Assessing Fluid Responsiveness in the MICU

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Last updated: March 19, 2022

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A Common Scenario

- Middle of the night in MICU.
- Patient who has been in the ICU for several days with shock has increasing vasopressors requirements.
- Senior (or fellow?) tells you to "go ultrasound the IVC".
- Why?

The Goal

- Increase DO_2 and tissue perfusion / oxygenation
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  - $DO_2 = (CO) \cdot (CaO_2)$
  - $DO_2 = (HR \cdot SV) \cdot (1.34 \cdot [Hgb] \cdot SpO_2)$
- if ↑SV, we (may) ↑CO and (may) get ↑DO_2
- Notice all the "mays" in there.

Physiology

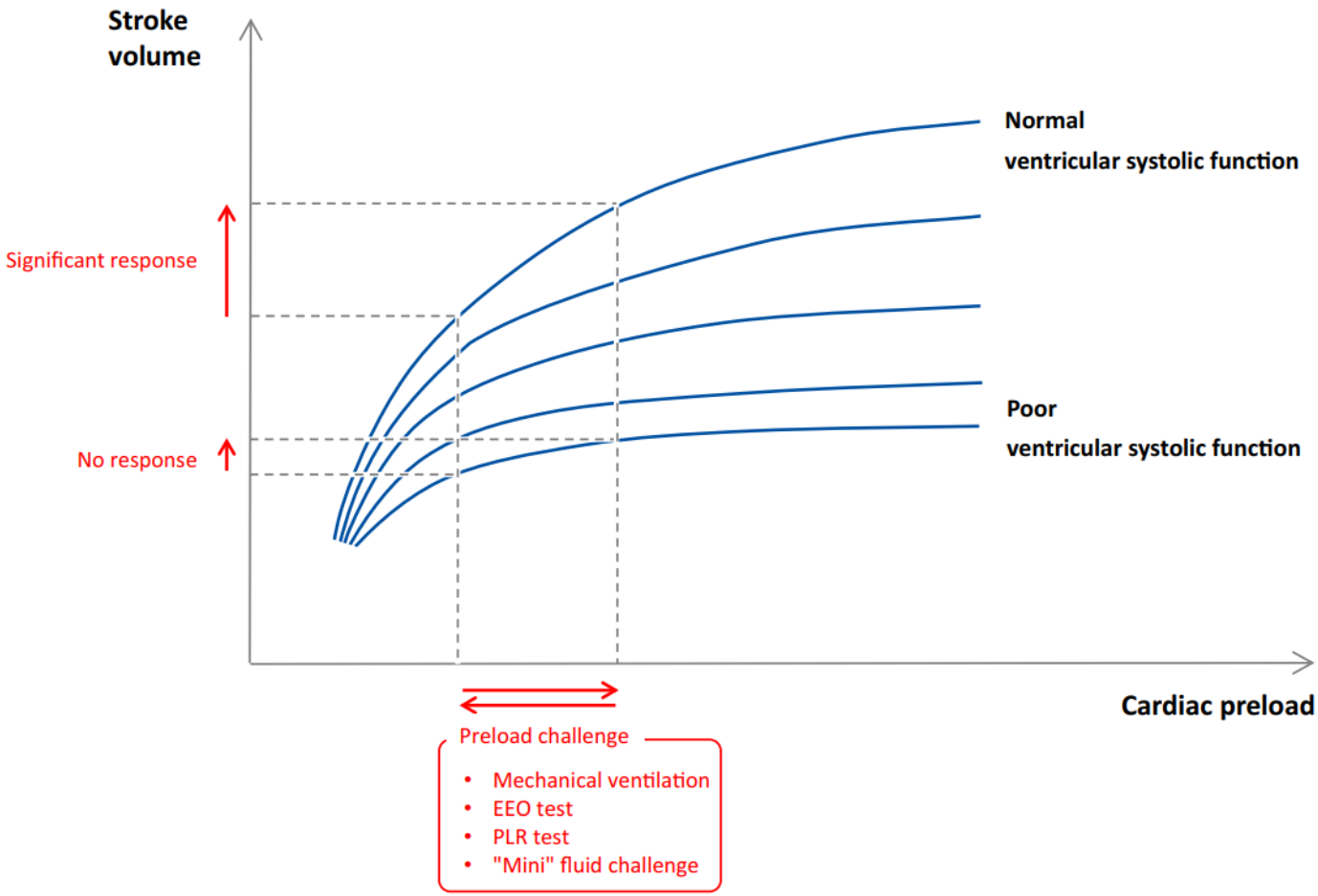

Fig. 1 Frank–Starling relationship. The slope of the Frank–Starling curve depends on the ventricular systolic function. Then, one given level of cardiac preload does not help in predicting fluid responsiveness. By contrast, dynamic tests include a preload challenge (either spontaneous, induced by mechanical ventilation or provoked, by passive leg raising, end-expiratory occlusion or fluid infusion). Observing the resulting effects on stroke volume allows for the detection of preload responsiveness. *EEO* end-expiratory occlusion, *PLR* passive leg raising

Some Thoughts

- Fluid responsiveness $\neq$ patient should be get fluids!
  - e.g., no shock

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- Fluid responsiveness $\neq$ patient should be get fluids!
  - e.g., no shock
- However, if $\downarrow$ CO and requires correction:
  fluid responsiveness $\implies$ $\uparrow$SV (and usually $\uparrow$CO, unless HR falls) if fluids are given

Strategies

Overview

Static	**Dynamic**
vital signs	passive leg raise
CVP / PCWP	end-expiratory occlusion test
“one off lactate / VBG”	IVC ultrasound
pulse pressure variation	LVOT velocity time index

Strategies

Overview 1

Static	Dynamic
~~vital signs~~	passive leg raise
~~CVP / PCWP~~	end-expiratory occlusion test
~~"one off" lactate / VBG~~	IVC ultrasound
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Strategies

Overview 2

Heart-Lung Interaction	**Independent**
pulse pressure variation	passive leg raise
end-expiratory occlusion test	
IVC ultrasound	
LVOT velocity time index	

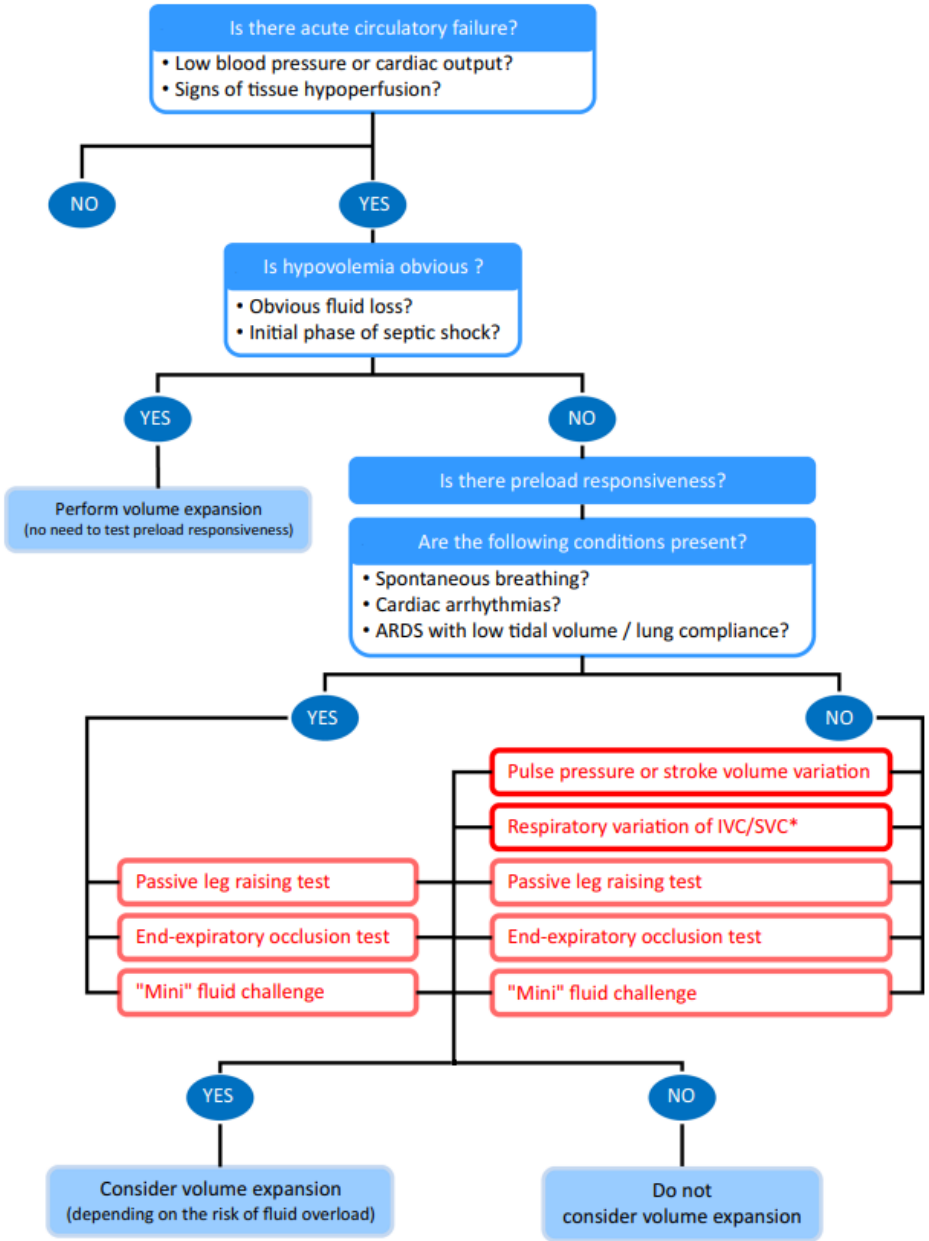

Fig. 2 Fluid strategy.*The variation in inferior/superior vena cava diameters can be used in case of cardiac arrhythmias. *ARDS* acute respiratory distress syndrome, *IVC* inferior vena cava, *PCO_2 gap* veno-arterial difference in carbon dioxide tension, *SVC* superior vena cava

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