Evaluation of the Eko DUO device in dogs and cats:

A new smartphone-based digital stethoscope paired with phonocardiography and electrocardiography

ECVIM-CA
32ND ANNUAL CONGRESS
1-3 SEPTEMBER 2022
SECC-GOTHENBURG SWEDEN

Tommaso Vezzosi, Lisa Alibrandi, Giovanni Grosso, Rosalba Tognetti

Department of Veterinary Sciences, University of Pisa, Pisa, Italy

IN SUPREMÆ DIGNITATIS 1343 UNIVERSITÀ DI PISA

Introduction

The Eko DUO is a smartphone-based digital stethoscope paired with simultaneous phonocardiographic and 1-lead ECG recording. The recordings can be stored and viewed on smartphones and shared.

Aim of the study

We compared audio recordings and ECG tracings obtained using the Eko DUO with conventional auscultation and standard ECG in dogs and cats to evaluate the device's clinical reliability.

Materials and Methods

Prospective observational study

A total of 99 dogs and 9 cats were included at the Veterinary Teaching Hospital of the University of Pisa between Dec 2020 and Dec 2021. The study was approved by the Welfare and Ethics Committee of the University of Pisa. All cases underwent conventional auscultation using an acoustic stethoscope (3M Littmann Classic II), standard 6-lead ECG, standard echocardiography and recording with the Eko DUO. All the audio recordings, the phonocardiographic tracings and the ECG tracings were then blind reviewed by a board-certified cardiologist.

Statistical analysis

The Shapiro-Wilk test was used to determine the normality of the data distribution.

Cohen's κ was used to calculate the agreement between conventional stethoscope findings and re-listening of digital stethoscope recorded traces, as well as for the agreement between standard ECG and Eko DUO ECG tracings regarding electrocardiographic findings.

Results

Substantial agreement was found in the diagnosis of heart murmur (κ=0.685; sensitivity 96%, specificity of 69%) [Figure 1] and gallop rhythm (k=0.741, sensitivity 100%, specificity 98%). In 9 cases with an echocardiographic diagnosis of heart disease only the digital stethoscope detected heart murmur or gallop rhythm. The Eko DUO was clinically reliable for the assessment of heart rate, ECG wave duration and intervals [Table 1]. Diagnosis of heart rhythm showed moderate agreement in the identification of atrial fibrillation (k=0.554, sensitivity 100%, specificity 90%). The detection of ventricular premature complexes and bundle branch blocks revealed an almost perfect agreement (k=0.838 and k=1, respectively) [Figure 2].

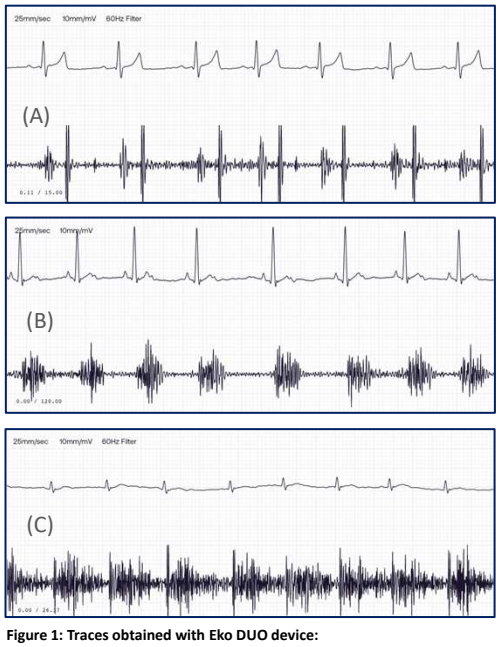

Figure 1: Traces obtained with Eko DUO device:
(A) Dog with no heart murmur
(B) Dog with holosystolic heart murmur.
(C) Dog with continuous heart murmur.

	Standard ECG*	Eko DUO*	Bias	95% Limits of agreement
FC (bpm)	130 (50 – 260)	140 (50 – 270)	-8	-41; +26
P (ms)	40 (20 – 50)	40 (30 – 60)	-3	−13; +7
PQ (ms)	110 (80 – 170)	120 (80 – 160)	-5	−32; +23
QRS (ms)	40 (30 – 80)	40 (30 – 80)	-4	−21; +14
QT (ms)	200 (140 – 300)	200 (160 – 300)	-8	−35; +19

Table 1: Results of Bland-Altman test regarding the comparison between standard 6-lead ECG and Eko DUO ECG tracings. *Values are expressed as median and range.

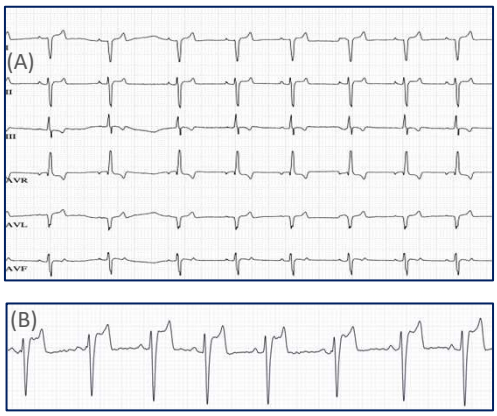

Figure 2: (A) Standard 6-lead ECG showing right bundle branch block [25 mm/sec, 10 mm/mV]. (B) ECG trace obtained with the Eko DUO device showing right bundle branch block in the same dog of (A) [25 mm/sec, 10 mm/mV].

Discussion

The Eko DUO is particularly efficient at ruling out the presence of a heart murmur and in detecting gallop rhythm. Interestingly, in 7 cases presenting an underlying cardiac disease, our digital stethoscope detected a heart murmur that was not identified using the conventional stethoscope. In 2 cats with cardiomyopathy, only the Eko DUO detected gallop rhythm. Cardiac auscultation with the Eko DUO is thus very reliable, and the device seems more sensitive than conventional auscultation.

Analysing phonocardiographic tracings while listening to audio recordings can lead to a more accurate assessment of any murmur or gallop rhythm. Regarding electrocardiographic performance, the Eko DUO also detected atrial fibrillation, in line with other smartphone-based devices. Finally, detection of ventricular premature complexes and branch blocks was excellent with the Eko DUO compared to standard 6-lead ECGs.

Conclusion

The Eko DUO shows good diagnostic accuracy in detecting heart murmurs, gallop rhythm and arrhythmias in dogs and cats, with a sensitivity possibly higher than classic acoustic stethoscopes. It could thus be used in veterinary telemedicine and for teaching cardiac auscultation.