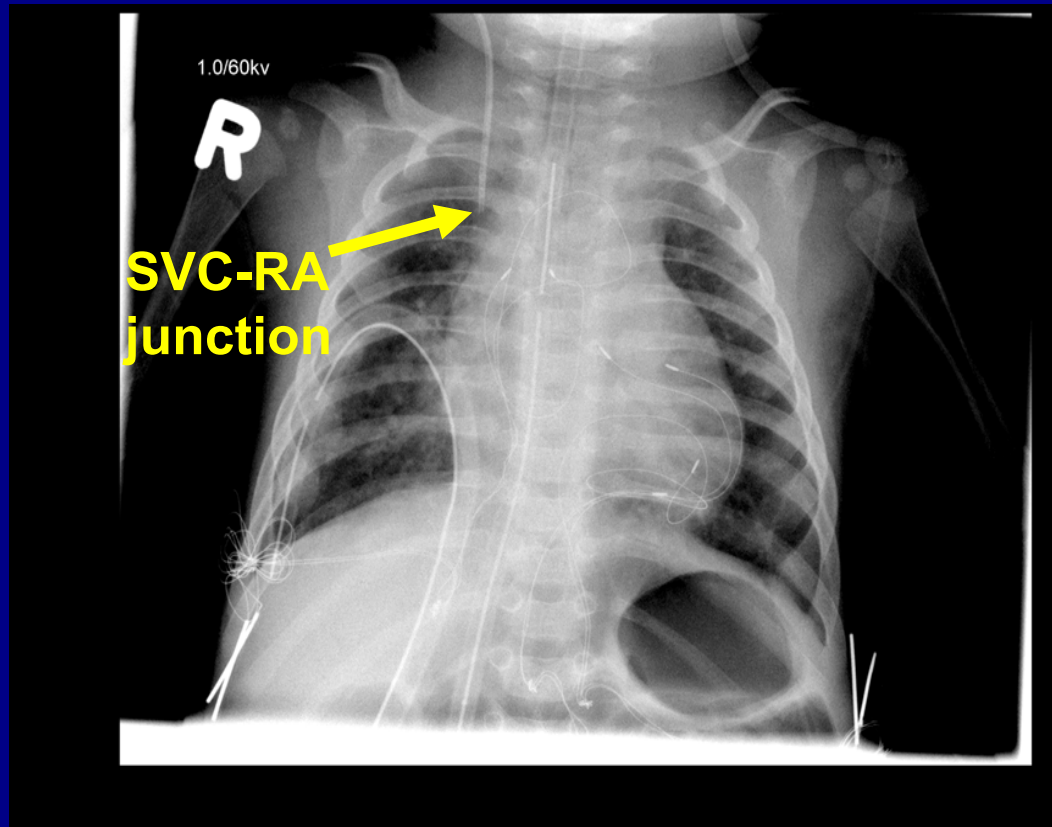


Can Nurses Use Continuous Central Venous Oxygen Saturation Monitoring, to Dictate How and When to Provide Care?

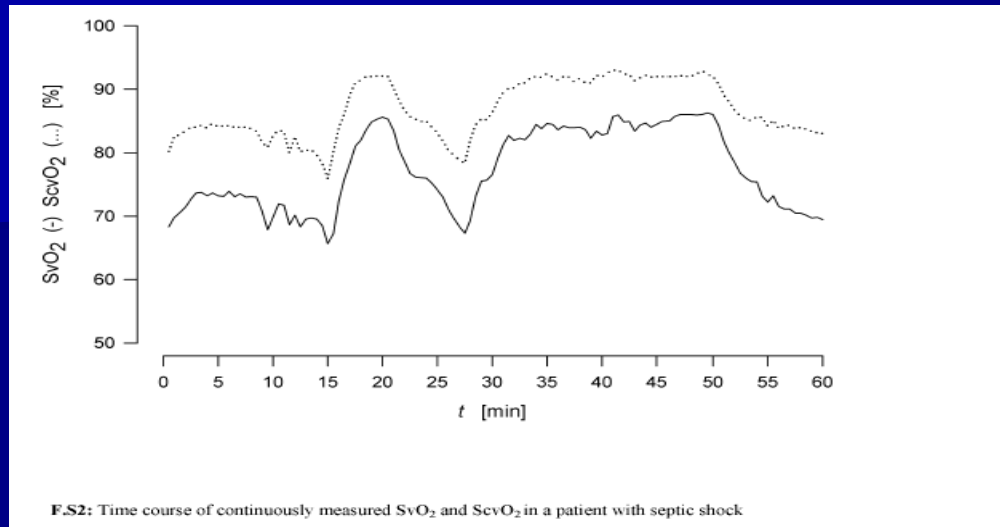
Caulette Young, RN, BSN
Pediatric Clinical Advisor
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So what is ScvO₂?

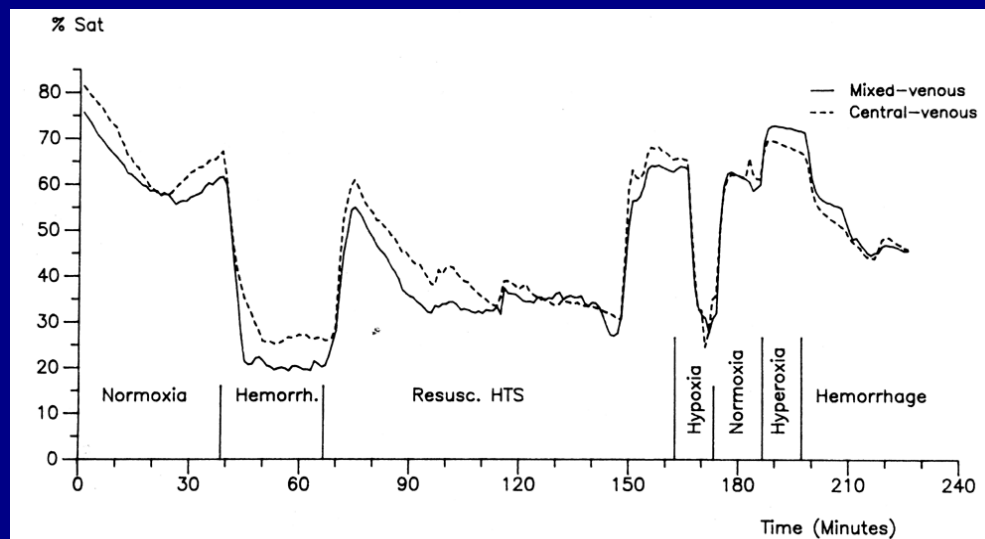
- Central venous oxygen saturation via percutaneous inserted central line catheter
- Ideally measured at the SVC-RA junction



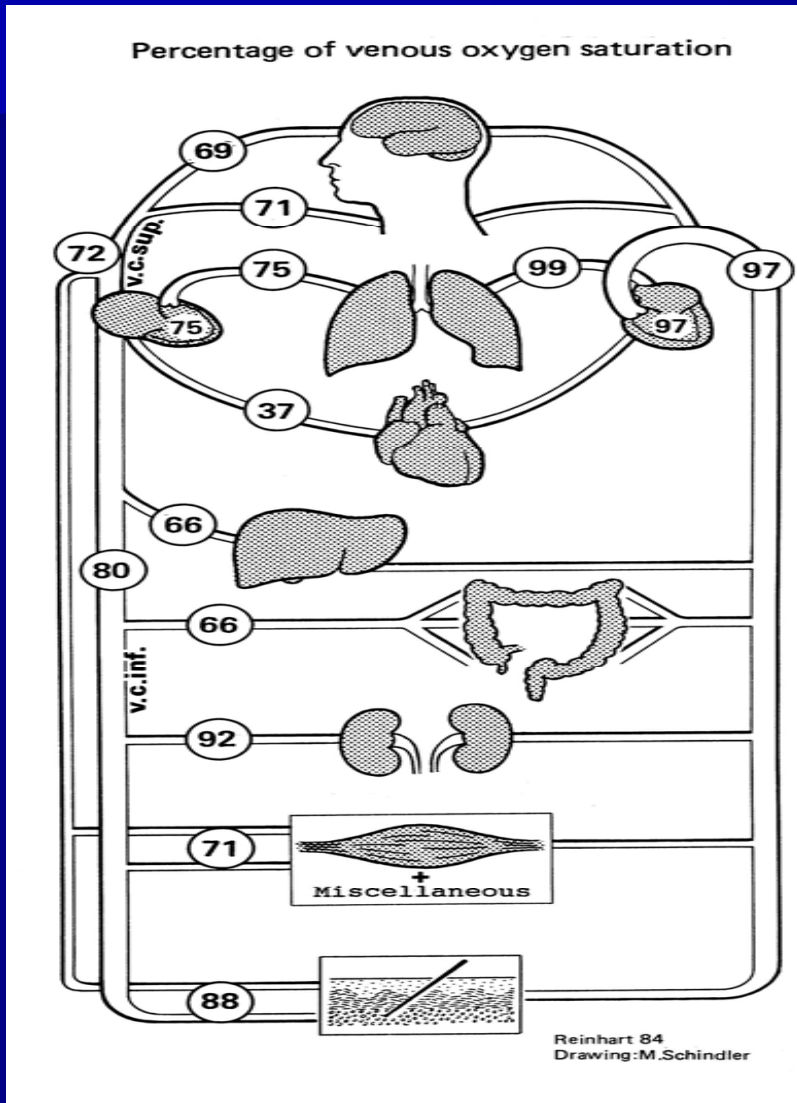
➤ Regional oxygen saturation from upper body



➤ Trends with SvO₂ values, nearly interchangeable

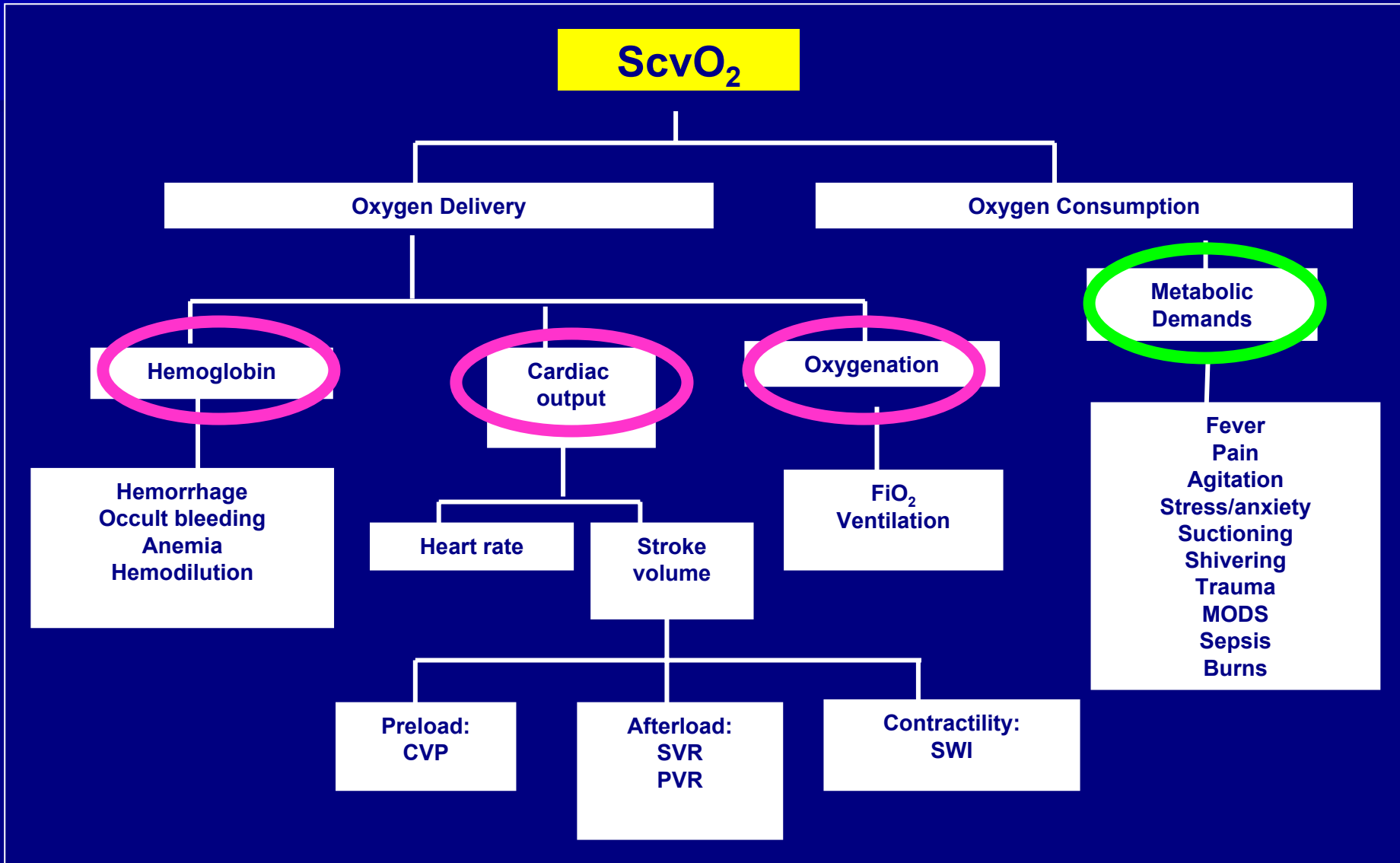


- Reflects O_2 level in the venous circulation after the tissues have extracted oxygen

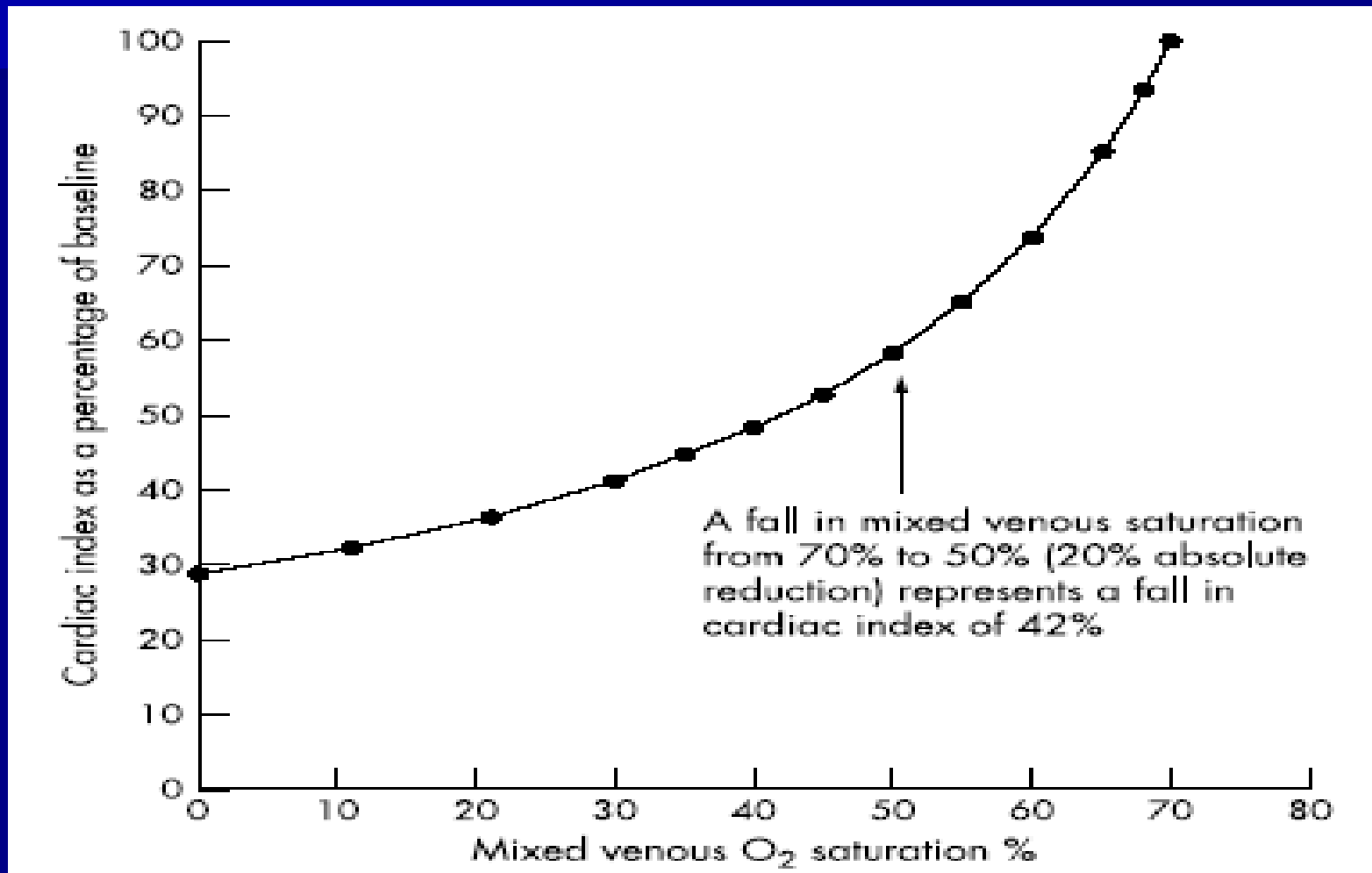


- $O_2ER = \text{ratio } VO_2 \text{ to } DO_2$
- It represents the proportion of DO_2 that is consumed by the tissues

➤ Indicative of balance between O₂ delivery & O₂ consumption

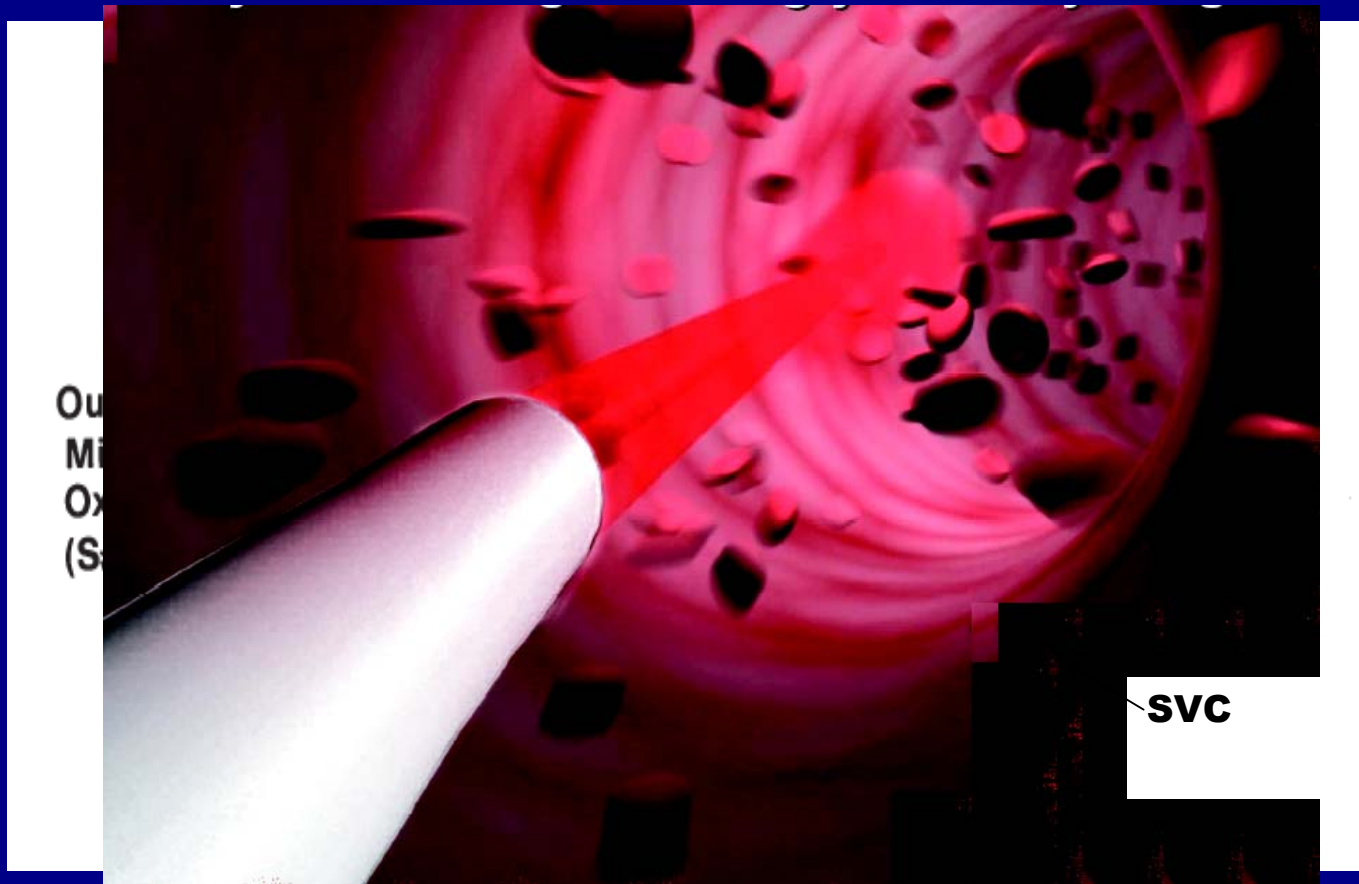


- Has been considered a surrogate for cardiac output / index in pediatrics



And how can it be measured continuously?

➤ Reflection spectrophotometry using fiberoptics



Why measure $ScvO_2$?

Indicates the
balance of:

O_2 Delivery

&

O_2 Consumption



“Oxygen delivery does not provide
informative neonatal tissue



© Jay H. Han
Critical Care Nursing of Infants and Children 2nd Ed

DO₂ is usually more than needed,
unless....



consumption increases beyond delivery,
or tissues are unable to extract oxygen

Oxygen Balance: DO_2 & VO_2

- Usually consumption (VO_2) **independent** of delivery (DO_2)

$$VO_2 = CO \times (SaO_2 - SvO_2) \times Hgb \times 1.34 \times 10 = \mathbf{120-200 \text{ ml/min/M}^2}$$

$$DO_2 = CO \times SaO_2 \times Hgb \times 1.34 \times 10 = \mathbf{650 \pm 50 \text{ ml/min/M}^2}$$

- If VO_2 increases or DO_2 decreases, tissue oxygenation is maintained by **increasing oxygen extraction**

$$O_2ER = VO_2/DO_2 \times 100 = \mathbf{25 \pm 2\%}$$

- If DO_2 drops below a critical level, oxygen extraction becomes exhausted results in VO_2 becoming **dependent** on DO_2

Tissue hypoxia occurs

Uncorrected imbalances

- Shift in dissociation curve: left or right
- Hypoxia / hypoxemia
- Acidosis
- Redistribution or maldistribution of blood
- MODS
- Pulmonary hypertension
- Cardiovascular collapse / cardiac arrest
- Necrosis & irreversible cell death
- Death

<u>SvO₂/ScvO₂</u>	<u>Physiology</u>
> 75%	Normal extraction
< 75% and > 50%	Compensatory extraction (↑ demand or ↓ supply)
< 50% and > 30%	Limits of extraction (beginning of lactic acidosis)
< 30% and > 25%	Severe lactic acidosis
< 25%	Cellular death

Using continuous ScvO₂ monitoring to evaluate tissue oxygenation at the bedside enables the clinician to detect early alterations in oxygen balance.

(Goodrich 2006 Crit Care Nurs Clin N Am)

Clinical Decision-making



How to use continuous ScvO₂ at the bedside

Vasoactive meds
Dysrhythmia
Congestive heart failure
Cardiac surgery
Arrests

Hemorrhage
Occult bleeding
RBC disorders
Anemia
Hemodilution

CO

Hb

ScvO₂

SaO₂

VO₂

Hypoxia/hypoxemia
Suctioning, atelectasis
Ventilation/oxygenation
Lung disease
Shunting

Sepsis
Work of breathing
Fever, Shivering
Trauma
Pain / anxiety



Factors

Increase % VO_2

➤ Non-sedated head injury	138%
➤ Burns	100%
➤ Sepsis	50 - 100%
➤ Shivering	50 - 100%
➤ MODS	20 - 80%
➤ Chest trauma	60%
➤ Work of breathing	40%
➤ Weighing patient	36%
➤ Changing position	31%
➤ Orthopedic injuries	10-30%
➤ Suctioning	27%
➤ CXR	25%
➤ Bath	23%
➤ Physical examination	18%
➤ Agitation	16%
➤ Fever, dressing change	10%

Medications

- **Norepinephrine** (0.10-0.31 μ /kg/min)
- Dopamine (5 μ /kg/min)
- **Dopamine** (10 μ /kg/min)
- Dobutamine
- **Epinephrine** (0.10 μ /kg/min)

Increase % $\dot{V}O_2$

10-21%
6%
15%
19%
23-29%

Medication / Intervention

- **Hypothermia** (each 1°C)
- MSO_4 (IVP)
- **MSO_4** (IVCD)
- Anesthesia
- **Assist/control ventilation**
- Neuromuscular blockade

Decrease % $\dot{V}O_2$

10%
9-21%
21%
25-50%
30%
50-100% (if shivering)

Clinician decision-making

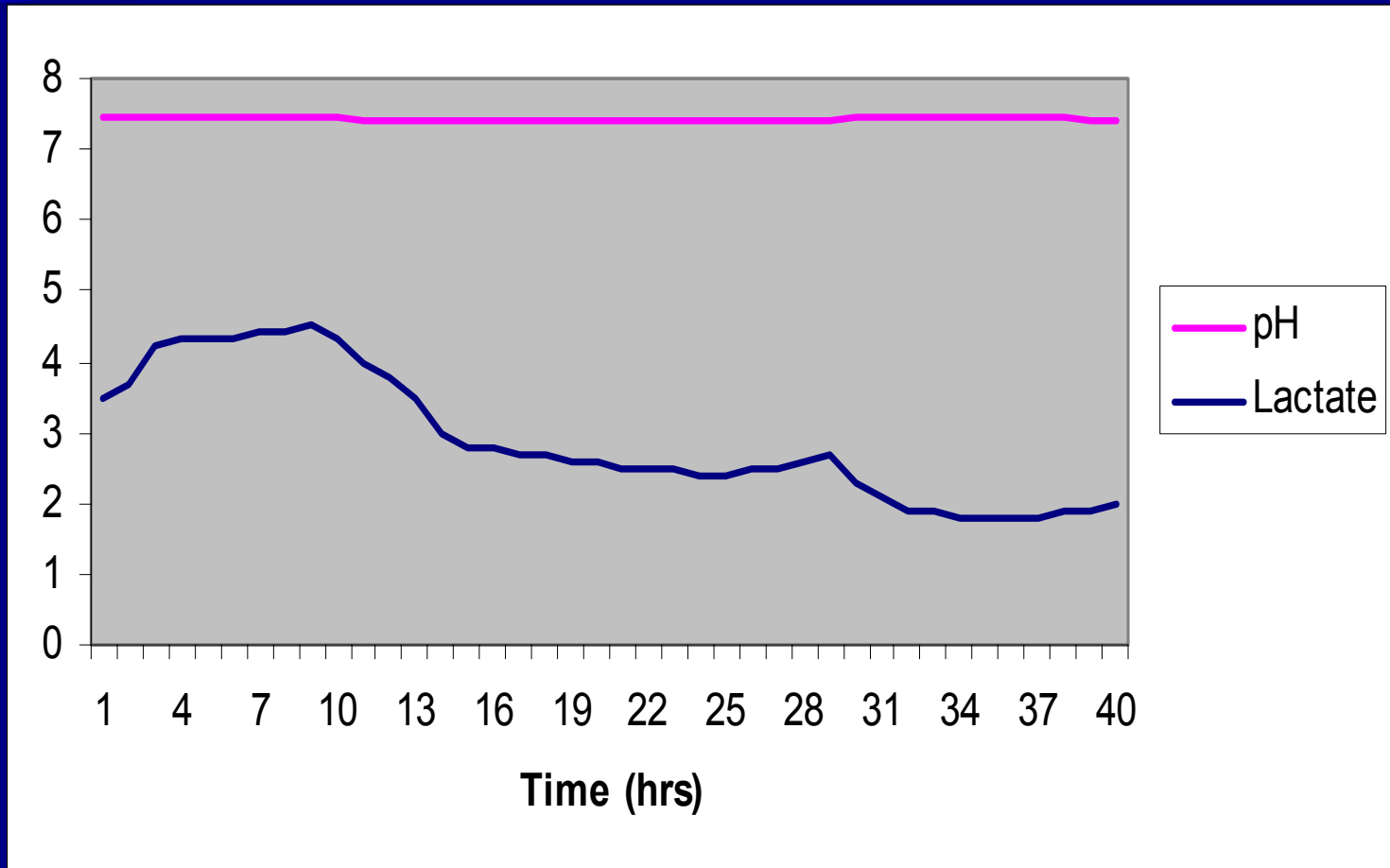
- Suctioning is not an innocuous procedure
 - How is it tolerated?
- Clustering care
 - Is it beneficial or harmful?
- Weaning tolerance
 - Ventilatory support
 - Inotropic support
 - Sedation/analgesia

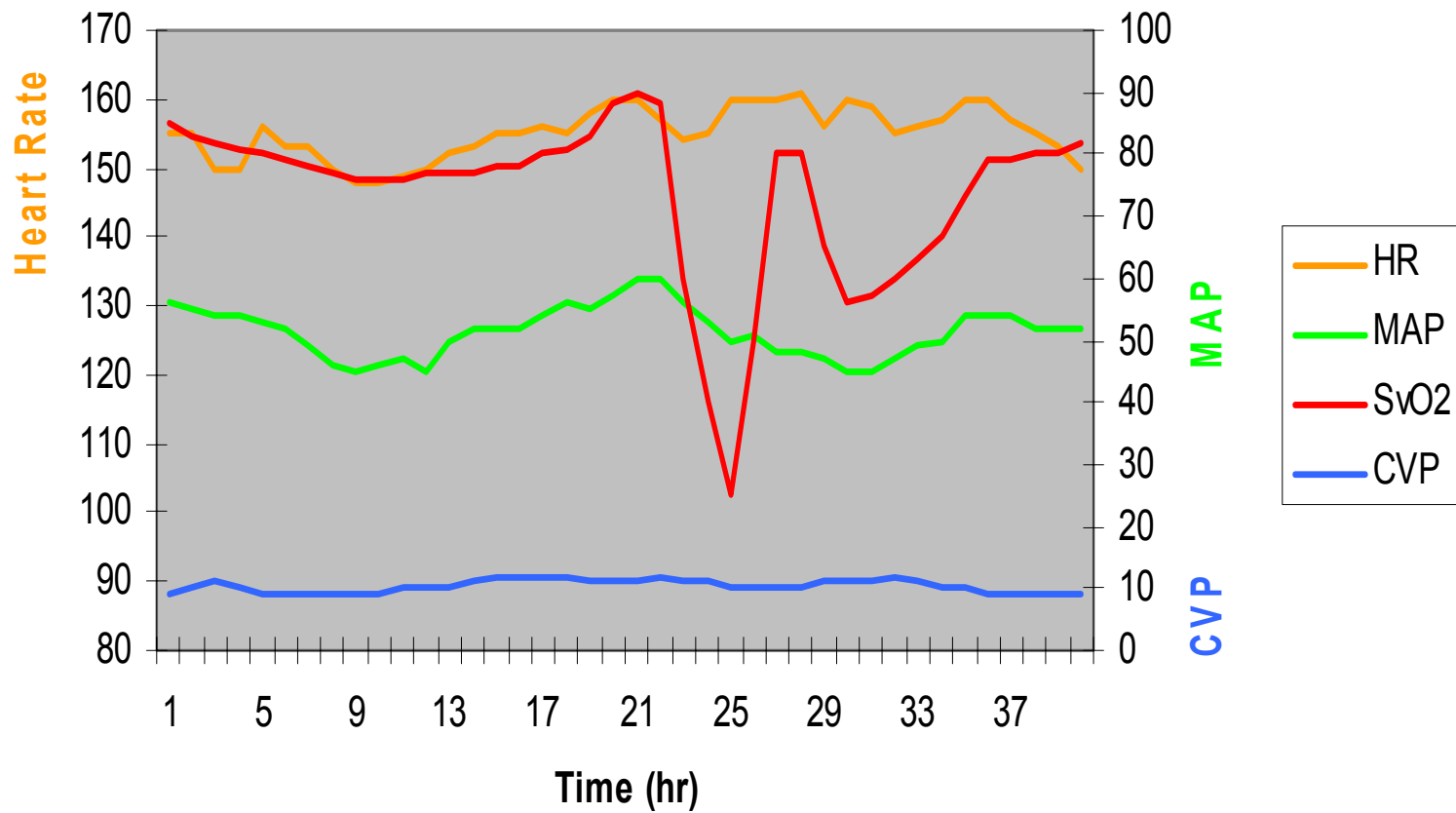
Understanding the clinical significance of SvO₂ (ScvO₂) measurements....can help guide clinical decision-making to assure adequate oxygenation to meet tissue needs.

(Sanders, 1997 Applied Pathophysiology)

Continuous central venous saturation monitoring in pediatrics: A case report

Neil Spenceley, MD; Peter Skippen, MD; Gordon Krahn, RRT;
Niranjan Kissoon, MD





Thank You!

Presentation Code 020

“Hypoxia not only stops the machine, it wrecks the machinery”
John Scott Haldane, 1880