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DIODE ENDOSCOPIC CYCLOPHOTOCOAGULATION IN VETERINARY OPHTHALMOLOGY

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Abstract

Endoscopic cyclophotocoagulation (ECP) is a relatively new method of cyclodestruction in the treatment of glaucoma, by lowering IOP through aqueous suppression. Although the coagulation of the ciliary processes using laser is well documented, this new endoscopic approach has numerous benefits comparing to the transscleral cyclophotocoagulation. The paper aims to present a review of the indications, techniques and efficacy of diode ECP. ECP uses a diode laser equipped with an endoscope which permits direct localization and photocoagulation of the ciliary processes. The procedure can be combined with phacoemulsification in patients with coexisting cataract. Other indications of diode endolaser are iridal mass, ciliary body neoplasia, uveal cysts and retinopexy in retinal detachment cases. The available clinical evidence reviewed suggest that ECP is a safe and effective procedure in veterinary ophthalmology.

***Key words**: endoscopic cyclophotocoagulation, diode laser, retinopexy, glaucoma.*

INTRODUCTION

Glaucoma is one of the most common causes of irreversible blindness in dogs and cats. The treatment is focused on lowering the intraocular pressure (IOP) by either improving aqueous outflow (filtering) or suppressing inflow (cyclodestructive). Many surgical techniques have been described for the treatment of glaucoma, but, recently, the use of endoscopic cyclophotocoagulation is becoming more accepted and is no longer reserved for end-stage cases (Falkenberry et al., 2009; Berke, 2006).

Traditionally, cyclophotocoagulation was performed with a diode laser through the sclera (transscleral cyclophotocoagulation, or TSCP) targeting the ciliary body without direct visualization and was reserved to refractory or end-stage glaucoma (Falkenberry et al., 2009). The benefits of using an endoscopic tool for laser application (termed endolaser cyclophotocoagulation, or ECP) include the direct visualization of the ciliary body, eliminating destruction of surrounding tissues, with the use of a minimal amount of laser energy (Bras et al., 2005; Lutz et al., 2008).

ECP uses a diode laser with a wavelength of 810 nm for photocoagulation, a 175 W xenon light source for illumination and video imaging for visualization of intraocular structures. The internal structures of the eye from the posterior aspect of the iris, ciliary body, pars plana, peripheral retina and more posterior retina may be imaged (Operator's manual for the E2 Laser and Endoscopy system, EndoOptiks).

MATERIALS AND METHODS

A review of published articles on ECP was conducted using PubMed database and Google search engine. The search words used included: *ECP*, *endoscopic cyclophotocoagulation*, *diode laser*, *transscleral cyclophotocoagulation*, *endolaser*, *glaucoma*, *retinopexy*. Both human and veterinary medicine articles were searched.

RESULTS AND DISCUSSIONS

Transscleral cyclophotocoagulation (TSCP) as a surgical treatment for glaucoma has been used in veterinary medicine.

In a study, TSCP was used as a treatment of primary glaucoma in 18 dogs. Adequate control of IOP was achieved in 92% of the cases in this study, and 50% of potentially sighted eyes regained vision and was maintained over 6 and 12 months follow-up. Complications were reported, such as cataract formation (25%) and corneal disease (45%) (Hardman et al., 2001, Cook et al., 1997).

The main disadvantage of TSCP is the lack of direct visualization of the ciliary body during the procedure that may lead to an increased risk of collateral damage to nontargeted tissues. (Harrington et al., 2012).

Described first in 1992 by Martin Uram, ECP permits visualization and photocoagulation of ciliary processes (in contrast with the TSCP which estimates the location of the ciliary body).

Although both techniques achieve aqueous suppression through cycloablation, there is a clear distinction between the two treatments when evaluating the extent of tissue destruction (Seybold et al., 2015).

Histopathologic studies have confirmed that ECP causes less damage to the ciliary body compared with TSCP, while still destroying the ciliary body epithelium (Pantcheva et al., 2007). A study of rabbit eyes conducted by Lin et al. showed that both transscleral and ECP are associated with occlusive vasculopathy, but the endoscopic route is associated with late reperfusion and therefore less chronic poor perfusion (Lin et al., 2006; Falkenberry et al., 2009). Immediately and 1 day after laser, both TSCP and ECP eyes demonstrated severely reduced or nonexistent blood flow in the areas of treatment. TSCP treated processes essentially remained non-perfused at the 1 week and 1 month time points. ECP treated processes showed some reperfusion at 1 week and greater reperfusion by 1 month. Histopathology confirmed the overall greater vascular occlusion seen with TSCP. Other associated side effects of TSCP are injury to the sclera, inflammation, hypotony, and phthisis (Lin et al., 2006; Mastrobattista et al., 1996).

The use of ECP is recommended in patients with uncontrolled glaucoma (>25 mmHg) on medical therapy or with an IOP> 20 mmHg on preoperative cataract screening. The procedure can be combined with phacoemulsification in patients with coexisting cataract. Other indications are iridal mass, ciliary body neoplasia, uveal cysts, retinopexy in retinal detachment cases (Bras, 2013).

ECP uses an endoprobe with endoscopic view and a diode laser treating each individual ciliary process until whitening and shrinkage is observed.

The pupil is dilated and the ciliary sulcus is expanded using a viscoelastic substance.

The probe is inserted intraocularly through a limbal incision (in the phakic, pseudophakic and aphakic eye) or pars plana (in the pseudophakic or aphakic eye, not recommended in the phakic eye) (Bras, 2013).

The amount of energy applied is titrable and the amount of cyclophotocoagulation is therefore calibrated for each patient. Laser energy is applied to each process until shrinkage and whitening occur (Bras et al., 2005; Lutz et al., 2008).

The entire ciliary process must be ablated in order to render it nonfunctional and thereby lower IOP (Uram, 1992). Bras et al. recommend that one third of the posterior ciliary process should be spared to avoid retinal edema. The ECP treatment zone can vary from 90° to 360°, depending on the hypotensive effect that is wanted to be achieved. Tissue explosion, "popping" or bubble formation should be avoided (Bras, 2013).

Following treatment, viscoelastic is removed using irrigation followed by wound closure (Falkenberry et al., 2009).

Endoscopic cyclophotocoagulation in veterinary ophthalmology has been reported, but no peer-reviewed studies on its use have been published.

ECP efficacy in treatment of bovine and equine glaucoma has been demonstrated by Harrington et al., according to studies published in 2010 and 2012.

Lutz et al. evaluated the use of ECP in pseudophakic and aphakic dogs with secondary glaucoma following primary cataract removal. A total of 15 dogs (n = 17 eyes) with secondary glaucoma were treated with a limbal approach endoscopic cyclophotocoagulation (ECP). He reported a 94% success of decreasing IOPs and 60% maintenance of vision over a 10 month period post-op. (Lutz et al., 2009).

Bras et al. described the successful use of ECP in 112 canine cases with >91% success of decreasing IOPs for a period larger than 12 months (Bras, 2013). In a study performed on 15 canine patients, Bras et al. reported the following complication: hypotension and retinal detachment (7%), uncontrolled IOP (5.5%), corneal disease (5.5%), hypertension and retinal detachment (2.7%), optic nerve degeneration (2.7%), SARDS (1.8%), normotensive and retinal detachment (0.9%), bacterial endophthalmitis (0.9%) (Bras, 2013). Another study reports as postoperative complications superficial corneal ulceration (1/17), recurrence of glaucoma (5/17), and phthisis with blindness (1/17) (Lutz et al., 2009).

Concerning the feline patients, Bras et al. used ECP successfully in 11 cats with glaucoma with a 92% success of decreasing IOP up to 1 year post-operatively and a 100% success of preserving sight. 50% of patients were off glaucoma medications. Complications included corneal ulcers (41.67%) and sequestrum (25%) (Bras et al., 2009).

Postoperatively, all patients received topical and oral CAI's and medications were decreased over time as IOP remained normal (Bras et al., 2005).

Bras recommends a treatment area of 180-200° as a prophylactic therapy or in cataract cases with IOP between 20 and 30 mmHg. As a therapeutic procedure, an area of 270-360° should be treated.

Some authors do not recommend the use of ECP in phakic patients because of the high risk of damage to the crystalline lens during the procedure (Morales et al., 2013)

Additional uses for diode endolaser include endolaser ablation of iridal melanoma (8 cases, 100% success rate in preventing growth, glaucoma or destruction of the globe), surgery of ciliary body neoplasia, endolaser uveal cyst coagulation, retinopexy in retinal detachment cases (with a high success rate for preventing further retinal detachment: 14/16 cases are reported sighted long term) (Bras, 2013).

CONCLUSIONS

Endolaser cyclophotocoagulation offers the advantage of direct localization and photocoagulation of the ciliary processes.

The available clinical evidence reviewed suggest that ECP is a safe and effective procedure in veterinary ophthalmology, that results in a therapeutic reduction of IOP and eliminates or reduces the use of glaucoma medication.

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