

COMPARING THE EFFECTIVENESS OF LASER THERAPY, MEDICAMENTS AND SURGICAL TREATMENT IN PATIENTS WITH ANGLE CLOSED GLAUCOMA

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Received: 21.04.2020.

Accepted: 12.06.2021.

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ABSTRACT

The study goal was to compare the efficiency of the medicaments, laser and surgical treatment in the patients with primary angle closure glaucoma (PACG) in order to achieve: normalization of intraocular pressure (IOP), maintaining the useful visual acuity and stabilization of visual field loss. All patients were treated at Clinic of Ophthalmology of Clinical Centre Kragujevac in Kragujevac, Serbia, in the period from June 15, 2010 to June 15, 2014. There were 116 patients in this study. They diagnosed with PACG, and they had been adequate selected for this study. They were treated with: medicaments; Nd:YAG (Neodymium:Yttrium Aluminum Garnet) laser iridotomy, and glaucoma surgery. Clinical ophthalmology controls have been introduced once or twice a month, and the vision field loss was tested three times every year. During the monitoring period of one year: no statistically significant difference occurred in terms of changes of the visual acuity among the three study-groups. The best IOP regulation was achieved after the laser treatment (53.4%), followed by the surgical treatment (28.5%), while the weakest was recorded in patients treated with the medicaments (18.1%). The percentage of the visual field loss was the biggest of patients treated with the medicaments (57%), and then the patients treated with the laser iridotomy (35%), while the least one occurred of the patients with the surgical treatment (23%). In the laser-treated group of 62 patients, the frequency of complications was 17.8%; while the out of 33 patients who had been treated (surgical), the frequency of complications was 19%. Laser iridotomy was shown to be effective of 89.5% of study-patients with PACG, while non-reactive study-patients underwent to the trabeculectomy. In addition to the high efficacy of Nd:YAG laser iridotomy in regulating of IOP values of the patients with PACG, the advantage of laser-method was in: the maneuvering of outpatients, it was easy to do, had a short lead time and was used in local anesthesia.

Keywords: Glaucoma, primary angle closure glaucoma, patients, therapy, iridotomy Nd:YAG laser.



UDK: 617.7-007.681-08
Eabr 2023; 24(3):213-218
DOI: 10.2478/sjocr-2021-0050

INTRODUCTION

Glaucoma is an optic neuropathy characterized by loss of retinal ganglion cells and atrophy of the optic nerve, with an increase of intraocular pressure (IOP). The angle closure, in primary angle close glaucoma is cause of 50% of all blindness in the world. It is the most destructive form of the progressive glaucoma disease (1).

The primary angle closure glaucoma occurs of a positive family anamnesis, in later life (years), more often in women and the people of Asian than European areas (origin) (2). Primary angle closure glaucoma is one of the rarest diseases in ophthalmology whose outcome must be largely predicted in relation to the anatomical predisposition of the eye (1, 2). The mechanism of IOP increase during PACG is: pupillary block, anterior chamber angle block in the root part of the iris, ciliary body edema and its forward positioning, etc (2).

The neodymium YAG laser is a photo-disruptor which emits radiation near the infrared part of the electromagnetic spectrum, and whose wavelength is 1065 nm. Indications for Nd:YAG laser iridotomy are: primary angle closure glaucoma, acute, intermittent and chronic glaucoma, the paired eye in the patients suffering from acute glaucoma, narrow angles suitable for closure, secondary angle closure with pupillary block, and the glaucoma formed by combined mechanisms (2).

With our laser treatment, our patients were painless and pain-free; easily tolerate intervention, which does not take too much time; it is also suitable for the ambulant patients, and without possible risks in general anesthesia (3).

The rare complications of Nd:YAG laser iridotomy of the clinical treatment are: corneal burns, macular burns, opalescence of lens, damages of blood vessels, dispersion of iris pigment, retinal detachment (ablation of chorioretina), etc. Patients sometimes have some pain, some blurred of the vision, blinding sensations and diplopic (4).

PATIENTS AND METHODS

This study was cohort, interventional and with "before and after" analysis. All study-patients were treated at Clinic of Ophthalmology of Clinical Center Kragujevac in Kragujevac, Serbia, in the period from June 15, 2010 to June 15, 2014. There were of 116 patients, aged 41-80 (years), gender equality, with diagnosis of PACG. All study-patients were adequately selected (included or excluded) in this study.

The detailed ophthalmological examination was performed, which included: measurement functional visual acuity (Snellen-tables), measurement IOP (Goldmann's applanation tonometry), bio-microscope examination (slit lamp), gonioscopy (Goldmann's glass with three mirrors), ophthalmoscopy with three mirrors, and the static perimetry. Depending on the clinical stage of glaucoma disease, study-patients are treated with: medicaments, laser (Nd:YAG laser iridotomy by *Carl Zeiss's* slit lamp) and by the surgical method.

Ophthalmological examinations were performed once or twice a month. Visual field was inspected and analysis a three times per year. There were the total of 33 patients, who were surgically treated in this study. The average age of patients was 64 years old, while the age interval was from 51 to 77 years.

Conditions and indications for performing iridotomy with Nd:YAG laser were: transparent all ocular media in front of the target tissue, the existence of the anterior chamber of the eye with minimal depth, etc.

The statistical method included: comparison of mean values of numerical variables between the three examined groups using Hi-quarry (χ^2 -test; $p>0.05$).

For the statistical data processing, the authors used statistical program SPSS, version 20.

The results of the study are presented in tables and graphs (figures).

The consent of the regional Ethics Committee of the Clinical Center of Kragujevac in Kragujevac, Serbia, was obtained for this study.

RESULTS

During one-year study of follow-up and analysis, the authors did not notice statistically significant differences in changes of visual acuity between the three study-groups of treatment (Nd:YAG laser iridotomy, surgical therapy, medicaments therapy) ($p>0.05$), Table 1, Table 2.

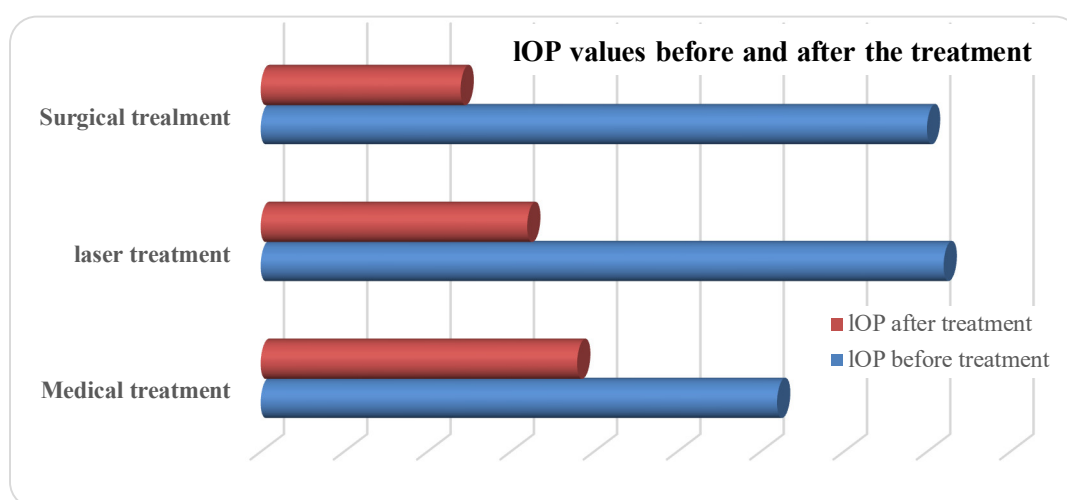
Table 1. Functional visual acuity (Snellen-tables) before Nd:YAG laser iridotomy, surgical therapy and medicaments

Visual Acuity	L+	0,01	0,05	0,06	0,1	0,2	0,3	0,4	0,7	0,8	0,9	1,0
Surgical		1	1		6	5	6	4	1	9		
Laser		2	3	5	9	7	8	9	9	10		
Medicaments					2	1	2	5	5		6	

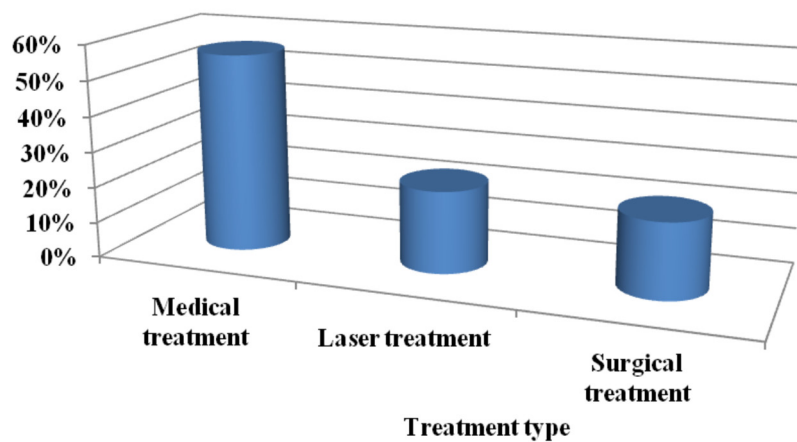
Table 2. Functional visual acuity (Snellen-tables) after Nd:YAG laser iridotomy, surgical therapy and medicaments

Visual Acuity	L+	0,01	0,05	0,06	0,1	0,2	0,3	0,4	0,7	0,8	0,9	1,0
Surgical	1	2	2	3	4	3	4	4	5	5		
Laser		4	5	6	9	6	8	8	7	9		
Medicaments				1	2	2	3	4	4	5		

The best regulation of IOP was achieved after laser treatment (53.4%), i.e. there was a very significant difference in IOP after treatment between laser treatment ($p<0.01$) and surgery (31%); there was also a significant difference in IOP after surgery compared to preoperative IOP values ($p<0.01$). The worst effect was observed in patients who were on medicaments treatment (19%); however, there was still a significant difference compared to IOP values before the medicaments ($p<0.05$), Figure 1.

Figure 1. IOP values (mmHg) before and after Nd:YAG laser iridotomy, surgical treatment and medicaments

Visual field loss was most pronounced in the patients treated with medicaments (56%), followed by patients treated with laser (23%), while it was lowest in patients treated surgery (21%), ($p<0.05$), **Figure 2.**

Figure 2. Percentage of visual field loss of relative type of the therapy

The significant decrease of IOP, the changes in functional visual acuity and the stability of changes in visual field (after laser treatment of iridotomia, ($p > 0.05$)) was shown, as prevention of the development of primary angle closure glaucoma, and stopping and/or slowing the progression of glaucoma disease.

In the group of 62 patients who were laser treated, 8 of them experienced increase of IOP; 5 of them experienced the iridotomy closure, while 3 patients experienced to the iritis. The frequency of complications was 17.8%, while of 33 operated patients the frequency of complications was slightly higher (19%).

DISCUSSION

Nd:YAG laser iridotomy has the great importance in the treatment of PACG, especially in acute glaucoma, as well in preventing the onset of acute attack in both eyes (responsible potential risk factors for acute angle closure glaucoma) (4).

Our results were: regulation of IOP was achieved by laser treatment (53.4%), surgical treatment (28.5%), while the least regulated was observed in the patients treated with medicaments (18.1%). The percentage of visual field loss was highest in the patients treated with medicaments (57%), followed by those treated with laser (35%), while the lowest loss occurred in the patients treated with surgery (23%). The incidence of laser-treated complications was 17.8%. In 33 patients, who were treated surgically, the frequency of complications was 19%. Laser iridotomy has been shown to be effective in 89.5% of our patients with PACG.

In many studies, laser treatment has been shown in 80% effective in the eyes with PACG, but it should be noted that the angle remains open after laser iridotomy and/or when the IOP is normal (5). In our study, the best regulation of IOP was achieved after laser treatment in 53.4% of patients.

Other authors have shown that laser iridotomy is responsible for the slow progression of visual field loss in angle closure glaucoma (6, 7). In our study, the loss of visual field in the patients treated with laser treatment was 35%.

In manuscript published by Singh P et al, about the efficacy of peripheral laser iridotomy, the authors demonstrated in 78% of the eyes with normal IOP after the Nd:YAG laser iridotomy (8), but in our study the best regulation of IOP was achieved after laser treatment of 53.4%.

Many studies indicate that surgical treatment of acute primary angle closure glaucoma (treatment strategies) has been reported, not only with risk and complication (our complications - 17.8%), but also with the consequential and final economic costs, evidences and economical considerations (9). Our research also confirms the facts presented by the mentioned authors, but we did not rely directly on the economic status of options in the treatment of angle closure glaucoma.

Many studies have shown that the indications for performing Nd:YAG peripheral laser iridotomy are: clinically significant or suspected pupillary block, as well as prevention of acute and/or chronic angular block, and bilateral localization (10), and have shown potential risk factors for acute glaucoma (11), and which opinions we share. Our results showed that laser peripheral iridotomy reduces the occurrence of primary angle closure glaucoma, and prevents the development of acute glaucoma of the other eye.

Chung HJ and co-authors indicated that complications of laser iridotomy were rare both yesterday and today (12), as shown by our clinical study.

A comparison of the laser iridotomy with the short duration of 532 nm Nd:YAG laser (Pascal) of a conventional laser in dark irises indicates better results (12), as some as in our experience.

Mingguang H et al have shown that laser effects and prophylaxis are better if laser iridotomy is performed in the lower quadrants, and in bilateral treatment (13), but our better experience has been associated with localization in the upper quadrants, contrary to the above recommendation, but the same of laser bilateral treatment.

Many authors presented the long term results of laser intervention after acute angle closure (in contrast to the lateral eye), after 6 years of follow-up, when glaucoma progression was present in 2.5% of patients, and 80% of patients maintained good functional visual acuity (14, 15), which is also indicated by our experience.

Flores-Sanchez et al have shown that laser prophylaxis of the patients with an acute attack was safe and effective in preventing angle closure glaucoma, and preventing long term increase IOP (16), which largely coincides with our study.

Jong VL et al pointed to prognostic factors for the success of laser iridotomy in acute angle closure glaucoma (17), and which are the subject of our future research, which will continue on this topic.

Lingam Vijaya et al suggested that glaucoma surgery, i.e. that the trepanotrabeculectomy was effective, but the operation was associated with an increased risk for postoperative cataract development, which will lead to the shallower anterior chamber and the other complications in glaucoma surgery (18), and which to indicated of the monitoring of our patients in postoperative course, too.

Laser peripheral iridotomy (LPI) in primary and acute angle closure glaucoma increased the angle width in all stages of primary angle closure, and had a good safety profile. There were limited data on the comparative efficacy of LPI versus the other treatments for the various stages of angle closure glaucoma, as a different efficacy of laser treatment (19, 20, 21), but which will be the subject in our future research.

CONCLUSION

The use of the laser therapy in the patients with acute closure glaucoma does not cause significant side effects, and leads to the prevention of primary angle closure glaucoma: significant reduction of IOP, minimal changes of functional visual acuity and stability the changes in visual field. The best regulation of IOP is achieved after laser treatment compared to surgical and medicaments treatments. This is one of the reasons why authors tend to choose Yag-laser method, when it is possible. The patients with the low risk of glaucoma progression should be treated with medicaments and laser iridotomy was also acceptable. The patients with high risk of glaucoma progression should be treated with the laser iridotomy and/or surgically. Apart from the great efficiency of Yag-laser iridotomy of IOP regulation in eyes with PACG: advantages of this method lay in possibility of outpatient treatment, the local anesthesia instead of general one, the comfort ability and the efficiency.

This original manuscript contains data that could be used to the clinical practice of ophthalmology. The topic covered of our study is always actual and applicable in every day in the clinical practice.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted in accordance with the Declaration of Helsinki and was approved by Ethics Committee of the Clinical Center of Kragujevac in Kragujevac, Serbia. All patients gave their informed consent for inclusion before they participated in the study.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

FUNDING

This work was supported by the Faculty of Medical Sciences, University of Kragujevac (Junior Project 23-10).

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