Original Article

Diode Laser Trans-Scleral Cycloablation as Surgical Treatment for Primary Open-Angle Glaucoma after Maximum Tolerated Medical Therapy

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Pak J Ophthalmol 2014, Vol. 30 No. 2

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Purpose: To establish the role of Diode Laser Trans-scleral Cycloablation (DLCA) as a primary treatment choice in Open Angle Glaucoma (POAG) after maximum endured medical therapy.

Material and Methods: It is a quasi-experimental study which was conducted at Layton Rahmatullah Benevolent Trust Free Eye Care and Cancer Hospital, Lahore (LRBT). The duration of study was 1 year (29-03-2013 to 29-03-2014). Sixty patients meeting the inclusion criteria (Inclusion Criteria were Primary Open Angle Glaucoma and Maximum tolerated oral / topical medication) were selected from the Glaucoma unit of LRBT for this study. Twenty five to 30 burns of Diode Laser were applied to 270 degrees avoiding 3 and 9 o clock positions, 1.5 mm posterior to the limbus. Laser was set at duration of 1.5 seconds and power between 1500 and 2000 mw. The power was attuned till a popping sound was heard and then reduced to just below that level. Patients were followed up for a period of one year.

Results: Out of a total of 60 eyes with mean age 52.73 ± 7.40 years, 36 (60%) were male and 24 (40%) were female. The mean pre-operative IOP was ± 41.62 mm Hg (The pre-operative IOP ranged from 28 mm Hg to 60 mm Hg). The mean post-operative IOP was 18.97 mm Hg on day one, 16.75 mm Hg at 1 week, 15.68 mm Hg at 1 month, 15.00 mm Hg at 6 months and by the end of a year it was about 14.15 mm Hg (The post-operative IOP ranged from 6 mmHg to 52 mm Hg). There was a considerable drop of more than 50% of post-operative IOP in contrast to pre-operative IOP.

Conclusion: Diode Laser Trans-scleral Cycloablation is a convenient, swift, well – endured modus operandi that provides a modest and variable lowering of intraocular pressure with few complications.

Glaucoma is the major cause of irrevocable blindness[1,7]. The incidence rate and prevalence of glaucoma in Pakistan is similar to that of other dark colored population of the developing countries, but tangible statistical data is lacking. According to a study carried out in Lahore, 23% of the blindness is found to be due to glaucoma[6].

Long term medical treatment is improbable, however, because of the long distances patients must travel for treatment, the high cost and low accessibility to medications. Glaucoma is often taken to be a surgical problem. Trabeculectomy with anti metabolites is an effective treatment for POAG[1,7]. Primary trabeculectomy is still a procedure of choice all over for cases in which a great lowering in IOP is the intent of the treatment, especially when high IOP

persists despite of giving maximum tolerable anti glaucoma medication (which varies from patient to patient)[2,8].

Diode Laser Trans-scleral Cycloablation (DLCA) has been used effectively for the cure of refractory glaucoma, as well as those eyes in which other surgical treatments have failed[1,7]. Diode laser is widely established as the remedy of choice in severe glaucoma cases and is appropriate as a primary surgical procedure[4,5].

In developing countries, there is a scarcity of both ophthalmologists and resources for eye care. Regrettably, medical and surgical treatment cannot be accessible to every glaucoma patient. Therefore, DLCA is an easy, swift and low cost surgical procedure for patients with POAG after maximum endured medical treatment. Diode laser is a harmless, efficient method to reduce the IOP in the treatment of different glaucomas with few severe complications.

MATERIAL AND METHODS

Sixty patients satisfying the inclusion criteria were chosen from the Glaucoma Unit of Layton Rahmatullah Benevolet Trust (LRBT) Hospital to be included in this study. The duration of study was one year which included six months of recruitment and six months of follow-up. After taking well versed permission, socio-demographic data (name, age, sex, occupation) was recorded. A complete ophthalmological history was taken. Preoperative and postoperative evaluation was done by including visual acuity with Snellen Chart, IOP with Goldmann applanation tonometer and Topcon air puff. Slit lamp examination with Haag streit BQ-900 was done for anterior segment examination. Super field 90 D lens was used for fundus evaluation including cup-disc ratio. Gonioscopic evaluation of anterior chamber angle with Goldmann triple mirror and perimetry with Humphry Visual Field Analyser was also done.

Inclusion Criteria were Primary Open Angle Glaucoma and Maximum tolerated oral / topical medication while Exclusion criteria were Uveitis, Cataract, Diabetes Mellitus, Hyper tension.

Treatment course of action included preoperative administration of peribulbar or subtenon anesthesia. Transscleral Diode Laser Cyclophotocoagulation ("cyclodiode") was performed using the Iridis Quantal. Laser was applied for 1.5 seconds with power between 1500 to 2000 mw. The power was adjusted until a popping sound was heard and then reduced to just below that level. Approximately 30 burns were placed 1.5 mm posteriorly to the limbus over 270 degrees. Oral NSAIDS, topical dexamethasone 0.1% eye drops along with anti glaucoma medication were continued for the 1st week. Miotics were discontinued for the 1st week. Anti glaucoma medication was tapered according to the drop in IOP. At 1 week post laser treatment oral acetazolamide was discontinued if the lOP was < 21 mm Hg. Oral acetazolamide was given to eighteen patients and was continued for up to one week. Topical steroids, usually dexamethasone 0.1% eye drops, were given four times a day for 2 – 4 weeks after treatment. Follow up was noted on 1st day, 1st week, 1st month, 6th month and 1 year.

Pre-op gonioscopic examination revealed POAG Grade III in all the patients. Visual acuity and Visual Field remained unchanged in all the patients.

Any complications occurring in patients like anterior segment inflammation, cataract, hyphema and hypotony were also taken into account.

RESULTS

Sixty patients were included in the study. Their ages ranged between 45 to 60 years and the mean age of patients was about 52.73 ± 7.40 years.

60% of the patients were male and 40% were female. 52% operated eyes were right and 48% were left eyes. Most of the patients were using three or more anti-glaucoma drugs pre-op (Figure 1).

The mean pre-operative IOP was ± 41.62 mm Hg (The pre-operative IOP ranged from 28 mm Hg to 60 mm Hg). The mean post-operative IOP was 18.97 mm Hg on day one, 16.75 mm Hg at 1 week, 15.68 mm Hg at 1 month, 15.00 mm Hg at 6 months and by the end of a year it was about 14.15 mm Hg (The post-operative IOP ranged from 6 mm Hg to 52 mm Hg). Mean post-operative IOP lessened by more than 50% as compared to mean pre-operative IOP (Figure 2). (The post-operative IOP ranged from 6 mm Hg to 52 mm Hg) (Table 1).

The mean post-operative IOP continued to decrease by the end of one year. Anterior segment inflammation was seen in only eight eyes (13.3%) out of 60 eyes. Similarly cataract as a complication occurred in 8 eyes (13.3%), hyphema in 5 eyes (8.3%) while 6 eyes (10%) developed hypotony. We had a maximum of 3 sessions in our series. Retreatment was

done in 44% of which only 6% received 3 treatment sessions.

Preoperative and postoperative mean intra ocular pressure was assessed using paired t test and final P values were 0.00 which is less than 0.05, and this shows that the test is highly significant (Table 2).

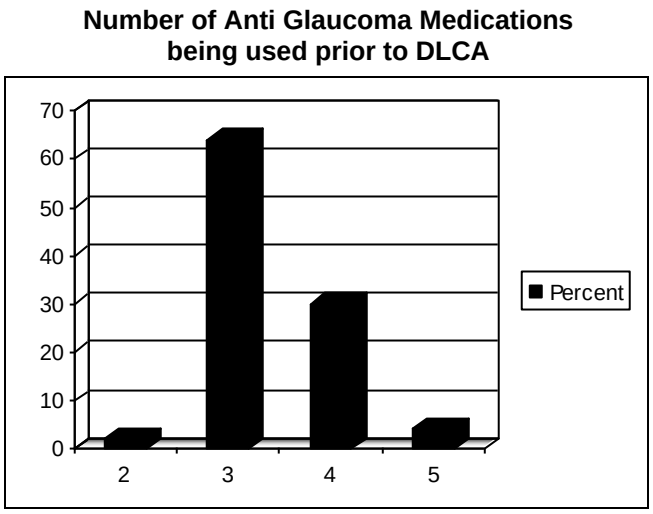

Fig. 1: Most of the patients were using three or more anti-glaucoma drugs pre-operatively.

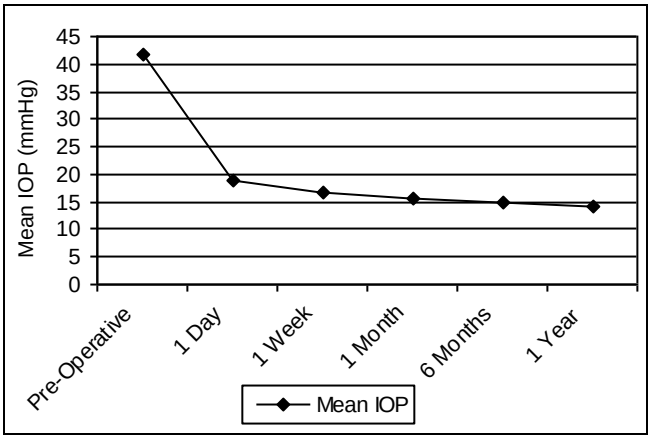

Fig. 2: Drop of mean IOP following DLCA

This proves that IOP decrease after DLCA by the end of one year is notably lower than the pre-operative IOP. The complications with DLCA were evaluated using chi square test, that included anterior segment inflammation, cataract, hyphema and hypotony, and it showed that the minimum expected frequency is 30.0, and P value for each complication is 0.00 which is less than 0.05, showing that the complication rate is not significant.

DISCUSSION

In this study of DLCA as primary treatment for POAG, the treatment was rapid and straight forward. Patient reception of treatment was exceptional and patient. DLCA is relatively safe as no major complications came into account.

DLCA has established itself a satisfactory track record for the treatment of refractory glaucoma[9-12]. It has also been tried as a primary surgical treatment in different types of glaucoma[13-15]. The complications are tolerable. Inconsequential and transitory complications like pain and inflammation were noted by most authors[16-18]. Some surgeons are trying it as an alternative to drainage implant surgery in complex glaucoma[19].

A constraint of the study may be that the group had a small number of 60 patients. However, adequate follow-up information from all patients was acquired and the cases were included on consecutive basis.

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[20-22]. We used a power of 1500-2000 mw titrating with the pop sounds. Spencer and Vernon used a fixed setting and did not alter it to hear the pop sound[3].

3 and 9 o' clock positions should be avoided to save ciliary nerves and in phakic eyes the probe must be 1.5 mm posterior to the limbus to avoid lens damage.

Structural changes occurring with diode laser trans-scleral photocoaggulation are thermal coagulative necrosis of ciliary epithelia and stroma followed by atrophy, fibrosis and fusion of ciliary processes**.** Oral NSAIDS, topical dexamethasone 0.1% eye drops along with anti glaucoma 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 < 21 mm Hg. Topical steroids, usually dexamethasone 0.1 % eye drops, were prescribed four times a day for 2 – 4 weeks after treatment.

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.

There is no agreement on how many times the procedure should be repeated. Spencer and Vernon repeated the procedure up to five times[22]. We had a

Table 1: Mean Pre-op and Post-op IOP

	Pre-Operative IOP	Post-Operative IOP on Day 1	Post-Operative IOP Week 1	Post-Operative IOP Month 1	Post-Operative IOP Month 6	Post-Operative IOP Month 12
N	60	60	60	60	60	60
Mean	41.62	18.97	16.75	15.68	15.00	14.15
Std. Deviation	8.61	9.86	8.26	8.41	7.44	6.60
Minimum	28	2	4	2	3	6
Maximum	60	40	38	46	50	52

Key: N is the number of patients

Table 2: Paired Samples t-Test

			Paired t-Test Statistics				
Group	Mean	SD	Mean Difference	Std. Deviation	t	df	Sig. (2 - tailed)
Pre-Op IOP	41.62	8.61					
Post-Op IOP by 12 Months	14.15	6.60	24.47	11.55	18.418	59	.000

$P < 0.05$. This shows that the reduction in IOP after application of DLCA at the end of one year is significantly lower than the pre-operative IOP

maximum of 3 sessions in our series. Brancato[18] and Bock[23] had a retreatment rate of 65% and 70% respectively. Noureddin[20] recommends that a high power setting results in better IOP control and lesser need for re-treatments.

The drop in IOP was more than 50% and final IOP was ± 14.15 mm Hg. Results in literature vary from 48%-92%[12,15,19,22]. Literature review advocates that better success rate is seen with higher power settings and increased number of treatments. Egbert[15] had a success rate of 48%. Their power settings were low and treatment repeated only in 20% cases.

Repeated treatment and higher power settings 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 which is 92%. A remarkable difference in their method was that they treated 360 degrees instead of 270 degrees.

Murphy 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.

Hypotony and phthisis are the most serious adverse effects of this therapy. In our series there was no case of phthisis and hypotony occurred only in 6 out of 60 patients.

The advantages of Diode Laser Trans-scleral Cycloablation are:

- Better scleral penetration due to longer wavelength
- Back scatter lessened
- Compact, Light weight & Portable
- Air or electrically cooled
- Standard current used

The findings of other investigators that DLCA is highly effective in lowering intraocular pressure were confirmed by our results. High success and low complication rate along with portability, resilience and easy to learn technique makes diode laser

cycloablation the treatment of choice for refractory and complex glaucoma.

CONCLUSION

Diode Laser Trans-scleral Cycloablation is a convenient, swift, well – endured modus operandi that provides a modest and variable lowering of intraocular pressure with few solemn complications. It can be used safely for treatment of POAG after maximum tolerated oral / topical therapy.

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