Bioreactance for estimating cardiac output and the effects of passive leg raising in critically ill patients

Editor—I read with interest the study of E. Kupersztych-Hagege and colleagues, entitled ‘Bioreactance is not reliable for estimating cardiac output and the effects of passive leg raising in critically ill patients’. However, I believe that this conclusion is flawed for the following reasons.

First, since 83% of the patients of the study had sepsis and ‘most of them’ had acute respiratory distress syndrome, it would be wise to restrict the title and conclusion to these patients.

Secondly, three thermodilution boluses were averaged as reference method and unexpected results were probably removed to ensure an adequate averaging, as generally recommended. In contrast, only one instantaneous value of bioreactance was collected. In a way, this is like comparing the resolution of a carefully taken picture and a freeze video image. In other papers where acceptable concordance was observed, 10 min of bioreactance trend lines were averaged while thermodilution boluses were performed. This method has been recommended for smoothing the impacts of artifacts, differences in time responses and precisions, and comparing really the two technologies.

Thirdly, it has been well shown that the minimum time response of the bioreactance technology was 1 min. In this study, the passive leg raising (PLR) results were assessed after 1 min. The bioreactance changes were therefore necessarily underestimated. This time delay limited to 1 min is surprising since two co-authors of this paper have popularized the PLR test recommending a time frame 30–90 s, especially in septic patients.

Finally, the study showed that the agreement between bioreactance and thermodilution was below that expected from chance alone (43%). This corroborates the area under the ROC curve close to zero for predicting fluid responsiveness. These results only tell us that, in this study, the inappropriate data acquisition seemingly made the value of bioreactance close to that obtained at random.

Subsequently, four references are provided to support the so-called ‘Bioreactance less promising results’. In reality, the paper from Fagnoul and colleagues included 11 patients, the paper from Engoren and Barbee investigated another technology (bioimpedance), the study of Weisz and colleagues was done in neonates where a bioreactance calibration factor has never been calculated. Finally, the paper from Mark and colleagues concluded that ‘Monitoring the hemodynamic response to a PLR manoeuvre using Bioreactance provides an accurate method of assessing volume responsiveness in critically ill patients’. I think it is still true.

Declaration of interest

P.S. was a consultant for Cheetah Med from 2005 to 2010.

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5 Marik PE, Levitov A, Young A, Andrews L. The use of bioreactance and Carotid Doppler to determine volume responsiveness and blood flow redistribution following passive leg raising in hemodynamically unstable patients. Chest 2013; 143: 364–70

doi:10.1093/bja/aeu119

Reply from the authors to Dr Squara

Editor—We are thankful to Dr Squara for his interest in our study and for his comments. We would like to answer his criticisms point by point.

First concerning the title of the article, we did not specifically demonstrate that the unreliability of the Nicom was related to septic shock or acute respiratory distress syndrome. In the absence of any certainty about this point and to be scientifically rigorous, we chose a title that simply specified the population that was actually included, that is, critically ill patients.

Secondly, no thermodilution curve was rejected from analysis. We previously showed that, with such a method, the precision of transpulmonary thermodilution is 12%. Dr Squara suggests that we should have taken the value of cardiac index averaged over 10 min rather than the instantaneous value of cardiac index displayed by the Nicom device. Of course, it is obvious that this would have reduced the influence of artifacts on cardiac index measurements. Nevertheless, the manufacturer clearly insists on the ‘fast responsiveness’ of the technique. What our study simply shows is that it is actually untrue, at least in critically ill patients.