

LETTER

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Preload dependence and hypotension: One of the causes and one of the consequences of poor tolerance of intermittent hemodialysis in the ICU?

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See related research by Bitker et al., <http://ccforum.biomedcentral.com/articles/10.1186/s13054-016-1227-3>

In the context of a better management of a negative fluid balance in critically ill patients, Bitker et al. recently published a prospective, observational study in *Critical Care* [1]. The occurrence of hypotension in 47 patients during 107 sessions of intermittent hemodialysis (IHD) was analyzed. The authors demonstrated that hypotension occurs frequently (57 %) but is seldom linked with a preload dependence defined by a passive leg raising test (cardiac index monitoring by a PiCCO[®] device; Pulsion Medical Systems, Feldkirchen, Germany). Although this study clarifies part of the genesis of hypotension during IHD, some comments can be made.

First, the authors focused on the occurrence of hypotensive episodes (an episode of systolic arterial pressure below 65 mm Hg, without duration criterion, and only the first episode of hypotension) during the IHD session. It is indeed a frequent complication that compromises the IHD session and the volume of fluid removal [2]. We question the clinical relevance of this criterion; it would have been useful to record other complications of IHD in hypovolemic patients, like supraventricular arrhythmias, elevation of the lactate level, or increase of vasopressor doses.

Second, the authors focused on preload dependence as the cause of hypotension during the IHD session, whereas

many other factors such as vasoplegia or induced cardiac depression may be involved [2]. Therefore, an echocardiographic assessment before and during the episode of hypotension could have been very helpful to explore the different causes of hypotension. The value of the mitral inflow E wave to early diastolic mitral annulus velocities ratio (E/Ea ratio) is a marker of the left ventricular filling pressure which was well validated by Vignon et al. in a study of hemodialysis-induced preload reduction [3] and which has already been linked to poor tolerance of fluid removal led by furosemide or hemofiltration (area under receiver operating characteristic curves of 0.74) [4]. One study failed to identify echocardiographic parameters linked with a poor tolerance of an IHD session, but its statistical power was quite low [5].

Last, the authors propose PiCCO[®] parameters as predictors for hypotension associated with preload dependence during IHD in critically ill patients. Maybe a strictly non-invasive monitoring, like echocardiography, should be preferred to the PiCCO[®] system at this late stage of treatment (median of 18 days). Nevertheless, Bitker et al. demonstrated that the first hypotensive episode during IHD sessions is rarely associated with a preload dependence.

Authors' response

Laurent Bitker and Jean-Christophe Richard

In their letter, Allyn et al. raised interesting issues regarding our study assessing the prevalence of preload-dependent

hypotension during IHD in the intensive care unit (ICU) [1]. We acknowledged the absence of a universally accepted definition of hemodynamic tolerance and the variability of criteria found in the literature. However, we decided to identify hemodynamic intolerance by a mean

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arterial pressure lower than 65 mm Hg, as it is a widespread criterion used in everyday practice to adjust catecholamine dose. Nevertheless, our risk factors for hemodynamic tolerance during IHD were similar to those reported in a recent study [6], suggesting that slight differences in definition of IHD hemodynamic intolerance have little impact on study results.

Allyn et al. state their preference for echocardiography over PiCCO® to assess hemodynamic tolerance during IHD. Although we acknowledge that the two techniques may be interchangeable or complementary or both, the PiCCO® device allows continuous hemodynamic monitoring during IHD and may be used more easily.

Vignon et al. showed that the mitral inflow wave to early diastolic septal mitral annulus velocities ratio (E/E') was related to fluid removal and cardiac preload during IHD [3]. In a selected population of 40 hemodynamically stable, ventilated acute respiratory distress syndrome patients in whom a negative fluid balance strategy could be applied, E/E' was indeed a satisfactory predictor of poor hemodynamic tolerance to fluid depletion [4], although its relatively low specificity (0.46) suggests that factors unrelated to cardiac preload were involved. Still, another study of 54 unselected ICU patients failed to identify any echocardiographic parameter related to cardiac preload as predictors of hemodynamic tolerance of IHD [5]. In our study [1], preload dependence at IHD onset was not predictive of hypotension during IHD, and poor hemodynamic tolerance of IHD was rarely related to preload dependence, essentially in mechanically ventilated patients.

Altogether, these findings might suggest that assessment of cardiac preload before IHD (assessed by any monitoring device) predicts hemodynamic intolerance of IHD in specific ICU populations (mechanically ventilated and hemodynamically stable patients), although the specific mechanism of hypotension should prompt an evaluation of hemodynamic status (by echocardiography, PiCCO®) to re-evaluate fluid removal rate by IHD.

Abbreviations

E/E_a : mitral inflow E wave to early diastolic mitral annulus velocities ratio;
ICU: intensive care unit; IHD: intermittent hemodialysis.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors read and approved the final manuscript.

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