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Research Article

NORMAL OCULAR ULTRASONOGRAPHIC FINDING IN DOG

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ABSTRACT
Ultrasonography is a relatively easy, safe and non-invasive examination method which can be used in diagnosis of ocular disorders as complementary to routine ophthalmic examinations especially when severe swelling of the eyelid, keratitis, cataract and intraocular hemorrhage prevent direct ophthalmic examinations. Transcorneal ultrasonographic scanning of left and right eyes of 10 dogs (5 male and 5 female) was performed using a 7.5-10 MHz transducer. Qualitative ultrasonographic findings of the eyes were described and measurements of the ocular structures were obtained. Mean±standard deviation of the anterior-posterior length of the eye axis, thickness of the lens and depth of the anterior chamber were as 19.41±0.78, 5.71±0.45 and 8.63±0.35mm, respectively. The result of this study can be used as normal value measurements in ultrasonographic evaluation of mixed breed dog's eye.

Keywords: *Ocular, Ultrasonographic Finding, Dog*

INTRODUCTION
Ultrasonography is an important method for the clinical assessment of various ocular and orbital diseases. With understanding of the indications for ultrasonography and proper examination technique, one can gather a vast amount of information not possible with clinical examination alone. B-scan ultrasound is most useful when direct visualization of intraocular structures is difficult or impossible. Ultrasonography has been used since 1956 for diagnostic ocular diseases in humans. Veterinary ocular ultrasonography was first described in 1968 (Coile and O'Keefe, 1998). Situations that prevent normal examination include lid problems (eg, severe edema, partial or total tarsorrhaphy), keratoprosthesis, corneal opacities (eg, scars, severe edema), hyphema, hypopyon, miosis, pupillary membranes, dense cataracts, or vitreous opacities (eg, hemorrhage, inflammatory debris) (Qureshi *et al.*, 2010).
Corneal edema is a common clinical sign of corneal ulceration, keratitis, anterior uveitis, and many systemic diseases, and precludes the direct visualization of intraocular structures by ophthalmoscopy (Whittaker *et al.*, 1999). Under such conditions; alternative diagnostic methods for intraocular diseases must be explored (Boroffka *et al.*, 1998; Bentley *et al.*, 2003; Scotty *et al.*, 2004).
Ultrasonography is a useful tool to evaluate the contents of the globe and orbit as is done routinely in companion animal medicine (Ribeiro *et al.*, 2009). Ultrasonography is used for: (a) evaluation of intraocular details obscured from visualization by the ocular media opacities. (b) Evaluation of retinochoroidal lesions especially tumors even with clear media (c) differentiation of solid from cystic and homogenous from heterogeneous masses. (d) Examination of retrobulbar soft tissue masses and normally present orbital structures (to differentiate proptosis from exophthalmos). (e) Identification, localization and measurement of non radio-opaque/radio-opaque foreign bodies. (f) Biometry and pachmetry. (g) Follow up evaluations.
Transcorneal ultrasonography enables the evaluation of intraocular structures in eyes with opaque, diseased corneas in order to evaluate the prognosis for vision following resolution of the corneal disease. The evaluation of ocular emergencies can be limited by lack of sophisticated tools and training. Direct visualization of intraocular structures is difficult or impossible when the eye lids are swollen shut after injury. Lens opacification and hyphema can also block the posterior view of the chamber.
Indications for ocular ultrasound include any clinical entity which impedes visualization of the globe and retrobulbar region. Severe corneal edema, corneal lacerations or ulcerations, cataracts or ocular masses may preclude visualization of deeper structures with traditional ophthalmoscopic methods. Another common indication for ocular ultrasound is disparity in globe size or an exophthalmic globe.

Knowledge of the ultrasonographic appearance and normal dimensions of the eye would be serve as a basis for ultrasonographic examinations when ocular disease may have caused alterations in dimensions and appearance. The aim of this study was to measure and evaluate the structures of the eye (the thickness of the cornea, lens, and vitreous, and sagital eyeball axis) in adult mixed- breed dogs using ultrasound equipment.

MATERIALS AND METHODS

Ten clinically healthy adult mixed- breed dogs, with no evidence of ocular disorder, five male and five female, weighing 8 – 10 kilograms, were prepared. All dogs had a pre-study ophthalmic examination that demonstrated dog's eyes were normal. Dogs were sedated intramuscularly with mixture of Xylazin and Diazepam.

The left and right eyes of dogs were scanned ultrasonographically in using a Piomedical ultrasound machine with a linear array transducer of 7.5-10 MHz.

To avoid trapping air between the transducer and the patient, the palpebral hair was thoroughly wetted before the acoustic gel was applied. After using enough gel on the upper eyelids, transcorneal scanning was started while the globe was imaged in both horizontal and vertical planes through the visual axis on the upper eyelid and perpendicular to the upper palpebral fissure respectively for a complete examination. This produces a cross-sectional image of the eye with the medial canthus to the right and lateral canthus to the left of the horizontal images. Attempts were made not to cause pressure on the cornea during placement of the transducer on the eyelid. The gain was set so that there was an anechoic region between the anterior and posterior lens capsule.

We measured five points in the adult dog's cornea: central, peripheral superior, peripheral inferior, peripheral nasal and peripheral temporal. The peripheral points were 1 mm from limbus (the junction of cornea and sclera). Ten measurements were taken at each point to determine the mean thickness. A Student t-test was used for statistical analysis.

RESULTS AND DISCUSSION

Results

In B-mode ultrasonography, four major echoes include cornea, anterior lens capsule, posterior lens capsule and retina-choroid sclera complex were easily seen (Figure 1). The cornea was represented as a curved hyper parallel echoic interface immediately under the eyelid. In some of the sonograms, the cornea could be seen as three thin layers, in which the anterior and posterior layers were quite hyper echoic and the middle layer appeared anechoic. Anterior chamber of the eye, lens cortex and nucleus and the vitreous were anechoic. Other echoic structures including Ciliary body, iris and optic disc could also be distinguished.

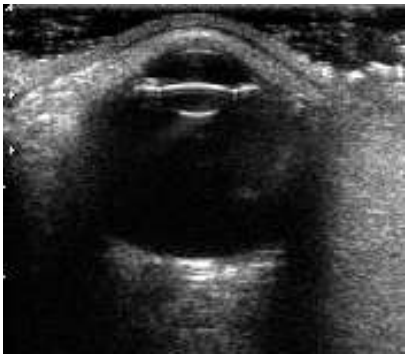

Figure 1: Ultrasound image of a normal eye

The lens thickness ranged from 4.9 to 7.1mm in adult dogs. The vitreous thickness ranged respectively from 18.8 to 20.9 mm. The parameters of the left and right eye differed insignificantly. The thinnest central cornea was 0.50±0.12 mm in the left eye and 0.58±0.13 mm in the right eye. Corneal thickness

ranged from 0.36 to 0.73 mm. The central part of the cornea was the thinnest and peripheral part was slightly thicker in adult dog. The peripheral temporal point of the cornea was the thickest. The results of the measurements on dog's eye were recorded in Table 1.

Table 1: Average values of optical components in adult mixed-breed dog's eye

Right eye			Left eye		
Lens Thickness Mm	**Vitreous Thickness mm**	**Sagital axis mm**	**Lens Thickness mm**	**Vitreous Thickness mm**	**Sagital axis mm**
5.69±0.87	8.56±0.64	19.44±0.98	5.71±0.91	8.64±0.58	19.27±0.86

Discussion

Ocular ultrasound is an addition to, not a replacement for, routine ophthalmic examination including assessment of menace, blink and papillary light response, fluorescein staining, nasolacrimal evaluation, determination of intraocular pressure and examination of anterior and posterior segments using a bright focal light source and direct and indirect ophthalmoscopy or bio microscopy, respectively (Reef, 1998; Gonzlez *et al.*, 2001). Several studies have been done on the eye ultrasonography in different kind of animals Veterinary (Coile and O'Keefe, 1998; Hughes, 1972; Hughes 1979). The most common clinical indications for ultrasound are to evaluate for the presence of a retinal detachment in eyes with a cataract, intraocular lesions including lens displacement, intravitreal hemorrhage and intraocular foreign bodies. In addition, orbital evaluation can be performed in instances of exophthalmoses or orbital trauma (Hillyer, 1993). In the study reported here anterior-posterior length of the eye axis, lens diameter, depth of the anterior chamber and depth of vitreous were measured in normal eyes of dogs to establish mean and standard deviation values. No difference was detected in any ocular component measurement between the right and left eyes of the adult mixed-breed dogs. It was in agreement with other investigations similar studies on enucleated eye of dog have been done.

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