Pleth Variability Index (PVi®)

An Index for Continuous Noninvasive Dynamic Indication of Fluid Responsiveness in Select Populations of Mechanically Ventilated Adult Patients from a Single Pulse Oximetry Sensor

PVi provides a continuous noninvasive measure of the relative variability in the photoplethysmograph (pleth) during respiratory cycles that may be used as a dynamic indicator of fluid responsiveness in select populations of mechanically ventilated adult patients.[1]

PVi is available alongside Masimo SET® Pulse Oximetry and rainbow® Pulse CO-Oximetry.

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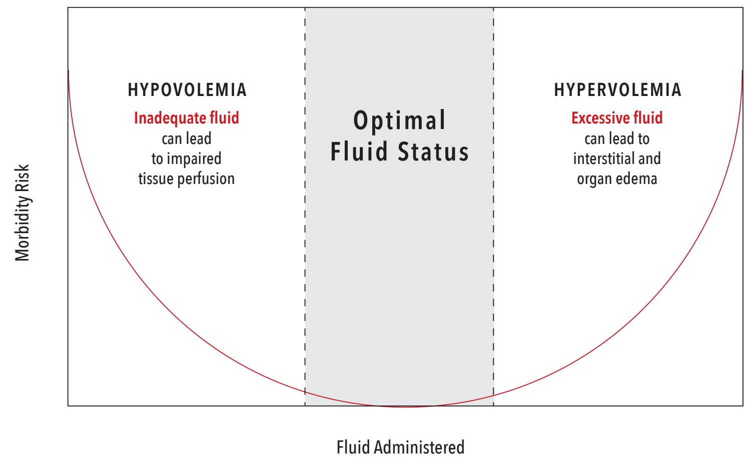
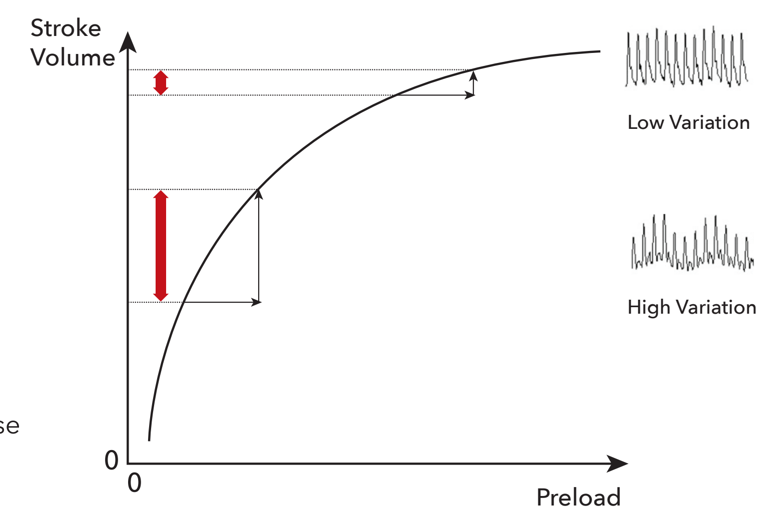
Fluid Optimization

- Fluid administration is one of the most common interventions made to increase cardiac output (CO). However, fluid administration should be balanced to avoid both hypovolemia and hypervolemia, which have both been associated with negative outcomes.[2]



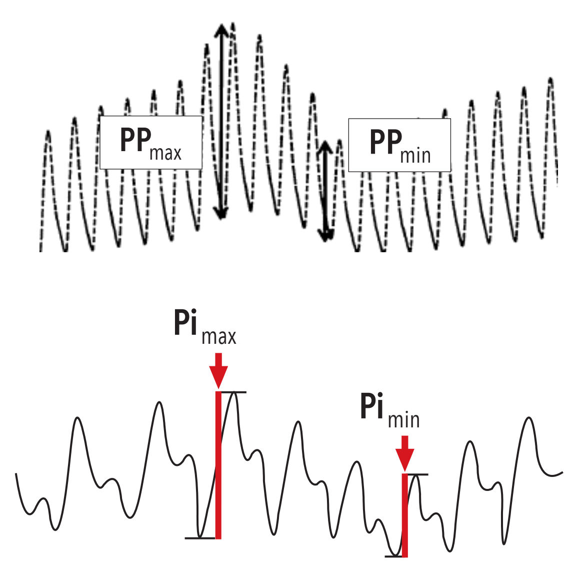
Identifying Preload Dependence

- Preload dependence is defined as the ability of the heart to increase stroke volume in response to an increase in preload/fluid.[1]
- The Frank-Starling curve defines the relationship between ventricular preload and stroke volume and the preload dependence of fluid responders.[1]
- During a respiration cycle, changes can be seen in the ventricular filling volume. When the preload/fluid volume is low, these changes in ventricular filling volume result in higher variations in stroke volume.[1]



Dynamic Parameters

- Multiple hemodynamic parameters (ex. SVV, PPV) have been used to help clinicians assess variations in the arterial pressure waveform resulting from the stroke volume from an indwelling (invasive) arterial cannula or through noninvasive blood pressure cuffs.[3]
- While dynamic parameters such as PPV and SVV use the arterial pressure waveform, PVi uses the arterial pleth waveform, which reflects the absorption concentration of arterial hemoglobin.[3]



PVi Technology Overview

Pleth Variability Index (PVi) is dynamic index between 0-100 which measures the relative variability of the pleth waveform noninvasively detected from a pulse oximetry sensor. It uses the detected pleth amplitudes to automatically calculate the dynamic changes that occur during the respiratory cycle. Higher variability in the pleth waveform has been associated with preload dependence and fluid responders.

This allows PVi to be used as a noninvasive dynamic indicator of fluid responsiveness in select populations of mechanically ventilated adult patients.

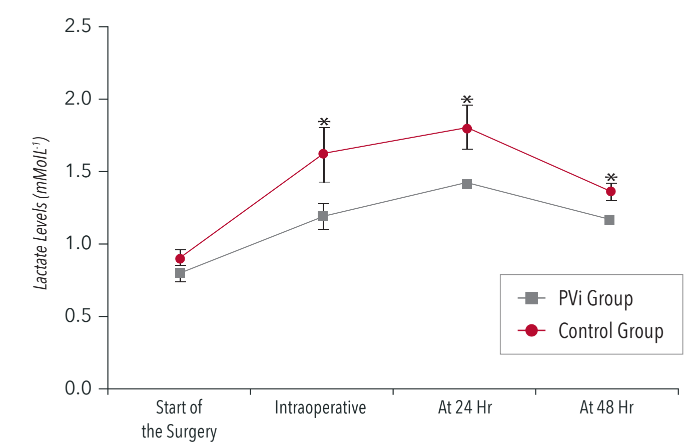
The ability of PVi to predict fluid responsiveness can be variable and influenced by numerous patient, procedural, and device-related factors. Fluid management decisions should be based on a complete assessment of the patient's conditon and not solely on PVi.

PVi in Fluid Management Protocols

- Hospital protocols, such as Goal-directed Therapy (GDT) and Enhanced Recovery After Surgery (ERAS), recommend fluid management as part of larger initiatives designed to improve patient care and safety.
- Proper balancing of fluids has been associated with decreased lactate build-up and shorter recovery times.[4,5]
- Numerous studies have evaluated the utility of PVi as part of various regimens and protocols for fluid management, with varying results and outcomes. For a list of studies, please visit: www.masimo.com/evidence/pulse-oximetry/pvi.

Goal-directed Therapy (GDT)

In a study of eighty-two patients undergoing major abdominal surgery, researchers found that PVi-based goal-directed fluid management reduced the volume of intraoperative fluid infused and reduced intraoperative and postoperative lactate levels.[4]



Enhanced Recovery After Surgery (ERAS)

In another study of one hundred and nine patients undergoing colorectal surgery, researchers found that the implementation of an enhanced recovery protocol which included PVi led to improved patient satisfaction and substantial reductions in lengths of stay, complication rates, and costs for patients.[5]

	Pre ERAS Protocol	Post ERAS Protocol
Length of Stay (days)	6.8 ± 4.7 (Median 5)	4.6 ± 3.6 (Median 3)
Mean 30-day direct cost	$20, 435 ± $12, 857	$13, 306 ± $9, 263

The GDT and ERAS studies summarized above were conducted on patients undergoing specific types of procedures and following specific fluid management protocols. The results may not be reflective of all cases and the described GDT and ERAS protocols may not be appropriate for all types of patients and procedures.

[1] Cannesson et al. *Journal of Cardiothoracic Vas Anes*. 2010. [2] Bellamy MC. *Br J Anaesth*. 2006 Dec;97(6):755-7. [3] Chandler et al. *J Clin Monit Comput*. 2012. [4] Forget P et al. *Anesth Analg*. 2010 Oct;111(4):910-4. [5] Thiele RH et al. *J Am Coll Surg*. 2015 Apr;220(4):430-43.

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