

Determination of cardiac output by ultrasound velocity dilution in normovolemia and hypovolemia in dogs

Shih A, Giguère S, Vigani A, Shih R, Thuramalla N, Bandt C. *Vet Anaesth Analg*. 2011 Jul;38(4):279-85. doi: 10.1111/j.1467-2995.2011.00604.x. Epub 2011 Jun 1.

Objective: The purpose of this study was to compare CO measured by use of lithium dilution (LiDCO) and ultrasound velocity dilution (UDCO) in a canine model of acute hemorrhage.

Study design: Prospective descriptive evaluation.

Animals: Twelve dogs (15-34 kg).

Methods: Dogs were anesthetized and instrumented to measure direct blood pressure, heart rate, arterial blood gases and CO. The CO was measured by use of LiDCO and UDCO techniques. Measurements were obtained from each animal at baseline and during a low CO state (hemorrhagic state). Measurements were converted to cardiac index (CI = CO/BSA) values for statistical analysis. To measure CO using UDCO, a 20 mL bolus of 0.9% sodium chloride was administered and CO was calculated from the transient dilution of blood proteins created by the injection bolus. Hypovolemia was induced by withdrawing 40% of the blood volume until the mean arterial blood pressure (MAP) was stable at 40 mmHg for 10 minutes. Agreement was determined using Bland & Altman analysis and concordance correlation coefficients.

Results: Twenty-four comparisons were made. Lithium determinations of CI ranged between 7.5 and 1.3 L minute⁻¹ m⁻², and the mean overall difference between the two methods was -0.40 L minute⁻¹ m⁻². The mean relative bias was $-17 \pm 21\%$ (limits of agreements: -59% to 25%). There was no significant effect of state of CI on bias or relative bias ($p = 0.24$ and $p = 0.10$, respectively). The concordance correlation coefficient between LiDCO and UDCO as 0.88 ($p < 0.0001$).

Conclusions: When compared to lithium dilution, the UDCO technique is a viable method for measuring cardiac output in a model of normovolemia and hypovolemia in dogs.