

Glaucoma in Dogs and Cats - Management with Cyclocryotherapy

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ABSTRACT

Background: The treatment of glaucoma often requires numerous therapeutic modalities to achieve the desired reduction in intraocular pressure (IOP). Cyclodestructive procedures or ciliary body destruction have been performed using techniques with considerable differences in efficacy and complication rates. Among these methods, cyclocryotherapy is non-invasive and simple for the management of uncontrolled glaucoma in dogs and cats. The objective of this case report is to describe the technique of carbon dioxide cyclocryotherapy to reduce intraocular pressure in dogs and cats with glaucoma.

Cases: Nine canine patients and one cat with glaucoma were treated with cyclocryotherapy performed under general anaesthesia. Clinical signs patients included blepharospasm, ocular pain, episcleral congestion and ocular hypertension. The patients showed higher levels of IOP, higher than 30 mmHg. Surgical treatment with general anaesthesia was applied. The pre-anaesthesia protocol included acepromazine 0.05 mg/kg with methadone 0.2 mg/kg, followed by intravenous propofol and maintenance with isoflurane and oxygen. An ophthalmological cryocautery unit was used with carbon dioxide as the cryogenic agent and a retinal cryoprobe of 3.2 mm diameter tip for the procedure. The method used was a double cycle of freezing and thawing for 60 s in each site. The cryoprobe was centred approximately 5 mm posterior to the corneoscleral limbus over the ciliary body. The temperature of each cyclocryotherapy spot was between -60°C and -80°C and each site was maintained in place for 60 s; 4 to 6 spots of the double freeze-thaw cycle were made. This technique did not have any serious complications during or after the application of cryotherapy, but chemosis and hyperaemia of the bulbar conjunctiva developed. Subconjunctival anti-inflammatory steroids were injected to minimise swelling and patient discomfort. Satisfactory results were observed; in all cases, the intraocular pressure decreased, with the usual result being a cosmetic and painless eye.

Discussion: Even with recent surgical and medical advances, pain and blindness are still common occurrences in glaucoma in human and veterinary practice. The cyclodestructive procedures included cyclodialysis, cyclodiathermy, cyclocryotherapy, and cyclophotocoagulation. The cryosurgery in veterinary ophthalmology has many indications for the treatment of ocular diseases and is effective at decreasing intraocular pressure in patients with persistent uncontrolled glaucoma. Cyclocryotherapy has been shown to reduce intraocular pressure in dogs, cats, rabbits and humans with normotensive and glaucomatous eyes. The application of a cryoprobe over the ciliary processes results in ablating ciliary tissue so that aqueous humour inflow is reduced to acceptable levels. In the clinical cases evaluated, there was a reduction in intraocular pressure reaching acceptable levels, with the usual result being cosmetic and painless eye. Medical therapy remains the predominant method for treating glaucoma in veterinary patients; therefore, cyclocryotherapy is an effective, simple way to lower IOP and is a reasonable treatment option for glaucoma management. Cyclocryotherapy has shown good results, with a low learning curve and it can also be repeated if necessary.

Keywords: eye, canine, feline, surgery.

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INTRODUCTION

Glaucoma have a lot of disorders that are often associated with increased intraocular pressure (IOP) leading to an optic neuropathy [20]. Glaucoma is an often painful, complex group of blinding optic neuropathies that have as predisposition factor the elevated intraocular pressure leading to loss of retinal ganglion cells and their axons, associated with degeneration of optic nerve head and retina [1,28]

The cryosurgery in veterinary ophthalmology has many indications for treatment of ocular diseases, including glaucoma, retinal detachments, cataract extractions, eyelid neoplasms, distichiasis, trichiasis, ectopic cilia, corneconjunctival mass and pigmentary keratitis.[2,3,25,34]. The treatment for glaucoma in humans with cryosurgery was first reported in 1950 [6]. Cyclocryotherapy has been shown to reduce intraocular pressure (IOP) dogs [25,29], cats [16,30], rabbits and man [31] with normotensive and glaucomatous eyes.

Cyclocryotherapy is a simple, noninvasive, quick, ablative surgical procedure that has been effectively used to treat advanced uncontrolled glaucoma [4]. The surgery objective decreases intraocular pressure (IOP) by destroying ciliary bodies, thereby reducing aqueous humor production [19]. The transscleral application of a cryoprobe over the ciliary processes with the function of ablating sufficient ciliary tissue so that aqueous humor inflow is reduced to clinically acceptable levels [10]. The objective of this case report is to describe the technique of the dioxide carbon cyclocryotherapy to reduce intraocular pressure in dogs and cats with glaucoma.

CASES

A total of 9 dogs (10 eyes) and 1 cat (1 eye) were included in this study, 4 females and 6 males, with confirmed primary glaucoma or secondary traumatic/inflammatory uveitis glaucoma and a median age of 7 years (range 2-13 years).

Ophthalmic evaluation was performed including fluorescein stain¹, slit lamp biomicroscopy², rebound tonometry³ and indirect binocular ophthalmoscopy⁴ prior to cryosurgery. The breeds of dogs submitted to the procedure in this case report were: pug, poodle, shitzu, chow chow, labrador and mixed breed. The only cat in the study is a persian breed. All cases and information about them are more detailed on Table 1.

Ocular ultrasonography was performed in all patients to excluded intraocular neoplasia. Dogs and a cat showed higher levels of intraocular pressure (IOP) with IOP higher than 30 mmHg.

This case report was carried out following the norms of the Association for Research in Vision and Ophthalmology (ARVO) statement on the use of animals in ophthalmic and vision research. The owners provided signed consent prior the intervention. All animals were submitted to general anesthesia with a protocol of pre-anaesthetic medication of 0.3 mg/kg intramuscular methadone⁵ [Mytedom[®] - 10 mg/mL, i.m] associated with 0.05 mg/kg acepromazine⁶ [Acepran[®] - 0.2%, i.m]. After 15 min, they were submitted to induction intravenously with 4 mg/kg of propofol⁵ [Propovan[®] - 10 mg/mL, i.v] and maintenance with isoflurane⁵ vaporised in oxygen, in pediatric baraka circuit. The animals were placed in sternal decubitus and eyeball centering was not necessary.

A double cycle of freezing and slow thawing of 60 s was performed with a 3.2 mm diameter probe to apply in direct contact, freezing a 5 mm area behind the corneoscleral limbus at 180° (Figure 1A). The procedure was made in the dorsal half of the eye in 4 sites. The probe was pressed against the sclera and freezing was performed for 60 s, followed by a slow thawing (Figure 1B). Then a second cycle was performed in the same way. During and after the application of cryotherapy, chemosis and hyperemia of the bulbar conjunctiva develop. Subconjunctival steroidal anti-inflammatory with dexamethasone⁷ [0.1 mg/kg, s.c] was injected to minimize swelling and patient discomfort. At the immediate post-operative, conjunctiva presented hyperemia, however, no signals of pain were observed.

Initial glaucoma treatment was continued and corticosteroid eye drops with polymixin, neomycin and dexamethasone⁸ administered 4 times a day, for 3 weeks to limit postoperative cornea-conjunctival inflammation. The use of these medications was tapered, as allowed. Follow-up included examinations 1, 7 and 30 days after surgery (D1, D7 and D30, respectively). The equipment used for surgeries was the Cryofast⁹. The cryogen substance used was carbon dioxide. Satisfactory results were observed without complications, in all cases the intraocular pressure decreased, with the usual result being a cosmetic and painless eye.

DISCUSSION

Glaucoma is considered a multifactorial disease in which numerous genes with varying numbers of alleles and related protein products are involved [1]. Canine primary angle closure glaucoma (PACG) is multifactorial, with several studies indicating it is not a simple genetic trait [7,12,15]. It has been suggested that glaucoma is not initiated by an immune response to specific retinal antigens, but rather the variety of immunoreactive molecules identified was due to the exposure of many epitopes during the neuronal cell death [11,17]. Actually, the most commonly used surgical techniques for canine glaucoma are placement of drainage implants to shunt aqueous humor, cyclodestructive techniques to reduce aqueous humor production and association of these 2 methods [20].

The cyclodestructive procedures included cyclodialysis, cyclodiathermy, cyclocryotherapy and cyclophotocoagulation [13]. In veterinary medicine, the first reports that described cyclocryotherapy date back to the 1980s [25,29,35]. Since its description by Bietti in 1950 [6] cyclocryotherapy in humans has retained a place in the management of certain types of glaucoma [5]. In human ophthalmology the cyclocryotherapy and others cyclodestructive procedures are used for neovascular or refractive glaucoma with success [31]. Cyclocryotherapy is applicable for chronic open and closed angle glaucoma, buphthalmia and glaucomas that are unresponsive to medical and surgical treatments [8,25]. Because of the absence of an incision, it is considered to be a less invasive type of procedure than incisional surgery [13]. Cyclocryotherapy has been shown to reduce intraocular pressure (IOP) in man, dogs [25,29], cats and laboratory animals with normotensive and glaucomatous eyes. Cyclocryotherapy causes graded destruction of the ciliary epithelium and proportionally related changes in IOP and aqueous humor dynamics [16].

The development of new glaucoma medications is slow, arduous, costly, and optimized for the human rather than canine eye [20]. Ophthalmic cryotherapy selectively destroys certain tissues within the eye while sparing other vital areas. Certain tissues are more sensitive to extreme low temperatures [25].

Primary glaucoma is subdivided into 2 main forms, primary open angle glaucoma, in which the drainage angle appears gonioscopically normal and primary angle closure glaucoma, in which the drainage

angle appears gonioscopically narrowed or closed [23]. In this case report gonioscopy wasn't used because patients presented corneal opacities and cyclocryotherapy was applied independent of the cause.

The corneal endothelium, uveal pigment cells, iridal sphincter and dilator muscles, ciliary body musculature, neurosensory retina, retinal pigment epithelium, and small vasculature of the uvea and retina can be selectively frozen and killed [1]. Even with recent surgical and medical advances, pain and blindness are still common occurrences in glaucoma in human [32] and veterinary patients [20]. End-stage procedures such as enucleation, evisceration with intrascleral prosthesis, and pharmacologic ablation of ciliary bodies are then recommended to address chronic discomfort for buphthalmic and blind globes [14].

Cyclodestructive procedures include a cyclocryotherapy and transscleral diode laser photocoagulation have been reserved as last option procedures in refractory glaucoma patients with poor visual potential [10]. The patients included in this case report presented blindness and uncontrol painfulness with only topical therapy. Functional vision cyclodestructive procedures and filtering techniques are used to control IOP in visual patients [22]. In humans the loss of functional vision occurred in fewer than 10% of eyes treated with cyclocryotherapy, and it is important to emphasize that only eyes with greatest risk and poorest prognosis were treated with this modality. Cyclocryotherapy has become an important addition to the surgical resource for treatment of some specific types of glaucoma [4].

In relation to the position of the probe the 3 and 9 o'clock positions are avoided to prevent direct damage to the long posterior ciliary blood vessels [10,14]. In counterpart cyclocryotherapy performed at each quadrant and at the 3-o'clock and 9-o'clock position, is an effective way to lower IOP and, thus, is a reasonable treatment option for refractory glaucoma human patients who experience with ocular pain and headaches [19]. In this study 3-o'clock and 9-o'clock position was not used to minimize risks of posterior ciliary artery damage. The sites used were 10 to 2-o'clock.

Previous studies indicate that cyclocryotherapy in cats does not produce successful results as those in dogs controlling IOP [27]. In other study, the results obtained from cyclocryotherapy performed using nitrous oxide was successful in feline glaucoma [18].

Table 1. Cyclocryotherapy evolution in canine and cat treatment.

Patients	1	2	3	4	5	6	7	8	9	10
Species	Canine	Canine	Canine	Canine	Canine	Canine	Canine	Canine	Canine	Feline
Breed	Pug	Chow Chow	Mixed breed	Mixed breed	Shih Tzu	Labrador	Mixed breed	Shih Tzu	Mixed breed	Persian
Age in Years	2	8	6	9	8	8	13	7	7	3
Sex	Male	Male	Male	Female	Male	Male	Female	Male	Female	Female
Affected eye	Right	Left	Left	Right	Left	Left	Right	Right and Left	Left	Left
Visual eye	No	No	No	No	No	No	No	Yes (right) No (left)	No	No
Glaucoma diagnosis	Traumatic hyphema	Primary	Uveitis	Post Traumatic	Primary	Primary	Uveitis	Primary (Right Eye) and Primary (Left Eye)	Primary	Uveitis
Previous treatment	Azopt® ⁸ Twice a day	Xalatan® ¹⁰ Twice a day	Azopt® ⁸ Twice a day	Cosopt® ¹¹ Twice a day	Azopt® ⁸ Travamed® ¹² Twice a day	Cosopt® ¹¹ Twice a day	Azopt® ⁸ Twice a day	Cosopt® ¹¹ Twice a day	Azopt® ⁸ Xalatan® ¹⁰ Twice a day	Cosopt® ¹¹
Pre Operatory IOP in mmHg	36	60	56	45	47	45	55	50 (Right) 57(Left)	48	56
Post Surgery (30 days) IOP in mmHg	6	6	17	7	15	14	19	14(Right) 15(Left)	14	12

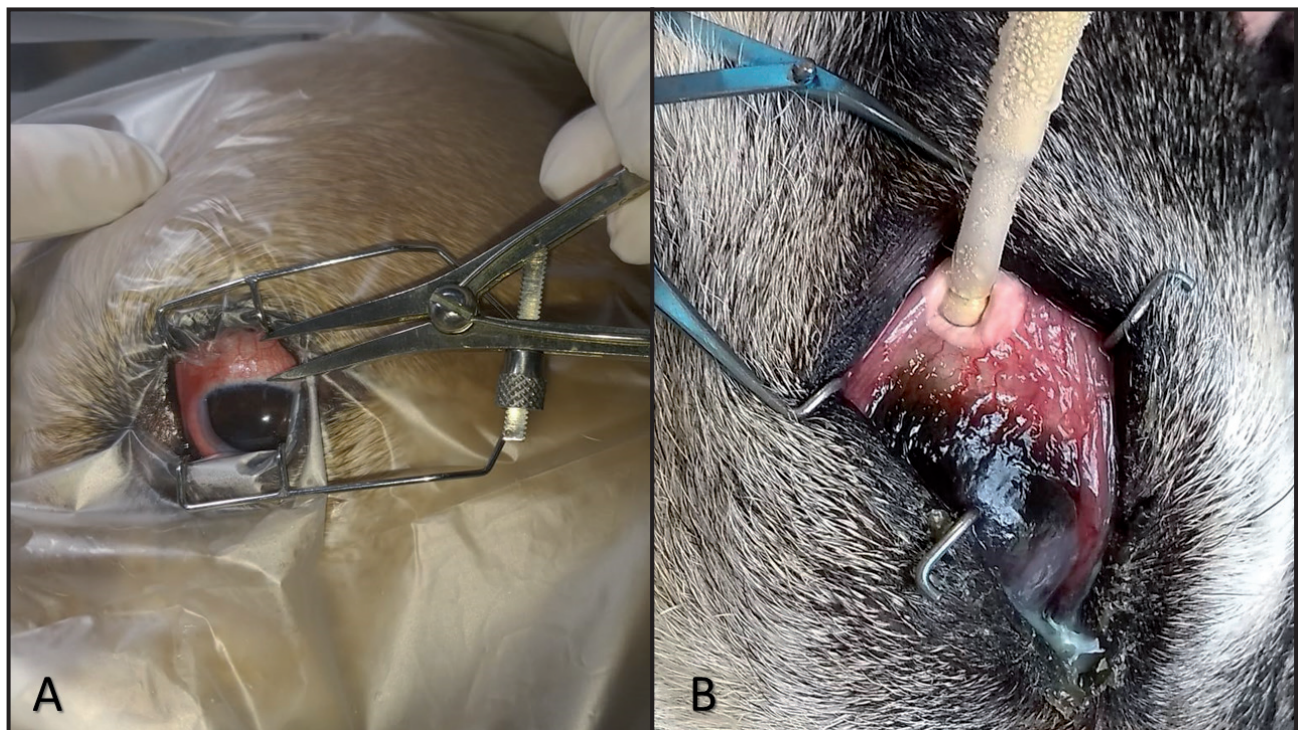


Figure 1. A- Caliper is used to measure 5 mm from the limbus. B- Cyclocryotherapy probe is applied.

Cyclodestructive procedures are often unsuccessful in the long term in cats, perhaps because of the nature of their glaucoma [23]. In an experimental study with cats undergoing cyclochoriotherapy with ophthalmic cryocautery, it was observed that all patients had a reduction

in intraocular pressure [16,30]. Cyclocryotherapy incite considerable inflammation and is contraindicated in cats with glaucoma secondary to uveitis or neoplasia [24]. In the present study, one feline patient presented good results in reduction of intraocular pressure.

The objective in cyclocryotherapy is to generate not complete but only partial necrosis in the ciliary epithelium to decrease aqueous humor production. The temperature in the ciliary epithelium required to produce this condition has been reported as between -12°C and -15°C [9]. For this reason the use of carbon dioxide was preferred because the range temperature is between -40 a -60°C.

Acute primary angle closed glaucoma also is 2 times more common in female dogs than in male dogs [23]. In our study no observe this sexual predilection. Success rates vary with the duration of follow-up, whether IOP control or preservation of vision was the goal, and whether the owner permits more than one freezing episode [23]. For good outcome of the refractory glaucoma treatment and in order to keep the target IOP after cyclodestruction as low as possible, it is necessary to continue with a corrected number of antiglaucoma drugs and to conduct eye examinations regularly [26]. In the preset case report all patients keep the antiglaucomatous therapy in definitively.

The overall success in human patients rate of ciclocryotheapry in lowering intra ocular pressure is estimated to be 34%-92%, depending on the type of glaucoma [26]. In veterinary medicine, until know there are not studies that describe success rates and complication. In this study observed IOP reduction without serious side effects.

Medical therapy remains the predominant method for managing glaucoma in veterinary patients. It may be used alone or in combination with surgical techniques to control intraocular pressure [1]. A great majority of veterinary ophthalmic drugs are administered to the ocular surface, owing to its ease of access for caretakers. Topical instillation, however, is inefficient for many reasons, including rapid tear turnover and absorption through the conjunctiva [1,21] The

development of new glaucoma medications is slow, arduous, costly, and optimized for the human rather than canine eye [20]. B-blockers decrease IOP primarily via reduced AH production however systemic absorption of topical b-blockers is also responsible for the frequently encountered cardiovascular and pulmonary adverse effects of the drug [33,36]. For these reasons the authors believe that cyclocryotherapy procedure is a good option for intraocular pressure IOP control and management.

Cyclocryotherapy offers an effective treatment alternative in eyes with uncontrolled glaucoma in dogs and cat, has shown good results, low learning curve, and it can also be repeated if necessary. More studies are needed to understand the effects in the medium and long term, as well as to establish criteria for its use.

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