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How Accurate Is Pulse Pressure Variation as a Predictor of Fluid Responsiveness?

To the Editor:

We read with interest the Perioperative Medicine article "Assessing the Diagnostic Accuracy of Pulse Pressure Variations for the Prediction of Fluid Responsiveness: A 'Gray Zone' Approach" by Cannesson *et al.*¹ and its accompanying editorial: "Insights in a 'Gray Zone.'"²

Fluid responsiveness is based on the proposition that an increase in cardiac output by at least a certain amount may be achieved by a specific bolus of a specified fluid, whereas nonresponders will require other means to increase the cardiac output. There are a number of limitations with this definition. The type of fluid used will have an impact on the amount of expansion of the intravascular compartment. In the study, iso-oncotic colloid was used, but even the volume effect of this will depend on the volume status of the patient (context sensitive).³ Associated with this is the fact that the endothelial glycocalyx is degraded by the release of cytokines during surgery or the release of atrial natriuretic peptide caused by hypervolemia.⁴ The minimally required increase in cardiac output will have a direct impact on the size of the "gray zone," as was demonstrated in the study, and the utility of bolus fluid therapy has been questioned following the publication of the Feast trial.⁵ Fluid responsiveness assessed by pulse pressure variation cannot distinguish between an increase in variation caused by fluid loss from that caused by vasodilation.

The concept of pulse pressure variation is closely related to the respiratory cycle and changes in pleural pressure. Pleural pressure changes are impacted by either smaller tidal volumes or poor lung compliance. As an extreme example, high-

frequency oscillation ventilation results in minimal pulse pressure variation irrespective of the volume status of the patient. For patients within the "gray zone," increasing the tidal volume may increase the pulse pressure variation indicating fluid responsiveness.

Although it may be reasonable to give a fluid bolus to patients above the upper limit of the gray zone, a knowledge of the cardiac output is extremely useful to make an informed decision on treatment for patients in or below the gray zone and avoid overloading the interstitial space with fluids. Lichtenstein⁶ has suggested that transthoracic ultrasound of the lungs may be useful in the early detection of interstitial syndrome (because of fluid overload, cardiac failure, or increased capillary permeability) by observing a change from A-line predominance to B-line predominance.

There are several limitations of the study that may make it difficult to apply to a more general population, including the male predominance in the study (75%) and the selection of mainly cardiac or abdominal aortic surgery (88%) with only 22% being general surgery.

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The "Gray Zone Approach": Assessing the Accuracy of Pulse Pressure Variation without Considering the Prevalence?

To the Editor:

We read with great interest the article of Cannesson *et al.*¹ regarding the accuracy of pulse pressure variation monitoring to predict fluid responsiveness. We applaud the introduction of "misclassification cost" as a novel approach to evaluate the clinical utility of a widely advocated monitoring technique.