Non-conventional (180 degrees) Argon Laser Peripheral Iridoplasty as Immediate Treatment for an Acute Attack of Primary Angle Closure Glaucoma

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The purpose of this study is to evaluate the efficacy and safety of 180 degrees of argon laser peripheral iridoplasty(ALPI) as a first-line treatment for acute primary angle closure glaucoma (PACG) without the use of systemic antiglaucoma medications. A cohort of 10 patients with an acute attack of PACG were recruited into the study. Each patient received topical pilocarpine 2% and timolol 0.5% and immediate 180 degrees of ALPI as a primary treatment. The mean intraocular pressure (IOP) of this group of patients was reduced from 57.2 mm Hg to 38.1 mm Hg at 15 minutes, 28.3 at 30 minutes and 20.8 mm Hg at 1 hour. Immediate limited (180 degrees) ALPI without systemic antiglaucoma medication proved to be safe and effective in controlling the IOP in the acute attack of PACG with a duration of attack ≤ 48 hours. It may be as effective as 360 degrees ALPI and therefore has a role in those patients in home 360 degree treatment is not possible.

Key words: Organ laser, peripheral iridoplasty, primary angle closure glaucoma

Primary angle closure glaucoma (PACG) is characterized by an abrupt rise in the intraocular pressure (IOP) caused by iris apposition to the trabecular meshwork. The eye suffering from PACG has elevated IOP, a shallow peripheral anterior chamber and corneal oedema. Laser iridotimy is the treatment of choice when there is a component of pupillary block[1] However when the eye is acutely inflamed and in the precense of corneal oedema, laser iridotimy may not be possible. Traditionally, treatment involves lowering the IOP with both systemic and topical medications, and subsequently releving the papillary block by laser peripheral iridotimy when the cornea is clear.

Systemic medication for PAGC include carbonic an anhydrase inhibitors and hyperosmotic agents. Topical medications include pilocarpine and beta-blockers[2]. Systemic carbonic an anhydrase inhibitors cause loss of appetite, paraesthesia and drowsiness in most patients. They can also cause potentially serious side effects such as metabolic acidosis, Stevens-Johonson sysdrome and blood dyscrasias[3,4,5,6]. They are contraindicated in patients with hypokalaemia, hyponatraemia, renal and hepatic failure, sulphonamide sensitivity and pregnancy. Systemic hyperosmotic agents may also cause rare but potentially life-threatening complication such as electrolyte disturbance, pulmonary oedema and congestive heart failure especially in patients with pre-existing cardiovascular diseases[7].

Systemic medication, together with topical anti-glaucomatus eye drops, take time to act. Cornial penetration of topically administered agents is extremely low when IOP is high. They some time fail to control the IOP. If the IOP remains high the definitive treatment of laser peripheral iridotimy may not be achieveable because of corneal oedema, shallow anterior chamber, and the thick iris resulting from the semi-dilated pupul and iris stromal oedema.

Traditionally argon laser peripheral iridoplasty (ALPI) has been used to open the closed angle mechanically in PACG (just as argon laser trabeculoplasty works in open angle glaucoma[8] when medical treatment fails to control the IOP. It is effective in situations when laser iridotimy cannot be performed because of corneal oedema secondary to high IOP. A ring of contraction burns (low power, long duration and large spot size) is placed on all the 360 degrees of the peripheral iris to contract the iris stroma near the angle. The contraction pulls the iris tissue away from the trabecular meshwork thus opening up the angle and lowering the IOP. This will allow the cornea to become clear and inflammation to subside before the definitive treatment is performed[9,10,11]. The usual practice is to perform ALPI 3 – 6 hrs after maximal medications fail to control the IOP[10]. The current practice of using ALPI only after maximal anti-glaucomatous medications fail may not be optimal. For those who fail to respond to the medical treatment incased optic nerve damage and permanent closure of the angle with damage to the trabecular meshwork may result from the prolonged elevated IOP[12]. Moreover, whether they respond to the medical treatment or not patients may also suffer from the side effects of the systemic medications.

For the above reasons we have undertaken a preliminary study in which PACG patients were treated with tropical anti-glaucomatous therapy and immediate ALPI, in the conventional 360 degree manner[13]. ALP without the use of systemic anti-glaucomatous therapy in PACG patients with the duration of attack off 48 hrs or less was found to both effective and safe in controlling the IOP. Corneal clarity returned early, facilitating the definitive treatment of laser iridotomy without delay.

The idea of 180 degree laser application in stead of the conventional 360 degrees originated from the fact that total laser energy delivered to the eye is directly proportional to the amount of inflammation and laser related complications.

Also it was observed in clinical practice that the patients who were treated incompletely because of non-cooperation still had reduction in their IOP. As long as the effective laser burns successfully open up part of the angle, the vicious cycle will be broken and pupillary block will be relieved. Also there are conditions in which 360 degrees ALPI may not be feasible. For example in uncooperative patients or patients with corneal opacities (such as pannus and pterygium obscuring part of peripheral iris. There has been no documentation in the literature as to how much ALPI is enough to abort an attack of PACG. This study aimed at evaluating the effectiveness and safety of 180 degree ALPI.

Materials and methods

A cohort of 10 patients with an acute attack of PACG were recruited in to the study. Inclusion criteria were (1) a first episode of PACG; (2) IOP ≥40mmHg (by applanation tonometry); (3) duration of attack ≤ 48 hrs; (4) no other previous ophthalmic disorder that may have had a persistent effect on the structure or function of the drainage angle. Exclusion criteria were (1) anti-glaucomatous treatment prior to the attack of PACG; (2) Corneal opacities not allowing laser applications to 180 degrees.

The involved eye of the patients was given 1 drop of 2% pilocarpine and 1 drop of 0.5% timolol. No systemic medication was administered. ALPI was performed under topical anesthesia with alcain eye drops (Alcon Pharmaceutical). Quantel medical 532nm green laser (France) used to apply the burns. The laser setting was 300 mW, 0.30 second duration and 500 µm spot size. The laser beam was focused onto the peripheral iris as close to the limbus as possible with the Abraham laser iridotomy contact lens (Ocular Instruments USA). A 180 degree segment of peripheral iris was treated. The end point was when localized iris contraction at the treated area became visible. The laser energy level was reduced if any of the following were observed: (1) charring of the iris; (2) formation of gas bubbles. The laser energy level as increased if there was no contraction response from the iris tissue. One drop of topical appraclonidine 1% was give immediately after ALPI as prophylaxis against the post-laser IOP rise.

IOP was measured by applanation tonometry immediately before and at 15, 30 and 60 min after ALPI. If the IOP remained above 22 mmHg at 60 min it was rechecked at 90 min after ALPI. The involved eye was given 1 drop of 2% pilocarpine 4 times a day and 1 drop of 0.5% timolol twice a day after ALPI until the definitive treatment of laser iridotomy was performed. Topical prednisolone 1% was also given 4 times a day for 1 week after ALPI.

Results

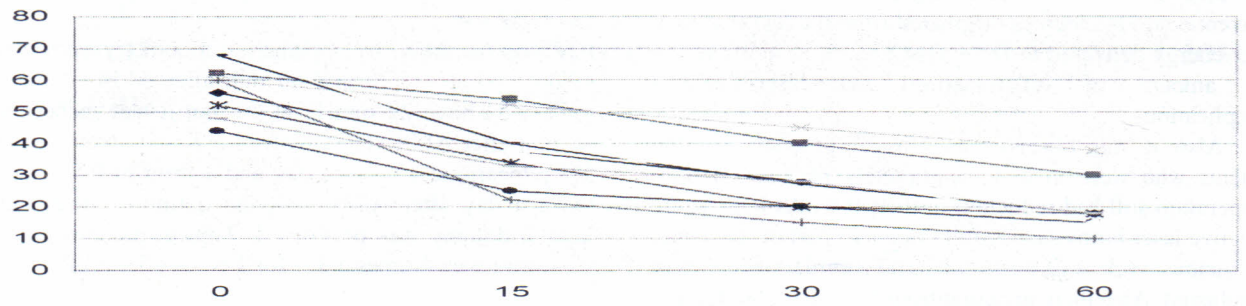
Puplilary block was clinically the mechanism underlying the acute PACG attack in all patients. There where 6 women and 4 men ranging in age from 55 years to 78 years (mean age 66 years). The duration of attack prior to presentation as determined by the onset ipane and decrease vision of the affected eye, ranged from 8 – 48 hrs. The visual acuity at presentation ranged from 6/36 to perception of light (PL). 90 % of the patients (9 out of 10) had a visual acutiy of 6/60 or less at the time of presentation. All patients have corneal oedema at presentation and all had a fixed mid-dilated pupil measuring 4–6 mm.

At presentation the IOP ranged from 44 mmHg – 70 mmHg (mean IOP 57.2 mmHg). Immediate ALPI was performed once the clinical diagnosis of PACG was established. The laser contraction burns were placed in the far periphery in 180 degrees of the iris. The mean number of contraction burns placed was 77 (range 38 – 135). The mean energy level .was 377 mW (range 325 – 420 mW). The exposure time was 0.30 sec and stop size was 500µm.

15 min after laser application the mean IOP dropped to a mean of 38.1 mmHg (range 22 – 54 mmHg). (Table 1). 30 min after ALPI mean IOP was 28.3 mmHg (range 15 – 45 mmHg). 1 hr after ALPI the mean IOP dropped to 20.8 mmHg (range 10 – 38 mmHg). In 70% of the patients (7 out of 10) the IOP was well within the normal limits. By 1 hr after ALPI 8 out of the 10 corneas had clarity reestablished allowing early laser iridotimy as definitive treatment. The visual acuity of the involved eye 1 day after ALPI ranged from 6/9 to perception of light (PL). With 5 of the 10 patients having a visual acuity of 6/24 plus. 4 patients out of 10 had visual acuity of only 6/60 to perception of light (PL) even after their corneas cleared. This was due to formation of cataracts.

Table 1

No.	Age/ Sex	Pre-ALPI VA	Pupillary size (mm)	IOP at presentation mHg	IOP at 15 min after ALPI	IOP at 30 min after ALPI	IOP at 1 hour after ALPI	Corneal Clarity 1 hour after AlPI	VA at 1 day after ALPI
1	70/F	6/60	6	56	38	28	18	CLEAR	6/60
2	72/F	CF	6	62	54	40	30	CLEAR	6/60
3	64/M	CF	5	52	45	30	28	CLEAR	6/60
4	78/F	CF	5	60	52	45	38	OEDEMA (+)	6/24+
5	60/F	6/60	5	52	34	20	18	OEDEMA (++)	6/60
6	65/M	6/36	4	44	25	20	15	CLEAR	6/12
7	77/M	PL	5	60	22	15	10	CLEAR	PL
8	55/F	6/60	5	68	40	27	18	CLEAR	6/24+
9	59/F	6/60	5	48	33	28	18	OEDEMA (++)	6/18+
10	60/M	6/60	5	70	38	30	15	CLEAR	6/9



Time in relations to ALPI Graphic Representation of intraocular pressure (IOP) changes before /after argon laser peripheral iridoplasty (ALPI) in 10 pts.

Discussion:

ALPI has a well established role in the management of patients with primary angle closure glaucoma (PACG) resistant to conventional topical and systemic anti-glaucomatous medication[9,10,11]. ALPI is traditionally applied to all 360 degrees of the peripheral iris. We studied laser application to 180 degrees of peripheral iris instead of 360 degrees encouraged by the observation that in patients in whom the treatment could not be completed previously for various reasons (for example a panus encroaching onto peripheral cornea or a pterygium or corneal scars resulting from inflammatory conditions) the IOP still dropped desirably. It has not been documented in the scientific literature that how much of the peripheral iris is to be treated to achieve pressure control in PACG.

In this study we applied ALPI of only half of the peripheral iris (180 degrees) in 10 consecutive patients with their first attack of PACG. This study was aimed at determining whether non conventional way of laser application to only half of the peripheral iris would be sufficient to abort an attack of PACG. From this study although the number of patients is limited it appears that 180 degrees argon laser peripheral iridoplasty may be well effective in the control of intraocular pressure (IOP) in primary angle closure glaucoma (PACG). It was able to lower the IOP from the initial dangerous level of 57.2 mmHg mean pressure to a much safer level of 20.8 mmHg of IOP in 60 min in over 70% of the patients. Topical apraconidine was used in this study as prophylaxis against post-laser IOP spike. It may have contributed to the IOP reduction in addition to the effect of the laser. None of the patients in this study suffered any complications arising from the laser procedure.

This study with its limitations of small number of patients and relatively short follow up period however does strongly suggest it to be an effective and safe procedure free from the potential systemic side effects of the conventional systemic medications. In the light of these observations we suggest that immediate ALPI may be considered as the first-line treatment of PACG. It is of particular value in those patients who are at risk of systemic complications. It would be more appropriate to propose a large scale prospective clinical trial to identify the minimum laser treatment required to abort an attack of PACG as it is well documented that anterior segment laser procedures carry risks if the amount of laser energy delivered is large. Theoretically the more laser burns that are applied to the iris, the more the inflammation and the higher the risk of corneal burn and lens injury. In view of the observations of this study treating 360 degrees of peripheral iris seems an over treatment. .

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