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Haemodynamic measurements (continuous cardiac output and systemic vascular resistance) in critically ill patients: transoesophageal Doppler versus continuous thermodilution

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Keywords

Cardiac output, catheterization, Doppler ultrasound, thermodilution, transosophageal, vascular resistance

Comments

This study involves only a small number of patients but indicates good correlation of cardiac output measurement between the two techniques. This was not so well founded in the case of systemic vascular resistance, but being a derived value in both cases it is subject to more errors. Use of the transosophageal Doppler has increased in popularity over recent years and this seems set to continue. It clearly has a place along side the pulmonary artery catheter to provide measurement of cardiac output and calculation of systemic vascular resistance both earlier and in a less invasive fashion.

Introduction

The themodilution method has become the most widely used means of measurement of cardiac output, and thereby allows calculation of other cardiac parameters such as systemic vascular resistance. Traditionally a bolus of cold saline has been used but more recently the continuous cardiac output catheter has been introduced which contains a thermal filament to periodically heat passing blood. This has made the technique less labour intensive but it is equally as invasive and both time and experience needed for accurate placement.

The transosophageal Doppler allows measurement and calculation of the same parameters by a less invasive manner.

Aims

To compare measurement of cardiac output and calculated systemic vascular resistance by the continuous cardiac output method with the readings obtained with the transosophageal Doppler.

Methods

Ten critically ill patients in whom pulmonary artery catheterization was indicated were recruited into the study. Both a transosophageal Doppler probe (connected to the machine ODM II, Abbott Lab USA) and a pulmonary artery catheter (Continuous Cardiac Output Thermodilution Catheter, PA3 H-8F, Baxter Edwards Critical-Care, Irvine. CA with a Vigilance, Baxter Edwards Critical-Care computer system) were sited in each patient. Two investigators then simultaneously recorded cardiac output and systemic vascular resistance. Each was blinded to the others results. Readings were taken both routinely, six times a day at periods of stability, and whenever clinically indicated.

The Bland Altman method was used to statistically analyze the results with the bias (mean difference between the readings) and the precision (SD of the bias) being calculated.

Results

One hundred and forty five pairs of cardiac output and systemic vascular resistance readings were gathered from ten patients. Cardiac outputs recorded varied between 2.4-13 l/min. The bias for all readings was 0.01 ± 0.48 l/min with the 95% confidence limits being -0.97/0.96 l/min. Systemic vascular resistance recordings varied from 309 - 2643 dyn s cm^{-5}. The bias for these readings was 18 ± 127 dyn s cm^{-5} with 95% confidence limits of 272/236 dyn s cm^{-5}.

Discussion

Accurate measurement of cardiac output by the transosophageal Doppler requires both assumptions to be made and preconditions to be met. The aortic diameter must conform to that calculated from the nomogram; the Doppler beam must be accurately focused and cardiac output must reflect descending aortic flow. Despite these potential sources of error, its use in measuring cardiac output has been previously validated against conventional thermodilution techniques and the results of this paper support its correlation against continuous cardiac output measurement.

The systemic vascular resistance calculations from the transosophageal Doppler provide a good general trend rather than an accurate value compared with the pulmonary artery catheter.

References

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