

## Coloboma Eyelid in Cats - Treatment with Carbon Dioxide Cryosurgery

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### ABSTRACT

**Background:** Eyelid colobomas are congenital and developmental disorders. Generally, they affect the temporal portion of the upper eyelids of cats, bilaterally. This ocular defect is accompanied by trichiasis associated with pain and ulcerative keratitis. Any breed can be affected and it has been reported in Domestic Shorthair, Persian, Burmese, Mongrel cats and captive felids. The objective of this case report is to describe the technique of dioxide carbon cryosurgery for the treatment of eyelid coloboma in felines.

**Cases:** Seven mongrel cats (14 eyes) with bilateral eyelid coloboma were included in this study, 5 females and 2 males, with a median age of 5 months (range 6-8 months). The patients presented with blepharospasm, bilateral mucopurulent ocular discharge and eyelid coloboma extension of 30-50% in the upper eyelid, resulting in severe trichiasis of both eyes. In 5 cats, 1 or both eyes were diagnosed with keratitis and superficial corneal ulcers. 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 utilised with carbon dioxide as the cryogenic agent and a retinal cryoprobe of 3.2 mm diameter tip, reaching -50°C for the procedure. The method used was a double cycle of freezing and thawing for 60 s in the margins of eyelid agenesis. Epilation of hairs was made after freezing with eyelash tweezers. Immediately after the surgical procedure, an Elizabethan collar was placed to safeguard the area and anti-inflammatory therapy with meloxicam 0.1 mg/kg once daily for 3 days was prescribed. Antibiotic ointment every 6 h (chloramphenicol and associations) was also prescribed for topical application. Two weeks post-operatively, hyperaemia, oedema and skin wounds at the margins were observed. After 30 days these clinical signs were minimal. No signs of pain were observed post-operatively. The follow-up was 90 days and the trichiasis was resolved in all cats.

**Discussion:** Usually, young cats are affected with eyelid colobomas. The age of the patients in this study was between 6-8 months. Eyelid colobomas are repaired with a variety of blepharoplastic procedures and the choice depends on the size and position of the defect. Generally, larger defects require more extensive reconstructive procedures. All techniques can have post-operative complications. Suture dehiscence, skin flap necrosis and facial deformation can occur with traditional surgical techniques. Furthermore, posterior hair growth in the margins can lead to new trichiasis. Cryosurgery was chosen and performed as the temperature of -20°C is sufficient to destroy hair follicles, without surgical incisions, avoiding scar formation. Hence, sutures are not necessary in cryosurgery procedures. Carbon dioxide is a good cryogenic agent for the purpose of this procedure. In the cases described, no recurrence of hair growth was observed in the follow-up period of 90 days. Nevertheless, a good aesthetic appearance was maintained. Therefore, the use of carbon dioxide cryosurgery is an effective and safe alternative for treatment of eyelid coloboma in cats. To our knowledge, no paper has described the use of carbon dioxide cryosurgery for the correction of palpebral agenesis in felines and other species as a single treatment. This technique is easy to perform, has good aesthetic and functional results and can be considered a treatment option for this congenital condition.

**Keywords:** eyelids, agenesis, cryosurgery, feline, congenital.

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## INTRODUCTION

An eye coloboma is a congenital defect in which a portion of the globe, lens or adnexa is absent or fails to form appropriately [22]. Eyelid coloboma or agenesis occurs infrequently in the domestic cat or captive felids, affects primarily the lateral portion of the upper eyelid and can be associated with other ocular abnormalities. Any breed can be affected [2,6,16,25].

In the portion of agenesis, the skin makes a direct transition into conjunctival tissue without an eyelid margin. This condition results in trichiasis, exposure keratitis, corneal vascularization, epithelial hyperplasia, corneal ulcers secondary to inability of palpebral function and hairs contact upon corneal superficies [18,20,24].

Several surgical treatments were described in the literature [3,7,8,10,20-22,25]. Cryosurgery is an alternative treatment for destruction of pilous follicles by quick freezing and slow thawing. A study with a nitrous oxide cryo unit, reaching a temperature of  $-20^{\circ}\text{C}$ , using a double freeze-thaw cycle revealed that it is sufficient to destroy the follicles with minimal damage to the eyelid margin [9].

To the author's knowledge, the present case is the first report of cryosurgery as a single treatment of eyelid coloboma in cats. The objective of this case report is to describe the technique of the dioxide carbon cryosurgery for treatment of coloboma eyelid in 5 cats.

## CASES

A total of 7 mongrel cats (14 eyes) with bilateral eyelid coloboma were included in this study, 5 females and 2 males, with a median age of 5 months (range 6-8 month). Ophthalmic evaluation was performed including fluorescein stain<sup>1</sup>, slit lamp biomicroscopy<sup>2</sup>, rebound tonometry<sup>3</sup> and indirect binocular ophthalmoscopy<sup>4</sup> prior to cryosurgery. The patients presented with blepharospasm, bilateral mucopurulent ocular discharge and an eyelid coloboma extension of 30% to 50% in the upper eyelid, resulting in severe trichiasis of both eyes and hairs in contact with the cornea. Consequently, keratitis and superficial corneal ulcer in 5 cats in 1 or both eyes were diagnosed. The equipment used for surgery was Cryofast<sup>5</sup> ophthalmological cryocautery unit with a retinal cryoprobe of 3.2 mm diameter tip, reaching  $-50^{\circ}\text{C}$  of temperature.

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. All animals were submitted to general anaesthesia with a protocol of pre-anaesthetic medication of methadone<sup>6</sup> [Mytedom<sup>®</sup> - 0.3 mg/kg IM] associated with acepromazine<sup>7</sup> [Acepran<sup>®</sup> - 0.05 mg/kg IM]. After 15 min, they were submitted to induction with propofol<sup>6</sup> [Propovan<sup>®</sup> - 5 mg/kg IV] and maintenance with isoflurane<sup>6</sup> [Isoforine<sup>®</sup>] vaporised in oxygen, in pediatric baraka circuit. The animals were placed in lateral decubitus. A double cycle of freezing and slow thawing of 60 s was performed with the probe in direct contact with the skin and hairs. Previous trichotomy was not made to better observation of trichiasis. The retinal cryoprobe was placed directly on the transition of skin and conjunctival tissue, applying freezing spots in all extension of defect (Figure 1). Later, manual epilation of the hair with eyelash tweezers was made with little resistance. Postoperative treatment consisted of topical antibiotic ointment chloramphenicol and associations<sup>8</sup> [Regencil<sup>®</sup> - TID, for 3 weeks]. Elizabethan collar was used for 10 to 14 days. Systemic non-steroidal anti-inflammatory<sup>9</sup> [meloxicam [Maxicam 0.5 mg<sup>®</sup> - 0.1 mg/kg SID for 3 days] was prescribed. The ophthalmic evaluation was made in 7, 14, 30 and 90 days.

At the immediate post-operative, eyelids presented edema and hyperemia. On the 14<sup>th</sup> day of post-operative, we observed hyperaemia, edema, microhemorrhages and skin wounds in the treated margins and after 30 days these clinical signs were minimal. No signals of pain were observed in the post-operative. The follow-up was 90 days and the trichiasis was resolved in all cats (Figure 2). In this period, the patients demonstrated ocular comfort, no corneal ulcers or keratitis, reduction of cornea neovascularization and opacity. Hence, no hair growth was observed in this time, keeping a good aesthetic appearance. No patients developed recurrent trichiasis in the previous treated area within the follow-up period.

## DISCUSSION

The feline eyelid agenesis has unknown aetiology. Possible causes are genetic, viral, and teratogenic [1,2,6,22]. This condition can affect other species including humans, sheep, goats and dogs [21]. In this report, only domestic cats were included.

Eyelid colobomas condition cause significant discomfort and is relatively difficult to correct [25]. Several surgical procedures and blepharoplasties have been cited in the literature to moderate and severe cases. Those severe cases affecting a greater portion of the superior eyelid may require the use of more complicated surgical techniques such as advancement and rotational flaps [22]. All techniques can have post-operative complications such as trichiasis, necrosis of skin flaps, suture dehiscence and facial deformation [12,21]. The surgical success may be negatively affected by graft necrosis, corneal abrasion from suture, dehiscence of suture lines, active herpes virus or bacterial conjunctivitis, and trichiasis at the donor-recipient junction [21]. Several complications of the surgical procedure were observed in our cases,

however, they were mild. [5,16]. The disadvantage of blepharoplasties the need of surgical reintervention when patients develop postoperative trichiasis [16].

Thereby, the cryosurgery is simple to perform and a non-invasive procedure of great potential use in trichiasis due to high sensibility of hair follicles to cold, particularly in areas where there is a lack of skilled surgeons to perform delicate eyelid operations [11,13]. Therefore, cryosurgery should be recommended for eyelid colobomas treatment as a single procedure. One of the advantages is that cryosurgery can easily be performed once again, with no injuries to the eyelid tissue, if the trichiasis does not resolve in the first procedure. Although, in our cases, all trichiasis were solved in the first surgery. Although colobomas are usually accompanied by other ocular anomalies [2,6]. In this report only one patient had also persistent pupillary membrane. Persistent pupillary membrane is the most common intraocular anomaly associated with eyelid agenesis [17].

Regarding to the age of patients, as a congenital defect, it is safe to affirm (and the literature corroborates) that young cats are affected. In this report, cats ages ranged between 6 and 12 months. Ages ranged from 2.2 months to 26 months (average age 10.7 months) [21]. In another study, 4 cats had 8 month-old and 1 cat had 9-year-old [22].



Figure 1. Cryoprobe in contact with hair and skin surface.

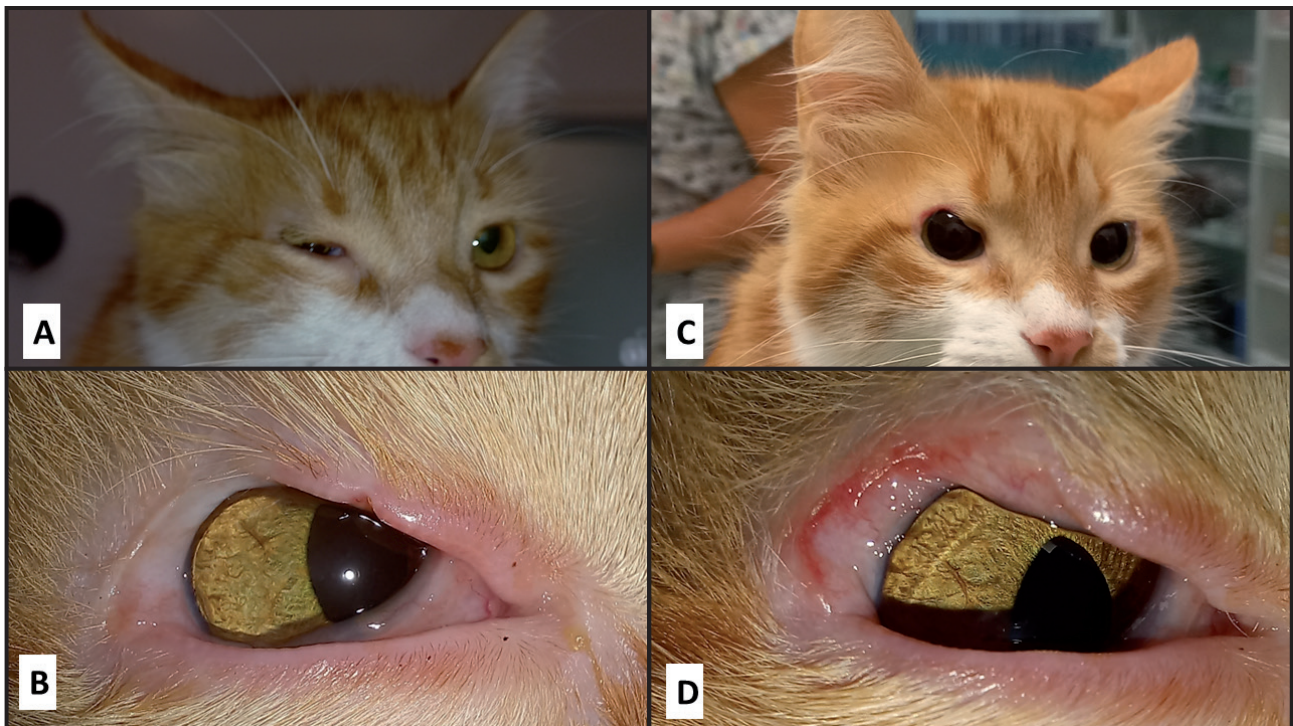


Figure 2. Timeline of cryosurgery treatment for of eyelid coloboma. A- Discomfort before the cryosurgery. B- Closed up photography of the same patient before the cryosurgery. C- One month after cryosurgery. D- Formation of a lid line without hairs after procedure.



There are no previous studies, using only the double-freeze-thaw cryotherapy technique with carbon dioxide or other cryogen agents for coloboma treatment. Carbon dioxide (-78.5°C) was first used by Pusey in 1907. Liquid carbon dioxide freezes easily when released from a cylinder into air and can be easily applied on various skin lesions [26]. Other studies use adjunctive cryosurgery to treat trichiasis secondary to conventional blepharoplasties, but not as an only procedure [6]. The authors chose cryosurgery with carbon dioxide as the primary treatment. No blepharoplasty technique was performed prior to surgery. The results were satisfactory because the cryosurgery avoided complications associated with these techniques and allowed good aesthetic, trichiasis correction and consequently reducing pain and keratitis.

A temperature of -20°C destroys the hair follicle without necrosis or scarring of the lid [4]. In the literature, we find studies with nitrous oxide (-80°C) and liquid nitrogen (-120°C) for the treatment of trichiasis, distiquiasis and ectopic cilia in humans and dogs [9]. In this study, the cryocautery unit using carbon dioxide and retinal probe reached temperatures of approximately -50°C, which was sufficient to destroy hair follicles of cats. Many theories of how cryotherapy provokes tissue death and irreversible injuries to hair follicles have been discussed. The first and most studied one is the direct cell injury [15]. Studies have been performed to understand the effect of freezing on biological tissue. One hypothesis is direct cellular injury from the extracellular space. The cell injury that occurs after freezing is thought to result from a high solute concentration causing cell dehydration. Ice formation causing intracellular organelle and cell membrane disruption has also been implicated [14,19].

Complications of cryosurgery include pain, hemorrhage, erythema, vesicular bullous lesions and crusts [9,15]. In this study, we observed small areas of hemorrhage and crusts which completely disappeared after 30 days. Our protocol included 2 cycles of 60 s of rapid freezing followed by slow thawing, as it is known that a single cycle reduces cell death rate. Besides, there is no difference in cellular death when 3 or more cycles are performed [23]. After freezing,

hairs are removed with no resistance with tweezers. Trichotomy was not performed before the procedure to facilitate location of hairs in contact with the cornea.

Regarding the use of anti-inflammatory agents, in this study, we opted for intravenous injection of dexamethasone during the surgery. In a previous study, the conjunctival chemosis and hyperaemia, produced in part by a prostaglandin mediated inflammatory response following cryotherapy, were decreased by nonsteroidal anti-inflammatory 1 h before cryosurgery. It is believed that anti-inflammatory injections pre or trans operative diminishes edema [4].

Cryosurgery is an easier procedure to perform, non-invasive, with shorter surgical duration, early recovery, good aesthetic results and forms a delicate scar that mimics palpebral tarsus. No surgical sutures are necessary in cryosurgery techniques. The temperature of carbon dioxide, freezing time and cycles, cryosurgery unit and cryoprobe proposed in this study were adequate for treating cat eyelid colobomas. No recurrence of hair growth was observed in the follow up period. The feline patients recovered ocular comfort and keratitis did not return, keeping good aesthetic and excellent function of eyelids.

Dioxide carbon cryosurgery with double freeze-thaw cycle for 60 s presented an adequate technique in application time and in freezing temperature for permanent destruction of pilous follicle. Therefore, it is easy to perform, non-invasive, safe and effective for treatment of eyelid coloboma in cats.

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