Why the Gray Zone May Shift within the Fog

To the Editor:

We read the article by Cannesson et al.1 and the accompanying editorial2 with great interest, and praise the effort to better define the clinical utility and applicability of pulse pressure variation (PPV), not only as a tool to predict volume responsiveness but also to move away from a single-threshold value for conducting intraoperative volume optimization and perioperative goal-directed fluid therapy. We would like to make three points.

First, the most commonly used index to assess volume responsiveness, by far in the United States, appears to be stroke volume variation (SVV). Although the area under the receiver-operating curve, in systematic reviews,3 shows that both PPV and SVV have excellent sensitivity and specificity in patients who are mechanically ventilated with normal tidal volumes and in a regular sinus rhythm, the threshold values discriminating between fluid responders and nonresponders are not the same for these two parameters.3,4 Thus, although strategies using the “gray zone approach” applied to PPV identify a range of values where volume responsiveness cannot reliably be predicted, this range may not be applicable when SVV is used for determining volume responsiveness. Although it is clear from the work of Joseph Erlanger, the father of the pulse pressure concept,5 that pulse pressure in man is proportional to left ventricular stroke volume (de-
How Accurate Is Pulse Pressure Variation as a Predictor of Fluid Responsiveness?

To the Editor:

We read with great 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 vasodilatation.

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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References


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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.