

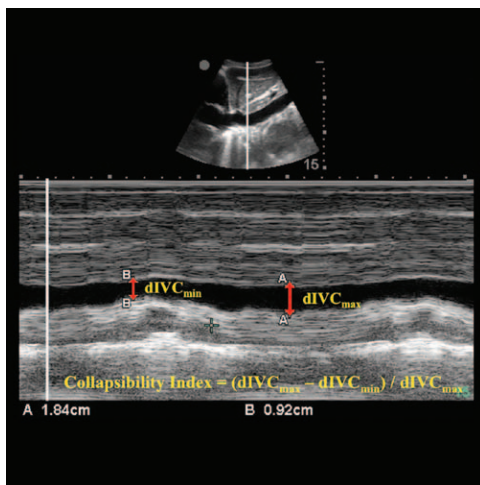
# Cautious Optimism

## Can Preoperative Ultrasound Predict Postinduction Hypotension?

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**H**YPOTENSION (mean arterial pressure [MAP] less than 55 mmHg) during general anesthesia lasting for even short periods of time can lead to major adverse events (MAEs) in the postoperative period.<sup>1</sup> Hypotension after induction of general anesthesia can be made less likely by (1) using proper dosing and rate of administration of specific drugs tailored to the patient's preoperative status and (2) prophylactic administration of fluids and vasoactive medications to patients identified as high risk for developing hemodynamic instability during induction. In this context, the study published in the current issue of *ANESTHESIOLOGY*, "Inferior Vena Cava Ultrasonography before General Anesthesia Can Predict Hypotension after Induction," is of clinical relevance.<sup>2</sup> The authors conclude that preoperative scanning of inferior vena cava (IVC) with point-of-care ultrasound and assessment of IVC collapsibility index (IVC-CI) can reliably predict hypotension (defined as MAP less than 60 mmHg or a 30% mean blood pressure decrease from baseline) after induction in 75% of patients with American Society of Anesthesiologists physical status I to III undergoing surgery. Hypotension was predicted when IVC-CI was greater than 43%. Assessment of IVC size alone was less clinically useful due to the reason that too many patients were in the unpredictable or gray zone (59%).

Currently, we use static parameters such as central venous pressure, pulmonary artery pressure, and dynamic markers of fluid responsiveness such as delta stroke volume, delta cardiac index, pulse pressure variation, and plethysmographic variations in the perioperative period to assess and optimize fluid status. Measurement of these parameters necessitates an invasive procedure (arterial line, central line, or pulmonary



***“[Point-of-care ultrasound of the inferior vena cava] is promising and has the potential to be useful for the safe and smooth conduct of anesthesia induction.”***

The authors need to be complimented for generating this hypothesis. This finding, if duplicated in larger populations with differing risk and patient characteristics (*e.g.*, body habitus), will have significant potential to reduce MAEs after the induction of general anesthesia.

It is important to note that there are several weaknesses that make it unclear as to how sensitive and specific the IVC-CI will be in a general population. First, this is a small study with differing patient characteristics. As shown by an increasing indeterminate IVC-CI in cardiac patients, the behavior of this parameter in patients with other risk factors (diastolic dysfunction and patients taking angiotensin-converting enzyme inhibitors) is unknown. Second, the definition of hypotension was also arbitrarily dichotomized with an MAP less than 60 mmHg instead of using percent change from baseline MAP as the sole definition. This could have led to a positive study finding while it

arterial catheterizations); however, it may not be required for the performed surgical procedure. Even if the use of a hemodynamic monitor is indicated, results from these parameters may not be available before anesthesia induction. Dynamic fluid responsiveness monitors have been well studied in mechanically ventilated patients and are not useful in spontaneously breathing patients during the preinduction period. Point-of-care ultrasound IVC scanning is a valuable technique to predict the risk of postinduction hypotension in the absence of a reliable preoperative monitor that predicts cardiovascular behavior during induction of anesthesia. Point-of-care ultrasound IVC scanning can be learned quickly and is reproducible to predict postinduction hypotension, which is valuable given the indeterminate risk seen only in 10% of patients.

Image: Jie Zhang, Chinese University of Hong Kong.

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could have been a well-described statistical effect of regression to the mean. Third, the predictive utility comes from custom fitting the parameters to the current data set. This prediction power is decreased often with validation cohorts. Fourth, the measurement of noninvasive blood pressure was less frequent (once every 2 min) than necessary in half the study population. This certainly could have lead to missed detection of hypotension, making the interpretation of this study finding difficult. Fifth, etomidate was the induction drug in this study. This may not be a common practice and it is unknown how this finding will change if any other drug such as propofol is used for induction. Finally, this method suggests an approach to prevent hypotension after induction. However, the bigger goal is to prevent hypotension in the entire intraoperative period. There is a need to use complimentary techniques such as dynamic fluid responsiveness to achieve the ultimate goal of reducing MAE.

Preoperative fluid optimization can perhaps be attempted with an IVC-CI target of 38% or less in the holding area in an attempt to reduce the incidence of postinduction hypotension. However, it has the potential to prolong either the turnover time or the anesthesia ready time. There is no doubt that this article will encourage the discussion about cost–benefit analysis. The cost of personnel training and equipment costs should be taken into consideration as well.

With the ever-expanding use of ultrasound in the perioperative period, this article will enable future studies to refine current findings. For now, this technique is promising and has the potential to be useful for the safe and smooth conduct of anesthesia induction.

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### Competing Interests

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