Transpulmonary thermodilution

In particular, arterial pressure allows only a rough estimation of cardiac output. Transpulmonary thermodilution is a technique that provides a full haemodynamic assessment through cardiac output and other indices.

Fluid therapy guided by cardiac output measurements is of particular importance for adequate cerebral perfusion and oxygenation in neurosurgical patients. We examined the usefulness of a noninvasive electrical velocimetry (EV) device based on the thoracic bioimpedance method for perioperative hemodynamic monitoring in patients after aneurysmal subarachnoid hemorrhage.

PATIENTS AND METHODS: In total, 18 patients who underwent surgical clipping or endovascular coiling for ruptured aneurysms were examined prospectively. Simultaneous cardiac index (CI) measurements obtained with EV (CIEV) and reference transpulmonary thermodilution (CITPTD) were compared. A total of 223 pairs of data were collected.

RESULTS: A significant correlation was found between CIEV and CITPTD (r=0.86; P<0.001). Bland and Altman analysis revealed a bias between CIEV and CITPTD of -0.06 L/min/m, with limits of agreement of ±1.14 L/min/m and a percentage error of 33%. Although the percentage error for overall data was higher than the acceptable limit of 30%, subgroup analysis during the postoperative phase showed better agreement (23% vs. 42% during the intraprocedure phase). Four-quadrant plot and polar plot analyses showed fair-to-poor trending abilities (concordance rate of 90% to 91%, angular bias of +17 degrees, radial limits of agreement between ±37 and ±40 degrees, and polar concordance rate of 72% to 75%), including the subgroup analysis.

CONCLUSIONS: Absolute CI values obtained from EV and TPTD are not interchangeable with TPTD for perioperative use in subarachnoid hemorrhage patients. However, considering the moderate levels of agreement with marginal trending ability during the early postoperative phase, this user-friendly device can provide an attractive monitoring option during neurocritical care [1)].

The aim of a study was to investigate cardiac performance and volume status after subarachnoid hemorrhage (SAH). Hemodynamic and volumetric parameters including cardiac index (CL), intrathoracic blood volume index (ITBVI), and extravascular lung water index (EVLWI) were evaluated by single indicator transpulmonary thermodilution (PiCCO) from days 1 to 4 in 32 patients with SAH treated surgically or endovascularly within 24 hours. Higher CL and lower ITBVI values were observed after SAH. The mean value of CI was 5.2 l/min/m2 on day 1, which gradually decreased to 3.4 l/min/m2 on day 4. The mean ITBVI value was 730 ml/m2 on day 1, which recovered to the reference range until day 4 by fluid administration aiming for normovolemia. Higher CL and lower ITBVI values were present in patients with poor clinical grade (WFNS grade IV, V) as compared with mild to moderate grade (I -III) ($p < 0.05$). Relationship between CL and SI were well correlated ($r = 0.77$, $p < 0.0001$). The results indicate that SAH predisposes patients to hyperdynamic and hypovolemic states associated with sympathetic hyperactivity, especially in patients with poor clinical grade. Bedside monitoring with the PiCCO system may be a powerful tool for the management of patients after SAH [2)].

Patients with aSAH who were admitted to the intensive care unit in 2016 were assigned to cohort 1, and those admitted in 2017 were assigned to cohort 2. In cohort 1, hemodynamic and fluid management was performed in accordance with the traditional pressure-based hemodynamic parameters and clinical examination, whereas in cohort 2, it was performed in accordance with the TPT monitor-measured flow-based parameters. The incidence of delayed cerebral ischemia (DCI) and pulmonary edema (PE) was determined. The functional outcome of patients was assessed using the modified Rankin scale (mRS) score and Montreal cognitive assessment (MoCA) test at 1 year following aSAH.

Cohort 1 included 45 patients and cohort 2 included 39 patients who completed the trial. The incidence of DCI (38% versus 26%) and PE (11% versus 3%) was comparable between the cohorts ($p > 0.05$). The mRS score was similar between the cohorts ($p = 0.11$). However, the MoCA score was 20.2 (19.2-21.4) and 23.5 (22.2-24.8) in cohort 1 and cohort 2, respectively ($p < 0.001$). Accordingly, the occurrence of poor MoCA score (38% versus 18%) was significantly lower in cohort 2 ($p = 0.045$).

TPT monitor-based hemodynamic management provides better cognitive outcome than standard hemodynamic management in patients with aSAH [3].

1)
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