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Vasoactive-Inotropic Score: A dilatory predictor of adverse short-term postoperative outcomes in pediatric patients undergoing cardiac surgical procedures with cardiopulmonary bypass.

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August 25, 2022

Abstract

The Vasoactive-Inotropic Score at 48 hours is a good surrogate marker for adverse postoperative events in pediatric patients undergoing cardiac surgery with cardiopulmonary bypass and is limited by its ability to delineate the underlying cause for an unfavourable clinical course. Thus, other predictors such as the Technical Performance Score are likely to highlight the underlying cause and can be used to improve outcomes. However, patients with a high postoperative VIS score at 48 hours may benefit from closer longer-term follow for outcomes such as late survival, functional class, and need for reoperation.

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Running Head : Vasoactive-Inotropic Score and Pediatric cardiac surgical outcomes

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Sun and colleagues [1], in their retrospective analysis of 400 pediatric patients over three months undergoing first-time cardiac surgery with cardiopulmonary bypass (CPB) in China, studied perioperative factors which were predictive of early postoperative adverse outcomes. The primary focus of the study was liberation from mechanical ventilation, with patients requiring mechanical ventilation for more than 24 hours postoperatively defined as the prolonged mechanical ventilation (PMV) group. 23% (93/401 patients) experience PMV. The secondary focus of the study was a composite of mortality and morbidity (bleeding, re-exploration, reoperation, open chest, ECMO use, etc.) outcomes.

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The study collected several perioperative hemodynamics-related data. The data most predictive of a need for PMV was the Vasoactive-Inotropic Score (VIS) at 48 hours, followed by the operation duration. In other words, patients who had a continuing need for the inotropic requirement at 48 hours after surgery were likely to need extended mechanical ventilatory support as compared to the patients that had been weaned off inotropes by that time (VIS 48 hours: 7 (PMV) vs. 0 (non-PMV), $p<0.05$). Using the ROC curves, a VIS cut-off score of 5.5 at 48 hours post-op had a sensitivity of 68% and specificity of 83% for predicting a continued need for PMV. The PMV group tended to have more extended operations with more prolonged cardiopulmonary bypass and cardiac arrest times. The PMV group also had a higher amount of fluid accumulation postoperatively despite having lower CPB prime volumes and operative blood loss. The PMV group did not differ from the non-PMV in the complexity of the procedure as measured by the RACHS-1 score and demographic data such as age. Both the groups were in a similar preoperative metabolic state as represented by serum lactate levels, but the postoperative serum lactate was higher in the PMV group. Mortality data was not reported independently in the study and was stated to be low by the authors and was likely due to >90% of the cases belonging to RACS-1 categories 2 and 3[2]. When the morbidity metrics were composited with mortality, the incidence was three times more common in the PMV group. As a result, the PMV group experience twice the amount of ICU and hospital length of stay.

The continued need for inotropic support at 48 hours is likely a surrogate marker for a protracted recovery. This is particularly true as the groups did not differ in the complexity of the surgical procedure as measured by the RACHS-1 system, as higher complexity procedures are known to have a more prolonged need for mechanical ventilation [3]. Similarly, there was no age difference in the groups as neonates, and young infants tend to have a longer recuperation time, which is another independent predictor of prolonged mechanical ventilation [3]. As alluded to earlier, paradoxically, the PMV group had smaller priming volumes and less operative blood loss, which are generally associated with better operative outcomes [4]. Thus, the underlying cause for suboptimal outcomes in the PMV group can either be a technical inadequacy of the repair or other underlying comorbid conditions such as an associated chromosomal anomaly that was not captured in the database. As defined by the Boston group and measured by the number of residual lesions, the Technical Performance Score is known to be associated with prolonged operative times and adverse early clinical outcomes, as described in this study [5]. A difference in the score between the groups may explain the difference in the outcomes. The dataset does not delineate associated chromosomal abnormalities. Genetic abnormalities are known to cause variation in surgical outcomes and in part may explain the outcome difference between the cohort [6]. The type of cardioplegia used is not available in the study, and if there was a difference between the groups, it might explain the difference in the spontaneous cardiac recovery rate after reperfusion in the groups.

The VIS score also appears to be a delayed predictor of a need for PMV as its discriminatory ability was best at 48 hours post-op. In other words, a significant inotropic requirement early in the postoperative course as measured by the VIS was not prognostic, but the trajectory of weaning off the inotropes was. Generally, by 48 hours postoperative, the patient's clinical course is apparent based on the overall clinical picture. Patients with a poor Technical Performance Score had inferior long-term outcomes [7]. Similarly, it would be interesting to see if a high VIS at 48 hours has a long-term prognostic impact.

In conclusion, the VIS at 48 hours is a good surrogate marker for adverse postoperative events in pediatric patients undergoing cardiac surgery with cardiopulmonary bypass and is limited by its ability to delineate the underlying cause for an unfavourable clinical course. Thus, other predictors such as the Technical Performance Score are likely to highlight the underlying cause and can be used to improve outcomes. However, patients with a high postoperative VIS score at 48 hours may benefit from closer longer-term follow for outcomes such as late survival, functional class, and need for reoperation.

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