

Preload Dependence and Microcirculation Relationship: Comment

To the Editor:

A well-performed study by Bouattour *et al*¹ concluded that preload dependence was associated with reduced sublingual microcirculation during major abdominal surgery. Fluid administration successfully restored microvascular perfusion. This finding suggests immediate correction of preload dependence to avoid reduced microcirculation. In the future, microvascular sublingual parameters could serve as additional indicators when deciding to administer fluids.

By this conclusion, the authors suggest that the presence of preload responsiveness might be associated with impaired sublingual microcirculatory perfusion and thus an abnormal microcirculatory perfusion might be an indicator of vascular volume. In this conclusion, however, we miss two important aspects. First, in general, fluid responsiveness is a normal physiological state² accompanied by a normal sublingual microcirculation.³ When from this state cardiac output is decreased by decreasing venous return either by tamponade, sepsis, or lower body negative pressure, the sublingual microcirculatory perfusion will deteriorate,³⁻⁵ and restoration of venous return, in these contexts, will improve sublingual microcirculatory perfusion.³⁻⁵ In the context of sepsis there is no real hypovolemia, but rather a decrease in venous return due to increased vascular capacitance of the venous circulation (unstressed volume). This is frequently referred to, clinically, as relative hypovolemia. In absolute hypovolemia (*e.g.*, hemorrhage) the decrease in venous return results from an absolute loss of intravascular volume. In both these cases, sublingual microcirculatory perfusion will improve after fluid resuscitation. From this, it's clear that an improvement in sublingual microcirculatory perfusion is not indicative of hypovolemia, but rather decreased venous return resulting from decreased stressed volume (mean systemic filling pressure). To further complicate the picture, after initial resuscitation in sepsis, patients' fluid responsiveness can be associated with normal sublingual microcirculatory perfusion.⁶ In the study by Bouattour *et al*,¹ the context of the patient is not clear, as the patients most likely started the procedure in a state of fluid responsiveness and normal

microcirculation. The response of the microcirculation to fluid resuscitation in this context doesn't necessarily clarify this, as both increased vasodilation during the surgery and bleeding will decrease venous return where fluid resuscitation is likely to improve microcirculatory perfusion.

Competing Interests

The authors declare no competing interests.

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Preload Dependence and Microcirculation Relationship: Reply

In Reply:

I would like to thank the authors of the letter for reminding us that the notion of preload dependence is not synonymous with hypovolemia. As mentioned in the article,¹ preload dependence is defined as a state in which increases in right ventricular and/or left ventricular end-diastolic volume result in an increase in stroke volume.² Changes in preload could be due to hypovolemia and/or a decrease in venous tone with increased venous capacity. Having a preload dependence does not give any indication of the state of the microcirculation. Indeed, microcirculation can be preserved up to a certain level of venous return decline, but can then be altered if the venous return decline is greater. For this reason, it is essential to have an assessment of microcirculation in order to titrate perioperative fluid and correctly administrate vasopressors.

With this in mind, our study highlights that the occurrence of preload dependence was associated with reduced sublingual microcirculation during major abdominal surgery. This shows that decreases in venous return during anesthesia for major abdominal surgery, regardless of cause, are sufficient to alter sublingual microcirculation. In these circumstances, sublingual microcirculation was not protected by self-regulatory mechanisms during venous return decreases. This should encourage us to correct the preload dependency episodes that may occur during surgery in order to avoid these microvascular alterations. As mentioned in the article,¹ the fact that fluid challenge was able to restore microcirculatory alterations pleads for hypovolemia. Fluid administration may have corrected an absolute hypovolemia due to a loss of blood volume or a relative hypovolemia due to a decrease in venous tone. In any case, correcting preload dependency remains a priority considering the risk of failure to treat an alteration of the microcirculation. Static (pulmonary artery occlusion pressure, central venous pressure, global end-diastolic volume, flow time of aortic flow) and dynamic (pulse pressure variation, stroke volume variations, vena cava diameter variations) hemodynamic variables have their own limits and their gray zone to guide fluid administration. Especially, pulse pressure variations cannot be used during arrhythmia, when tidal volumes are less than 8 ml/kg of ideal body weight, when spontaneous breathing occurs, or when pulse pressure variation value is in the gray zone (between 9 and 13%). Microvascular sublingual measurements could be an additional tool in the

future to support the decision to administer fluids or vasopressors. It is clear that we must continue to develop techniques to analyze the behavior of microcirculation because the ultimate goal of hemodynamic optimization is the optimization of microcirculation and tissue oxygenation.

Competing Interests

The author declares no competing interests.

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IV Fluids for Major Surgery: Comment

To the Editor:

The review article of perioperative fluid therapy by Miller and Myles¹ provides new recommendations for fluid administration during major surgery. Many studies performed during the past 15 yr show that a restrictive strategy consisting of 3 to 5 ml⁻¹ · kg⁻¹ · h⁻¹ of crystalloid fluid during surgery provides a better outcome in comparison with 10 to 12 ml⁻¹ · kg⁻¹ · h⁻¹. The authors now swing the pendulum once again and recommend the larger amount. The basis for their recommendation consists of only two retrospective studies and their own prospective study, the RELIEF (Restrictive Versus Liberal Fluid Therapy in Major Abdominal Surgery) trial.²

We believe that the patient's preoperative fluid status should be considered when giving recommendations of this kind. Miller and Myles encourage unrestricted intake of