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Transescleral cyclophotocoagulation treatment for painful eye with glaucoma neovascular

Tratamento do olho cego dolorosopor glaucoma neovascular com ciclofotocoagulação transescleral

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Abstract

Objective: *To evaluate the effectiveness and safety profile of standard transescleral cyclophotocoagulation (CTCTE) and its technical variation of slow cooking (CTCTE SC) in patients with neovascular glaucoma pain.* ***Methods:*** *Patients underwent ophthalmological examination, grading their pain level through a graphical / numerical scale and divided into two groups, one for treatment with CTCTE and another CTCTE SC. Follow-up was performed on the first, thirtieth and ninetieth days.* ***Results:*** *Of the 26 patients included, 11 (42.3%) were male. The average age of the patients was 69 years. Of these, 16 patients underwent CTCTE treatment and 10 patients underwent CTCTE SC. Intraocular pressure (IOP) had a mean pre-treatment of 49 ± 23 mmHg in the CFCTE group and medians at the 1st, 30th and 90th postoperative days respectively: 32 ± 24 mmHg, 38 ± 18 mmHg, 43 ± 10 mmHg. In the group submitted to the CFCTE SC technique, the previous IOP was 54 ± 16 mmHg and averages on the 1st, 30th and 90th postoperative days respectively: 38 ± 22 mmHg, 39 ± 10 mmHg, 44 ± 09 mmHg. Pain reduction was effective in 88.4% patients. During the postoperative period, hyperemia, chemosis and hyphema were observed. No serious complications were observed.* ***Conclusion:*** *Painful blind eye treatment with low load transscleral cyclophotocoagulation was a safe and effective procedure for pain resolution, but presented a low level of intraocular pressure reduction in both techniques used.*

Keywords: *Eye pain, Blindness/etiology; Glaucoma, neovascular/surgery; Laser coagulation/methods*

Resumo

Objetivo: Avaliar a efetividade e o perfil de segurança da ciclofotocoagulação transescleral padrão (CTCTE) e sua variação técnica denominada slow cooking (CTCTE SC) em pacientes com olho cego doloroso por glaucoma neovascular. **Métodos:** Pacientes foram submetidos a exame oftalmológico, graduando o nível da dor através de escala gráfica/numérica e divididos em dois grupos, um para tratamento com CTCTE e outro CTCTE SC. O acompanhamento foi realizado no primeiro, trigésimo e nonagésimo dias. **Resultados:** Dos 26 pacientes inclusos, 11 (42,3%) eram do sexo masculino. A idade média dos pacientes foi de 69 anos. Destes, 16 pacientes foram submetidos ao tratamento CTCTE e 10 pacientes a CTCTE SC. A pressão intraocular (PIO) teve média pré tratamento de 49 ± 23 mmHg no grupo CFCTE e medias no 1º, 30º e 90º dias pós-operatórios respectivamente: 32 ± 24 mmHg, 38 ± 18 mmHg, 43 ± 10 mmHg. No grupo submetido a técnica CFCTE SC a PIO prévia foi 54 ± 16 mmHg e médias no 1º, 30º e 90º dias pós-operatórios respectivamente: 38 ± 22 mmHg, 39 ± 10 mmHg , 44 ± 09 mmHg. A redução da dor foi efetiva em 88,4% pacientes. Durante o pós-operatório foi verificado hiperemia, quemose e hifema. Não foram observadas complicações graves. **Conclusão:** O tratamento do olho cego doloroso com ciclofotocoagulação transescleral com baixa carga foi um procedimento seguro e eficaz na resolução da dor, mas apresentou um baixo nível de redução da pressão intraocular em ambas técnicas usadas.

Descritores: Dor ocular; Cegueira/etiologia; Glaucoma neovascular/cirurgia; Fotocoagulação a laser

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Introduction

Painful blind eye is a challenging disease in the ophthalmologist's routine due to the great impact on patients' quality of life. The main etiologies related to it are neovascular glaucoma (NVG), primary closed angle glaucoma, eye trauma, and bullous keratopathy. Such pathologies may trigger pain due to corneal decompensation, epithelial defects, inflammatory processes, increased intraocular pressure (IOP), and ocular ischemia.[1]

NVG is a severe form of secondary glaucoma resulting from the proliferation of fibrovascular tissue in the anterior chamber angle causing progressive angular closure. In a large percentage of cases, increased IOP is refractory to conventional treatment, and it is not unusual to lead to significant visual loss. [2] It is associated with multiple pathologies, 97% of which related to retinal ischemia, and the remaining 3% to intraocular inflammation. The ischemic entities responsible for most cases are diabetic retinopathy, central retinal vein obstruction (CRVO), and ischemic eye syndrome.[3] Retinal ischemia characterizing these pathologies triggers the release of factors such as the vascular endothelial growth factor (VEGF) promoting neovascular growth. Under these conditions, the main source of VEGF is Müller cells. Once released, it can stimulate the growth of the iris neovascularization in the anterior chamber and the camerular sinus.[4]

Ciliary body destruction has been used for treatment of glaucoma since the 1930s. Cyclodestructive procedures have gained an important role in the management of refractory glaucoma due to their effectiveness. Studies have reported success rates ranging from 60% to 90% in different cycledestructive techniques (cryotherapy, Nd-YAG, and laser diode).[5] The occurrence of complications such as low visual acuity, iritis, pain, bleeding, phthisis bulbi and hypotonia is high, so the patient should be carefully selected.[6]

Cyclophotocoagulation can be via endoscopic or transescleral transpupillary route (TSCPC), the latter being the most used one.[7] Histopathological analysis has shown that the use of TSCPC effectively induces a coagulative necrosis of the pars plicata with slight pars plana extension leading to unspecific destruction of the pigmented, unpigmented and capillary epithelium of the ciliary processes. This damage to ciliary processes is presumed to result in reduced aqueous production and reduced IOP.[8]

Diode laser TSCPC has been shown to be safer than other available procedures, such as cryotherapy and YAG laser which are associated with an increased risk of postoperative complications.[2,9] The main indications are patients with refractory glaucoma, neovascular glaucoma, and pain relief in those with high IOP associated with low visual acuity. The maximum suggested load of 60-80 J of energy per session is a safer approach to developing hypotonia and phthisis bulbi.[10] The standard technique uses an initial power of 1.75 W and duration of 2.0 seconds (3.5 J per application). With this technique, the power is adjusted to more 0.25 W if there is no "pop" or less if there is a "pop" during applications. Audible "pops" are now believed to indicate overtreatment, and their presence can be used to quantify laser parameters and that the maximum level of energy used should be slightly below the threshold required to produce said "pops". [11]

Slow TSCPC or slow cooking (TSCPC SC) is a technique based on iris pigmentation beign an estimate of laser energy absorption in the ciliary body. Eyes with darker pigmentation require less energy. For dark or light brown irises we use 1.25 W and 4.0 - 4.5 seconds, and eyes with other iris pigmentation are treated with 1.5 W and 3.5 to 4.0 seconds. TSCPC SC can achieve equivalent IOP control, reducing the incidence of prolonged postoperative inflammation compared with standard TSCPC. [12,13]

The present study aims to evaluate the effectiveness and safety profile of TSCPC and TSCPC CS in the management of patients with painful blind eye due to NVG, emphasizing the main causes of this entity, measuring pain, and determining the main side effects found.

Methods

A prospective study approved by the Ethics Committee of Centro Universitário Christus (Unichristus) under opinion No. 2,633,009 covering patients with painful blind eye due to NVG without improvement with topical treatment with corticosteroids and atropine. All patients underwent transscleral cyclophotocoagulation (TSCPC) with guidance on possible risks. Patients who used oral analgesic for pre and postoperative pain relief, patients with keratopathy, and with IOP lower than 21 mmHg after hypotensive eye drop suspension for 30 days were excluded.

Prior to the procedure, a complete ophthalmic clinical evaluation was carried out, confirming the absence of light perception by two examiners and spontaneous pain measurement by means of a colored graphical numerical scale ruler illustrated grading pain from 0-10, with 0 being without pain and 10 the most intense pain, in addition to blue to light and red to strong pain (Figure 1). A questionnaire was applied to record information such as gender, race, age, presence of comorbidities, cause of NVG, affected eye, and Goldmann applanation tonometry.

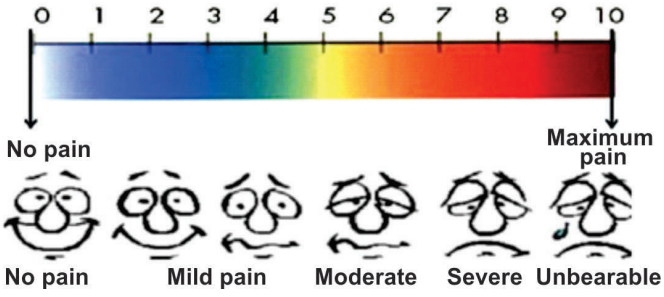

Figure 1: Graphical numerical scale used for pain measurement

Patients underwent a session of TSCPC with laser diode (810 nm) model OPTO FTC/TTT/i-PDT 2000 after retrobulbar block with 3 ml of xylocaine 2% by three experienced glaucoma specialists. The G-probe was positioned 1.5mm from the limb vertically. They were randomly separated into two groups, one using a protocol of TSCPC SC based on the technique proposed by Gasterland, 1.5 W for 4 seconds, 360 degrees using 3 points per quadrant, [13] regardless of the iris color, and another group in the standard model (TSCPC) with 2 W for 2 seconds, 360 degrees using 3 points per quadrant. In case of a "pop", the power would be reduced by 0.25 W. Both saving the region of 3 and 9 hours.

The prescription after the procedure was a weekly regressive topical corticosteroid every 6 hours for 30 days, and atropine 1% every 12 hours for 15 days. Ophthalmic and pain conditions were

followed up in the postoperative period on the first, thirtieth and ninetieth days. The treatment would be considered successful with pain grade lower than 3 and no need to use anti-inflammatory eye drops. A descriptive statistical methodology with measures of central dispersion and t-student statistical test was used considering significance with $p<0.05$ with the software JMP.

Results

In the present study, 28 eyes were selected from 28 patients. Two patients were excluded because they used oral analgesics in the immediate postoperative period. Of the 26 patients included, 11 (42.3%) were male and 15 (57.3%) female, of which 14 (53.9%) were right eyes and 12 (46.1%) left eyes. The average age of patients was 69 ±10 years. Of these, 16 patients underwent standard TSCPC treatment, and 10 patients underwent TSCPC SC. Follow-up time for all patients was 90 days.

Among the comorbidities presented by the study patients, we can mention systemic arterial hypertension (34.6%), diabetes mellitus (30.7%), polycythemia vera, amyotrophic lateral sclerosis, Marfan syndrome, brain tumor, and depression. Table 1 lists the different causes of NVG identified in patients.

Table 1
Causes of neovascular glaucoma in patients undergoing cyclophotocoagulation

Causes	TSCPC	TSCPC SC
Vascular Cause (CRVO)	7	6
Retinal detachment	1	1
Diabetes	5	3
Uveitis	3	0
Total	16	10

Considering standard transscleral cyclophotocoagulation (TSCPC), transscleral cyclophotocoagulation technique slow cooking (TSCPC SC)

During the treatment with TSCPC, the average load used in patients undergoing the TSCPC group was 58 J ± 19 J, and 60J in the TSCPC SC group, as we had no "pop" nor the need for power reduction. Table 2 illustrates the reduction in IOP in the posttreatment follow-up periods between the two techniques used.

Table 2
Average IOP prior and during follow-up after treatment

	TSCPC (n=16)	TSCPC SC (n=10)	p-Value
Pré	49 ± 23 mmHg	54 ± 16 mmHg	0.27
1st PO	32 ± 24mmHg	38 ± 22mmHg	0.26
30th PO	38 ± 18mmHg	39 ± 10mmHg	0.43
90th PO	43 ± 10mmHg	44 ± 09 mmHg	0.40

Considering standard transescleral cyclophotocoagulation (TSCPC), transescleral cyclophotocoagulation technique slow cooking (TSCPC SC), and postoperative (PO) day.

Figure 1 relates the level of pain reported by patients in the pre- and post-treatment period with both techniques. The overall retreatment rate for residual pain control was 3.8%, being necessary in only one patient who had been treated by the standard method. TSCPC retouching was performed 3 months after the first session in the same way as the initial treatment.

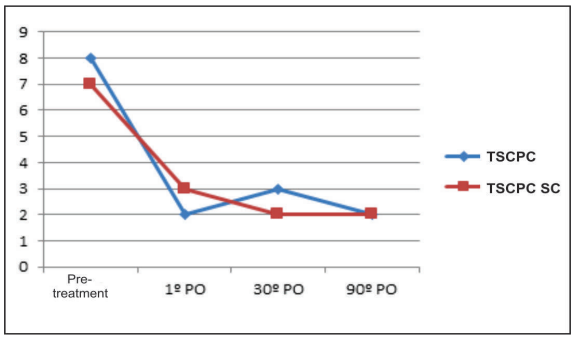

Figure 2: Pain level measured before and after treatment in both groups. Considering standard transescleral cyclophotocoagulation (TSCPC), transescleral cyclophotocoagulation technique slow cooking (TSCPC SC), and postoperative (PO) day.

No serious complications such as phthisis bulbi, vitreous hemorrhage, hypotonia (considered to be intraocular pressure below 5 mmHg) were observed in either group after ninety days. Thus, an overall success rate of 88.4% was observed, since 23 patients reported pain improvement on the first day after the procedure. Only 2 (7.69%) patients remained with the same level of pain, and 1 (3.8%) reported increased pain at the first post-TSCPC evaluation.

Considering standard transscleral cyclophotocoagulation (TSCPC), transscleral cyclophotocoagulation technique slow cooking (TSCPC SC).

Table 3
Incidence of postoperative adverse events observed in the first 30 days

	TSCPC (n=16)	TSCPC SC (n=10)	p-Value
Hyperemia	13 (81%)	5 (50%)	0.0001
Chemosis	4 (25%)	2 (20%)	0.0001
Hyphema	2 (12,5%)	0	0.0001

Discussion

NVG may be due to various pathologies. We found a higher prevalence of NVG of etiology due to central venous occlusion accounting for 50% of cases. In contrast to most studies encompassing etiologies with systemic vascular pathologies such as diabetic retinopathy and ischemic eye syndrome, [2] TSCPC is a procedure presenting variable results, and which can be seen as a noninvasive repetitive intervention of glaucoma. [13] Variations in the ciliary body anatomy and pigmentation may further influence success, and may explain why response to treatment varies from individual to individual. [11] In our assessment (Table 2), standard TSCPC was able to reduce IOP by 34.7% on the first postoperative day, and to 12.2% on the ninetieth day. In the group treated with TSCPC SC, the reduction on the first day was 30%, and 19% at the end of the 90 days. The literature justifies a possible recovery of damaged ciliary body part, which may lead to increased IOP[13–15] Duerr et al. found the same reduction in IOP when comparing both techniques. [12]

Concerning efficacy in pain relief, resolution of symptoms was observed in 88.4% of patients, improving quality of life without the need for daily anti-inflammatory eye drops. In the study, only one patient had to repeat treatment, corroborating other studies in which TSCPC has shown an effective technique for pain reduction, although not always with IOP reduction. [7,14,15] Probable nerve lesion following the procedure or decreased production of inflammatory factors generated by destruction of the ciliary body and decreased vascular perfusion in pars plicata would explain the parallel decrease in pain.[16–18]

An average of 60J sessions was used in both techniques, being below the safe amount of 80J described in the literature ,[2] which could justify the low decrease in IOP. Some studies showed protocols for NVG using an average of 105,4 ± 36,8J.[19] In our study no serious postoperative complications were found, as in the literature studied.[20,21] The main finding was conjunctival hyperemia in 70% of patients in the first 30 days of follow-up, most prevalent in the TSCPC technique.

The main complication described in the literature for the procedure is the worsening of visual acuity. [7,14] This data cannot be measured in our study because all patients included had no light perception. No cases of hypotonia or phthisis bulbi were identified as a consequence of TSCPC, showing a low rate of this dreaded complication, reinforcing the efficiency of the procedure.[6.21] Regarding the intrinsic limitations of the study, we can mention the procedure not being carried out only by one professional, and the fact that the pain measurement is subjective to each patient. There is also criticism about the small number of patients in each group and the short follow-up period, and results may change after ninety days.

Conclusion

The present study evaluated patients with NVG which was mostly secondary to central retinal vein occlusion in treatment for painful blind eye using TSCPC. The procedure was effective in 84% of patients in pain control without serious ocular consequences in both the standard and the slow cooking techniques during the ninety days of follow-up.

The reduction in intraocular pressure was relatively low in both groups, with the slow cooking group having a greater reduction at the end of the follow-up period. Considering that low-load techniques can be used in painful blind eyes in low-IOP eyes, it is effective in treating pain and with low IOP-lowering effectiveness, but does not avoid the risk of phthisis bulbi.

The development of alternative therapies for clinical treatment of refractory glaucoma and improved quality of life has shown good results, often avoiding gutting in severe cases of painful blind eyes.

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