Surgical Treatment of Canine Glaucoma

Cyclodestructive Techniques

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KEYWORDS

• Canine • Glaucoma • Laser • Cyclophotocoagulation • Transscleral • Endoscopic

KEY POINTS

- Surgical treatment of glaucoma is directed toward altering aqueous humor production, drainage, or a combination of both.
- The most common surgical treatment performed to decrease aqueous humor production in primary or secondary glaucoma is diode cyclophotocoagulation.
- Diode laser energy can be applied via a transscleral approach (transscleral cyclophotocoagulation), or an endoscopic approach (endoscopic cyclophotocoagulation).
- Endoscopic cyclophotocoagulation provides direct visualization of the targeted ciliary body. The ability to observe tissue effect and titrate the energy, sparing adjacent tissues, results in fewer potential postoperative complications.
- Endoscopic cyclophotocoagulation combined with phacoemulsification and intraocular lens implantation can be performed in primary or secondary glaucoma cases.

Videos on endoscopic cyclophotocoagulation for the surgical treatment of canine glaucoma accompany this article at http://www.vetsmall.theclinics.com/

INTRODUCTION

Glaucoma is a common cause of vision loss in cats and dogs. Increased intraocular pressure (IOP) is a significant risk factor in the pathogenesis of the disease in humans and a constant factor in canine glaucoma. Addressing increased IOP represents the only treatable and measurable component in terms of successful glaucoma treatment. IOP represents the balance between aqueous humor production and outflow. There are many pathophysiologic mechanisms that can threaten this balance, leading to

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glaucoma. Initially, most dogs affected with glaucoma are managed medically. Long-term IOP control is often a challenge, requiring surgical intervention to maintain vision. Surgical treatment of glaucoma is directed toward altering aqueous humor production, drainage, or a combination of both. Damage to the secretory epithelium of the ciliary body leads to a decrease in aqueous humor production, whereas filtration surgery provides an alternate path for aqueous outflow.

Previously available surgical techniques for glaucoma carried a high long-term rate of failure, thus a conservative approach with long-term medical treatment has been recommended, followed by surgery in cases of refractory uncontrolled IOP. Surgical procedures in glaucomatous dogs are now more commonly recommended because of an increased knowledge of glaucoma pathogenesis and improvement of surgical techniques. There is preliminary information that early intervention on minimally affected eyes could provide a more successful outcome.[1] However, randomized, prospective, controlled studies with strict inclusion criteria comparing different treatment modalities are lacking. The decision to pursue surgical treatment of glaucoma depends on several factors including cause (primary vs secondary glaucoma), clinical stage (acute vs chronic), and the presence or potential for vision (**Fig. 1**). Most of the surgical procedures for visual patients involve the use of sophisticated techniques, with variable but usually significant financial impact for the owners. Demanding postsurgical topical therapy, close follow-up initially, and owner's expectations are also considered. Factors that influence the surgical treatment success include the surgeon's experience and skills as well as available instrumentation.

This article describes cyclophotocoagulation (CPC) methods to manipulate the aqueous production in primary and secondary glaucoma cases that are sighted or have potential to have vision restored postoperatively.

CYCLOPHOTOCOAGULATION

Destruction of the ciliary body (CB) has been used to treat glaucoma since the 1930s.[2] Multiple cyclodestructive modalities have been used, such as diathermy,[2] cryotherapy,[3–7] ultrasonography,[8] and photoablation.[9–11] CPC can be performed using different laser wavelengths and is the most commonly used cyclodestructive procedure.

CPC causes partial destruction of the CB through coagulation necrosis of the pigmented ciliary epithelium with subsequent thermal damage to the nonpigmented epithelium. Thermal damage is also responsible for vascular occlusion or nonperfusion of the ciliary processes (CPs).[12] The applied laser energy is well absorbed by uveal melanin, resulting in blanching, shrinking, and thereby damage to the secretory ciliary epithelium of the CP that produces aqueous humor.

The goal of CPC is to cause partial destruction of the CB through selective destruction of the ciliary epithelium. Possible undesired consequences such as marked disruption of the ciliary epithelium with severe architectural damage to the ciliary muscle, stroma, and adjacent sclera, and acute occlusive vasculopathy (in some cases permanent nonperfusion), have been reported.[12–15] There is agreement that the amount of energy delivered is correlated with tissue destruction and inflammation, and with postoperative complications. Balance between desired tissue destruction for adequate IOP control and overtreatment is the ideal surgical goal, although sometimes difficult to attain. Tailoring energy delivery and the subsequent amount of tissue destruction depends on tissue characteristics that may vary in each individual patient.

Lasers used for CPC are within the near-infrared electromagnetic spectrum and include neodymium-doped yttrium aluminum garnet (Nd:YAG; 1064-nm wavelength) and diode (810-nm wavelength). The transscleral use of an Nd:YAG laser either with noncontact or contact methods to achieve cyclodestruction has been described.[10,11,16] One study