

Volume Responsiveness in Children, A Comparison of Static and Dynamic Indices.
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Introduction

Assessing intravascular volume status in children is challenging and guided by little evidence¹. Extensive literature in adults has shown that dynamic indicators of volume responsiveness are superior to static indicators at predicting cardiac output responses to fluid administration^{2,3}. The aim of our study was to compare static indicators (central venous and pulmonary arterial occlusion pressures, CVP and PAOP) and peripheral dynamic indicators (pulse pressure variation, ΔPP , pulse oximeter plethysmograph variation, ΔPOP , and plethysmograph variability index, PVI) as predictors of volume responsiveness in children.

Methods

Following institutional review board approval, a prospective study was performed. Children undergoing cardiac catheterization for transcatheter repair of left to right shunts or electrophysiology studies under general anesthesia were recruited. Exclusion criteria were clinical instability, unrepaired shunts or rhythms other than sinus rhythm. Data was collected following completion of the procedure; a pulmonary artery catheter was placed under fluoroscopic guidance. Pulse oximeter plethysmograph, central venous, arterial and pulmonary arterial waveforms were recorded and analyzed retrospectively. Cardiac output (CO) was measured using thermodilution at baseline and after a fluid bolus (10 ml/kg). The indices: CVP, PAOP, ΔPP , ΔPOP and PVI were also calculated for both time points. The ability of each variable to predict the cardiac output response was assessed using Pearson correlations.

Results

Twenty children were recruited, with one exclusion due to clinical instability. Median age was 6.09 years (range: 1.2 - 16.1 years) and median weight was 26.3 kg (range: 8.9 - 74 kg). There was a poor correlation between pre-bolus values of the three dynamic indices and the cardiac output change (ΔPP : $R^2= 0.036$, $p= 0.48$; ΔPOP : $R^2= 0.02$, $p= 0.55$; PVI: $R^2= 0.047$, $p= 0.37$). Similarly initial and changes in values of static indicators demonstrated poor correlation with change in cardiac output (CVP: $R^2= 0.016$, $p= 0.6$; PAOP: $R^2= 0.002$, $p= 0.84$).

Conclusion

This study failed to show any ability of static or peripheral dynamic indicators to predict the cardiac output response to fluid administration in children.

1. Arch Dis Child 2003;88:46-52. 2. Crit Care Med 2009;37:2642-7. 3. Chest 2008;134:172-8.

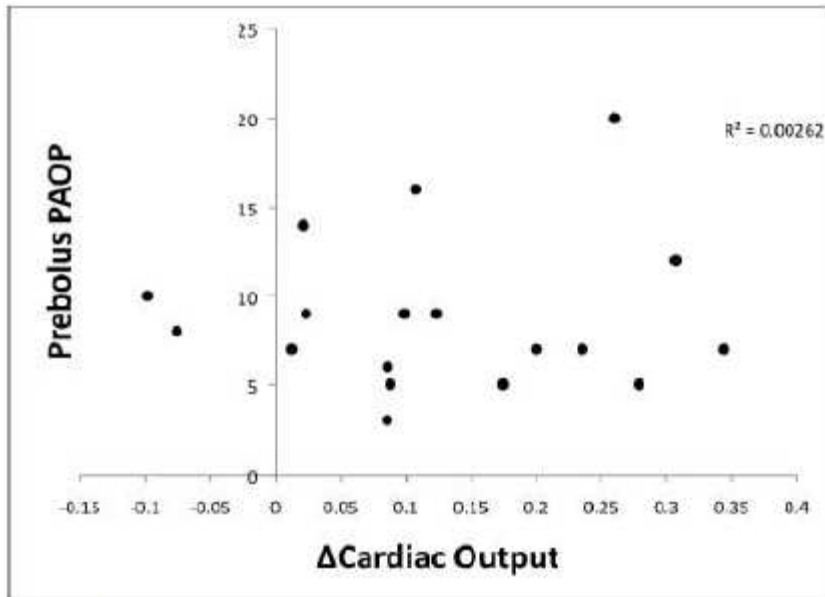


Figure 1: Pulmonary Artery Occlusion Pressure vs Cardiac Output response

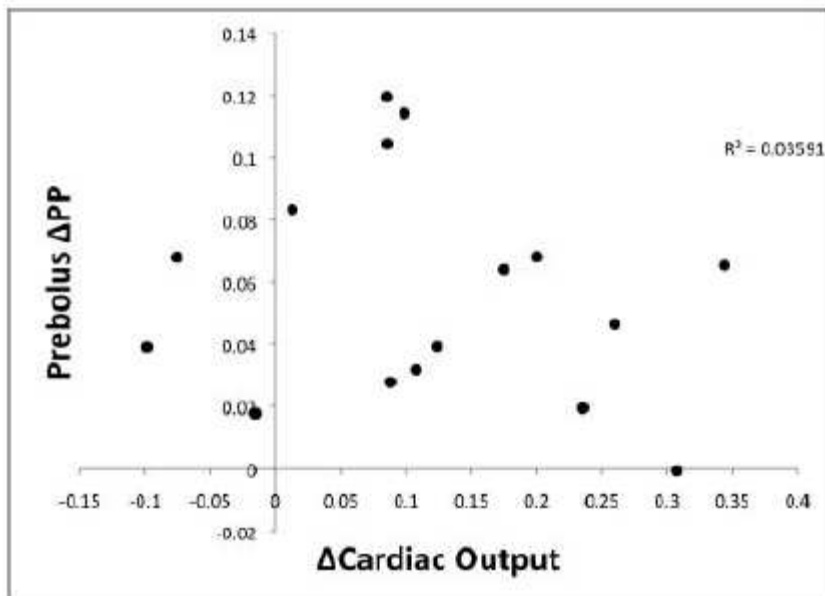


Figure 2: Pulse pressure variation vs Cardiac Output response