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Alternative methods to assess cardiac index: different parameters for physicians when swan-ganz catheter is not available

Cimatti A.; Blanco M.; Mrad S.; Cohen Arazi H.; Iamevo R.

Sanatorium Mitre, Buenos Aires, Argentina

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Introduction: invasive hemodynamic monitoring with Swan-Ganz catheter (SGC) has been the gold standard to determine the cardiac index. However, in many centres is not always available, and the Fick method is also validated for that purpose, but without the same accuracy. There are other used laboratory parameters; nonetheless there is lack of evidence about its association with the cardiac index. We aim to describe the association between these parameters and the patient"s hemodynamic condition.

Objectives: to assess the association between hemodynamic parameters obtained by SGC and data obtained with a jugular central venous catheter, in critically ill cardiac patients hospitalised in the Intensive Care Unit.

Methods: prospective, double-blind, observational study, conducted from September 2019 to November 2020. A total of 45 patients with SGC were enrolled. We measured cardiac output and cardiac index (by thermodilution method and Fick estimated method), other hemodynamic parameters, lactic acid, central venous oxygen saturation (CVO2) and venous-to-arterial carbon dioxide difference (VACO2). The variables were analysed with t-test, Wilcoxon and chi2, as appropriate. Statistical significance was assumed when p was less than .05.

Results: we analysed 45 patients (mean age 58 years; 87% men; 23% postoperative cardiac surgery subjects; mean ejection fraction 30%). We registered a 6% in-hospital mortality and the mean in-hospital stay was 19 days (IQR 25-75: 8-25). We observed a significative correlation between impaired cardiac index (≤2.2 L/min/m2) obtained by SGC and Fick method (r 0.43; p= .0041). Elevated lactic acid and reduced CVO2 were not well correlated with impaired cardiac index (r 0.51, CI 95%: 0.32-0.71; r 0.30, CI 95%: 0.13-0.48; respectively). Among patients with impaired cardiac index, all of them had a VACO2 over 7 mmHg. The c-statistic to predict impaired cardiac index using VACO2 over 7 mmHg was 0.66 (CI 95%: 0.48-0.84), correlation not observed for the CVO2 values. Elevated lactic acid (≤1.9 mmol/L) was only associated with noradrenaline infusion over 0.7 g/kg/min (c-statistic 0.55; p= .0002).

Conclusions: when invasive hemodynamic monitoring with SGC is not available, the VACO2 value over 7 mmHg (obtained with a central venous catheter) appeared to be a better predictor of impaired cardiac index than the determination of CVO2. The Fick method was an acceptable replacement of the invasive monitoring. Also, noradrenaline infusion over 0.7 g/kg/min, but not cardiac index or other laboratory parameters, showed a better correlation with elevated lactic acid.