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B-mode ultrasonographic appearance of the globe and intraocular structures of eye in dogs

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Abstract
Transcorneal B-mode ultrasonographic scanning of 74 eyes of 37 healthy dogs of 11 different breeds of either sex was performed without any sedation, anaesthesia or analgesia to study ultrasonographic appearance of the globe and intraocular structures of eye in dogs. Qualitative echo findings of the eyes were described.

Keywords: B-mode ultrasonographic, globe, intraocular structures

Introduction

Ocular ultrasonography is a good diagnostic tool for routine ophthalmic examinations (Gorig, 2006) [12]. Ultrasonography enables the evaluation of intraocular structures and gives immediate result with excellent definition. Ultrasonography is valuable in the investigation of both ocular and orbital diseases. Ultrasonography is safe, non-invasive, well tolerated, non-toxic, rapidly performed and relatively inexpensive.

Ultrasonography is used for various purposes *viz*., evaluation of intraocular details obscured from visualisation by the ocular media opacities, evaluation of retino-choroidal lesions especially tumors even with clear media, differentiation of solid from cystic and homogenous from heterogeneous masses, examination of retrobulbar soft tissue masses and normally present orbital structures (to differentiate proptosis from exophthalmos), identification, localisation and measurement of non-radiopaque/radio-opaque foreign bodies, detection of retinal detachment, detection of lens dislocation or rupture, detection of vitreous degeneration, guidance of fine-needle aspirates of orbital and ocular lesions, ocular biometry and pachmetry (Kealy and McAllister, 2000; Maggs *et al*., 2008 and Ribeiro *et al.*, 2009) [16, 18, 27].

Knowledge of the ultrasonographic appearance and normal dimensions of the eye would serve as a basis for ultrasonographic examinations when ocular disease may have caused alterations in the dimensions and appearance intraocular structures (Potter *et al.*, 2008) [24].

Therefore keeping above information in mind, the present work was undertaken to study the B-mode ultra sonographic appearance of the globe and intraocular structures of eye in dogs.

Materials and Methods

In the present study, B-Mode Ultrasound of Intraocular Structures in Dogs was conducted in 74 eyes from 37 healthy dogs on clinical cases of dogs presented to Department of Veterinary Surgery and Radiology, Bikaner for routine check-up.

History of vision changes, age, any injury, time elapsed since occurrence of problem, use of recent medications and presence of diabetes was obtained from the dog owner. The eyes were checked for clarity of cornea, opacity of lens, cataract, conjunctival appearance, conjunctival vascularity and discharge, if any.

Ophthalmic ultrasonography was performed with an ultrasound machine (Fig. 1-Ultrasonix Vet, Ultrasonix Medical Corporation, Canada) using a 5-14 MHz linear transducer (Fig.2) using high frequency sound waves to produce detailed images of eye. No pre-examination drug or medication was used. All the dogs were examined using verbal and physical restraining without any sedation or anaesthesia / analgesia.

The dogs were placed in lateral recumbency facing the head towards the ultrasound machine. Eyes were thoroughly flushed with physiological saline before performing the ultrasound examination. Sterile coupling gel (Fig.3-SUJA Medical Corporation, Jaipur, Rajasthan, Inidia).was used and directly placed on the cornea for the examination.

Transducer was directly placed on the cornea after application of coupling gel. Scanning depth was kept 4 cm while frequency was set to 14 MHz. The globes were examined in a sagittal (longitudinal) plane (Fig. 4) as standard described models (El-Maghraby *et al*, 1995; Potter *et al*, 2008) [24].

Optimal B-scan sonogram along the central optic axis enabled visualisation of the cornea, aqueous chamber, anterior lens capsule, posterior lens capsule, vitreous chamber, posterior ocular wall.

After examination of the eyes excess sterile coupling gel was wiped off with the help of cotton from surrounding of eye lids and margins while eyes were rinsed off with physiological saline to remove coupling gel. No other special care was taken post-examination.

Results and Discussion

Even for animals in which direct observation of intraocular structures is not possible, ultrasonography may be helpful for tumour identification, performance of measurements, and comparison of findings to those for the contralateral eye (Gonzalez *et al*., 2001) [11]. Structures that cannot be observed by use of routine ophthalmologic examination techniques, such as ciliary bodies or retro-bulbar spaces, can be evaluated via ultrasonography (Hoffmann and Kostlin, 2004) [15].

Opening of eyes in pups was reported to be between ten to fifteen days by Paunksnis *et al*., (2001) [22] and Ferriera *et al*., (2003) [8]. In young pups, clinical examination of the eyes is not possible until the eyelids have opened during the first 14 days and thereafter, it is difficult because of restless behaviour, small globe size, and the incompletely developed tapetumlucidum, but these factors do not limit ultrasonographic examination of the eye which was in the agreement with the lower limit of the age in present study (Boroffka, 2005) [4].

The B-mode probe used in the present study operated at a frequency of 5-14 MHz, allowed complete evaluation of the globe which was in accordance with Ribeiro *et al.,* (2010) [26]. The scanning depth was kept 4 cm which allowed excellent evaluation of the intraocular structures and was in agreement with Whitcomb (2002) [3].

Hillyer (1993) [14] stated that transpalpebral and trans-corneal ultrasonographic techniques were useful to evaluate the normo-echoic ocular pattern of the eye. However, trans-corneal technique has some risk of corneal damage but outweighed by the enhanced image quality so transcorneal method was adopted in present study.

The present study was conducted in lateral recumbency by manual restrain and blepherostasis on unsedated dogs similar to Lee *et al.,* (2003) [17] and Bentley, (2015) [3] this allowed adequate evaluation of the eye globe, avoided rotation of eye ball and upward movement of third eyelid which were reported as the common problems faced in sedated or general anesthetized and closed eyelids by Dar *et al.,* (2014) [5], Penninck *et al.,* (2001) [23] and Mustafa (2005) [20]. Thus, sedation and general anaesthesia proposed previously by Gonc¸ alves *et al.,* (2009) [10] did not appear necessary and with these techniques, risks inherent in anaesthesia, as well as additional costs, were eliminated in present study.

Many parameters in the anterior segment may be lost in the near-field reverberation artefact as observed by Poulsen *et al.,* (2000) [25] and Nautrap *et al.,* (2000) [21] and a standoff can be used to avoid this problem as advocated by Silva *et al.,* (2010) [29] and Singh *et al.,* (2015) [30]. Conductive gel used as a standoff pad in present study as advocated by was effective and allowed adequate evaluation of the anterior segment of the eye, as well as identification of its structures in all eyes evaluated to obtain reliable images.

After ultrasound examination, excess coupling gel was carefully wiped from the eyes as reported by El-Tookhy and Tharwat (2013) [7] and rinsed with sterile 0.9% sodium chloride solution as stated by Martins *et al.,* (2010) [19] to prevent the corneal irritation (Kealy and McAllister, 2000; Maggs *et al.,* 2008; Singh *et al.,* 2015) [16, 18, 30]; and eyes were re-examined for the identification and treatment, if necessary, of iatrogenic corneal lesions resulting from the examination as advised by Martins *et al.,* (2010) [19]. But in present study no iatrogenic corneal lesions were noticed from the examination this was in accordance with Gonc¸alves *et al.,* (2009) [10] in dogs and cats and by Toni *et al.,* (2010) [32] in rabbits.

Normal ultrasonogram of a healthy eye of a dog has been shown in Fig. 5. The globe was observed as a round and well-delimited structure with distinct borders in bony orbit. All three primary structures in the globe, the anterior chamber, vitreous chambers and the lens, were anechogenic (Singh *et al.,* 2015) [30]. The anterior chamber filled with aqueous humour was identified as an anechoic area in B-mode ultrasound just behind the cornea while cornea was characterised by two parallel and convex hyper-echoic lines near the contact area of transducer which were in agreement with Boroffka *et al.,* (2006) [4].

In normal dogs, the iris and posterior chamber are usually difficult to distinguish from the adjacent ciliary bodies but using high-resolution transducers, the posterior chamber can be seen as an anechoic, triangular space between the lens, ciliary body, and iris as reported by Penninck *et al.,* (2001) [23] however, in present study at 14 MHz frequency it was possible to observe distinguished anterior chamber, ciliary bodies and posterior chamber as well.

The anterior and posterior margins of the lens were hyper-echogenic creating a distinct delineation between the chambers and the lens. It was possible to identify the lens by identifying both anterior and posterior capsules. Anterior lens capsule appeared as convex hyper-echoic line while posterior lens capsule appeared as concave hyper-echoic line and the nucleus of the lens was identified as an anechoic area between two hyper-echoic lines of the anterior and posterior lens capsules (Williams, 2004) [35]. The iris and the ciliary body were relatively hyper-echogenic structures that in reality circumferentially surround the lens. However, on ultrasonic examination they appeared at the lateral margins of the lens (Scotty *et al.,* 2004) [28].

The vitreous chamber, filled with vitreous humour, was identified as anechoic area between the posterior lens capsule and posterior pole of the eye which appears hyper-echoic (Williams, 2004) [34] and (Haraldsen, 2014) [13].

The posterior pole of the eye, which includes the retina, the choroid and the sclera, was identified as a hyper-echogenic and concave structure. It was hard to differentiate retina, choroid and sclera and collectively termed as sclero-retinal rim. The optic disc appeared as a slightly brighter region that may be either raised or depressed, relative to the posterior globe, in normal eyes. The optic nerve and extra ocular muscles were hypo-echoic, relative to the echogenic retro-bulbar fat separating them just posterior to the globe surrounded by hypo-echogenic ocular muscles. These structures converged toward the posterior orbital apex near the optic canal, forming a cone shape, with the base at the posterior wall of the globe (Haraldsen, 2014) [13].

In present study, the hyper-echogenicity of the optic nerve was presumably due to orientation of the beam parallel to the nerve fibers and the highly organised, homogeneous structure of the optic nerve compared to adjacent fat as reported by Potter *et al.*, (2008) [24].

The ultrasonographic appearances of present study corroborated with ophthalmologically normal eyes of dogs (Paunksnis *et al.*, 2001) [22], feline (Gilger *et al.*, 1998) [9], equine (Svaldeniene *et al.*, 2004) [31], cattle (Assadnassab and Fartashvand, 2011) [1], buffalo (Assadnassab and Fartashvand, 2013) [2] and camel (Yadegari, *et al.*, 2013) [35].

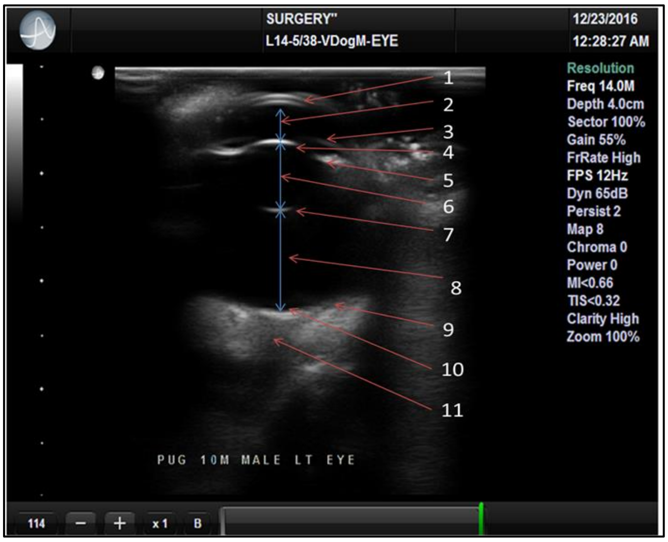
It was concluded that ultrasound can be used as a tool for ophthalmologic examination and determined normal echogenicity of the main ocular structures.

Fig 1: Ultrasonix Vet Ultrasound machine

Fig 2: Linear Array Probe (5-14MHz)

Fig 3: Sterile Coupling Gel

Fig 4: A Labrador retriever adult male in lateral recumbency during ultrasonographic examination. Probe positioned in sagittal/ longitudinal plane.



1: Cornea
2: Aqueous chamber
3: Iris
4: Anterior lens capsule
5: Ciliary body
6: Lens
7: Posterior lens capsule
8: Vitreous chamber
9: Sclero retinal rim
10: Optic disc and
11: Optic nerve

Fig 5: Normal B - Mode ultrasonogram of left eye of 10 months old male Pug dog.

References

1. Assadnassab G, Fartashvand M. Ultrasonography of vitreous chamber in Iranian Holstein cattle. Advances in Environmental Biology 2011;5(7):1854-1856.
2. Assadnassab G, Fartashv M. Ultrasonographic evaluation of buffalo eyes. Turkish Journal of Veterinary and Animal Sciences 2013;37(4):395-398.
3. Bentley E 2015. Ophthalmic ultrasound. https://cvm.ncsu.edu/wp-content/uploads/2016/./Bentley_Ophthalmic_Ultrasound.pdf
4. Boroffka SAEB, Voorhout G, Verbruggen AM, Teske E. Intraobserver and interobserver repeatability of ocular biometric measurements obtained by means of B-mode ultrasonography in dogs. American Journal of Veterinary Research 2006;67(10):1743-1749.
5. Dar M, Tiwari DK, Patil DB, Parikh PV. B-scan ultrasonography of ocular abnormalities: A review of 182 dogs. Iranian Journal of Veterinary Research

2014;15(2):122-126.
6. El-Maghraby H, Nyland TG, Bellhorn RW. Ultrasonographic and biometric evaluation of sheep and cattle eyes. Vet. Radiol. Ultrasound 1995;36:148-151.
7. El-Tookhy O, Tharwat M. Clinical and ultrasonographic findings of some ocular conditions in sheep and goats. Open Veterinary Journal 2013;3(1):11-16.
8. Ferreira FM, Jones SP, Cassotis N, Ramsey DT, Gearhart P, Cardoso F. Early postnatal development of central corneal thickness in dogs. Veterinary Ophthalmology 2003;6(1):19-22.
9. Gilger BC, Davidson MG, Howard PB. Keratometry, ultrasonic biometry and prediction of intraocular lens power in the feline eye. American Journal Veterinary Research 1998;59(2):131-134.
10. Gonc Alves GF, Leme MC, Romagnolli P *et al*. Biometriaultrassonogra´ficabidimensionalem tempo real de bulbo ocular de gatosdome´sticos. Cieˆncia Animal Brasileira 2009;10:829-834.
11. Gonzalez EM, Rodriguez A, Garcia I. Review of ocular ultrasonography. Veterinary Radiology & Ultrasound 2001;42(6):485-495.
12. Gorig C, Varghese T, Stiles T, Broek J, Zagzebski JA, Murphy CJ. Evaluation of acoustic wave propagation velocities in the ocular lens and vitreous tissues of pigs, dogs, and rabbits. American Journal of Veterinary Research 2006;67(2):288-295.
13. Haraldsen KR. Examination and measurements of the canine lens with B-mode ultrasound 2014. www.huveta.hu/bitstream/10832/1282/1/RiiserHaraldsen Karoline Thesis.pdf
14. Hillyer MH. Ocular ultrasonography in the horse In: The Veterinary Annual, 33rd edition, edited by Raw ME and Parkinson (Oxford, Blackwell Scientific Publications) 1993, 131-137.
15. Hoffmann I, Köstlin R. Die sonographische Untersuchung des vorderen Augenabschnittesbeim Kleintier. Teil 1: Untersuchungstechnik und echographische. Normal befunde. Tierarztl Prax K 2004;32:175-179.
16. Kealy JK, McAllister H. Diagnostic Radiology and Ultrasonography of the Dog and Cat. 3rd Edn, WB Saunders Co., St. Louis 2000;1-20:377-378.
17. Lee HC, Choi HH, Choi MC, Yoon JH. Ultra sonographic measurement of optic nerve sheath diameter in normal dogs. J Vet. Sci 2003;4(3):265-268.
18. Maggs D, Miller P, Ofri R. Slater’s fundamentals of veterinary Ophthalmology, 4th ed., Saunders, St. Louis, Missouri 2008, 103-104.
19. Martins BC, Rodrigues Jr EF, Souza ALG, Almeida DE, Brito FL, Canola JC. A and B mode ultrasonography in preoperative evaluation of lens and posterior segment of dogs eyes with cataract. Pesquisa Veterinária Brasileira 2010;30(2):121-126.
20. Mustafa TA. The Bell’s phenomenon in new borns. Neurosciences 2005;10(1):41-43.
21. Nautrap CP, Tobias R, Cartee RB. An Atlas and Textbook of Diagnostic Ultrasonography of the Dog and Cat. 1st edn., Manson Publishing, Hannover 2000, 75-85.
22. Paunksnis A, Svaldeniene E, Paunksniene M, Babrauskiene V. Ultrasonographic evaluation of the eye parameters in dogs of different age. Ultragarsas 2001;2(39):1-4.
23. Penninck D, Daniel GB, Brawer R, Tidwell AS. Cross-Sectional Imaging Techniques in Veterinary Ophthalmology. Clinical Techniques in Small Animal Practice 2001;16(1):22-39.
24. Potter TJ, Hallowell GD, Bowen IM. Ultrasonographic anatomy of the bovine eye. Veterinary Radiology and Ultrasound 2008;49(2):172-175.
25. Poulsen NC, Tobias R, Cartee RB. An Atlas and Textbook of Diagnostic Ultrasongraphy of the Dog and Cat.1stEdn, Manson publishing, Hannover 2000, 92-105.
26. Ribeiro AP, Santos NL, Silva VC, Campos AF, Teixeira A, Laus JL. Ultrasonographic and ecobiometric findings in the eyes of adult goats. Ciência Rural 2010;40(3):568-573.
27. Ribeiro AP, Silva ML, Rosa JP, Souza SF, Teixeira IA, Laus JL. Ultrasonographic and echobiometric findings in the eyes of Saanen goats of different ages. Veterinary Ophthalmology 2009;12(5):313-317.
28. Scotty NC, Cutler TJ, Brooks DE, Ferrel E. Diagnostic ultrasonography of equine lens and posterior segment abnormalities. Veterinary Ophthalmology 2004;7(2):127-139.
29. Silva ML, Martins BC, Ribeiro AP, Groszewicz de Souza AL, Laus JL. A- and B-modes echobiometry in cataractous and noncataractous eyes of English Cocker Spaniel dogs. Arq. Bras. Med. Vet. Zootec 2010;62(5):1080-1085.
30. Singh S, Purohit S, Pandey RP. B-Mode Intraocular Echo-morphometry of Murrah Buffalo (*Bubalusbubalis*). Ruminant science 2015;4(2):249-254.
31. Svaldeniene E, Babrauskiene V, Paunksniene M. Ultrasonic biometry of bovine, porcine and canine eye's parts. Veterinarmedicinasraksti (Latvia) 2004, 289-291.
32. Toni MC, Meirelles AEWB, Gava FN, Camacho AA, Laus JL, Canola JC. Rabbits’ eye globe sonographic biometry. Veterinary Ophthalmology 2010;13(6):384-386.
33. Whitcomb MB. How to diagnose ocular abnormalities with ultrasound. American Association of Equine Practitioners 2002;48:272-275.
34. Williams DL. Lens morphometry determined by B-mode ultrasonography of the normal and cataractous canine lens. Veterinary Ophthalmology 2004;7(2):91-105.
35. Yadegari M, Saleh A, Ashtari A, Ashtari SM. B-mode ultrasound biometry of intraocular structures in dromedary camels (*Camelus dromedarius*). Global Veterinaria 2013;10(1):71-74.