Editorial

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What is your strategy for fluid management?

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Optimizing fluid management for operation has become a topic of increasing interest. The static parameters of cardiac preload, such as central venous pressure (CVP) and pulmonary artery occlusion pressure (PAOP) are poor predictors of fluid responsiveness (FR) [1], and it is not appropriate to use these parameters for making decisions regarding fluid management. Two reasons can be given for this, considering the Frank-Starling relationship. Firstly, markers of preload are not always accurate measures of cardiac preload. Secondly, assessment of preload is not assessment of preload responsiveness [2].

Alternatives for detecting FR have been investigated and the concept of respiratory variations of hemodynamic signals has emerged based on heart-lung interactions during mechanical ventilation [3]. Many dynamic parameters such as systolic pressure variability, pulse pressure variability (PPV) and stroke volume variability (SVV) from pulse-contour analysis have been shown to be predictive of FR [4]. These variables are highly accurate for FR and have a greater accuracy than the traditional static indices [5]. Recently, the noninvasive pulse oximeter-derived pleth variability index (PVI) was introduced. This index predicts FR as accurately as do SVV and PVI-based goal-directed fluid management reduced intraoperative and postoperative lactate levels [6]. However, these dynamic parameters cannot be used in patients who have spontaneous ventilation or cardiac arrhythmia. A low tidal volume also makes these variables poorly predictable [7]. The chest must be closed and intra abdominal pressure has to be within the normal range [8,9]. SVV is influenced by positive end-expiratory pressure and ventricular function. Likewise, the changes of vasomotor tone impact the plethysmographic waveform [10].

Researchers have thus sought alternative predictors of FR for use in patients with spontaneous breathing. The passive leg-raising (PLR) test was developed and is considered to be the gold-standard method for this group and can also be used in mechanically ventilated patients. Elevation of the patients' legs to 45° autotransfuses around 300 ml of whole blood into the central circulation. Many studies show an increase in PAOP, left ventricular end-diastolic dimension, E-wave of mitral flow, and left ventricular ejection time during PLR [11]. Kweon et al. [12] in the current issue of the Korean Journal of Anesthesiology, compared the hemodynamic changes of PLR and exaggerated lithotomy position. They showed an increase in mean blood pressure, PAOP, CVP, the left ventricular end-diastolic area index, and systemic vascular resistance in both positions, but there was an increase of cardiac output in PLR only. Although FR is not the main subject of this article, it may be helpful to understand the hemodynamic response of fluid challenge in patients under general anesthesia. PLR has been validated for predicting FR, but it requires the determination of cardiac output with a fast-response device, because the hemodynamic changes may be transient. Available techniques are transthoracic echocardiography, transpulmonary thermodilution, transthoracic Doppler ultrasonography, and stroke volume from analysis of the systemic arterial pressure wave [13].

Although they have many limitations, dynamic parameters have the potential to help anesthesiologists in making decision about fluid therapy in patients under general anesthesia with mechanical ventilation. The PLR test may be helpful for the evaluation of the volume status of patients preoperatively, especially in an emergency operation in which there is not enough time to evaluate and correct volume status. There are many studies that show dynamic parameters and PLR test

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are predictive of FR in intensive care unit or the operating room [14,15]. However some reports show contradictory results, indicating that SVV or PPV are not reliable predictors of FR during operation [16,17]. Clinical application of these parameters may be more complicated than expected, especially during operation. Anesthesiologists are becoming more familiar with the echocardiogram and this device may be helpful for optimizing fluid management. Many devices and parameters for FR are emerging, all of which need to be understood by anesthesiologists.

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