Abstract

Introduction: Knowing whether or not a fluid infusion can improve cardiac output (*fluid responsiveness*) is a crucial when treating hemodynamically unstable patients.

For this reason, new indices, the so-called dynamic indices of fluid responsiveness, have been recently introduced in clinical use. If stroke volume, or stroke volume-derived parameters (pulse pressure and aortic flow) show wide variation during mechanical ventilation, a good response to fluid therapy can be predicted.

Aim of work: Our aim of this study was to evaluate the extent to which respiratory changes in IVC diameter and IVC-collapse index (IVC-CI) can be used to predict fluid responsiveness in comparison to the standard method which is PPV, to study the changes in CO in relation to changes in IVC-CI before and after fluid resuscitation and to evaluate the agreement between the three methods (IVC-CI, PPV and SVV) in assessment of fluid responsivess in mechanically ventilated septic patients.

Forty patients (26 males, 14 females mean age 58.2±12.8 ys) were included in the study with acute circulatory failure due to sepsis with no contraindication to give intravenous fluids.

All patients were mechanically ventilated under complete sedation and muscle relaxation with volume controlled ventilation (TV=8-10ml). Radial arterial catheter was inserted and connected to Flo-Trac device which was connected to Vigileo monitor. Mean arterial pressure of all patients was maintained ≥ 65mmHg with noradrenaline infusion. An intravenous fluid bolus (500cc Hes-steril) was infused over 10-15 minutes before and after which hemodynamic parameters were recorded.

Transthoracic Doppler echocardiography was used to measure cardiac output before and after fluid bolus. Responders were defined as those who had an increase in cardiac output ≥15 of baseline measurement, while patients showed an increase in CO<15% were considered non-responders.

Patients & Methods: Echocardiography study was completed by measuring the IVC diameter during the inspiration and expiration through the subcostal view using combined 2-D and M-mode, then IVC-CI was manually calculated using the following formula:

IVC-CI (%)= (Dmax during inspiration – Dmin during expiration/Dmin during expiration) x 100. Vigileo Flo-Trac system was used to measure SVV, SV and CO. Pulse pressure variation was manually calculated using the following formula: PPV (%) =(maximal pulse pressure-minimal pulse pressure/mean pulse pressure)×100.

Results: Fluid responders comprised 60% of patients which is nearly similar to previous studies. Baseline stroke volume variation (SVV1) was able to predict responders with a good sensitivity and specificity. The study confirmed the ability of manually calculated baseline pulse pressure variation (PPV1) to predict fluid responders. Baseline inferior vena cava collapse index (IVC-CI) proved to be an easy, bed side, rapid and non-invasive technique to predict fluid responsiveness. Central venous pressure failed to predict fluid responders. Roc curve analysis of PPV1, SVV1, IVC-CI1 and baseline CVP (CVP1), showed the highest area under the curve (AUC) for PPV1, SVV1 and IVC-CI1 (0.974, 0.906 and 0.877 respectively), while it was 0.354 for CVP1.

Conclusion: Inferior vena cava collapse index is non invasive, rapid and bed side measurement to assess fluid status. A best cult of value of ≥ 18% predicted fluid responders with a sensitivity 91.7% and specificity 87.5%. Stroke volume variation showed significant ability to differentiate between fluid responders and non-responders with good sensitivity and specificity. A best cut off value of ≥ 10 % predicted fluid responders with a sensitivity 91.7% and specificity 93.8 %. The study also confirmed the ability of pulse pressure variation as a good index predicting fluid responsiveness. A best cut of value of ≥13% separated fluid responders with a sensitivity 95.8% and specificity 93.8%.

Kew word: Pulse pressure variations, stroke volume variation, Inferior vena cava collapse index, cardiac output, fluid responsiveness