Ability of Pleth Variability Index to Detect Preload Changes in Orthotopic Liver Transplant Patients.

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Background

Orthotopic Liver Transplantation (OLT) is a complex operation in which significant hemodynamic derangements occur due to alterations in ventricular preload during occlusion of inferior vena cava (IVC) and cross-clamping of the portal vein. Traditional methods of assessing ventricular preload and fluid responsiveness in these patients include invasive cardiac pressure monitoring and right ventricular thermodilution cardiac output (CO). Respiratory variations in the pulse oximetry plethysmographic waveform amplitude have also been shown to correlate with changes in ventricular preload and to predict fluid responsiveness in mechanically ventilated patients.[1] Recently, a new non-invasive device (Radical-7 pulse oximeter monitor, Masimo Corp.) has been introduced that continuously detects changes in the plethysmograph waveform and computes a Plethysmography Variability Index (PVI) reflecting alteration in preload.[2] Hemodynamic changes during OLT provide an excellent clinical model for demonstrating the effectiveness of PVI to reflect acute changes in preload. Our study was designed to test the ability of PVI to detect changes in preload during cross clamping and reperfusion during OLT.

Methods

In this unblinded study of 22 adult patients undergoing OLT, we prospectively recorded study data within 5 minutes after IVC and portal vein cross-clamping and within five minutes after reperfusion. Study data included hemodynamic measurements (HR, MAP, pulmonary artery pressure, CVP, and thermodilution CO), respiratory parameters, and PVI. Determination of bivariate correlation and linear regression between PVI and all study parameters were achieved using SPSS version 16.0.

Results

In all patients at cross-clamp we found a significant negative correlation between CO and PVI (-0.651; p-value < 0.01) and at reperfusion we found a trend towards correlation between CO and PVI, however, this was not statistically significant (-0.426; p-value = 0.069). When patients were divided based on the use of veno-venous bypass (VVB) and no VVB (n = 12), we found a significant negative correlation between CO and PVI at reperfusion in the no VVB group (-0.639; p-value < 0.05). Additionally, in the no VVB group we found a significant negative correlation between PAD and PVI at both cross clamping (-0.514; p-value <0.1) and reperfusion (-0.700; p < 0.05)

Discussion

This study demonstrates the ability of PVI to reliably detect acute changes in ventricular preload in patients undergoing OLT during cross-clamping and reperfusion. Our results indicate a significant correlation in PVI with surgically induced changes in preload when compared with thermodilution CO and PAD pressures. Assuming there was no significant acute change in RV contractility at the study intervals, PVI changes must reflect changes in preload. This study also

demonstrates the applicability of this new monitor to provide rapid, real-time detection of hypovolemia in a dynamic clinical setting.

References: 1. Cannesson M Crit Care 2005; 9:R562-8; 2. Cannesson M Anesth 2007; 107:A451.