

Correlation Between Deviations of Target Parameters During a Perioperative Crystalloid Fluid Loading in a 3-Step Minimal Volume Loading Test for Total Knee Arthroplasty Patient.

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Introduction

Goal directed fluid management implies maximization of cardiac stroke volume (SV). However, measurement of SV has numerous limitations. Thus, indirect assessment of SV by measurement of more available parameters such as perfusion index (PI), venous and capillary hemoglobin concentration (Hb) or mean arterial blood pressure (MAP) seems attractive. Theoretically, it is possible since acute change in capillary PI is associated with change in systemic vascular resistance, haemodilution induced change in venous Hb is associated with change of blood volume that tends to change preload, and change in MAP may be associated with changing sympathetic stimulation and volume status. Correlation of SV deviations and capillary haemodilution can also exist since SV and arteriolar/ venular tone are affected by the same neuro-humoral stimulus. Objectives: Our prospective clinical trial aimed to investigate correlation between deviations of SV and MAP, capillary PI, venous and capillary Hb during crystalloid loading performed according to 3-step minimal volume loading test (mVLT) [1].

Methods

After approval by Ethics and signed consent, fifteen ASA II patients scheduled for primary total knee arthroplasty were enrolled. The 3-step mVLT was performed before anesthesia induction and after 24 postoperative hours. Every step consisted of 5 ml/kg bolus of acetated Ringer's followed by 5 minutes without fluid. Parameters were recorded before and after each mVLT step. Radial artery was cannulated for MAP (DASH 3000w, GE Medical Systems Information Technologies, Milwaukee, USA) and SV (LiDCOTMPlus, London, UK) measurements. Venous Hb was analyzed in laboratory. Capillary Hb (SpHb) and PI were measured noninvasively (Radical-7, Masimo, USA). Mathematical model of bolus induced response of deviations (BIRD-math) was used to calculate continuous and shifting residual-to-baseline deviations [1]. Continuous deviations reflect dynamics of parameter's fractional change during one mVLT step, and shifting reflect the tendency of continuous deviations by comparing two steps.

Results

Twelve subjects completed the study. Good correlation was found between the continuous ($r_{xy} = 0.843$, $p = 0.035$) and shifting ($r_{xy} = 0.893$, $p = 0.035$) deviations of MAP and SV, also between shifting deviations of SpHb and SV ($r_{xy} = 0.959$, $p = 0.016$).

Conclusions

Monitoring of MAP and SpHb provides indirect evaluation of SV response to fluid challenges.