Original Article

Outcomes of primary Angle Closure Glaucoma Management

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Abstract

Objective: To investigate the results of primary angle closure glaucoma (PACG) management on intraocular pressure (IOP).

Methods: This was a cross-sectional study conducted in the ophthalmology Department, Tabriz Medical Sciences University ,Nikookary Eye Hospital, Tabriz, Iran . Subjects with angle closure were treated with YAG laser iridotomy at the time of diagnosis. These patients were re-examined in follow-up period for Patency of iridotomy, intraocular pressure (IOP), visual acuity, gonioscopic findings and automated threshold perimetry and Peripapillary RNFL thickness for detecting progression. Iridotomy was classified unsuccessful in eyes where further surgical intervention was required or in which there was a loss of visual acuity to <3/60 from glaucomatous optic neuropathy . All primary angle-closure glaucoma subjects (244 eyes) who had undergone Nd:YAG laser iridotomy between 2005 and 2008 were studied.

Results: A total of 244 patients were studied. The mean age of the study population was 64.60±9. 49 years with a median of 66 years (range: 45 -80). The mean follow-up period was 21.59 ± 12.37months. Nd:YAG laser iridotomy for primary angle-closure glaucoma controlled the condition without any need for further medical or surgical therapy in 37 (15.2 %) cases, but the remainder who required added treatment included: 152 eyes (62.3%) medical treatment., 23 eyes (9.4 %) trabeculectomy, 18 eyes (7.4%) phacoemulsification surgery, 8 eyes (3.3%) phacoemulsification with trabeculectomy and 6 eyes (2.5%) cyclophotocoagulation . In this study Nd: YAG laser iridotomy as a prophylactic procedure in the fellow eye of all patients was effective in preventing an acute angle-closure attack in the all the follow-up period.

Conclusions: For most eyes with primary angle-closure glaucoma after Nd: YAG laser iridotomy, additional medicine and surgery was required in the follow-up period. Medication therapy was needed more than other therapy. Early phacoemulsification appeared to be more effective in preventing IOP rise in uncontrolled cases.

Keywords: Primary angle-closure glaucoma, Nd: YAG laser iridotomy, Intra-occular pressure (JPMA 61:636; 2011).

Introduction

Primary angle closure glaucoma (PACG) is the form of glaucoma that causes the greatest amount of visual loss in Asia.[1-3] Glaucoma is an optic neuropathy characterized by a gradual loss of retinal ganglion cells and thinning of the retinal nerve fiber layer. The diagnosis of glaucoma is classically based on three criteria: an elevated IOP, typical visual field defects, and characteristic optic disc damage.[4,5]

Risk factors include race, female gender, and older age, anatomic abnormalities (shallow anterior chamber, small corneal diameter, and increased lens thickness).[6,7] Mechanisms of action in primary angle closure include papillary block and plateau iris configuration.[3] Primary angle-closure glaucoma is an important pathologic entity and must be effectively and promptly treated, so as to prevent permanent visual loss and optic nerve damage. Conventional therapy consists of decreasing intraocular pressure (IOP) by medications,[8,9] which in some cases may prove to be ineffective, have side effects or even life-threatening complications.[10]

Today the common interventional procedures used to relieve pupil block are either YAG laser iridotomy (YPI) or surgical peripheral iridectomy (SPI). Trabeculectomy is reserved for patients who either have significant angle damage, prolonged attacks not responding to treatment, or who need a second procedure when the first one fails.[11] During the acute angle-closure attack or shortly thereafter, depending on the degree of corneal oedema and iris vessel engorgement, Nd:YAG laser peripheral iridotomy is usually performed in cases of pupillary block. This procedure has been found to be as effective as surgical iridectomy in managing increased IOP in angle closure glaucoma,[9] and has a low failure rate in IOP management (10%), usually when more than 270 degrees of synechiae are present.[12]

The treatment of primary angle-closure glaucoma has been influenced by the development of the YAG laser and its ability to perform iridotomies as an outpatient procedure.[11]

Nd:YAG laser iridotomy to relieve pupillary block is safe and effective in treating or preventing angle-closure glaucoma. However, recent studies showed that the long-term follow-up of laser peripheral iridotomy

might not be satisfactory.[13]

Nd:YAG laser iridotomy has largely superseded operative peripheral iridectomy in the treatment of angle closure glaucoma. Laser surgery is more convenient and less costly than operative surgery.[3] While the risks of endophthalmitis and flat anterior chamber are removed by Nd:YAG laser iridotomy, laser surgery remains an invasive treatment.[14] To the best of our knowledge, the strength of this paper is the number of primary angle-closure glaucoma eyes included being much greater than those in the previous studies. The aims of this study were to evaluate the outcomes of Nd:YAG laser iridotomy on intraocular pressure (IOP) in patients with primary angle-closure glaucoma in East Azerbaijan state, because all primary angle-closure glaucoma cases from all the East Azerbaijan states are referred to our Ophthalmology Department of Tabriz Medical Sciences University for Nd:YAG laser iridotomy.

Patients and Methods

Between February 1 2005 and February 31 2008, a sample of individuals who had been diagnosed with primary angle-closure glaucoma and who had undergone Nd: YAG laser iridotomy at Department of Ophthalmology, Nikookari Eye Hospital, Tabriz University of Medical Sciences were reviewed. Information collected included age, sex, visual acuity, IOP, optic disc atrophy grading for the presence of glaucomatous optic neuropathy (Cup), standard automated perimetry (SAP) for damage and the results of medical and surgical treatment during the follow-up period. All of the patients received maximal medical treatment initially. Following informed consent the Nd: YAG laser iridotomy had been performed 2 to 5 days after the attack when corneal oedema decreased and the pressure had been controlled medically in acute primary angle-closure glaucoma. This was followed routinely by prophylactic Nd: YAG laser iridotomy in the fellow eye. All the patients fulfilled the following criteria: primary angle-closure glaucoma diagnosis (blurred vision or haloes around lights, raised IOP, and shallow anterior chambers or closed angles on gonioscopy). If the pressure remained uncontrolled with medication, after Nd: YAG laser iridotomy, further surgery was done without delay. A classification system was used to characterize visual field defects. The global indices of perimetry such as mean deviation, glaucoma hemifield test, and pattern standard deviation (PSD) of the visual fields were documented. All of the eyes had no history of intraocular surgery. Data were expressed as Mean ± SD. These were analyzed with the paired T test. Statistical significance was set at $p < 0.05$. The Statistics Package for Social Science (SPSS 16.0) was used for statistical analysis.

Results

A total of 244 patients with primary angle-closure glaucoma (244 eyes) treated with Nd: YAG laser iridotomy met the inclusion criteria. There were 85 (34. 8%) males and 159 (65. 2 %) females and mean age was 64.60±9.49 years. Demography of the study participants are shown in Table-1. The mean follow-up period was 21.59 ± 12.37months. The mean presenting IOP was 57.17±14.94 mmHg. Ninety -seven eyes (39.75%) had chronic primary angle closure glaucoma, 147 eyes (60.25%) had acute primary angle closure glaucoma. The differences between preoperative and last postoperative IOP were statistically significant in the chronic and acute primary angle closure glaucoma ($p<.0$ 0.1). Gonioscopic qualitative widening of the angle was achieved in 91% of eyes after laser treatment, most also had some areas where peripheral anterior synechiae were present in 41 % of eyes. The mean vertical cup-to disc ratio was 0.71 ± 0.17. The duration of symptoms before consultation was from 2 to 5 days in acute primary angle closure glaucoma patients. The number of applications for Nd:YAG laser iridotomy ranged from 11 to 48 spots. The short-term complications included transient iris bleeding and post-laser iridotomy IOP spike. IOP increased in approximately 32% of eyes after laser

Table-1: Demographic and clinical characteristics of the study population.

Variable	Frequency (n=244)
Age (mean ± SD	64.60±9.49 years
Sex (Male : Female)	85:159
follow-up period	21.59 ±12.37months
The mean presenting Intra ocular pressure (mean ± SD)	57.17±14.94 mmHg
Last Intra ocular pressure(mean ± SD)	17.34± 8.82
Only Nd:YAG laser iridotomy treatment	37(15.2 %)
Additional treatment	207(84.8%)

Table-2: Visual field defect in Acute Angle closure glaucoma patients.

Nasal Step	4.7%
Para central	5.8%
Arcuate Scotoma	25.6%
Peripheral Scotoma	15.1%
Severe All Field	36%
Normal	12.8%

Table-3: Additional treatment in eyes with primary angle-closure glaucoma (PACG) and Nd:YAG laser iridotomy for control of the intraocular pressure.

Additional treatment	No	Percent
Only YAG PI	37	15.2
Yag PI + Medication	152	62.3
Trabeculectomy	23	9.4
Phaco	18	7.4
CPC	6	2.5
Phaco and trab	8	3.3
Total	244	100.0

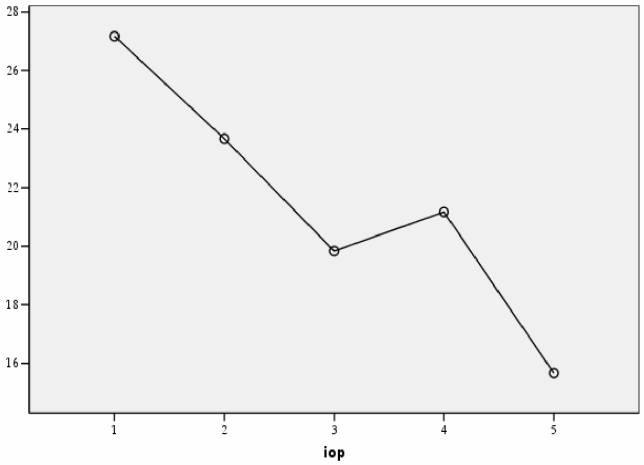

Figure: The error bar represents the mean IOP (mm Hg) and 95%CL of presumed intraocular pressure repeated measurement over time (five follow up).

iridotomy. Antiglaucoma medication and oral acetazolamide were given if IOP was more than 25 mmHg. The IOP spike 5 resolved by the first week postoperatively. The mean IOP after one day treatment was 23.67±14.33 mmHg. Two hundred seven (84.8%) eyes developed a subsequent rise in IOP during follow-up after Nd:YAG laser iridotomy. Only 37 (15.2%) eyes were controlled with Nd:YAG laser iridotomy without additional medication. One hundred fifty two (62.3%) eyes required further medical treatment to control IOP. There was no significant difference in the proportion of eyes successfully controlled with Nd:YAG laser iridotomy alone (p = 0.36) or requiring medication (p = 0.62) in the 2 sexes. In the follow-up period, 23 eyes (9.4%) required trabeculectomy surgery for poorly controlled IOP. Eight (3.3%) eyes underwent combined trabeculectomy with cataract extraction and lens implantation. The difference in the proportion of eyes requiring surgery in the 2 sexes was not statistically significant (p = 0.42). The mean first IOP after Nd:YAG laser iridotomy was 21.64 ± 11.79 mmHg. The mean IOP was 17.94 ± 17.34 mmHg. The mean first vertical cup-to disc ratio was less than 0.5 in 113 (46.2%) and the mean cup-to disc ratio was less than 0.7 (43.8%). The mean visual acuity was less than 7/10 in 115 (47.15%) at first and less than 5/10 (43.03) eyes at last. IOP follow up had decreased in 138 eyes (56.6%), increased in 88 (36.1%) eyes and had no change in 18 (7.4%) eyes. Visual acuity follow up had decreased in 86 (35.2%) eyes, increased in 66 (27%) eyes and had no change in 92 (37.8%) eyes. vertical Cup-to disc ratio follow up had increased in 87 (35.65%) eyes and had no change in 157 (64.35%) eyes. The mean perimetry parameters for mean deviation (MD) were -13.56±11.40 DB and for pattern standard deviation (PSD) was 5.66±3.28 DB. Demographic and clinical characteristics of the study population are shown in the Table-1. Severe visual field defect that involved all quadrants were seen in 36% of patients (Table-2). Peripapillary Retinal nerve fiber layer (RNFL) thickness was automatically calculated by Fast RNFL thickness of Stratus optical coherence tomography (OCT 3000). Average Retinal nerve fiber layer (RNFL) thickness for the affected eyes was correlated with the interval of follow-up by using inverse regression analysis (P <0.002; R2 _ 0.72). Additional treatment for control of the intraocular pressure are shown in Table-3. The error bar represents the mean IOP of five follow up 95%CL of presumed intraocular pressure repeated measurement are shown in Figure-1.

Discussion

Pupillary block is a significant mechanism causing angle-closure glaucoma. Nd:YAG laser iridotomy is effective in widening the drainage angle and reducing IOP in eyes with primary angle-closure.[13] Primary angle-closure is conventionally treated with laser peripheral iridotomy, followed by antiglaucoma medication, and then surgery if necessary. Previous studies have shown that laser iridotomy is effective for IOP control in Caucasians.[3,10] However, reports from Asian populations[13,15] showed that Nd:YAG laser iridotomy might be inadequate to maintain IOP control in the long term medication. Ablation of the ciliary body (cycloablation) is a recognized therapeutic approach to the refractory glaucoma. Diode cyclophtocoagulation decreases IOP more effective in refractory glaucoma.[16] In our study, 6 eyes (2.5%) underwent Diode laser cyclophtocoagulation for low vision refractory glaucoma. Nolan et al[15] examined 164 eyes of 98 Mongolian subjects with primary angle-closure and found that iridotomy failed in 47% of eyes with established optic neuropathy. Alsagoff et al[8] studied 83 eyes with PACG of different Asian ethnicities (e.g. Chinese, Malay,Indian) and found that 53% of eyes became medically uncontrolled after laser iridotomy. We noted similar findings, that 40.7% of eyes with AACG and 20.4% eyes with CACG required filtering surgery because of poorly controlled IOP. Nd:YAG laser iridotomy alone may be ineffective for IOP control in most Taiwanese eyes with PACG. YAG laser is now at the forefront of treatment for AACG and usually as the first line treatment, because there is no need for anaesthesia and theatre time. In our study only 37 (15.2%) eyes were treated with Nd: YAG laser iridotomy alone without rise in IOP and 152 (62.3%) eyes required further medical treatment to control IOP. Other studies put this figure between 19% and 24%. Chen et al noted similar findings, that 51.9% of eyes required medical treatment to control IOP because of poorly controlled IOP.[13] Nd:YAG laser iridotomy alone may be ineffective for IOP control in most eyes with PACG.[13] In our stady 23 (9.4%) eyes underwent trabeculectomy, 18 (7.4%) eyes had cataract extraction, because of poorly controlled IOP. Chen et al found that 88.2% patients experienced an IOP

rise after Nd:YAG laser iridotomy within the first month and 11 (40.7%) eyes required filtering surgery because of poorly controlled IOP.[13] Post-laser iridotomy IOP spike, different kinds and dosing patterns of drugs and patient compliance may affect long-term outcome. In ours and Chen et al[5] study in all patients, Nd:YAG laser iridotomy was performed first, but in some cases followed by medication and surgery. It seems that long-term IOP control might be inadequate by Nd:YAG laser iridotomy only. Close monitoring of IOP at frequent intervals after Nd: YAG. Our study showed that eyes with AACG needed more medical treatment and surgical intervention, which is consistent with earlier reports. Eyes with AACG may have had some degree of permanent angle damage and diminished outflow after acute episode. Also, there is potentially increased angle crowding by progressive lens swelling. Although the mechanisms causing alterations in lens metabolism are unknown, more rapid cataract formation was noted after acute angle closure.[17-20] Also, Asian eyes tended to have more severe attacks with longer duration. Perimetry is the gold-standard for monitoring functional assessment and severity of damage in progression of glaucomatous damage rather than for initial diagnosis in glaucoma and showed severe visual field defect that involved any quadrants.[20] Why did YAG laser iridotomies do less well than expected? It would appear that who had a Nd-YAG laser iridotomy as the initial procedure (YPI) had a significantly greater risk of needing a second surgical procedure (repeat YPI, surgical iridectomy, or trabeculectomy). Furthermore after Nd: YAG laser iridotomy, in patients with the longest duration of symptoms (and presumably in those with advanced chronic angle damage),a delay in presentation, elderly patient , duration of the acute attack, iridotomy followed, if necessary, by medical therapy and trabeculectomy has been reported to be an effective method of dealing with this problem. Our paper showed that YAG laser iridotomy was more successful in the patients presenting early when compared with a patient presenting late . These factors might contribute to the failure of IOP control and more surgery can be needed in AACG eyes. Documentation by UBM or OCT would be advised. The long-term effect of laser iridotomy in patients with angle closure depends on how successfully the angle is opened. In our study the angle of 222 eyes (91%) were opened after Nd:YAG laser iridotomy.

Conclusion

Eyes with primary angle-closure glaucoma subjected to Nd:YAG laser irodotomy required medication and surgery. Early phacoemulsification proved more effective.

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