Dynamic variables predict fluid responsiveness in pre-school and school children undergoing neurosurgery: a prospective observational study

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Background

The evidence that plethysmographic variability index (PVI), pulse pressure variation (PPV), FloTrac/Vigileo-derived stroke volume variation (SVV), and Eadyn (dynamic arterial elastance) predict fluid responsiveness in children is limited by conflicting results. We aim to evaluate their accuracy and reliability to predict fluid responsiveness after induction in children aged 4–9 years undergoing major neurosurgery.

Methods

Children aged 4–9 years undergoing intracranial epileptic foci excision were enrolled. After the induction of anesthesia, fluid loading with 10 mL/kg of Ringer's solution over 10 min was administered before surgical incision. PVI, PPV, SVV, and Eadyn were measured before and within 5 min after fluid loading. Respiratory variation in aortic blood flow peak velocity (ΔVpeak) >15% at baseline, measured using transthoracic echocardiography, identified fluid "responders". The abilities of dynamic variables to predict an increase in mean arterial pressure (MAP) of >10% following fluid loading were also assessed.

Results

Fourteen (31.8%) of forty-four patients were responders defined by a baseline ΔVpeak >15%. Before fluid loading, only the PVI value was significantly different between R and NR (P=0.017). Baseline PVI showed fair diagnostic accuracy for fluid responsiveness, with an area under the curve (AUROC) of 0.735 and the cutoff value of 13%. The R group showed a significantly greater absolute change in PPV and SVV after fluid loading from baseline compared with the NR group (P=0.021 and 0.040, respectively). The absolute change in the PPV and SVV values from baseline was greater in R than those in NR (P=0.021 and 0.040, respectively). Twenty (45.5%) showed a MAP increase of >10% following fluid loading and were defined as responders. Baseline ΔVpeak and SVV showed fair predictive values for a MAP increase of >10% (AUROC =0.758 and 0.715, respectively).

Conclusions

PVI at baseline showed fair reliability to predict fluid responsiveness after anesthesia induction in mechanically ventilated children aged 4–9 years undergoing neurosurgery. Baseline ΔVpeak and SVV were fairly predictive for an increase in MAP following fluid loading.