

# Fluid Balance in Patients After Cardiac Surgery

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## To the editor:

Recently, Dr. Delshad<sup>1</sup> investigated the role of fluid balance (NFB) in patients after cardiac surgery and found that positive FB (> 3000 mL) was significantly associated with longer ICU or hospital length of stay. This is an important finding, however; several limitations need to be addressed. Fluid overload has been recognized as an important risk factor in various critical diseases such as sepsis, acute respiratory distress syndrome, and intracranial hemorrhage. Several studies also reported that high FB was associated with poor outcomes, such as increased acute kidney injury incidence<sup>2</sup> or mortality,<sup>3</sup> in patients after cardiac surgery. However, most studies mainly focused on the detrimental effect of positive FB, while the impact of negative FB has been ignored. Nevertheless, in clinical practice, maintaining adequate tissue perfusion is even more important than avoiding fluid overload, as inadequate fluid resuscitation may directly lead to tissue hypoperfusion. For instance, Okusa<sup>4</sup> reported that hypovolemia was common in patients after cardiac surgery, and inadequate fluid administration may contribute to the development of acute ischemic renal failure. In addition, several studies also found that the association between FB and poor outcomes may be non-linear. In a retrospective study including critically ill patients, Balakumar<sup>5</sup> reported that compared with even FB (0 to < 5%), both negative (< 0%) and positive ( $\geq$  5%) FB was related to an increased long-term mortality. Another study<sup>6</sup> also indicated a "U" shape association between FB and outcomes as both negative and positive FB were strong risk factors for AKI non-recovery. Therefore, the category method (< 2000 mL, 2000 to 3000 mL, and > 3000 mL) in current study may overwhelm true association between negative FB and outcomes. In addition, two minor issues also should be noticed in multivariable logistic regression: 1) Translate the continuous variable "FB" into a dichotomous variable may weaken the statistical power to detect true association, for instance; association between negative FB

and outcome, or volume-dependent relationship between possible FB and outcome; 2) FB was recorded up to 24 hours after ICU admission in the current study, thus considering 3000 mL of FB, as the cut-off point may be inappropriate; using logistic regression could be a good option. Finally, we thank Dr. Delshad for the valuable research.

The authors declare that they have no competing interests.

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Qianghong Xu MM,<sup>1</sup> Jianping Jiang MM<sup>2</sup>

<sup>1</sup>Department of Intensive Care, Zhejiang Hospital, Hangzhou, Zhejiang, China

<sup>2</sup>Department of Internal Medicine, Pinghu First People's Hospital, Pinghu, Zhejiang, China

Correspondence to:

Jianping Jiang MM

Department of Internal Medicine, Pinghu First People's Hospital, 500#, Sangang-Road, Pinghu, Zhejiang, (Postal-code: 310000), China

Tel: 0086 137 3800 9563

E-mail: juntt0701@163.com