An Assessment of Three Non-invasive Cardiac Output Monitors' Ability to Track Haemodynamic Changes in Elective Open Heart Surgery Patients.

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Background

Non-invasive cardiac output (NICO) monitors have the potential to provide information about a patients' haemodynamic state and help guide fluid management. This study looks at the ability of three NICO monitors, the Oesophageal Doppler Monitor (ODM)[1], the Vigileo Flotrac (FT)[2] and the LiDCO rapide (LI)[3] to detect haemodynamic changes and predict fluid responsiveness in elective open heart surgery patients.

Method

This was a prospective observational study of 15 elective cardiac patients. In all patients, there was simultaneous haemodynamic recording using the three test devices and thermodilution with a pulmonary artery catheter. Measurements were taken before and after the administration of a fluid which was defined as 250mls of a colloid or crystalloid given rapidly over 5-10mins. The cardiac index (CI) was compared using Bland Altman analysis. A fluid responder was defined as a patient in whom the CI as measure by thermodilution increased by >10%. The ability of the devices to predict fluid responsiveness was assessed using the area under receiver operating curves(ROC)[4] for these parameters: Stroke Volume Variation Flotrac (SVV-FT), Stroke Volume Variation LiDCO (SVV-LI), Flow corrected time Oesophageal Doppler (FTc-ODM).

Results

In 15 patients we recorded 22 fluid events.

Table 1: Cardiac Index - Limits of Agreement (LOA)

Device	LOA (l/min)	Bias (l/min)
OD	-1.26 to 1.61	-0.23
FT	-1.1 to 0.60	-0.2
LI	-0.90 to 1.2	0.12

Table 2: Area under ROC's

Device (parameter)	Area under ROC
FT (SVV)	0.45
LI(SVV)	0.65
OD(Ftc)	0.45

Conclusions

This observational study shows the NICO-devices have an acceptable bias but with wide LOA as assessed by Bland Altman analysis. This is consistent with previous published papers[5,6].

Based on the area under the ROC curves, the parameters that have been purported to be clinically useful in guiding fluid therapy (SVV-FT, SVV-Li, OD-Ftc) would not be useful in predicting fluid responsiveness in our study population.

References

[1]CardioQ^{TM}, Deltex Medical

[2]LiDCO rapide^{TM}, LiDCO Ltd

[3]Vigileo/FloTrac^{TM}, Edwards Lifesciences

[4]Feldman, Anesthesia & Analgesia, 2009

[5]Critchley and Critchley, Journal of Clinical Monitoring and Computing, 1999

[6]Mayer, BJA, 2008