

USCOM-Non Invasive Doppler – Are Cardiac Output Measurements Accurate in Both Infants and Adults?

Peter R. Lichtenthal, M.D., Rob A. Phillips, D.M.U., Julie A. Sloniger, M.S., Jack G. Copeland, M.D.
Anesthesiology, University of Arizona, Tucson, Arizona

Introduction:

Cardiac output (CO) is an important measurement used for assessment of cardiovascular status and guidance of therapy. Heart failure is an increasingly common condition which when intractable may result in transplantation or implantation of mechanical assist devices. Diagnosis, intervention and peri-operative management is preferably determined by CO measurement, so accurate and reliable measurement of CO is critical. A variety of clinical methods are currently in use to measure CO and range in complexity, accuracy and invasiveness. In children there is a particular need for a non-invasive approach to cardiovascular hemodynamic management. The USCOM system (USCOM Ltd, Sydney, Australia) is a novel non-invasive CW Doppler device for measurement of right and left sided CO that has previously been validated in COs from 0.36l/min to 17l/min and in neonates as small as 390gms. The aim of this study was to compare USCOM measurements in an unselected population of children and adults undergoing current clinical standard CO assessment using a variety of methods, as our previous experience has been limited to adults with CO ranging from 5l/min to 8l/min.

Method:

After IRB approval, 560 paired measurements were analysed from 24 convenience sampled subjects in whom CO was measured as part of routine clinical management for transplantation, peri-operative cardiac surgical assessment or bridge to transplantation. The reference CO measurement (STD) was made using a variety of clinically accepted methods and included Fick (3), Echo (2), PAC (11), and Mechanical assist devices (CardioWest (7) and LVad (1)). Contemporaneous USCOM measures of CO were made and mean values compared using Pearson's correlation coefficients and Bland-Altman analysis.

Results: Patients ranged in age from 3mths to 82yrs, weighing from 0.39kgs to 118kgs, and BSA varied from 0.25m² to 2.45m². Mean CO values by USCOM and STD were 4.69±2.35 and 4.68±2.39l/min respectively, and varied from 0.85l/min to 8.00l/min. The mean difference between methods was 0.002±0.204l/min, with a mean % error between measures of 0.1 %. There was excellent correlation of CO without significant difference (r=0.996, p<0.005).

Conclusion: Non-invasive USCOM measurements of CO compare favorably to current clinical measures in children and adults across a wide range of sizes and COs. These data confirm that the non-invasive USCOM is an accurate alternative to current methods for determining CO.

Anesthesiology 2006; 105: A466

Copyright © 2006, American Society of Anesthesiologists.
All rights reserved.