

CHINESE MEDICAL SCIENCES JOURNAL

ORIGINAL ARTICLE

Factors Related to Prognosis of Refractory Glaucoma with Diode Laser Transscleral Cyclophotocoagulation Treatment

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Key words: predictive factor; diode laser; transscleral cyclophotocoagulation; intraocular pressure

Objective To evaluate the predictive factors of refractory glaucoma treated with diode laser transscleral cyclophotocoagulation (TSCP) in a midterm observation.

Methods Fifty-four consecutive patients (54 eyes) with refractory glaucoma were enrolled and underwent TSCP (power of 1.5-2.0 W, exposure time of 2 seconds and 20-50 applications). Patients were regularly followed up for 12 months. Intraocular pressure (IOP) was measured before TSCP treatment and at each follow-up visit. Patients were divided into the sensitive and insensitive groups according to the effect of a single treatment of TSCP on IOP. The success rate was defined as the percentage of eyes achieving an IOP between 5 and 21 mm Hg following TSCP therapy at their final follow up visit. Difference of age between the sensitive and insensitive groups was evaluated with Independent-samples T test and that of gender distribution of two groups was evaluated with Fisher's exact test. The success rate of different types of glaucoma to TSCP was calculated.

Results A total of 32 patients were sensitive to TSCP (sensitive group) and 22 patients were insensitive to TSCP (insensitive group). The success rates of female (77.8%, 14/18) and cases being over 50 years (71.4%, 20/28) were higher than those of male (50.0%, 18/36) and ones being under 50 years (46.2%, 12/26) (all $P > 0.05$). The age of the sensitive and insensitive groups was 56.0 ± 15.5 and 46.4 ± 15.4 years, respectively ($P = 0.029$). The age ($P = 0.029$) and gender distribution ($P = 0.046$) of the two groups had significant difference. The success rate of neovascular glaucoma, primary angle-closure glaucoma, primary open angle glaucoma, traumatic glaucoma, uveitic glaucoma, and secondary glaucoma after silicone oil injection to TSCP was 57.1%, 100.0%, 50.0%, 20.0%, 81.8%, and 0%, respectively.

Conclusion Age, gender, and type of glaucoma appear to be associated with effect of TSCP on IOP control.

Chin Med Sci J 2011; 26(3):137-140

CONTACT diode laser transscleral cyclophotocoagulation (TSCP) has been widely accepted as an effective and relatively safe procedure for reducing intraocular pressure (IOP) of glaucoma patients who are resistant to conventional treatments.^{1, 2} Compared with other cyclodestructive modalities, TSCP appears to have better outcome, less inflammatory response, and minor visual acuity damage.³ However, the outcome of TSCP therapy for refractory glaucoma is unpredictable, such as there was no identified association between total diode laser energy delivered and the change in IOP.⁴⁻⁶ In addition, no consensus exists between efficacy of TSCP and age, gender, type of glaucoma, etc.⁶⁻⁹ The goal of the study was to identify possible predictive factors that could help establish optimum management planning.

PATIENTS AND METHODS

Patients

During January 2008 to August 2008, a total of 54 consecutive refractory glaucoma patients (54 eyes), who undergoing TSCP therapy in the Department of Ophthalmology of Peking Union Medical College Hospital, were enrolled in this study. Inclusion criteria for TSCP therapy were as follows: (1) advanced glaucoma patients with inadequate IOP control by maximum tolerated medical therapy; (2) advanced glaucoma patients who had the failed filtration surgery in the past, or for whom filtration surgery was declined or deemed to present a high risk of failure; (3) severe ocular hypertension causing pain and/or corneal edema. Criteria of exclusion were the best-corrected visual acuity of 6/20 better and presence of sclera thinning. The following data: patients' age, gender, glaucoma diagnosis, antiglaucoma medications, slitlamp biomicroscopic appearance and type of prior anti-glaucoma surgeries, were recorded. All of the enrolled patients signed informed consent for TSCP treatment.

Follow-up examinations were performed at 1 day, 1 week $\pm$ 1 day, 2 weeks $\pm$ 2 days, 1 month $\pm$ 1 week, 3 months $\pm$ 1 week, 6 months $\pm$ 2 weeks, and 12 months $\pm$ 4 weeks after the initial TSCP treatment.

TSCP

TSCP was performed under retrobulbar anaesthesia with 2% lidocaine. G probe was used in our treatment which was attached to the Oculight SLx semiconductor diode laser (Iris Medical Instruments Inc, CA, USA). Each laser photocoagulation treatment included 20–50 applications of 1.5–2.0 W energy applied for 2 seconds to treat about 270 degrees of the ciliary body excluding the temporal qua-

drant. The laser energy was adjusted individually according to appearance of the popping sound.

IOP measurement

IOP was measured with Goldmann applanation tonometer (GAT, HAAG-STREIT, Bern, Switzerland) before treatment and at each follow-up. Patients achieving an IOP of less than 21 mm Hg 4 weeks after the initial TSCP treatment and without IOP rebound during the 12-month follow-up were considered to be sensitive to TSCP. Hypotony was defined as an IOP of less than 5 mm Hg at the final follow up visit. TSCP therapy was repeated if the IOP was still above 21 mm Hg with maximum medical therapy 4 weeks after the initial TSCP treatment or IOP increased to 21 mm Hg or higher at the final follow-up visit. Patients who needed repeated TSCP treatment during 12-month follow-up were insensitive to TSCP. The success rate was defined as the percentage of eyes achieving an IOP between 5 and 21 mm Hg following TSCP therapy at their final follow-up visit.

Statistical analysis

Statistical analysis was performed using SPSS 11.0. Difference of age between the sensitive and insensitive groups was compared with Independent-samples T test and that of gender distribution of two groups was compared with Fisher's exact test. The success rate of different types of glaucoma to TSCP was calculated. A *P*-value < 0.05 was considered significant.

RESULTS

In the 54 enrolled patients, 36 were male and 18 were female. The mean age was 52.1 $\pm$ 16.2 years, and 28 cases were over 50 years, 26 cases under 50 years. The diagnostic categories of glaucoma included neovascular glaucoma (NVG; 52.0%, 28/54), primary open angle glaucoma (POAG; 7.4%, 4/54), primary angle-closure glaucoma (PACG, 7.4%, 4/54), traumatic glaucoma (9.3%, 5/54), uveitic glaucoma (20.4%, 11/54) and secondary glaucoma after silicone oil injection (3.7%, 2/54).

Thirty-two patients were sensitive to TSCP (sensitive group), including 18 male and 14 female, aged 56.0 $\pm$ 15.5 years. The IOP of 87.5% (28/32) patients was between 5 and 21 mm Hg at the final follow-up. In this group, hypotony occurred in 12.5% (4/32) patients. The pre-treatment IOP was 44.7 $\pm$ 14.4 mm Hg. The post treatment IOP was 26.5 $\pm$ 11.6 mm Hg on postoperative day 1, 22.1 $\pm$ 9.7 mm Hg at 1 week follow-up, 16.5 $\pm$ 5.1 mm Hg at 1 month follow-up, 15.4 $\pm$ 5.3 mm Hg at 6 months fol-

low-up, and 14.8 ± 5.5 mm Hg at 12 months follow-up.

Twenty-two patients were insensitive to TSCP (insensitive group). This group included 18 male and 4 female, aged 46.4 ± 15.4 years. Ten patients refused TSCP re-treatment. Twelve patients required a second sitting of TSCP treatment at the 4th week after initial treatment, and eight of them received a third treatment during 4-6 months after the initial treatment. The average IOP was 47.7 ± 10.7 mm Hg at baseline and decreased to 32.6 ± 7.5 mm Hg, 27.7 ± 9.7 mm Hg, and 27.4 ± 8.0 mm Hg at 1 day, 1 week, and 1 month after the initial treatment. The IOP of 12 patients receiving a second sitting of TSCP treatment decreased to 25.5 ± 10.6 mm Hg, and that of 8 patients undergoing the third time treatment was 24.7 ± 9.8 mm Hg.

Satisfactory outcomes occurred in female and old patients. The success rates of female (77.8%, 14/18) and cases being over 50 years (71.4%, 20/28) were much higher than those of male (50.0%, 18/36) and ones being under 50 years (46.2%, 12/26) (all $P > 0.05$). The age of the sensitive and insensitive groups was 56.0 ± 15.5 and 46.4 ± 15.4 years, respectively ($P = 0.029$). The age ($P = 0.029$) and gender distribution ($P = 0.046$) of the two groups had significant difference. Of all glaucoma categories, the best outcome occurred in eyes with PACG, which had the highest success rate (100.0%). The success rates of other categories were: 81.8% in uveitic glaucoma, 57.1% in NVG, 50.0% in POAG, 20.0% in traumatic glaucoma, and 0% in secondary glaucoma after silicone oil injection. The most common type of glaucoma in this study was NVG. There were 28 NVG patients, including 18 male and 10 female. The success rates of male and female NVG patients were 44.4% and 80.0%, respectively.

DISCUSSION

Although TSCP has been widely accepted as an effective procedure to treat refractory glaucoma, the fact is that TSCP is not effective to all kinds of glaucoma patients. Because there are high interindividual differences, to evaluate patient's sensitivity to TSCP before treatment can increase success rate and reduce incidence of hypotony.

The most frequently used way to explore predictive factors in previous studies is to sort and class patients by age, gender and type of glaucoma and to calculate the success rate in each class. In our study, to address the correlation between effect of TSCP and patient characteristics, we divided patients into the sensitive and insensitive groups according to whether IOP could be well controlled after the initial treatment. The differences of these two groups in age and gender distribution were evaluated.

Due to the limited sample numbers, we used the success rate to evaluate the sensitivity of different types of glaucoma to TSCP.

The result demonstrated age was a predictive factor of TSCP treatment. This finding was consistent with the results of references 8 and 9. A study focused on post-traumatic glaucoma and glaucoma in aphakia also demonstrated that effect of TSCP was better in the older than that in the younger.¹⁰ Gender was demonstrated to be associated with effect of TSCP treatment in this study. Female was more sensitive to TSCP than male. This was consistent with findings of a retrospective study in which treatment failure was found to be associated with male (multivariate regression analysis, $P = 0.008$).⁶ When we analyzed the glaucoma types by gender, we noticed that most uveitic glaucoma patients were female, while most NVG patients were male. Owing to this, we regarded that the difference in sensitivity between male and female had no relation to the different composition of glaucoma type.

Many retrospective studies have showed that success rate is different in different types of glaucoma. A high success rate was achieved in inflammatory glaucoma (77.3%-85.0%)^{9, 11, 12} and POAG (89.5%).⁹ The results were relatively poor in traumatic glaucoma (57.1%), aphakic glaucoma (57.1%), and congenital or juvenile glaucoma (62.5%).^{9, 10} More than one TSCP was performed in 85% of glaucoma cases in aphakia and 76% of post-traumatic glaucoma cases.¹⁰ In our study we found uveitic glaucoma and PACG were sensitive to TSCP, while traumatic glaucoma and secondary glaucoma after silicone oil injection were insensitive to TSCP. Female NVG patients were sensitive to TSCP, while male NVG patients were insensitive to TSCP.

In conclusion, success of TSCP treatment depends on age, gender of patients, and glaucoma type. Individual treatment protocol should be made according to these predictive factors before TSCP application.

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Erratum

In Vol. 26, Issue 2, the list of authors and their affiliations for the article "Alpha-Galcer Administration after Allogeneic Bone Marrow Transplantation Improves Immune Reconstitution in Mice" should be as follows:

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