Figure 1 – A. Represents a fluid-responsive circulation and shows the intersection of the venous return and cardiac function curves at end-expiration (solid cardiac function curve) and end-inspiration (dotted curve). The inspiratory drop in pleural pressure shifts the cardiac function curve to the left, moving the intersection point to a lower right atrial pressure. The IVC tends to collapse accordingly. B. The circulation is characterized by depressed cardiac function and high intravascular volume and would not respond to further fluid loading. Inspiration shifts the cardiac function curve to the left as in A but, because the circulation is operating on its flat portion, the intersection with the venous return function line shifts imperceptibly. Right atrial pressure will not fall measurably, and the IVC will not collapse. SV = stroke volume.

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unless we understand that low right atrial pressure in patients with shock most commonly results from vasoplegia and hypercontractile heart function, two physiologic processes that only incompletely respond to fluid. The frequent “incomplete responses” encountered in low right atrial pressure is precisely why a better guide to fluid decisions is needed.

The aforementioned physiology strongly brings into question Dr Schmidt’s statement that “ΔIVC during spontaneous breathing predicts FR (diagnostic OR, 13.2).” To be fair, Dr Schmidt admits that this predictive ability is less than in passively ventilated patients and that spontaneously breathing patients is ΔIVC’s weakest link. Given the conflicting nature of these statements, a more specific analysis of the cited evidence is warranted.

The OR for FR of 13.2 was taken from a study published in 2014 by Zhang et al. Unfortunately, this “meta-analysis” contains too many limitations to be useful: (1) only a single study of IVC collapse in spontaneously breathing patients was used to calculate the OR (the study by Muller et al., in which 40% of patients were in shock from clinically overt hypovolemic insults); (2) one “negative” study of IVC collapse by Brun et al. was excluded after being mischaracterized as not having studied spontaneously breathing patients; (3) another “negative” study by Corl et al. was excluded due to incomplete data for meta-analysis; and (4) it was published prior to publication of three more of the largest “negative” studies on IVC collapse. The more current summary from Table 1 in my Counterpoint far better demonstrates its actual poor predictability.

In summary, based on the near complete lack of supportive physiology, experimental evidence, or clinical data demonstrating the ability of IVC collapse to reliably predict fluid needs in the critically ill, IVC ultrasound should not serve as the primary guide to fluid resuscitation.

References