Iranian Veterinary Surgery Association

IRANIAN JOURNAL OF VETERINARY SURGERY

Journal homepage: www.ivsajournals.com

ORIGINAL ARTICLE

Comparison of Transcorneal and Transpalpebral Ultrasonographic Measurements of the Eye in Iranian Mix Breed Dog

Roham Vali[1*], Moslem Razeghi[2]

[1] *Assistant Professor, Department of Clinical Sciences, School of Veterinary Medicine, Kazerun Branch, Islamic Azad University, Kazerun, Iran.*

[2] *DVM, Faculty of Veterinary Medicine, Kazerun Branch, Islamic Azad University, Kazerun, Iran.*

Received: 29 October 2018
Accepted: 3 August 2019
Online: 6 August 2019

Keywords:

Dog;

Eye;

Transcorneal;

Transpalpebral;

Ultrasonography.

Abstract

Objective-The aim of this research was to compare transcorneal and transpalpebral ultrasonography study of the dimensions (ecobiometry) and the ultrasonographic aspect of Iranian mix breed dogs.

Design- Experimental study

Animals- Ten adult male dogs

Procedure- Ten adult male dogs with the mean age 4±1.39 years and the mean weight of 16.7±2.31 kg were selected and distributed in two equal groups. Transcorneal and transpalpebral ultrasonographic scanning of left and right eyes of dogs were performed using with a 12 MHZ transducer. The transducer was placed in a longitudinal position (sagittal plane) until optimal B-scan images, were obtained.

Results- Means and standard deviations of the intraocular structures of both transcorneal and transpalpebral were as, Anterior chamber depth (2.99±0.242, 2.78±0.285 mm), Lens thickness (6.62±0.364,7.02±0.612 mm), Vitreous chamber depth (8.81±0.354, 8.79±0.552 mm) and Axial globe length (19.60±0.452,19.50±0.592 mm) respectively. No significant differences were observed when comparing left and right eyes of dogs in both methods within the same group and comparing between two groups ($p>0.05$).

Conclusion and clinical relevance- Results of this study can be used as a template in diagnosis of ocular disease and facilitates the use of transpalpebral ultrasonography in the evaluation of ocular structures in ocular disease especially painful conditions.

* Correspondence to: Roham Vali, Department of Clinical Sciences, School of Veterinary Medicine, Kazerun Branch, Islamic Azad University, Kazerun, Iran. E-mail: rohamvali@gmail.com

DOI: 10.22034/IVSA.2019.154146.1165

1. Introduction

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.[1,2] Ophthalmic ultrasonography is an indispensable tool in veterinary ophthalmology because it helps in diagnosing alterations that are not identified in the routine eye examination, especially when there is opacification of the transparent media of the eye (cornea, aqueous humor, lens and vitreous humor).[3] Some ocular diseases such as corneal ulceration, keratitis, anterior uveitis, and many systemic diseases, with corneal edema precludes the direct visualization of intraocular structures by ophthalmoscopy.[4]

Under such conditions; alternative diagnostic methods for intraocular diseases must be explored.[3,5] Transcorneal ultrasonography provides an excellent noninvasive manner to image the globe and retrobulbar space. In this method direct contact with the cornea makes clear and sharper images of intraocular structures.[6,7] Transpalpebral ultrasonography is especially useful when opacification of the anterior segment of the eye limits a complete ophthalmoscopic examination or when severe swelling of the eyelids prevents examination of the globe.[2,6]

Ultrasonographic examination provides excellent visualization of the cornea, anterior and posterior chambers, anterior and posterior reflections of the lens capsule, iris and ciliary body, optic nerve and disc, and retrobulbar space.[2,5,6,7]

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.[3,5] For this reason, the aim of this research was to compare transcorneal and transpalpebral ultrasonography study of the dimensions (ecobiometry) and the ultrasonographic aspect of Iranian mix breed dogs.

2. Materials and Methods

Ten adult male healthy Iranian mix breed dogs, with the mean age of 4±1.39 years and the mean body weight of 16.70±2.31 kg were included in this study and distributed in two equal groups. Prior to ultrasonographic evaluation, all dogs underwent a complete ophthalmic examination. None of the dogs had a history of ophthalmic disease, they were clinically healthy, and their eyes showed no abnormalities.

Transcorneal and transpalpebral ultrasonography were used in group 1 and 2 respectively. In group one B-mode transcorneal ultrasonography was performed in both eyes simultaneously by the same operator after administration of a topical anesthetic gel. Lubricating jelly was placed on the 12 MHz transducer tip (BK Medical ultrasound machine) as a stand-off pad.

The transducer was placed in a longitudinal position (sagittal plane) with applying Light pressure to maintain good contact between the transducer and the cornea until optimal B-scan images, were obtained. In the second group the transpalpebral method was used with no contact between the probe and cornea. Ultrasound was performed on the eyelid with minimal pressure on it.

Measurements of the following parameters were recorded in both methods: anterior chamber depth, lens thickness, vitreous chamber depth and axial globe length. The anterior chamber depth was measured as the distance between echoes from the posterior corneal surface and the anterior lens surface. The lens thickness was the distance between echoes from the anterior and posterior lens surfaces. The vitreous chamber depth was the distance between echoes from the posterior lens surface and the retina. The axial globe length was measured from the posterior corneal surface to the retina.

For statistical analysis sample T-test was used to determine the differences between two methods. Statistical significance was set at $p< 0.05$.

Figure 1. Transcorneal ultrasonographic image of normal eye in adult Iranian mix breed dog with intraocular dimensions. 1: Cornea, 2: Anterior chamber, 3: Anterior capsule of lens, 4: Posterior capsule of lens, 5: Vitreous chamber, 6: Optic disc

Figure 2. B-Mode ultrasonography of Iranian mix breed dog eye indicating: 1: Anterior chamber depth, 2: Lens thickness, 3: Vitreous chamber depth 4: Axial globe length

3. Results

In accordance with the ultrasonographic findings in other domestic species, on the B-mode images the cornea, anterior and posterior lens capsule, sclera, iris and optic disc appeared hyperechoic areas (Figure 1). The cornea was represented as a curved hyper parallel echoic interface immediately under the eyelid. In sonographic images of the present study, which used high frequency (12 MHz), the cornea is seen as three thin distinct layers, in which the anterior and posterior layers were quite hyper echoic and the middle layer appeared anechoic. The Anterior chamber, the nucleus of the lens and vitreous chamber filled with anechogenic liquids so appeared as anechoic area (Figure 2). Mean±SD of measured parameters is demonstrated in Tables 1 and 2. Table 3 shows the comparison between the transcorneal and transpalpebral measurements of intraocular structures regarding transcorneal and transpalpebral measurements. Although no significant differences were observed when comparing left and right eyes of dogs in both methods within the same group and comparing between two groups (p>0.05), but the anterior chamber depth and lens thickness showed more values in transcorneal and transpalpebral methods respectively. The values of other parameters in both methods were in close together.

4. Discussion

Ultrasound has been used in ophthalmology since 1956. By using ultrasound, information can be obtained on intraocular structures. It is especially useful when opacification of the anterior segment of the eye limits a complete ophthalmoscopic examination or when severe swelling of the eyelids prevents examination of the globe.[2] On the other hand eye-related diseases such as corneal edema, exophthalmos, lens luxation and retinal detachment can be detected.[5,6] In most of the ultrasound studies on the ocular structures of animals the transcorneal method has been considered for higher quality image.[6,7] In some cases, including eyelid diseases, where the possibility of imaging through the cornea is difficult, the palpebral method is preferable.[6] In this study, we tried to highlight the differences in the results of both methods. The ultrasonographic appearance of dog eyes showed great similarity in comparison to other domestic species. [4,8,9-11] In current research the mean and standard deviation of anterior chamber depth and lens thickness in transcorneal method were 2.99±0.242, 6.62±0.364 mm respectively,

Table 1. Transcorneal ultrasonographic measurements of eye structures (mm) in 10 adult Iranian mix breed dogs

Parameter (mm)	Mean			SD			Min			Max		
	total	right	left	total	right	left	total	right	left	total	right	left
Anterior chamber	2.99	3.02	2.96	0.242	0.238	0.270	2.7	2.7	2.7	3.3	3.3	3.3
Lens thickness	6.62	6.56	6.68	0.364	0.336	0.420	6.1	6.2	6.1	7.1	7	7.1
Vitreous chamber	8.81	8.88	8.47	0.354	0.389	0.343	8.4	8.5	8.4	9.5	9.5	9.2
Axial globe length	19.60	19.46	19.74	0.452	0.559	0.313	18.8	18.8	19.2	20.1	20.1	20

Table 2. Transpalpebral ultrasonographic measurements of eye structures (mm) in 10 adult Iranian mix breed dogs

Parameter (mm)	Mean			SD				Min				Max
	total	right	left	total	total	right	left	total	total	right	left	total
Anterior chamber	2.78	2.84	2.72	0.285	0.270	0.319	2.3	2.6	2.3	3.3	3.3	3.1
Lens thickness	7.02	6.84	7.20	0.612	0.801	0.346	5.6	5.6	6.6	7.8	7.8	7.5
Vitreous chamber	8.79	8.88	8.70	0.552	0.521	0.628	7.8	8.2	7.8	9.5	9.5	9.3
Axial globe length	19.50	19.52	19.48	0.592	0.593	0.661	18.7	18.9	18.7	20.2	20.2	20.2

Table 3. Comparison of transcorneal and transpulpebral measurements (Lt+Rt) in 10 adult Iranian mix breed dogs

Parameter(mm)	Transcorneal	Transpulpebral	P value
Anterior chamber	2.99±0.242	2.78±0.285	0.093
Lens thickness	6.62±0.364	7.02±0.612	0.093
Vitreous chamber	8.81±0.354	8.79±0.552	0.924
Axial globe length	19.60±0.452	19.50±0.592	0.676

while the amount of these parameters in transpalpebral method were as 2.78±0.285 and 7.02±0.612 mm. The values of vitreous chamber depth and axial globe length are approximately the same in both methods. The results of present study showed, although there was no significant difference between the results of two ultrasound methods, but the anterior chamber depth and lens thickness showed more values in transcorneal and transpalpebral methods respectively. Such differences may be related to ocular irritation after jelly instillation and tip of ultrasound probe, which may reduce intraocular pressure values, consequently reducing anterior chamber depth due to antidromic stimuli.[4] Paunksnis *et al*. measured some ocular parameters in ten adult dogs by transcorneal ultrasonography.[12] According to Paunksnis study all parameters measured, significant differences were not observed between left and right eyes of the same age.[12] They reported the lens thickness 5.54±0.807, 5.84±0.606 mm in right and left eyes, respectively. In our study the amount of lens thickness in transcorneal method was different with above study (6.56±0.336, 6.68±0.420 mm). The amounts of other parameters in both study are close together. The amount of anterior chamber in our study and Toni *et al*. nearly close together.[13] They reported the amount of anterior chamber in 10 brachycephalic dogs 2.92±0.37 mm while in our study it was 2.99±0.242 mm.[14] The vitreous chamber depth was the only parameter that showed different values in two studies 8.81±0.354 mm against 9.48±0.74 in Toni *et al*. study. Silva *et al*. measured the eye parameters in thirty dogs from different breeds and ages.[15] In their study the amount of anterior chamber depth showed less values than present study (2±0.06 against 2.99±0.242 mm).[15] They found positive correlation between the biometric measurements of the eye ball and the dogs age.[15] The comparison between the results of current study and other reports showed the findings of our study was different in some parameters such as lens thickness and anterior chamber. Differences between the two studies may be related to breed or type of dogs or differences such as age and weight of dogs. Schiffer *et al*. showed that axial globe length of adult male dogs was found to be significant longer than that of adult female dogs.[9] According to Cottrill study the axial globe length of dolichocephalic dogs was significantly longer

than that of mesocephalic dogs.[16] On the other hand However, using a higher frequency provides clear images without artifacts, especially in the anterior chamber that could affect the measurements of parameters. Results of this study showed that both ultrasound techniques can be used for measurements of intraocular structures. It should be kept in mind that in transcorneal method, images are of higher quality and without artifacts.

Results of this study can be used as a template in diagnosis of ocular disease and facilitates the use of transpalpebral ultrasonography in the evaluation of ocular structures in ocular disease especially painful conditions.

Acknowledgement

The authors would like to thank the members of the diagnostic imaging department of the faculty of veterinary medicine, for their assistance.

Conflict of Interests

None.

References

1. Hamidzada WA, Osuobeni EP. Agreement between A-mode and B-mode ultrasonography in the measurement of ocular distances. *Veterinary Radiology and Ultrasound*, 1999; 40(5): 502-507.
2. Whitcomb MB. How to diagnose ocular abnormalities with ultrasound, in Proceedings. *American Association of Equine Practitioners*, 2002; 48: 272–275.
3. Scotty NC, Cutler T J, Brooks D E, Ferrell E. Diagnostic of equine lens and posterior segment abnormalities. *Veterinary Ophthalmology*, 2004; 7(2): 127-139.
4. Ribeiro AP, Santos NL, Silva VC, Campos AF, Teixeira IA, MALaus, JL. Ultra-sonographic and echobiometric findings in the eyes of adult goats. *Ciência Rural*, 2010; 40: 568-573.
5. Bentley E, Miller PE, Diehl KA. Use of high-resolution ultrasound as a diagnostic tool in veterinary ophthalmology. *Journal of American Veterinary Medicine Association*, 2003; 223: 1617-1622.
6. Kealy J, McAllister H. Diagnostic Radiology and Ultrasonography of the Dog and Cat, 3rd ed. *Saunders, St Louis*, 2000; pp: 377-378.
7. Spaulding K. Eye and Orbit. In: Penninck D, d´Anjou MA. *Atlas of Small Animal Ultrasonography*. Blackwell Publishing, Iowa, 2008, pp: 49-90.
8. Gilger BC, Davidson MG, Howard PB. Keratometry, ultrasonic biometry, and prediction of intraocular lens power in the feline eye. *American Journal of Veterinary Research*, 1998; 59(2): 131-134.
9. Schiffer SP, Rantanen NW, Bryan GA, Leary GM. Biometric study of the canine eye, using A-mode ultrasonography. *American Journal of Veterinary Research*, 1982; 43(5): 826-830.
10. Vali R, Sayadi E. Ultrasonographic measurements of Intraocular Structures in Healthy Dareh-shori Horse. *Journal of Large Animal Clinical Science Research*, 2015; 8(1): 47-52.
11. Vali R. Reference measurements and ultrasonographic intraocular structures in goats. *Online journal of Veterinary Research*, 2016; 20(6): 410-414.
12. Paunksnis A, Svaldenienė E, Paunksnienė M, Babrauskienė V. Ultrasonographic evaluation of the eye parameters in dogs of different age. *Ultragarsas*, 2001; 2(39): 1-4.
13. Toni MC, Meirelles A E W B, Laus JL, Canola JC. Ophthalmic ultrasound of dogs with different skull conformations. *Veterinary Ophthalmology*, 2010; 13(6): 384-386.
14. Svaldenienė E, Paunksnienė M, Babrauskienė V. Appliance of digital ultrasonic technique in canine cornea investigations. *Ultragarsas*, 2003; 1(46): 41-45.
15. Silva EG, Pessoa GT, Moura LS, Guerra PC, Rodrigues RPS, Sousa FCA, Ambrósio CE, Alves FR. Biometric, B-mode and color Doppler ultrasound assessment of eyes in healthy dogs. *Pesquisa Veterinária Brasileria*, 2018; 38(3): 565-571.
16. Cottrill NB, Banks WJ, Pechman RD. Ultrasonographic and biometric evaluation of the eye and orbit of dogs. *American Journal of Veterinary Research*, 1989; 50(6): 898- 903.

نشریه جراحی دامپزشکی ایران
سال ۲۰۱۹، جلد ۱۴ (شماره ۲)، شماره پیاپی ۳۱

چکیده

ارزیابی مقایسه‌ای دو روش اولتراسونوگرافی قرنیه‌ای و پلکی برخی شاخص‌های چشم در سگ مخلوط ایرانی

رهام والی[۱]، مسلم رازقی[۲]

[۱] گروه علوم درمانگاهی، دانشکده دامپزشکی، واحد کازرون، دانشگاه آزاد اسلامی، کازرون، ایران.
[۲] دانش‌آموخته دکترای دامپزشکی، دانشکده دامپزشکی، دانشگاه آزاد اسلامی واحد کازرون، کازرون، ایران.

هدف- این تحقیق به‌منظور مقایسه دو روش اولتراسونوگرافی قرنیه‌ای و پلکی در اندازه‌گیری برخی از شاخص‌های چشم در سگ مخلوط ایرانی انجام گرفته است.

طرح مطالعه- مطالعه تجربی

حیوانات- ۱۰ قلاده سگ نر مخلوط ایرانی با میانگین سن ۱/۳۹ ± ۴ سال و وزن ۲/۳۱ ± ۱۶/۷ کیلوگرم

روش کار- ۱۰ قلاده سگ نر بالغ در یک محدوده سنی که سابقه بیماری مرتبط با چشم را نداشته‌اند انتخاب شدند. ابتدا سگ‌ها را به‌طور تصادفی به دو گروه مساوی تقسیم کرده، در گروه اول از روش پلکی و در گروه دوم از روش قرنیه‌ای اقدام به اولتراسونوگرافی شد. اولتراسونوگرافی در حالت خوابیده با استفاده از یک ترانسدیوسر خطی با فرکانس ۱۲ مگاهرتز که به‌صورت طولی بر روی پلک یا قرنیه قرار داده شد، انجام گرفت.

نتایج- در تصاویر به‌دست‌آمده میانگین و انحراف معیار شاخص‌های موردنظر در روش‌های اولتراسونوگرافی قرنیه‌ای و پلکی به ترتیب عبارت بودند از: عمق اتاقک قدامی ۰/۲۴۲±۲/۹۹ و ۰/۲۸۵±۲/۷۸ میلی‌متر، قطر (ضخامت عدسی) ۶۲/۳۶۴±۶/۰ و ۰/۶۱۲±۷/۰۲ میلی‌متر، عمق زجاجیه ۰/۳۵۴±۸/۸۱ و ۰/۵۵۲±۸/۷۹ میلی‌متر و طول محور چشم ۰/۴۵۲±۱۹/۶۰ و ۰/۵۹۲±۱۹/۵۰ میلی‌متر. تفاوت معناداری بین چشم‌های چپ و راست در هر دو روش در هر گروه و در مقایسه دو گروه یافت نشد.

نتیجه‌گیری و کاربرد بالینی- اندازه‌های به‌دست‌آمده از دو روش قرنیه‌ای و پلکی اختلاف معناداری را بین شاخص‌ها نشان نداد. لذا در مواردی که بیماری‌های مربوط به پلک باعث دردناکی چشم می‌گردد می‌توان از روش پلکی به‌جای قرنیه‌ای استفاده کرد.

واژه‌های کلیدی: سگ، چشم، قرنیه‌ای، پلکی، اولتراسونوگرافی