



## Editorial

## Early hemodynamic resuscitation of septic shock: what do the new Surviving Sepsis Campaign guidelines really provide?

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A new version of the Surviving Sepsis Campaign (SSC) guidelines for sepsis and septic shock<sup>[1]</sup> has been published a few months ago. In this editorial, we aim to focus on similarities and differences between the 2021 and 2016 SSC guidelines,<sup>[2]</sup> in terms of hemodynamic management. The first striking difference concerns blood lactate measurements. It is now suggested to guide resuscitation to decrease serum lactate but not normalize it as previously suggested. Indeed, as stated in an editorial by Hernandez and Teboul, “since non-hypoperfusion-related causes of hyperlactatemia might predominate in an unknown number of patients, aiming at strictly normalizing lactate might lead to excessive resuscitation with inherent fluid and vasopressor overload, and eventually to increased morbidity and mortality”.<sup>[3]</sup> In a recent multicenter randomized controlled trial in septic shock called ANDROMEDA-SHOCK, an early resuscitation strategy guided on capillary refill time (CRT) was shown to result in lesser organ dysfunction at 72 h than a strategy based on decrease in blood lactate.<sup>[4]</sup> In a subsequent Bayesian analysis of ANDROMEDA-SHOCK, the CRT-based strategy was shown to reduce mortality as compared to the lactate-based strategy.<sup>[5]</sup> These data support the new SSC recommendations stating that CRT can be used to guide resuscitation.<sup>[1]</sup>

The following 2021 SSC hemodynamic recommendation has left us puzzled: “For patients with sepsis-induced hypoperfusion or septic shock, we suggest that at least 30 mL/kg of intravenous (IV) crystalloid fluid should be given within the first 3 h of resuscitation.” Although this recommendation is similar to that given in the previous version of the SSC guidelines,<sup>[2]</sup> it is highly questionable, because there is still no argument to support it. First, there is a great heterogeneity among patients with septic shock in terms of severity of hypovolemia. As an example, it is likely that the plasma volume deficit is lower in patients with community-acquired pneumonia than in those with sepsis from

abdominal origin or sepsis associated with massive fluid losses. Second, patients differ in terms of comorbidities, and infusion of the same volume of fluids may have different consequences in terms of benefit and harm. In other words, giving a fixed volume of fluids in all patients could result in persistent organ hypoperfusion in some patients and fluid overload in others. This emphasizes the need to personalize the initial fluid resuscitation.<sup>[6]</sup> As an example, from a starting infusion rate (e.g., 10 mL/kg/h), it is reasonable to increase the infusion rate if severe hypovolemia is suspected (evident fluid losses, abdominal sepsis, presence of mottling, increased CRT, and low pulse pressure).<sup>[7]</sup> In cases of increasing dyspnea or fall in arterial oxygen saturation during fluid administration, the infusion rate should be reduced. After some time and depending on the severity of shock, a hemodynamic reassessment is necessary. Waiting for 3 h as suggested by the latest SSC guidelines is unreasonable as most patients with septic shock suffer from severe hemodynamic instability.<sup>[3]</sup> It is wiser to reassess hemodynamics after 30–60 min. If shock persists, it is important to use dynamic variables of preload responsiveness to assess whether cardiac output would increase after continuing fluid administration.<sup>[7]</sup> Even if the presence of preload responsiveness has been confirmed, administration of fluid should not be systematically performed and depends on the absence of markers of fluid intolerance, especially markers of severe pulmonary edema. The SSC guidelines are not precise enough about the importance of assessing the risks of fluid infusion in patients with septic shock, especially in those with associated acute respiratory distress syndrome.

Another striking issue of the 2021 SSC hemodynamic guidelines<sup>[1]</sup> is the lack of clarity about when norepinephrine should be given. In the 2012 version of the SSC guidelines, it was stated that vasopressors should be used early as an emergency measure in patients with severe shock, when diastolic arterial blood pres-

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sure is too low.<sup>[8]</sup> In the 2016<sup>[2]</sup> and 2021 SSC guidelines,<sup>[1]</sup> these conditions incomprehensibly disappeared. For us, norepinephrine should be initiated when the arterial tone is assumed to be reduced and, in this connection, a low diastolic arterial blood pressure could be an excellent trigger.<sup>[6,9]</sup>

In conclusion, early hemodynamic resuscitation is essential in the management of septic shock. A resuscitation strategy based on markers of peripheral perfusion such as the CRT is important. Correction of low blood flow (mainly due to hypovolemia) and correction of severe hypotension (mainly due to vasodilatation) should be conducted early and at the same time in most cases. Due to considerable heterogeneity between patients in terms of characteristics and the severity of hemodynamic failure, comorbidities, and the origin of sepsis, customization of the initial cardiovascular management is mandatory. The future version of the SSC guidelines should consider the concept of customization more than it has been done so far.

### Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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