

COMPARISON OF DIRECT AND INDIRECT BLOOD PRESSURE MONITORING IN ANAESTHETIZED SWINE

INTRODUCTION

Systolic (SAP), diastolic (DAP) and mean (MAP) arterial blood pressure are commonly measured in veterinary medicine. There are several methods to measure arterial blood pressure, being classified as non-invasive or indirect methods, such as the oscillometric method; and invasive or direct methods. The gold standard of blood pressure monitoring is direct arterial blood pressure measurement, which is accomplished by intra-arterial catheterization. The oscillometric technique is based on the detection of pressure pulse changes within a cuff bladder produced by changes in the diameter of the underlying artery.

Ideally, arterial blood pressure should be measured with devices that have been validated in the species of interest and under the circumstances in which the patient is being tested. Precision and accuracy of oscillometric devices are compared to the invasive method as to assess the fulfillment of the validation studies recommended by the 2007 Consensus Statement of the American College of Veterinary Internal Medicine (ACVIM).

OBJECTIVES

1. To determine the viability of using invasive methods in anaesthetized swine.
2. To evaluate if the multiparametric monitor VetCare (B.Braun) is able to correctly measure SAP, DAP and MAP with the oscillometric method in anaesthetized swine.
3. To compare arterial blood pressure values obtained with the oscillometric method with those obtained with the invasive method in anaesthetized swine.
4. To determine if the oscillometric method can be validated according to the ACVIM guidelines for monitoring arterial blood pressure in anaesthetized swine.

MATERIAL AND METHODS

Blood pressure was monitored using direct and indirect methods on eight anaesthetized cross-bred Landrace and Large White female swine. Invasive blood pressure was measured using a catheter inserted into a popliteal artery and an electronic transducer. The cuff for the oscillometric measurement was placed in the metatarsal region. The pressure transducer and the oscillometric device were connected to the multiparametric monitor VetCare (B Braun, Spain). Data on blood arterial pressure was recorded every 5 minutes during all the anaesthesia period. Agreement between direct and indirect blood pressure measurements was estimated by the Bland-Altman method.

RESULTS AND DISCUSSION

The number of measurements obtained per patient depended on the duration of the anaesthesia period. This period lasted for 107.5 ± 23.75 minutes (average \pm SD) and the number of measurements for each period was 23.75 ± 6.11 (average \pm SD) per animal. The total number of measurements used this study was 198. All measurements include SAP, DAP and MAP values obtained by the oscillometric and invasive methods.

Table 1. Descriptive statistics of arterial blood pressure measurements obtained using invasive and non-invasive methods and comparison to ACVIM recommendations.

	ACVIM recomendations	Systolic		Diastolic		Mean	
		Invasive	Non- invasive	Invasive	Non- invasive	Invasive	Non- invasive
Mean \pm SD (mmHg)		101.92 \pm 11.52	75.81 \pm 9.70	52.31 \pm 7.24	31.03 \pm 7.22	68.69 \pm 7.52	52.65 \pm 7.89
Min-Max (mmHg)		74-138	47-100	30-78	15-57	46-99	31-72
Bias \pm SD (mmHg)	$\leq \pm 10 \pm (\leq 15)$	-26.11 ± 10.89		-21.27 ± 8.12		-16.03 ± 8.08	
95% Límits of agreement (mmHg)	$\leq \pm 10 \pm (\leq 15)$	-47.46 and -4.76		-37.19 and -5.35		-31.87 and 0.18	
$\leq \pm 10 \text{mmHg}$ (%)	≥ 50	8		8		27	
$\leq \pm 20 \text{mmHg}$ (%)	≥ 80	33		45		71	
Pearson's correlation coefficient	≥ 0.9	0.49		0.37		0.45	

The results of this study demonstrate that measurements obtained by the oscillometric method were not in good agreement with directly measured pressure. The indirect method underestimated the value of all blood arterial pressure parameters. Furthermore, the oscillometric method failed to meet the ACVIM validation criteria for arterial blood pressure measurement devices.

CONCLUSIONS

1. Obtaining SAP, DAP and MAP values by the direct method in anaesthetized swine is easier when the popliteal artery is used.
2. The oscillometric method of the monitor VetCare (B.Braun, Spain) is able to provide SAP, DAP and MAP in anaesthetized swine.
3. The oscillometric method underestimates the value of all arterial blood pressure parameters (SAP, DAP and MAP) when compared to the intra-arterial method in anaesthetized swine.
4. According to the results obtained in this preliminary study, the oscillometric device does not fulfill the validation criteria imposed by the ACVIM guidelines in anaesthetized swine.