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Short Communication

The Effects of Xylazine-Ketamine Anesthesia on Intraocular Pressure in Dogs

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ABSTRACT

Glaucoma is defined as the increase in the intraocular pressure (IOP) causing visual loss due to the circulation deficits of the aqueous humor. The IOP measurement can be obtained without any problem in calm animals. However, some animals do not allow IOP measurement without sedation or anesthesia. The purpose of this study is to determine the effect of xylazine HCl (as a sedative) and ketamine HCl (as an anesthetic in combination with xylazine HCl) on the IOP in dogs. In this study, 35 dogs of different breed, age and gender that were brought to Istanbul University Veterinary Faculty Education and Research Hospital Surgery Department with different surgical indications were used. As a result xylazine HCl sedation and xylazine HCl + ketamine HCl anesthesia decrease the intraocular pressure significantly and the IOP measurements in glaucoma suspicious dogs must be obtained without xylazine HCl sedation or xylazine HCl + ketamine HCl anesthesia were determined.

Key Words: Xylazine, ketamine, IOP, dog, anesthesia

ÖZET

KÖPEKLERDE KSİLAZİN-KETAMİN ANESTEZİSİNİN GÖZ İÇİ BASINCI ÜZERİNE ETKİSİ

Glokom, humor aközün dolaşımındaki bozukluktan ötürü oluşan ve görme kaybı ile sonuçlanan, göz içi basıncındaki artış olarak tanımlanabilir. Sakin mizaçlı hayvanlarda göz içi basıncı ölçümü hiçbir problemle karşılaşılmaksızın gerçekleştirilebilmektedir. Ancak bazı hayvanlar sedasyon veya anestezi olmaksızın göz içi basıncı ölçümüne müsaade etmemektedir. Bu çalışmanın amacı, köpeklerde, bir sedatif olarak ksilazin HCl ve bir anestezik madde olarak – ksilazin HCl kombinasyonuyla birlikte- ketamin HCl kullanılmasının, göz içi basıncı üzerine etkilerini tespit etmektir. Bu çalışmada İstanbul Üniversitesi Veteriner Fakültesi Eğitim ve Araştırma Hastanesi'ne farklı cerrahi endikasyonlarla getirilen, 35 adet, farklı yaş, ırk ve cinsiyette köpek kullanılmıştır. Çalışmanın sonucunda, ksilazin HCl sedasyonu ve ksilazin HCl + ketamin HCl kombinasyonuyla yapılan anestezinin göz içi basıncını belirgin olarak düşürdüğü ve glokom şüpheli köpeklerde göz içi basıncı ölçümünün bu maddeler kullanılmadan yapılması gerektiği sonucuna varılmıştır. Bununla birlikte bu iki sedatif ve anestezik maddenin, göz cerrahisinde güvenli bir şekilde kullanılabileceği sonucuna varılmıştır.

Anahtar Kelimeler: Ksilazin, ketamin, göz içi basıncı, köpek, anestezi

Introduction

Glaucoma is defined as the increase in the intraocular pressure (IOP) causing visual loss due to the circulation deficits of the aqueous humor. If the rise in the IOP does not cause any visual loss, this is called ocular hypertension (Miller, 2003).

The IOP measurement can be obtained without any problem in calm animals. However, some animals do not allow IOP measurement without sedation or anesthesia.

The balance between aqueous humor production and drainage, choroidal blood volume and central venous pressure like several physiological factors can effect the IOP (Cunningham, 1986).

Xylazine is a α_2 adrenergic receptor agonist sedative agent and it was synthesized in Germany in 1962 for use as an antihypertensive but was found to have potent sedative effects in animals (Lemke, 2007). The drug produces a statistically significant reduction in heart rate, decrease in aortic flow, initial increase in blood pressure followed by a decrease, and increase in peripheral resistance after IV administration in dogs. (Klide et al., 1975). Administration of xylazine to dogs can cause vomiting, which increases intraocular pressure dramatically was reported (Lemke, 2007).

Ketamine is a dissociative anesthetic agent and the cardiovascular effects of dissociative agents are characterized by indirect cardiovascular stimulation. In dogs anesthetized with ketamine, mean arterial pressure, heart rate and cardiac output increase while peripheral vascular resistance remains mostly unchanged (Topal, 2005). Effect of intravenous ketamine administration alone, on the IOP in dogs was studied and significant increase after 5 and 10 minutes at 5 mg/kg dose was determined (Hofmeister et al., 2006).

The source of information about the effects of xylazine-ketamine anesthesia on IOP in dogs is attributed to a study in 1977 (Gelatt et al., 1977). However the IOP measurement method was old and unreliable according to the same author when compared to current methods (Gelatt et al., 2007).

The aim of this study was to determine the effects of these two agents on IOP and by these means try to clarify the availability of use in dogs with pain due to any ocular lesion and/or simplify the measuring of IOP in aggressive animals. Also we aimed to assess the reliability of use these two agents in ophthalmic surgery.

Materials and Methods

In this study, 35 dogs of different breed, age and gender that were brought to Istanbul University Veterinary Faculty Education and Research Hospital Surgery Department with different surgical indications were used. Preoperative clinical examinations and blood tests for anesthetic availability were carried out.

Routine clinical eye examinations were performed before the procedure and the dogs, which had no abnormalities in both eyes were used. In 5 minutes after the dropping proparacaine HCl 0.5% (Alcaine®, Alcon) for local anesthesia, the first IOP measurement was carried out. The other two measurement results were obtained; 10 minutes after the 2 mg/kg IV xylazine HCl (Rompun®, Bayer) sedation and 10 minutes after the 5 mg/kg IV ketamine HCl (Ketasol®, Interhas) administration. An aplanation tonometer (Tono-Pen XL, Reichert®) was used for the IOP measurements. The IOP measurements in both eyes of all dogs were carried out in sternal position. During the measurements, tonometer was held as parallel to the ground and the mean IOP value was determined by the average of 5 IOP measurements. Obtained data were statistically evaluated by using the Student-T test.

Results

According to the results of the statistical analysis of the obtained data, the differences between the measurements before and after the sedation and anesthesia were found to be significantly different ($P<0.05$).

Even though, decrease in IOP after xylazine HCl administration exhibited a sharp drop when compared to average IOP values after ketamine HCl administration; statistical analysis of average IOP values after xylazine HCl sedation and ketamine HCl anesthesia were not significant (P>0,05) (Table 1).

Table 1. Average IOP values and standard deviation of 35 dogs before and after medications.
Tablo 1. İlaç uygulamaları öncesi ve sonrasında 35 köpeğin ortalama göz içi basıncı değerleri ve standart sapmaları.

	Number of Dog	Average IOP Value (mm/Hg)	Standard Deviation (mm/Hg)
Before Medication	35	17.8571	4.2506
After Xylazine HCl	35	14.2857*	3.4091
After Ketamine HCl	35	13.3429	2.9798

* Statistically important decrease in IOP was observed after Xylazine HCL premedication when compared before medication.

Discussion

In aggressive dogs which are resistant to restraint and have a painful eye disease like glaucoma, measurement of IOP without sedation or short term anesthesia was not possible, that is why some premedication agents and/or general anesthetics needed to be administered before the IOP measurements. The most frequently used agents in our clinic for this purpose are xylazine HCl and ketamine HCl.

Xylazine HCl and ketamine HCl are routinely used in veterinary medicine almost fifty years as a sedative agent and general anesthetic respectively (Greene and Thurmon, 1988; Hartney, 2012). Although there are some published papers with different results about their effects on IOP, there is not generally accepted consensus on this issue (Gellatt 1977; Hofmeister et al., 2006; Sinclair, 2003).

Some research reported that, when the alpha-2 agonists including xylazine and medetomidine are parenterally administered, they cause vomiting and holding the head down, which cause a significant increase in IOP (Kilic and Unsaldi, 2005; Lemke, 2004). But in other research, it was determined that the IV administration of medetomidine did not cause any significant increase in the IOP but only some miosis (Verbruggen et al., 2000). At this point, two important subjects we have to focus on the alpha-2 agonists: Administration route and the pupil size. Most cats and 10%-20% of dogs vomit shortly after IM administration of xylazine (Lemke, 2007), however do not after IV administration. We did not observe vomiting in any of our patients after IV xylazine administration in our study. Moreover, miosis is a desired condition in the treatment of glaucoma which helps to reduce IOP by widenning the irido-corneal angle and increasing the drainage of aqueous humor (Saroglu 2013). Informations about the intravenous administration and vomiting relation and mitotic effect of alpha-2 agonists are supported the result of our study.

In human medicine the effect of ketamine on IOP is a controversial issue. In some researches, a slight increase in IOP independent of changes in blood pressure has been observed but in another research, IV or IM administration of ketamine alone did not effect the IOP was reported (Lin, 2007). In veterinary medicine, IV administration of ketamine at 5 mg/kg dose caused a significant and clinically important increase in IOP in dogs in which premedication was not administered was reported. However in the same study IV administration of ketamine at the 10 mg/kg dose did not increase the IOP. Author of this study explains this result as higher doses of ketamine induced greater sedation (Hofmeister et al., 2006). However the aim of our study was not to deal with the effect of ketamine on IOP without premedication cause we already know since ketamine has an

increasing effect on IOP when used alone (Topal, 2005).

The information about the effect of xylazine-ketamine anesthesia on IOP in dogs is attributed to a previous study (Gelatt et al., 1977) and IOP measurement method of this study is not accepted by even its own author (Gelatt et al., 2007). It can be simply realized that more reliable results with new and reliable tonometer should be obtained.

In our study, we found that the IOP is significantly decreased following the xylazine HCl administration to a lesser extent following the ketamine HCl administration.

In conclusion, xylazine HCl sedation and xylazine HCl – ketamine HCl anesthesia significantly reduces the IOP in dogs and IOP measurements of glaucoma suspicious dogs must be obtained without the use of these two anesthetic agents. Secondly, it was determined that these two anesthetic agents can be used in ophthalmic surgery for their IOP reducing effects.

We suggest that, the reason for our different results from mostly cited study (Gelatt et al., 1977), is attributable to the Schiotz Tonometer used for measurements.

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