-4 cc of 2% xylocaine was used in patients 18 years or above. In younger patients treatment was performed under general anesthesia.

Laser energy was delivered using the G-probe placed 1.5mm from the limbus. The direction of the probe was parallel to the visual axis. 25-30 laser burns were applied for 270 degrees strictly avoiding 3 and 9 o'clock positions to save the ciliary nerves and vessels. Energy settings were 1.8 – 2.1 W applied for 1 second duration resulting in a power delivery of 1.8 – 2.1 J per application (45 – 63 joules per session). Pop sound of the laser burn was the end point.

Oral NSAIDS, topical dexamethasone 0.1% eye drops along with antiglaucoma medication except miotics were continued for the 1st week. Anti glaucoma medication was tapered in accordance with the drop in intraocular pressure. At 1 week post laser treatment oral acetazolamide was discontinued if the lOP was <22 mmHg, with reintroduction of topical IOP lowering medications at the discretion of the clinician. Topical steroids, usually dexamethasone 0.1 % eye drops, were prescribed four times a day for 2-4 weeks after treatment. Post treatment follow up was done on day 1, week 1, 4, 6 and then at 4, 5 and 6 months. Topical IOP lowering medications were reintroduced if lOP control was inadequate.

Retreatment was done if the IOP was above 22 mmHg at 4th post laser week. Number of applications and power was increased to 32 and 2.4 W respectively. Duration was kept the same as before that is 1 second. Treatment was repeated for a maximum of 3 times.

The treatment was considered successful if the IOP at 6 months was between 5 and 21 mmHg with or without topical medication.

RESULTS

114 eyes of 94 patients were treated. 88(94%) patients (102 eyes) completed at least 6 months follow up and were included in the study. Those who did not complete at least 6 months follow up were excluded from the study. Mean follow up was 11 months ranging from 6 months to 22 months. Mean age of the patients was 41 years. (Range 1-62 years). Visual acuity was PL to 6/36.

The diagnostic groups of patients receiving treatment are shown in Table 1. Primary angle closure glaucoma was found to be the most common cause of refractory glaucoma in our patients followed by neovascular glaucoma, post retinal detachment surgery and primary open angle glaucoma.

The mean pre treatment IOP of 102 eyes (of 88 patients) was 41.79±9.50 mmHg. The effect of treatment at 1, 3 and 6 months is shown in Fig 1. Mean IOP at 1, 3 and 6 months was 16.65±9.71 mmHg, 16.5±9.52 mmHg and 16.18±8.21 mmHg respectively. Figure 2 shows a comparison of pre and post treatment IOP in 102 eyes. Eyes were divided into 5 groups based on pre and post treatment intraocular pressure.

Maximum number of sessions in our patients were 3 (Table 2). There were 6 eyes of 3 patients that received treatment thrice. 38(37%) eyes had two and 58(57%) eyes had only one treatment session.

Complications are tabulated in table 3. Uveitis and hyphema were the more commonly observed complications which resolved in 2-4 weeks with more

frequent instillation of topical steroids. Hypotony defined as IOP less than 5 mmHg was seen in 2 eyes (2 patients). Neurotrophic ulcer which was believed to occur due to inadvertent application of laser to ciliary nerves was seen in 1 eye only. No case of phthisis or lens damage was seen.

DISCUSSION

Diode laser cycloablation has developed an acceptable track record for the treatment of refractory glaucoma[12-14]. It has also been tried as a primary surgical treatment in different types of glaucoma[15-17]. Complications profile is acceptable and most authors have reported insignificant and transient complica-tions like pain and inflammation[18-20]. Some surgeons are trying it as an alternative to drainage implant surgery in complex glaucomas[21].

Table 1: Diagnostic Groups of Eyes undergoing DLCA

Primary angle closure glaucoma	26
Neovascular glaucoma	21
Post retinal surgery	16
Primary open angle glaucoma	14
Trauma	10
Inflammatory	6
Buphthalmos	3
Aniridia	3
Sturge Weber Syndrome	1
Peter's anomaly	1
Steroid induced	1

Table 2: No. of laser sessions

No of sessions	No of eyes n (%)
1	58 (57)
2	38 (37)
3	6 (6)

Table 3: Complications

Anterior segment inflammation	8
Hyphema	8
Moderate to severe pain	6
Hypotony	2
Vitritis	2
Neurotrophic ulcer	1

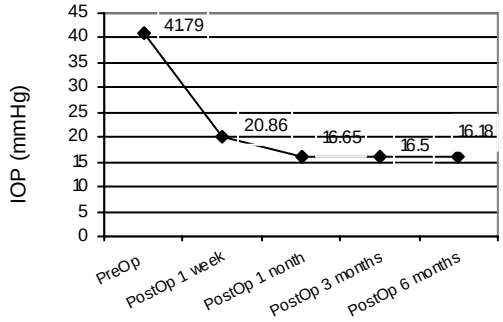

Fig. 1: Decrease in intraocular pressure after treatment

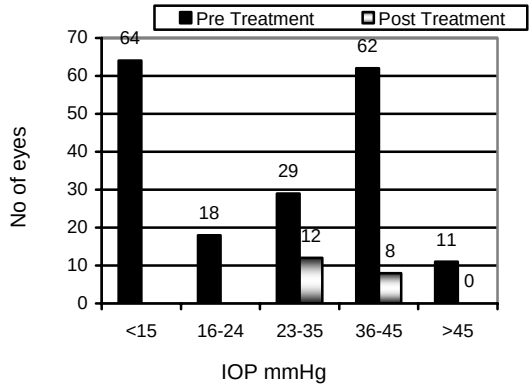

Fig. 2: Comparison of Intraocular pressure pre and post treatment

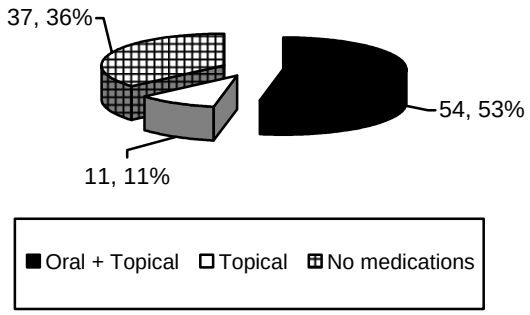

Fig. 3: Topical and oral medications required after surgery (No of Eyes)

No standard protocol has yet been agreed upon for the energy settings. Different settings have been used ranging from 1.5 Watts to 2.5 Watts for 1-2 seconds[22-24]. We used a power of 1.8-2.1 W titrating with the pop sounds. Spencer and Vernon used a fixed setting and did not alter it to hear the pop sound[24].

We had a mean drop of 50.08% in IOP. This is comparable to other studies mentioned above where a decrease of 20%-65% in mean IOP has been reported.

Regarding the number of treatment sessions again there is no agreement on how many times the procedure should be repeated. Spencer and Vernon repeated the procedure up to five times[24]. We had a maximum of 3 sessions in our series. Retreatment was done in 44% of which only 6% received 3 treatment sessions. Brancato et al[20] and Bock et al[25] had a retreatment rate of 65% and 70% respectively. Noureddin et al[22] recommend that a high power setting results in better IOP control and lesser need for retreatments.

Our success rate is 80.3% (IOP < 21 mmHg) at 6 months. Results in literature vary from 48%-92%[14,17,21,24]. Reviewing the literature one finds that better success rate is seen with higher power settings and increased number of treatments. Egbert et al[17] had a success rate of 48%. Their power settings were low and treatment repeated only in 20% cases. They recommend that higher power settings and repeated treatment would improve success but they were conservative because they were undertaking the procedure as a primary treatment. Highest rate we could find in literature is that of Gupta and Agarwal[21] which is 92%. A striking difference in their method was that they treated 360 degrees instead of 270 degrees.

Murphy et al[1] have also measured the sensitivity to cyclophotocoagulation and found chronic angle closure glaucoma and glaucoma secondary to retinal surgery to be the most sensitive to this treatment. Though we specifically did not measure the sensitivity but our findings seem to confirm this.

Most serious adverse effects of this therapy are hypotony and phthisis. Rates reported are highly variable. In our series there was no case of phthisis and hypotony occurred only in 2 of 102 eyes. (<2%).

CONCLUSION

Our results confirm the findings of other investigators that transscleral diode laser cycloablation is highly effective in lowering intraocular pressure. High success and low complication rate combined with portability, durability and easy to learn technique makes diode laser cycloablation the treatment of choice for refractory and complex glaucoma.

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