

CARDIAC OUTPUT MEASUREMENT WITH THE USCOM ULTRASONIC CARDIAC OUTPUT MONITOR

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The USCOM (Ultrasonic Cardiac Output Monitor) non-invasively determines cardiac output (CO) by transpulmonary artery continuous-wave Doppler measurements using a transthoracic transducer. The aim of this study was to validate the USCOM by comparing it to the well-accepted thermodilution method using continuous cardiac output measurements from a pulmonary artery catheter.

Methods

We enrolled randomly selected patients undergoing right heart catheterization as part of their clinical management. Edwards Lifesciences Swan-Ganz Continuous Cardiac Output Thermodilution Catheters were used to measure continuous cardiac output (CCO). The continuous cardiac output system calculates and updates the cardiac output every 45-60 seconds. Blind to the CCO results a contemporaneous USCOM Doppler profile was recorded. From this profile five consecutive continuous wave Doppler outputs were measured according to ASE guidelines, and the mean of these five beats was recorded (CO_USCOM). Statistical analysis used linear regression and the method of Bland and Altman.

Results

We studied eight male and seven female patients, with a total of 83 paired data sets from 15 patients. No patients were excluded from study because of inadequate Doppler profiles. The linear regression of CCO on CO_USCOM showed a fairly high correlation ($R^2 = 71.4\%$). The Bland Altman analysis of cardiac outputs $<5\text{L/min}$ had a bias of 0.12 and limit of agreement -1.21 to +1.45 l/min. With $\text{CO} >5\text{L/min}$ CO_USCOM tended to underestimate CCO.

Discussion

This study found good agreement between cardiac output as measured by the USCOM and continuous thermodilution cardiac output monitoring with a right heart catheter. We observed that at higher cardiac outputs the USCOM tended to underestimate the CO as measured by thermodilution. This may be due to underestimation of the pulmonary annular diameter with greater stroke volumes.

Conclusion

The USCOM is a non-invasive device that has good agreement with invasive measurements over a wide range of clinically relevant cardiac outputs.

