

LETTER

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Variability of response to the fluid bolus is again demonstrated

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See related research by Obonyo et al. <https://ccforum.biomedcentral.com/articles/10.1186/s13054-017-1679-0>

The AFRIM study by Obonyo et al. [1] presents haemodynamic data worthy of closer analysis. The inferior vena cava collapsability index (IVCCI) was used as a surrogate measure of intravascular volume status. However, this measurement is of limited use in spontaneously breathing patients, as demonstrated by a recent meta-analysis [2]. According to Table 1 from [1], 100% of group 1 and group 2 demonstrated chest indrawing leading to the generation of significant negative intrathoracic pressures and making the measurements invalid.

The purpose of a fluid bolus is to increase stroke volume and hence cardiac output. Although these patients

were dehydrated, only 5 out of 11 in group 1 and 5 out of 9 in group 2 demonstrated a 10% increase in stroke volume following the fluid bolus. Two patients in group 1 demonstrated a 10% *decrease* in stroke volume index, with a decrease of 48% in one case! It would interest us what the authors believe the reason for this effect is.

We believe that the administration of fluid, even in hypovolaemic patients, is more complex than often appreciated, with an interaction of many factors related to vascular biology, and further investigation is required to enable an optimisation of fluid delivery and to avoid the detrimental effects of fluid overload.

Authors' response

The AFRIM study authors

We are encouraged by the interest in fluid resuscitation in children with severe acute malnutrition and hypovolaemic shock, and have read with keen interest the contribution by Dr. Ellis Muggleton highlighting the limited utility of IVCCI in spontaneously breathing patients.

In the manuscript, while presenting these data [1], the authors noted the limitations in interpretation of the IVCCI, especially with respiratory distress characterised by deep (Kussmaul's) breathing and chest indrawing. Given the limited ability of IVCCI to predict fluid responsiveness (FR), it is important to underline the fact that a single negative test with recognised limited utility cannot be used to rule out FR [2] and more research on non-invasive assessment of FR is needed as there is still emerging research advocating utility of IVCCI [3].

Reduction in stroke volume index following fluid bolus administration is indeed an unexpected finding. Nonetheless, our findings stimulate a new direction of

inquiry investigating the mechanisms underlying the pathophysiology of hypovolaemia with severe malnutrition as well as the interpretation of the patients' relative position on the Frank-Starling curve with respect to FR. This is particularly important in the context of little understanding on the effect that fluid administration has on the complex patho-biological interaction of intravascular hypovolaemia and severe malnutrition. Previous research has shown that hypovolaemia and dehydration are associated with higher mortality in severe malnutrition [4]. The AFRIM study showed no supportive evidence of increased risk of cardiac failure in severely malnourished children receiving fluid resuscitation for hypovolaemic shock [1]. The patient with a stroke volume reduction of 48% also had an increase in the systemic vascular resistance index of 56%, which could be indicative of an advanced stage of illness with extreme physiological compensation.

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Abbreviations

FR: Fluid responsiveness; IVCCI: Inferior vena cava collapsability index

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