

Comparison of Blood Pressure Measurements with Direct Method and Cardell Method in Dogs

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Abstract

Background: Invasive arterial pressure is the accepted gold standard in veterinary medicine for blood pressure measurement. The present study was conducted to compare blood pressure measurements in dogs. **Subjects and Methods:** The present study was conducted in the department of Veterinary Sciences on 20 dogs. In all dogs, direct arterial pressure and Cardell method of measurement of blood pressure was used. **Results:** The mean age of dogs was 7.6 years and mean weight was 31.4 kgs. Common diagnosis in dogs was PDA in 2, intestinal perforation in 5, hemoabdomen in 3, adrenal neoplasia in 4, chylothorax in 3 and pericardial effusion in 3 cases. The difference was non-significant ($P > 0.05$). There was significant difference in blood pressure both systolic and diastolic blood pressure in different groups measure by direct method and Cardell method. **Conclusion:** Authors found significant difference in blood pressure of dogs with different illness recorded by different methods.

Keywords: Blood pressure, Cardell method, Dog.

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Introduction

Blood pressure is measured indirectly, or noninvasively, in anesthetized and critically ill dogs using ultrasonic Doppler flow monitors (DOP) and oscillometric methods, and directly, or invasively, using a pressure transducer interfaced with an arterial catheter. Invasive arterial pressure is the accepted gold standard in veterinary medicine for blood pressure measurement.^[1] However, invasive blood pressure (IBP) monitoring can be costly and requires advanced technical skills and specialized equipment. Also, arterial catheterization, which is required for invasive monitoring, poses several risks including infection, embolus formation, and hemorrhage. Therefore, blood pressure measurement is commonly obtained by noninvasive methods, making it important to know the accuracy of certain noninvasive blood pressure (NIBP) monitoring devices, as compared with the gold standard, IBP.^[2]

The most routine method using the stethoscope is not easily applicable to domestic animals, Korotkoff sounds being generally inaudible. Nevertheless, one study reports the measurement of the arterial blood pressure based on the auscultatory method.^[3] Invasive methods by arterial cannulation are most commonly used in research. A recent article described a practical method of measuring the arterial blood pressure by puncturing the femoral artery in the conscious dog. In the dog, studies have been conducted on the indirect evaluation of the mean, systolic and diastolic

arterial blood pressures.^[4] The present study was conducted to compare blood pressure measurements in dogs.

Subjects and Methods

The present study was conducted in the department of Veterinary Science. It comprised of 20 dogs. The study was approved by the Ethical Committee.

In all dogs, direct arterial pressure and Cardell method of measurement of blood pressure was used. Normotension was defined as an average direct mean arterial pressure (MAP) of 80–100 mm Hg. Hypotension was defined as an average direct MAP <80 mm Hg. Hypertension was defined as an average direct MAP >100 mm Hg. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

Results

Table 1: Measurement of parameters

Parameters	Mean
Age	7.6 years
Weight	31.4 kgs

[Table 1, Figure 1] shows that mean age of dogs was 7.6 years and mean weight was 31.4 kgs.

[Table 2 & Figure 2] shows that common diagnosis in dogs was PDA in 2, intestinal perforation in 5, hemoabdomen in 3, adrenal neoplasia in 4, chylothorax in 3 and pericardial

effusion in 3 cases. The difference was non-significant ($P > 0.05$).

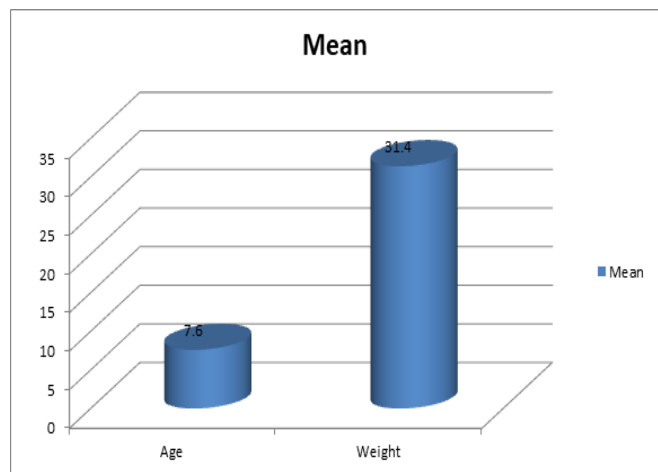


Figure 1: Measurement of parameters

Table 2: Diagnosis of dogs

Diagnosis	Number	P value
PDA repair	2	0.12
Intestinal perforation	5	
Hemoabdomen	3	
Adrenal neoplasia	4	
Chylothorax	3	
Pericardial effusion	3	

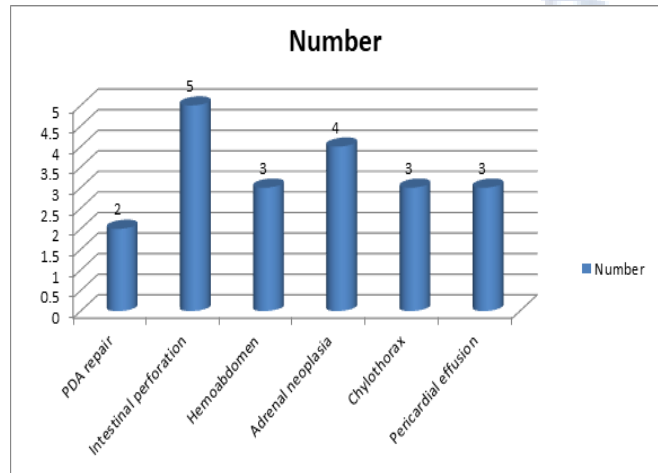


Figure 2: Diagnosis of dogs

Table 3: Assessment of blood pressure in dogs

Group	Pressure	Direct (mm Hg)	Cardell (mm Hg)	P value
Hypotensive	Systolic	100.2	124.5	< 0.05
	Diastolic	55.6	70.1	< 0.05
Normotensive	Systolic	146.6	132.6	< 0.05
	Diastolic	68.7	74.5	> 0.05
Hypertensive	Systolic	157.8	158.5	> 0.05
	Diastolic	84.5	96.1	< 0.05

[Table 3, Figure 3] shows that there was significant difference in blood pressure both systolic and diastolic blood pressure in different groups measure by direct method and

Cardell method.

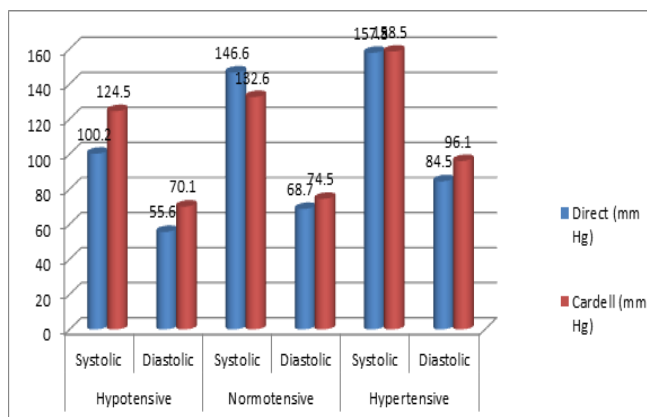


Figure 3: Assessment of blood pressure in dogs

Discussion

When comparing indirect blood pressure measurements with direct measurements it is important to consider that direct techniques measure the actual pressure within a vessel, whereas indirect techniques use cuff pressure in accordance with the detection of blood flow to estimate pressure. Both indirect and direct measurement techniques are susceptible to various sources of error, such as operator inexperience, incorrect cuff size, and movement during measurements from the dorsal pedal artery it was not possible to occlude any part of that particular limb proximal to that site.^[5] Therefore, the cuff used for indirect measurements was placed on the contralateral limb. The position of the cuff on the up leg, did allow for more accurate placement of the cuff at the level of the heart.^[6] Whereas the transducer, used for direct measurements, could be positioned at the level of the heart regardless of the level of the limb, the dorsal pedal artery was used because of its noted advantages over other sites.^[7] Use of the proximal pelvic limb, just above the hock, for indirect pressure monitoring has been shown to have low variation in NIBP readings and good correlation with direct measurements in anesthetized and conscious, laterally recumbent dogs.^[8] The present study was conducted to compare blood pressure measurements in dogs.

In this study, we included 20 dogs. The mean age of dogs was 7.6 years and mean weight was 31.4 kgs. Bosaick et al,^[9] conducted a study in which three consecutive measurements of systolic, diastolic, and mean arterial pressure (MAP) were recorded for each of the 3 indirect devices (only systolic for DOP), along with concurrent IBP measurements. The data were categorized into 3 groups: hypotensive (direct MAP < 80 mm Hg), normotensive (80 mm Hg direct MAP 100 mm Hg), and hypertensive (direct MAP > 100 mm Hg). Each indirect method was compared with the corresponding direct arterial pressure using the Bland-Altman method. Within the hypotensive group, each indirect method overestimated the corresponding IBP. Within the normotensive group all indirect systolic measurements and the PAS diastolic measurements

underestimated the corresponding IBP. The remaining indirect measurements overestimated the corresponding IBP. Within the hypertensive group, DOP and CAR systolic measurements underestimated the corresponding IBP, and the remaining indirect measurements overestimated the corresponding IBP. In hypertensive dogs oscillometric systolic measurements were more accurate than MAP. In hypotensive dogs MAP measurements were more accurate than systolic measurements. All indirect measurements were most accurate in hypertensive dogs.

We found that common diagnosis in dogs was PDA in 2, intestinal perforation in 5, hemoabdomen in 3, adrenal neoplasia in 4, chylothorax in 3 and pericardial effusion in 3 cases. There was significant difference in blood pressure both systolic and diastolic blood pressure in different groups measure by direct method and Cardell method.

Chalifoux et al,^[10] conducted a study in which the determination of the arterial blood pressure was done on 12 healthy mixed breed dogs in both the anesthetized and the conscious state, to evaluate two instruments (Doppler flow detector and infrasonde D4000), in their ability to indirectly determine arterial blood pressure. The coefficients of variation were higher with indirect methods when compared with the results obtained by cannulation. These coefficients were lower with the Doppler flow detector. The correlation study showed that both apparatuses were reliable in most situations. The infrasonde D4000 was more accurate than the Doppler in the conscious animals. However the results showed a lack of precision in hypertensive conscious dogs. The diastolic arterial blood pressure was particularly precise in the case of the anesthetized hypotensive dogs. Its sensitivity allowed it to register muscle movement artifacts. The Doppler flow detector showed less variation and was particularly accurate in both anesthetized and conscious hypertensive dogs. Its sensitivity allowed artifact movement sounds to be detected. The Doppler should be used in quiet surroundings or earphones should be worn by the evaluator. Some form of restraint is needed with the use of both instruments. Even if the correlations with the direct arterial blood pressure values were better with the infrasonde D4000, greater variations were found in the individual

readings. The Doppler instrument represents in the hands of the investigators a better instrument for routine monitoring of blood pressure in the dog.

Conclusion

Authors found significant difference in blood pressure of dogs with different illness recorded by different methods.

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