Use of 'tidal volume challenge' to improve the reliability of pulse pressure variation.

Crit Care 21, 60 (2017)

INTRODUCTION : Fluid loading is usually the first step in the resuscitation of patients with acute circulatory failure. Fluids are administered with the aim of increasing cardiac output and oxygen delivery. Thus giving fluid is not beneficial if cardiac output does not increase. Uncorrected hypovolemia may result in inappropriate administration of vasopressor infusions, which may in turn affect tissue oxygenation, leading to organ dysfunction and death On the other hand, excessive fluid loading is associated with increased complications, mortality. Thus, it is important to identify fluid responders to know who can benefit from fluid administration and to avoid fluid overload in those who are not fluid responsive. However, identifying which patients will respond to volume expansion presents a daily challenge in ICUs today.

ACADEMIC P.E.A.R.L.S

Pediatric Evidence And Research Learning Snippet

Tidal Volume Challenge to Assess Fluid Responsiveness

How to perform and interpret the tidal volume challenge: This test is performed to assess fluid responsiveness in patents in shock, ventilated using low tidal volume without spontaneous breathing activity. The PPV is noted from the bedside monitor at baseline (tidal volume 6 ml/kg PBW). The tidal volume is then transiently increased from 6 ml/kg PBW to 8 ml/kg PBW for one minute. The PPV is recorded at 8 ml/kg PBW and the tidal volume is reduced back to 6 ml/kg PBW. The ΔPPV6–8 after performing the tidal volume challenge is recorded. A ΔPPV6–8 greater than 3.5% predicts fluid responsiveness with high accuracy.PPV is unreliable in patients with low lung compliance, especially in patients with ARDS .Thepredictive value of PPV was related to the compliance of the respiratory system and if the compliance was < 30 ml/cmH2O, PPV was less accurate in predicting fluid responsiveness volume challenge. Thus, the tidal volume challenge may help identify responders even when compliance of the respiratory system is low in patients receiving low tidal volume ventilation with recruitable lungs.

Limitations of the tidal volume challenge: The tidal volume challenge may not be able to overcome the other limitations associated with the use of PPV, such as spontaneous breathing, cardiac arrhythmias, open chest, and raised intra-abdominal pressure and needs to be evaluated in these settings. Alternative techniques, such as PLR or end-expiratory occlusion, when applicable, may be considered in these situations.

Conclusion: The PPV is a dynamic parameter that can be easily recorded from a bedside monitor and reliably predicts preload responsiveness. In addition, it does not require continuous cardiac output monitoring or any other tools or maneuvers to be performed. One of the major limitations with its use in patients receiving controlled mechanical ventilation is that it is unreliable during low tidal volume ventilation, which is now widely practiced in ICU patients. This major limitation can be easily overcome by using the 'tidal volume challenge' a simple bedside test, following which PPV can reliably predict fluid responsiveness. Whether this test may also have the potential to overcome other limitations associated with the use of PPV needs to be further studied. Alternative methods to assess preload responsiveness may be required to overcome the other limitations with the use of PPV.

EXPERT COMMENT

"Use of a tidal volume challenge increases the reliability of PPV to predict fluid responsiveness during low tidal volume ventilation, which is now common practice in the ICU. It is a simple test that can be performed easily at the bedside. Importantly, observing the changes in PPV (obtained from a simple bedside hemodynamic monitor) during this test does not require a cardiac output monitor, making this test applicable even in resource-limited settings. The ΔPPVfb accurately confirms fluid responsiveness. Thus, a combination of ΔPPV6–8 with ΔPPVfb can help predict and thereafter confirm fluid responsiveness when continuous cardiac output monitoring is unavailable."

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With warm regards,

Reference

Myatra, S., Monnet, X. & Teboul, JL. Use of 'tidal volume challenge' to improve the reliability of pulse pressure variation. *Crit Care* **21,** 60 (2017). https://doi.org/10.1186/s13054-017-1637-x