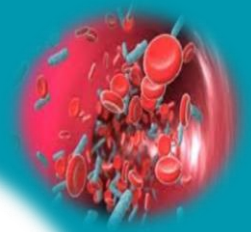
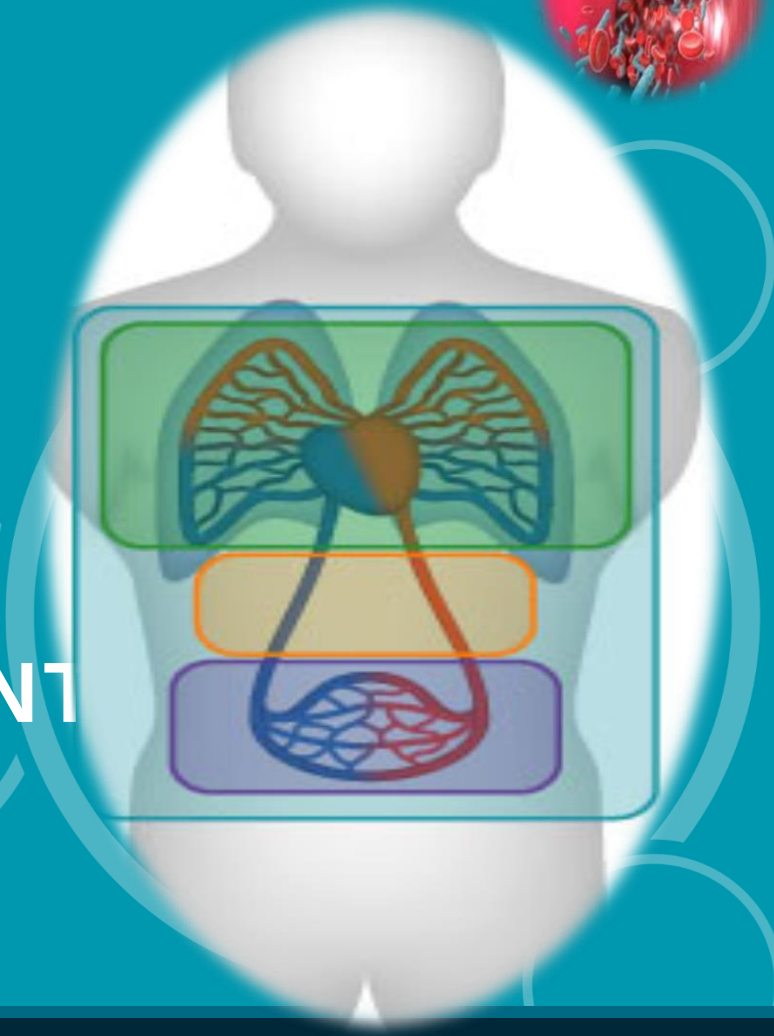




HYDRATION OF THE SEPTIC PATIENT

PER H. LAMBERT
HEAD OF CLINIC ANAESTHESIA,

NORTH DENMARK REGIONAL HOSPITAL

NORTH DENMARK REGION

600.000 inhabitants

Two hospitals

North Denmark Regional Hospital

Aalborg University Hospital

NORTH DENMARK REGIONAL HOS ocations

NEW DEFINITION 1991 > 2001 > 2016!

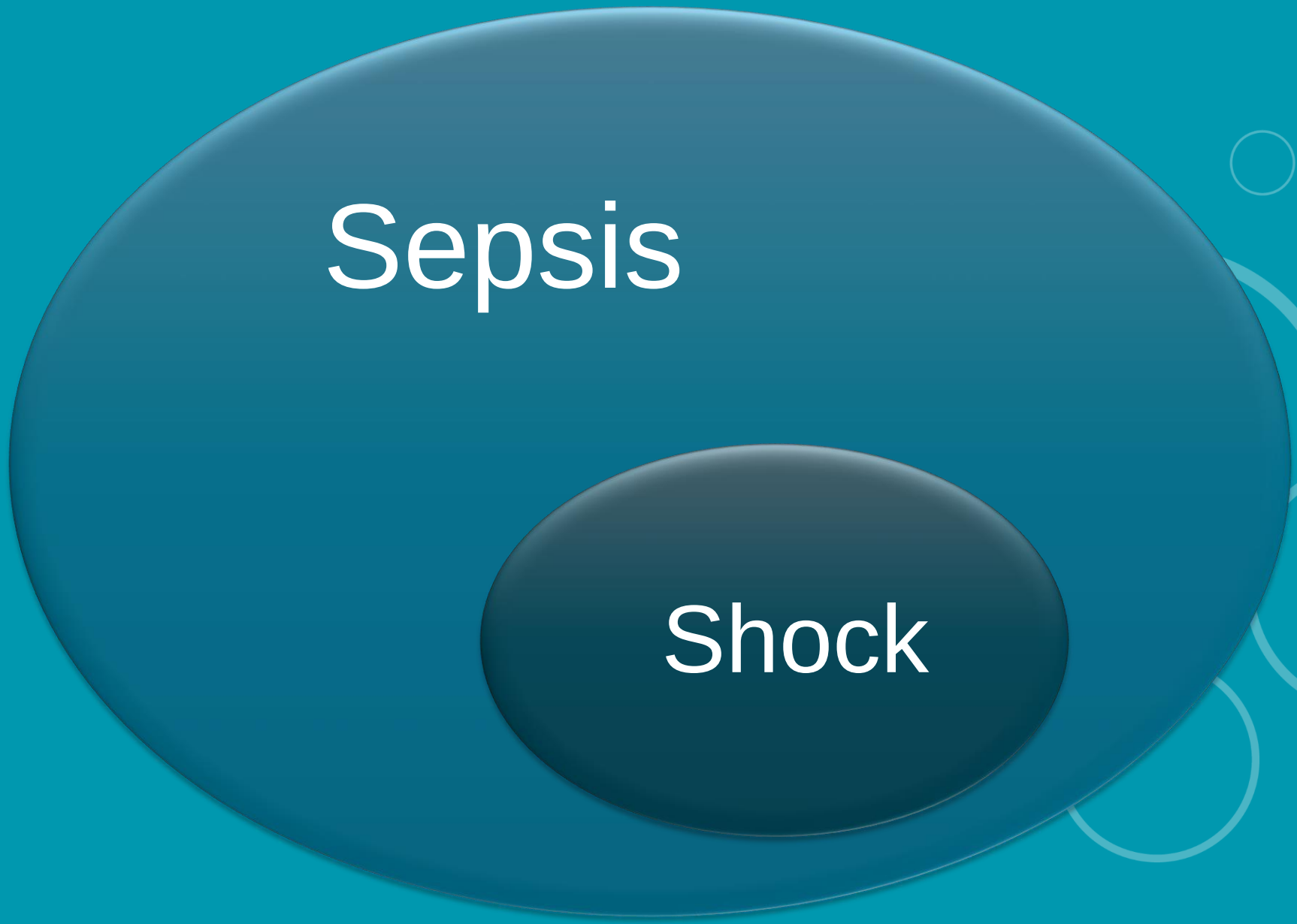
Infection-triggered organ dysfunction

Sepsis:

“Life-threatening organ dysfunction due to dysregulated host respons to infection”.

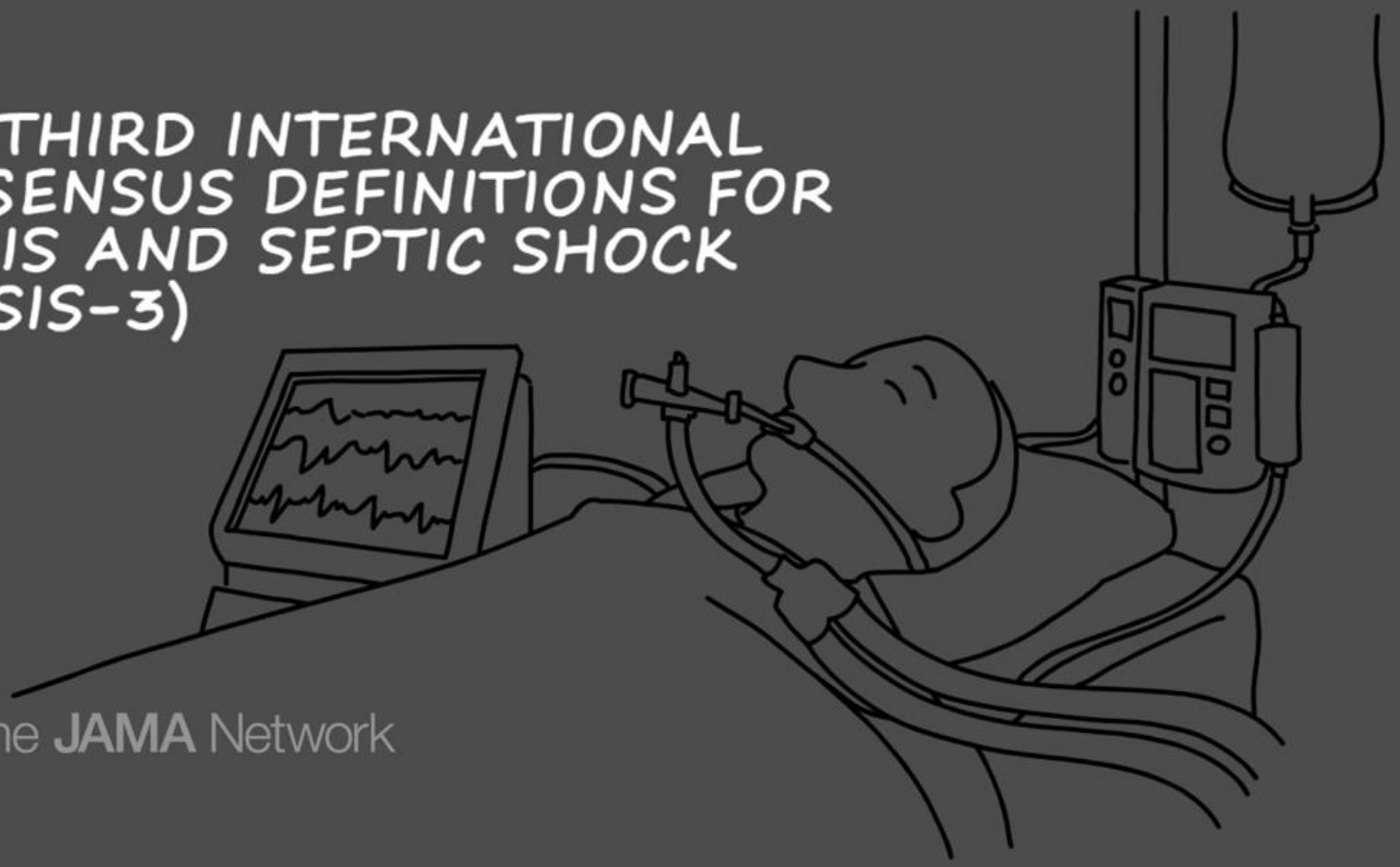
Septic shock:

“A subset of sepsis in which underlying circulatory, cellular and metabolic abnormalities are associated with a greater risk of mortality than sepsis alone”.


Sepsis
Shock

THE THIRD INTERNATIONAL CONSENSUS DEFINITIONS FOR SEPSIS AND SEPTIC SHOCK (SEPSIS-3)

JAMA



The JAMA Network

HYDRATION OF THE SEPTIC PATIENT
WHAT DO WE NOT KNOW ?

1. How much — Volume
2. When — Timing
3. Types — Types

HOW MUCH AND WHEN ?

Klinik für
Operative Intensivmedi
und Intermediate Care

Indication & timing

Study inclusion after initial resuscitation (10-12h)

Mortality

Initial danger
Hypovolemia

Secondary danger
Hypervolemia

\+ Crystal
Survival benefit

\- VISEP/6S/CHEST
Worse outcome/Side effects

Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

TO BE COMPLETED WITHIN 3 HOURS OF TIME OF PRESENTATION*:

1. Measure lactate level
2. Obtain blood cultures prior to administration of antibiotics
3. Administer broad spectrum antibiotics
4. Administer 30ml/kg crystalloid for hypotension or lactate ≥4mmol/L

* *"Time of presentation" is defined as the time of triage in the emergency department or, if presenting from another venue, from the earliest chart annotation consistent with all elements of severe sepsis or septic shock during chart review.*

WHAT DO WE KNOW ABOUT TYPES?

- Synthetic Colloids are harmful
- Human albumen is fairly safe, with limited effekt
- We do not want to give unnessesarry bloodproducts
- Saline
- ”Physiologic” solution

CONCLUSION

Difficult issue

Type and dose

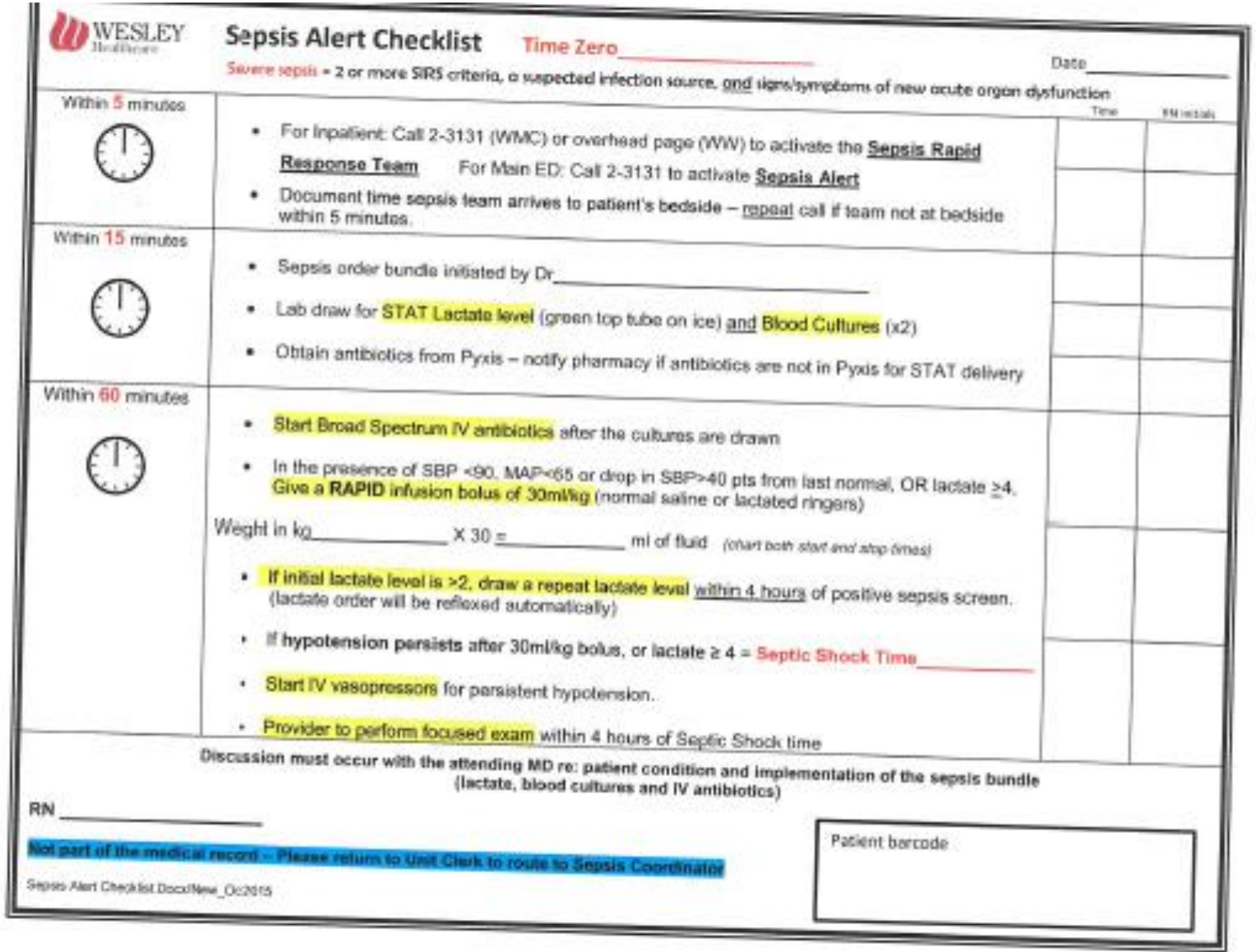
Time is important

Physiological prisciples

Define at treatment goal

Treatment protocol

TREATMENT PROTOCOL



WESLEY Healthcare

Sepsis Alert Checklist

Time Zero _____ Date _____

Severe sepsis = 2 or more SIRS criteria, a suspected infection source, and signs/symptoms of new acute organ dysfunction

		Time	RN initials
Within 5 minutes	• For Inpatient: Call 2-3131 (WMC) or overhead page (WW) to activate the **Sepsis Rapid Response Team** For Main ED: Call 2-3131 to activate **Sepsis Alert** • Document time sepsis team arrives to patient's bedside – repeat call if team not at bedside within 5 minutes.		
Within 15 minutes	• Sepsis order bundle initiated by Dr _____ • Lab draw for **STAT Lactate level** (green top tube on ice) and **Blood Cultures** (x2) • Obtain antibiotics from Pyxis – notify pharmacy if antibiotics are not in Pyxis for STAT delivery		
Within 60 minutes	• **Start Broad Spectrum IV antibiotics** after the cultures are drawn • In the presence of SBP <90, MAP<65 or drop in SBP>40 pts from last normal, OR lactate ≥4, **Give a RAPID infusion bolus of 30ml/kg** (normal saline or lactated ringers) Weight in kg _____ X 30 = _____ ml of fluid *(chart both start and stop times)* • **If initial lactate level is >2, draw a repeat lactate level** within 4 hours of positive sepsis screen. (lactate order will be reflexed automatically) • If **hypotension persists** after 30ml/kg bolus, or **lactate ≥ 4** = Septic Shock Time _____ • **Start IV vasopressors** for persistent hypotension. • **Provider to perform focused exam** within 4 hours of Septic Shock time		

Discussion must occur with the attending MD re: patient condition and implementation of the sepsis bundle (lactate, blood cultures and IV antibiotics)

RN _____

Not part of the medical record – Please return to Unit Clerk to route to Sepsis Coordinator

Sepsis Alert Checklist Docx\New_Oct2015

Patient barcode

Surviving Sepsis Campaign

BUNDLES

TO BE COMPLETED WITHIN 3 HOURS:

1) Measure lactate level.
2) Obtain blood cultures prior to administration of antibiotics.
3) Administer broad spectrum antibiotics.
4) Administer 30 ml/kg crystalloid for hypotension or lactate ≥4mmol/L.

"Time of presentation" is defined as the time of triage in the emergency department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements of severe sepsis or septic shock ascertained through chart review.

TO BE COMPLETED WITHIN 6 HOURS:

5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥65 mm Hg.
6) In the event of persistent hypotension after initial fluid administration (MAP < 65 mm Hg) or if initial lactate was ≥4 mmol/L, re-assess volume status and tissue perfusion and document findings according to Table 1.
7. Re-measure lactate if initial lactate elevated.

Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

TO BE COMPLETED WITHIN 3 HOURS OF TIME OF PRESENTATION*:

1. Measure lactate level
2. Obtain blood cultures prior to administration of antibiotics
3. Administer broad spectrum antibiotics
4. Administer 30ml/kg crystalloid for hypotension or lactate ≥4mmol/L

* *"Time of presentation" is defined as the time of triage in the emergency department or, if presenting from another care venue, from the earliest chart annotation consistent with all elements of severe sepsis or septic shock ascertained through chart review.*

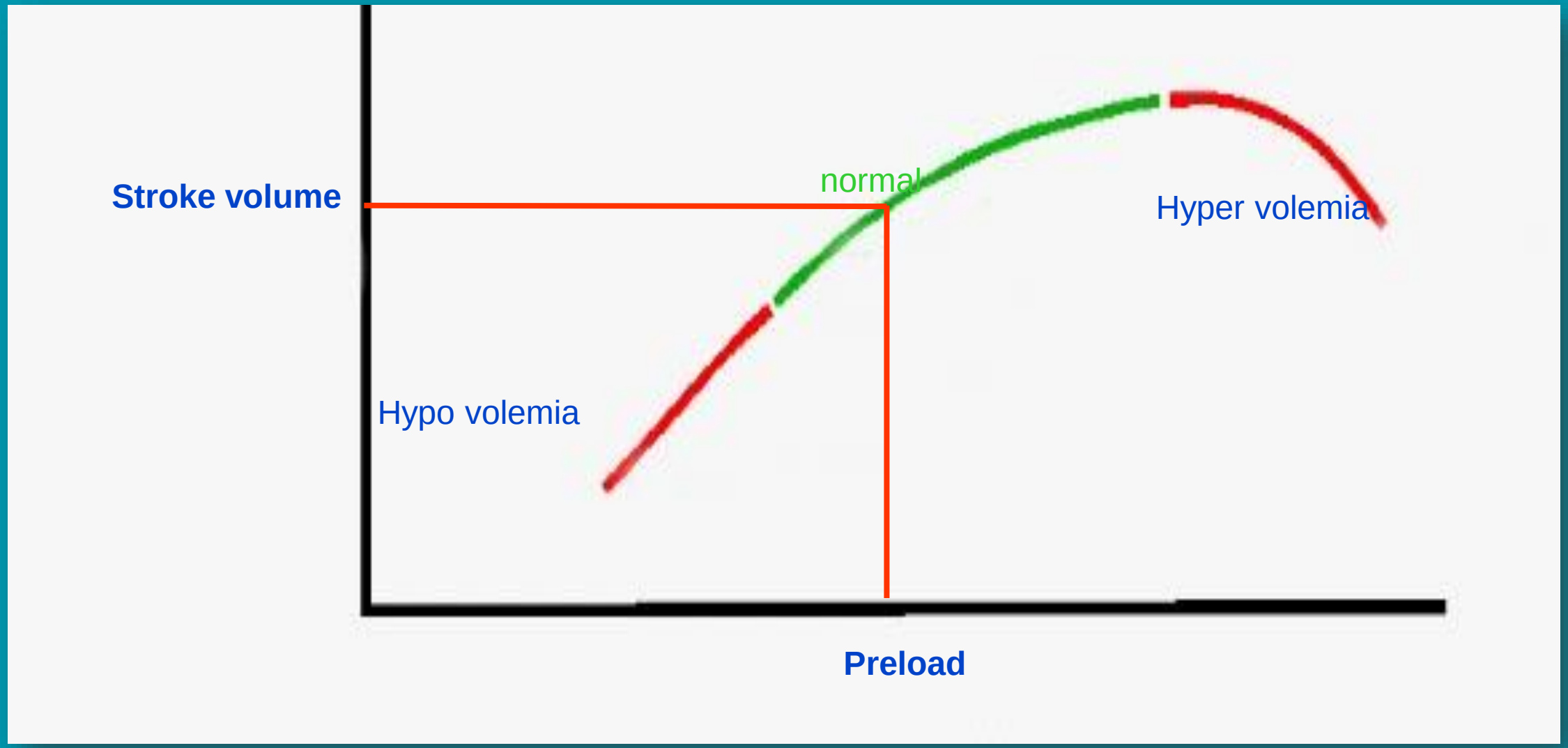
Fluid Therapy

- **We recommend an initial fluid challenge in patients with sepsis-induced tissue hypoperfusion with suspicion of hypovolemia to achieve a minimum of 30 mL/kg of crystalloids (a portion of this may be albumin equivalent). More rapid administration and greater amounts of fluid may be needed in some patients. *(Grade 1C)***

Fluid Therapy

- **We recommend that a fluid challenge technique be applied wherein fluid administration is continued as long as there is hemodynamic improvement either based on dynamic (eg, change in pulse pressure, stroke volume variation) or static (eg, arterial pressure, heart rate) variables *(Ungraded).***

PHYSIOLOGICAL PRINCIPLES
FRANK-STARLING RELATIONSHIP

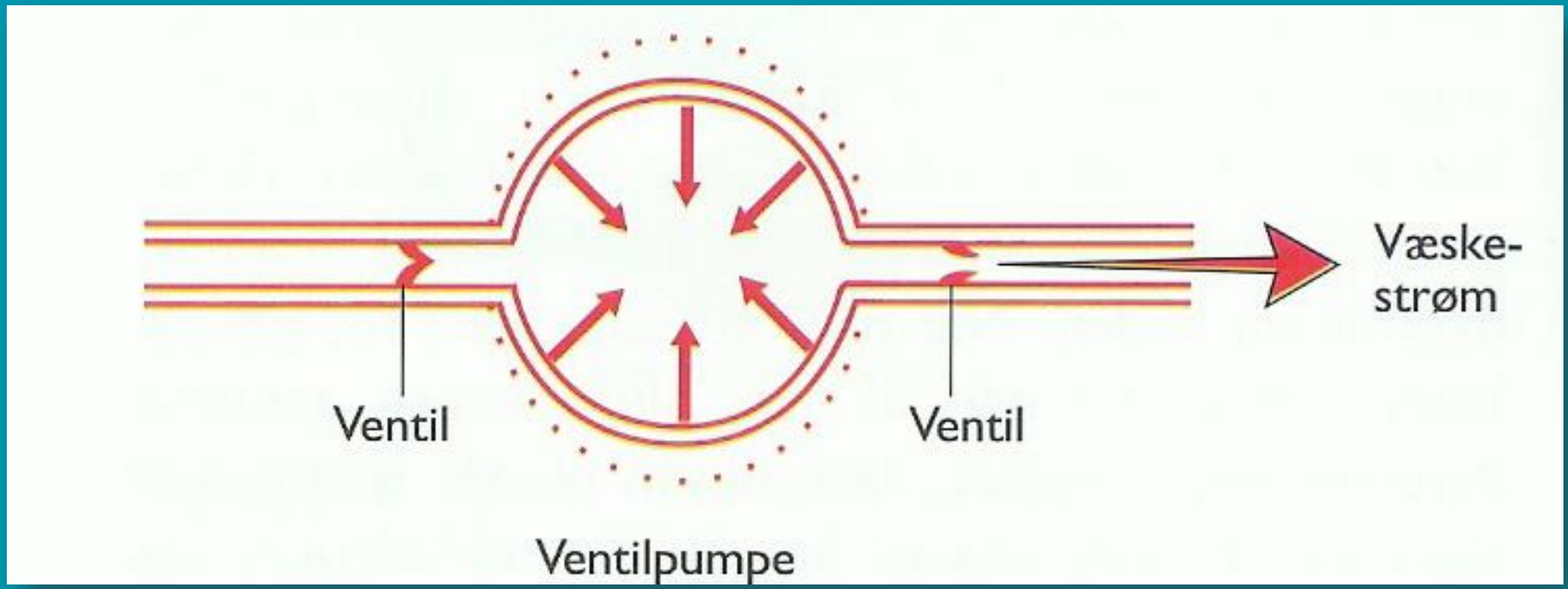


PHYSIOLOGICAL PRINCIPLES

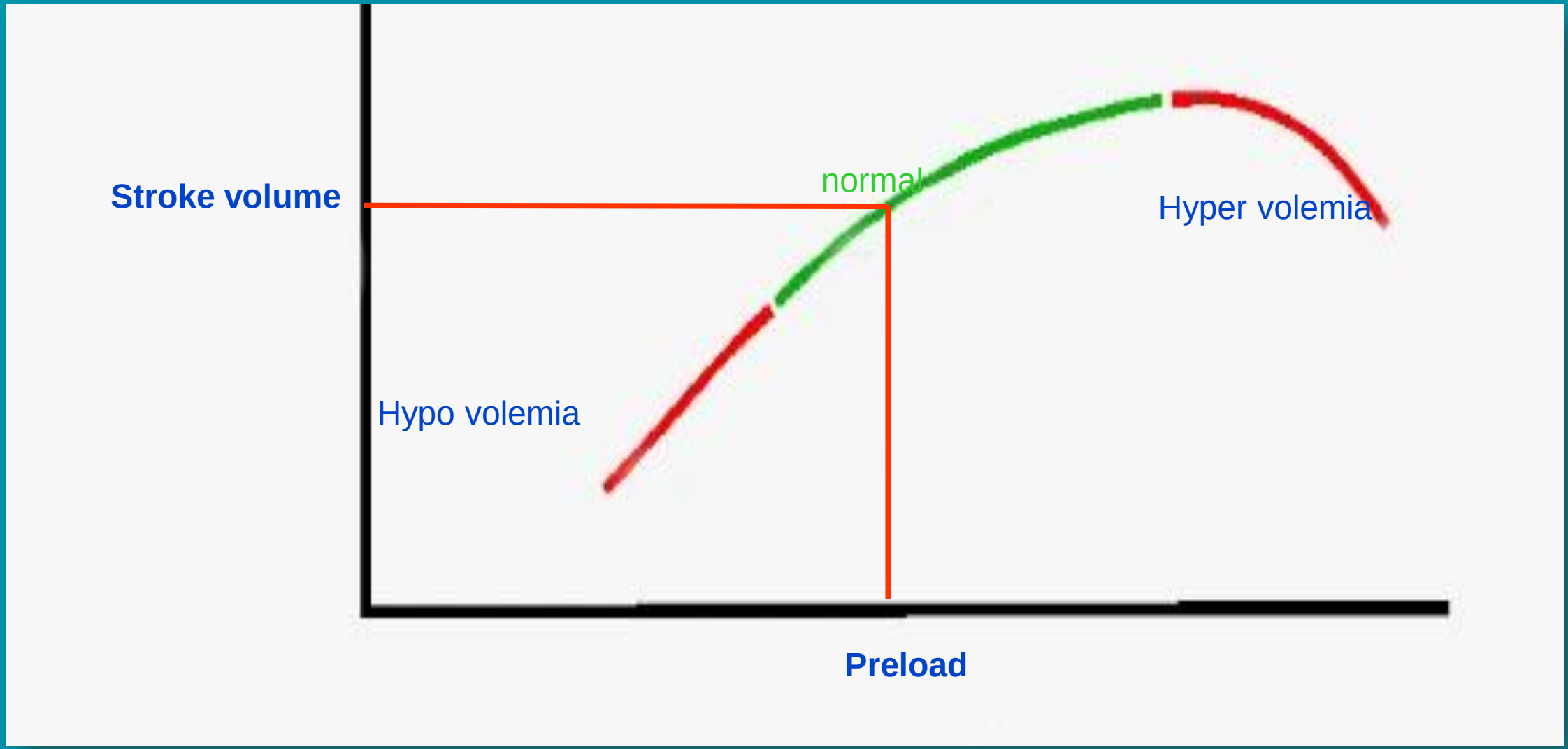
- PRE-LOAD
- ”CARDIOVASCULA FUNCTION”
- ”AFTERLOAD” = VASKULÆR TONUS

THE ENDOTHELIAL GLYCOCALYX

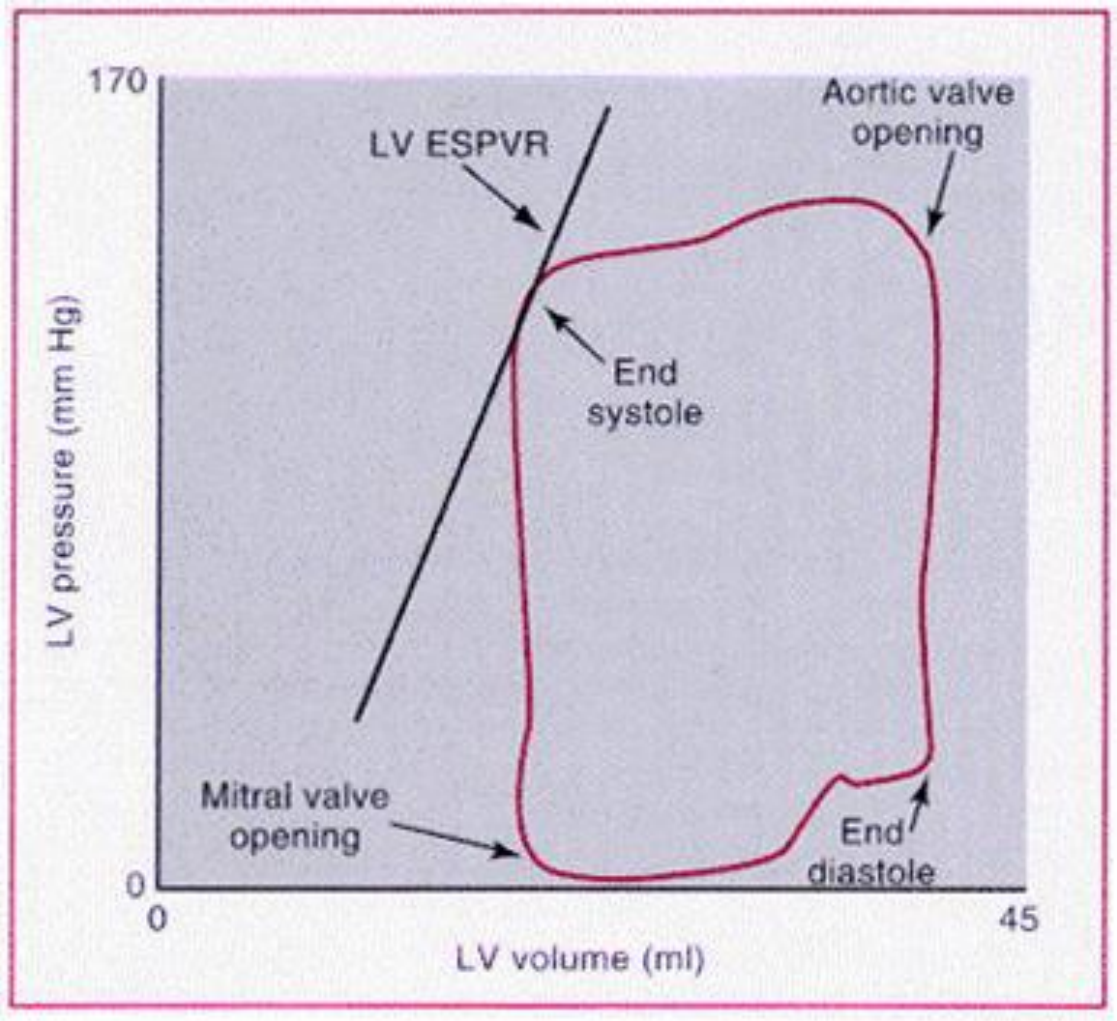
THE HEART IS A DOUBBLE ……valve pump

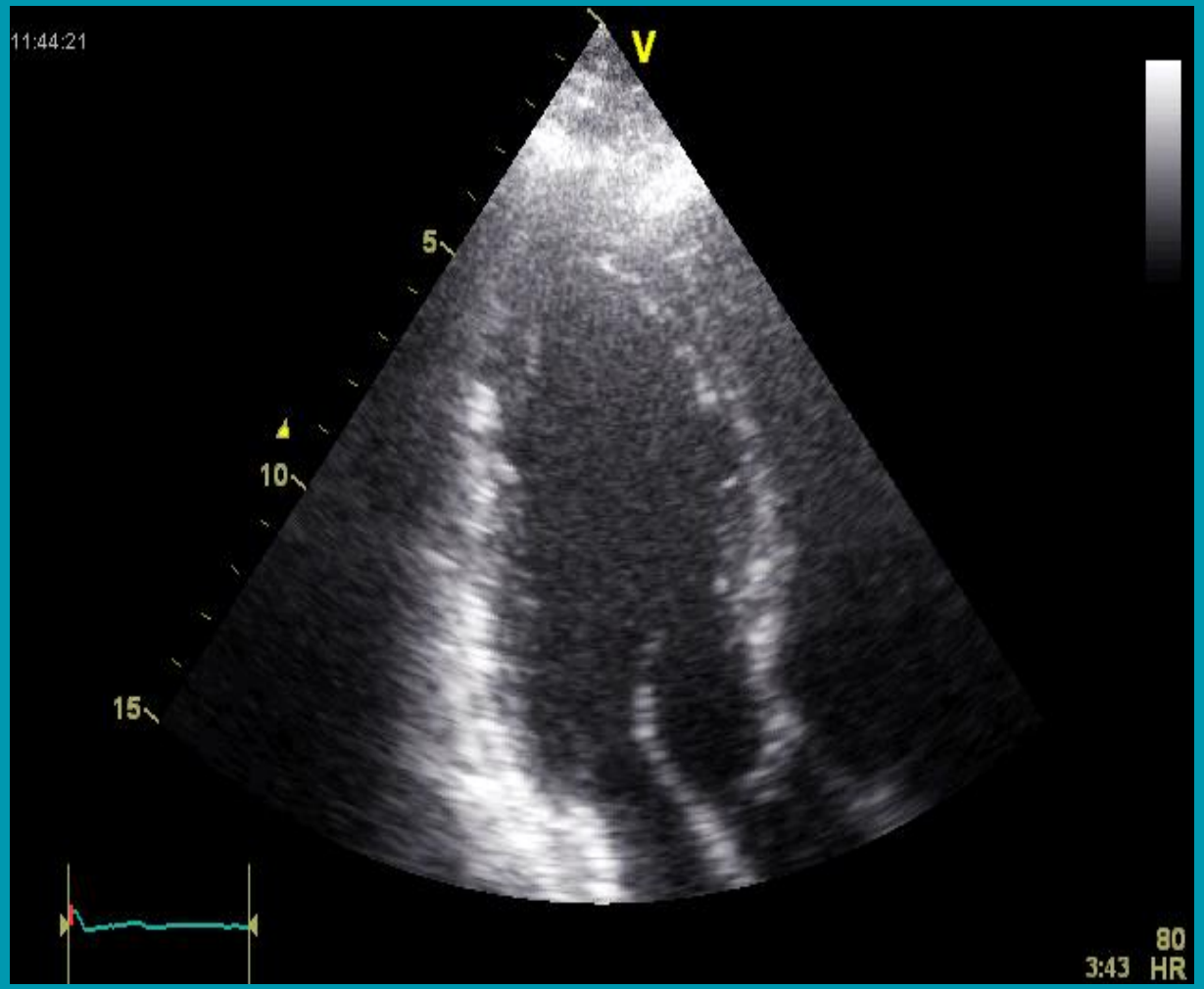


FRANK-STARLING RELATIONSHIP



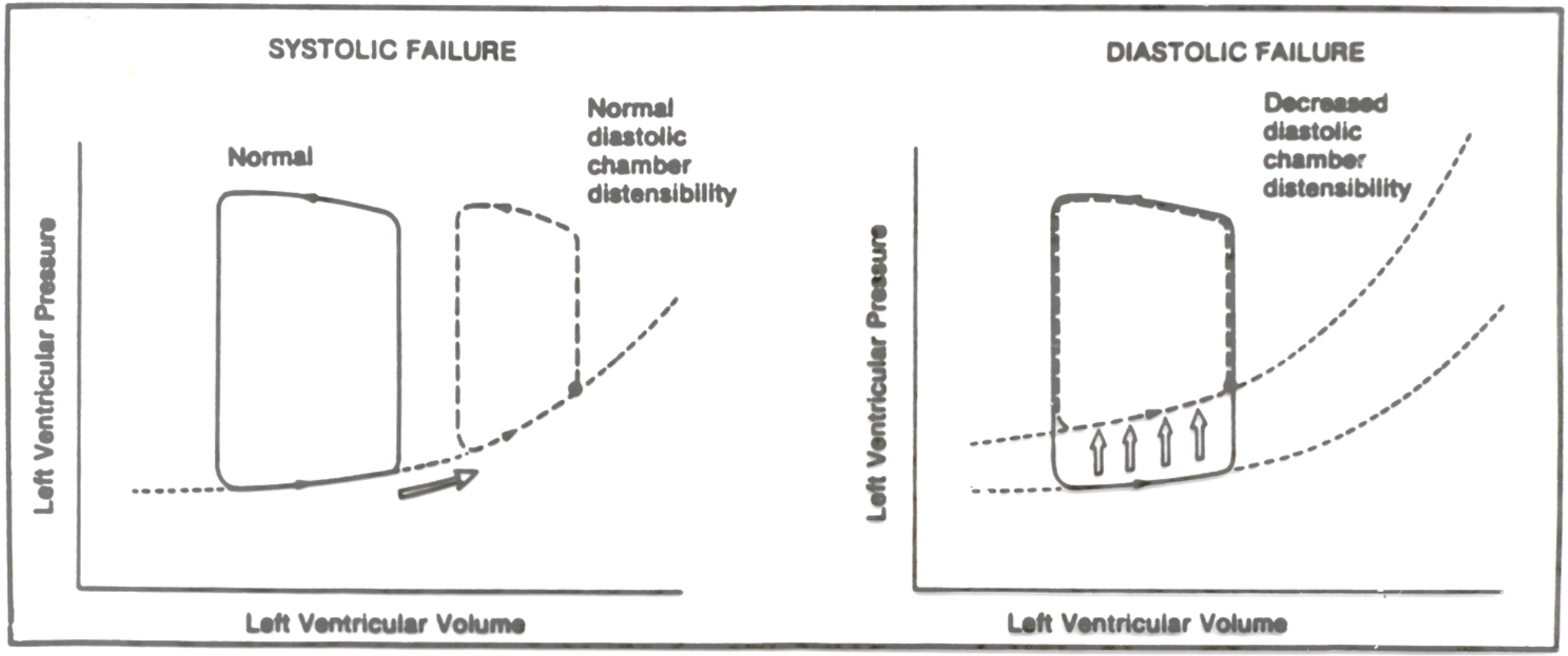
PRELOAD



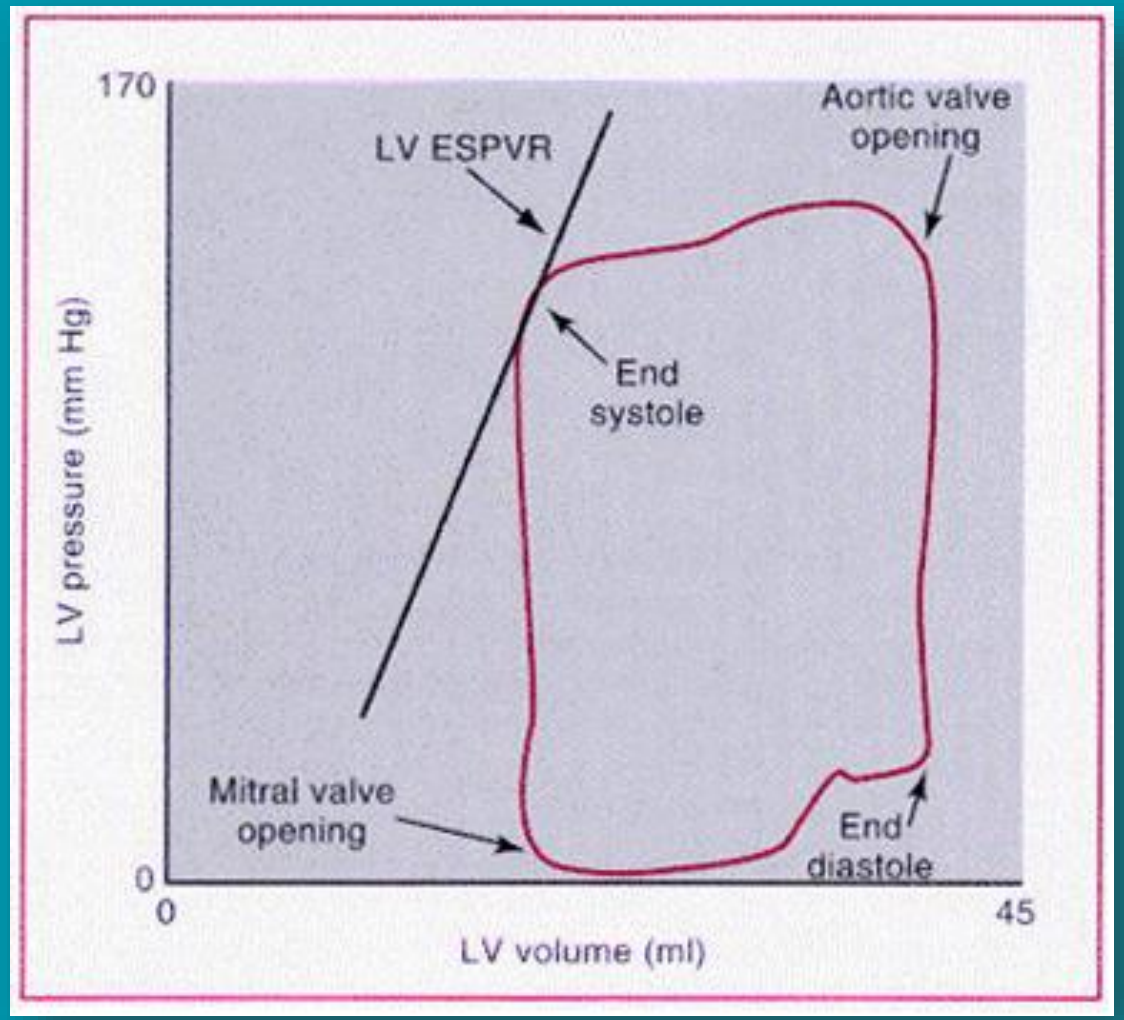


EF = SV / LVEDV =Preload

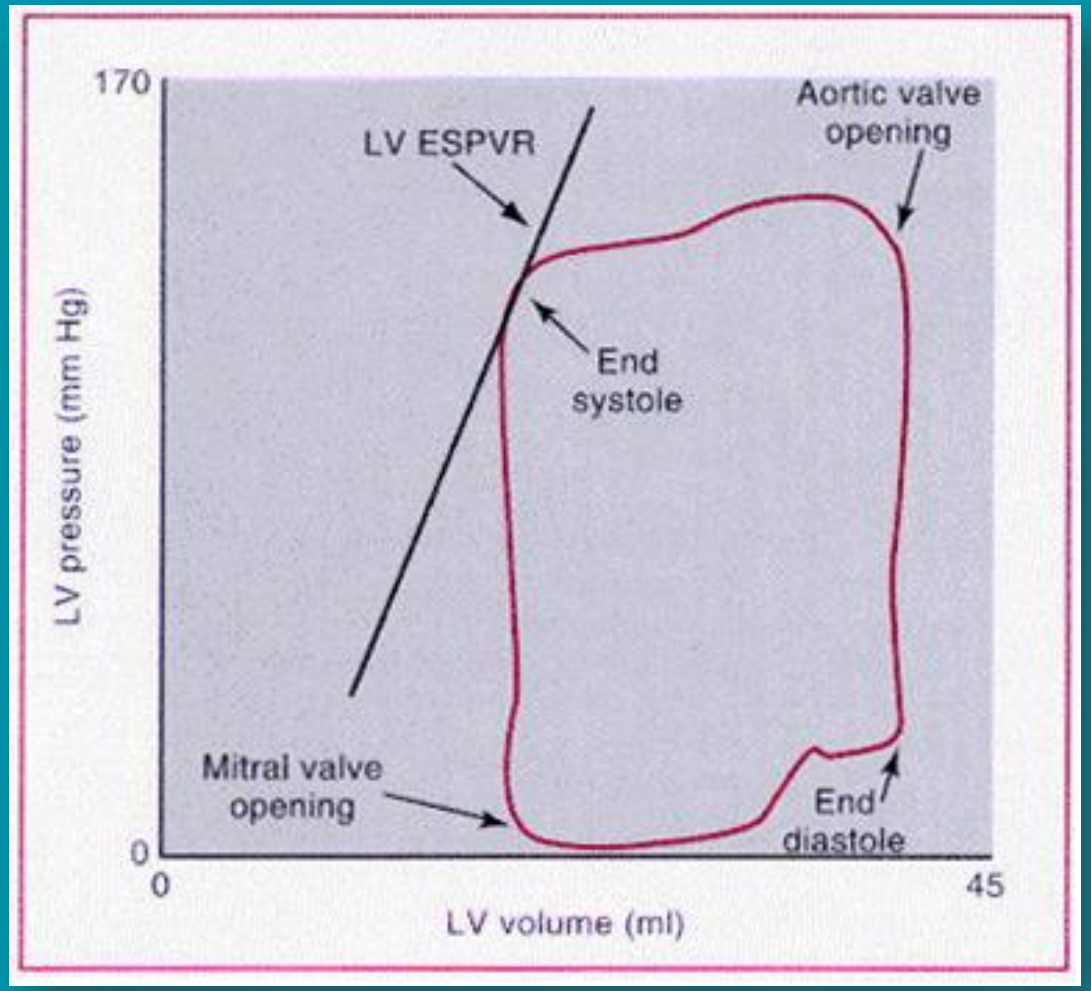
SYSTOLIC VERSUS DIASTOLIC DYSFUNCTION



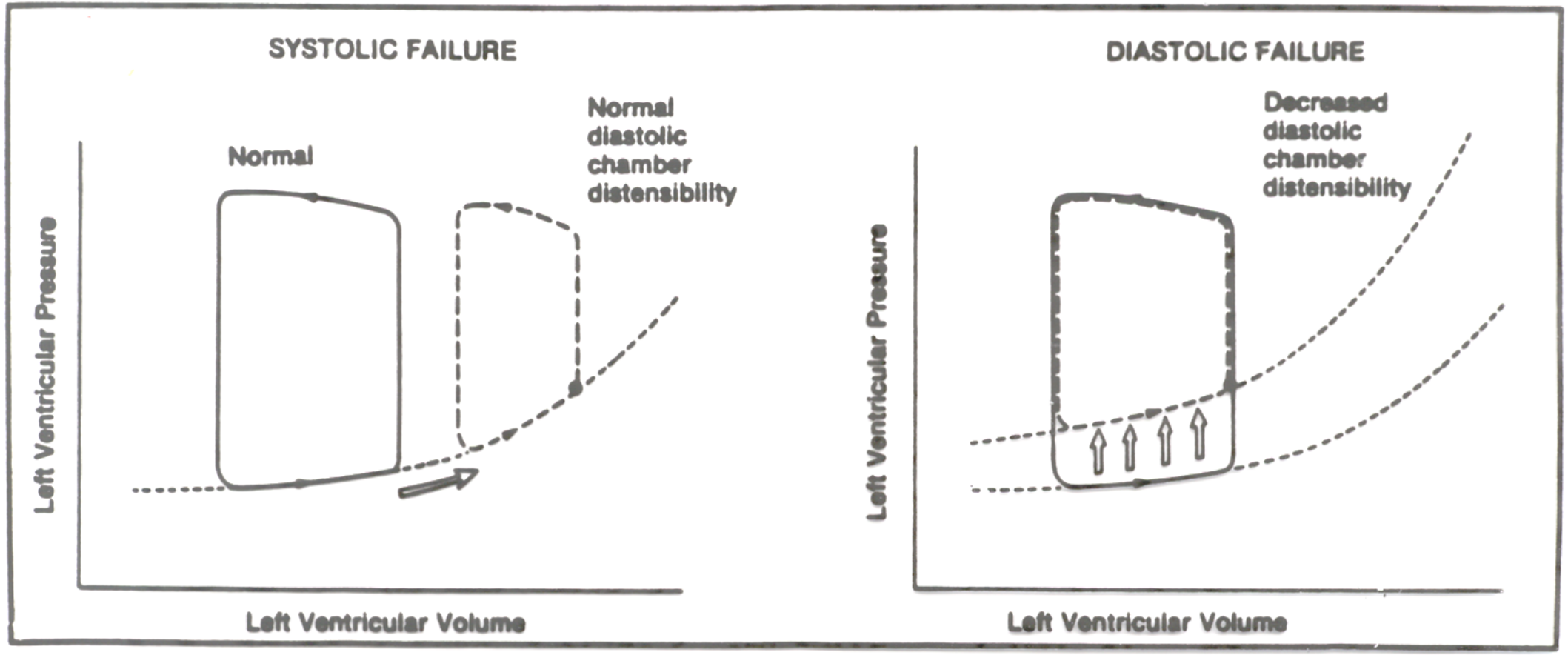
Systolisk dysfunktion



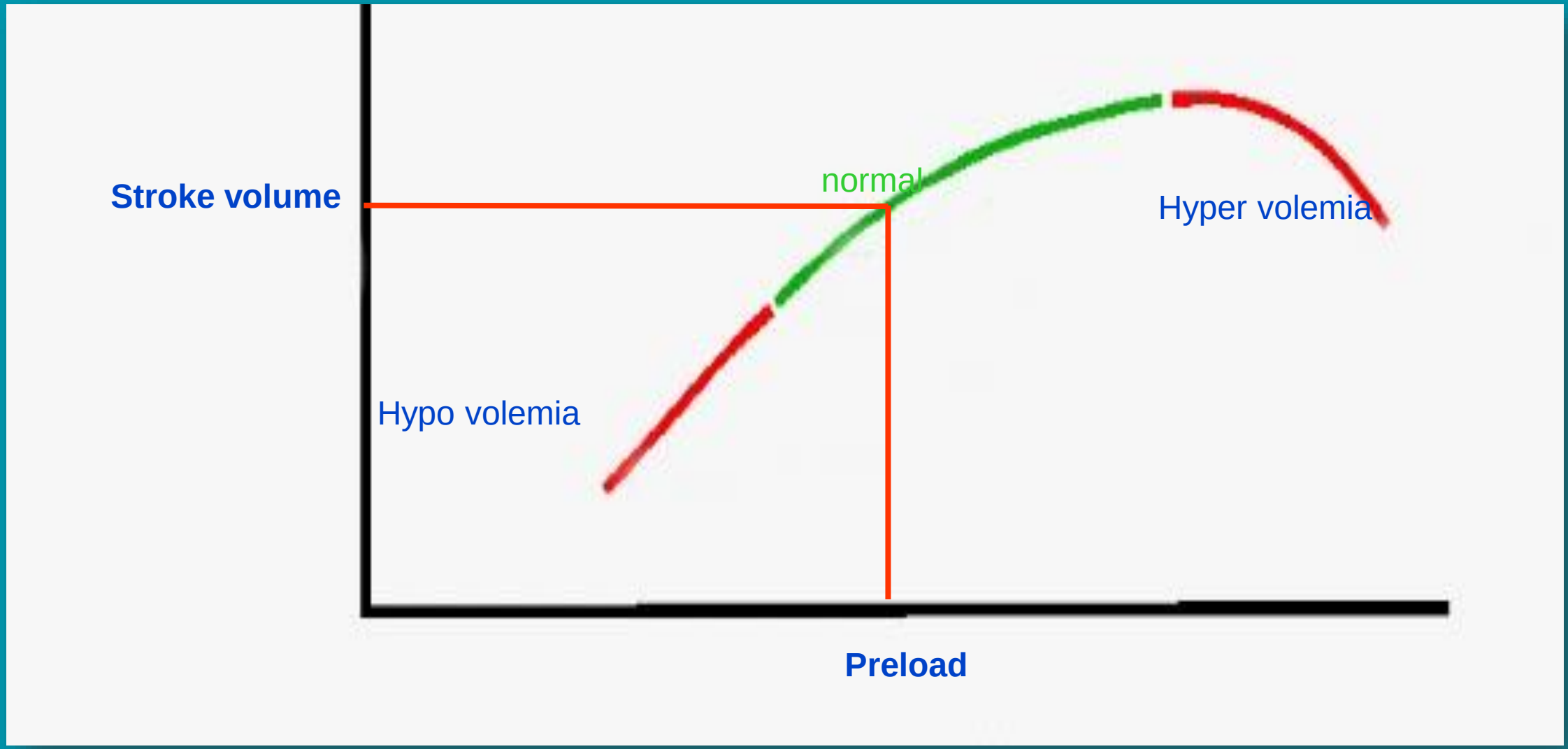
DIASTOLISK DYSFUNKTION

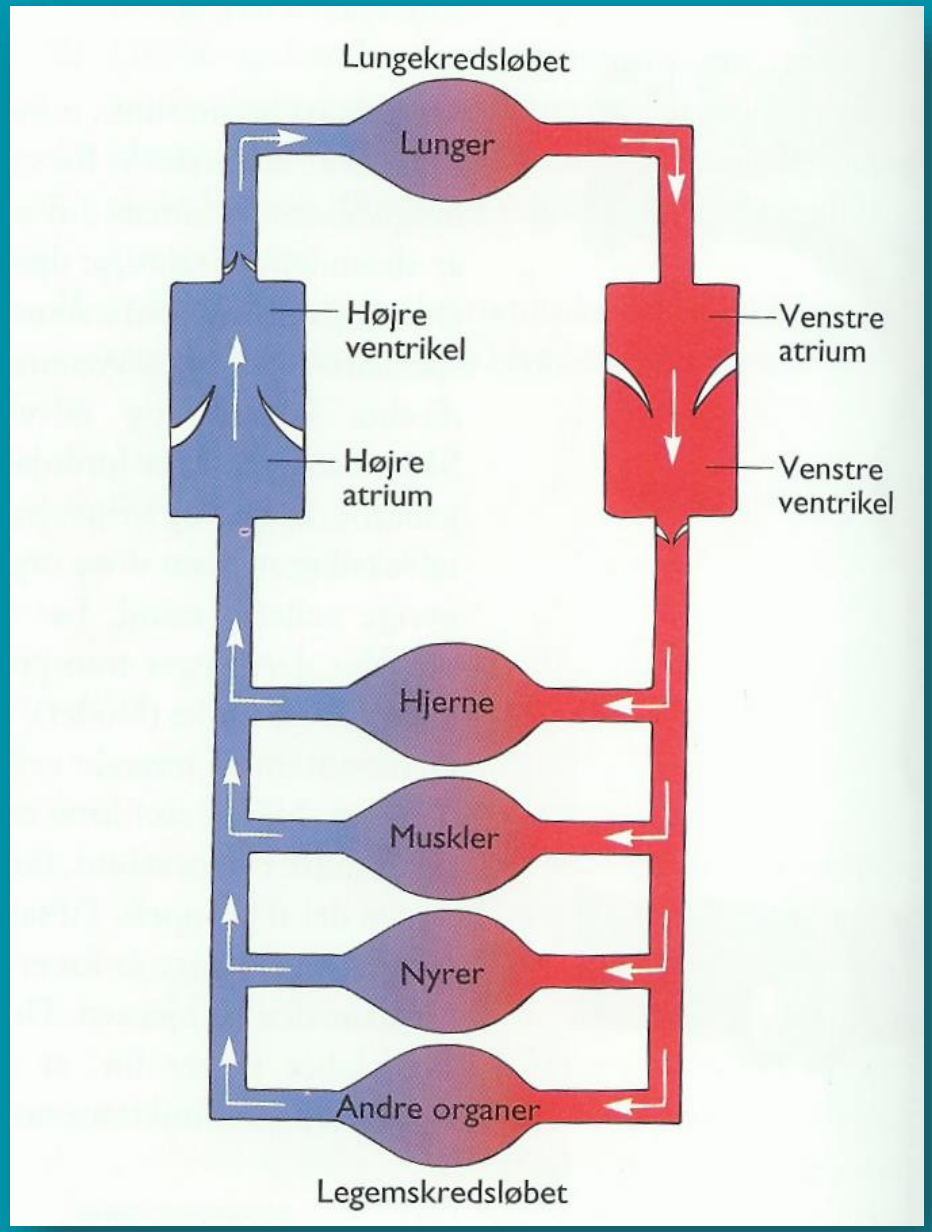


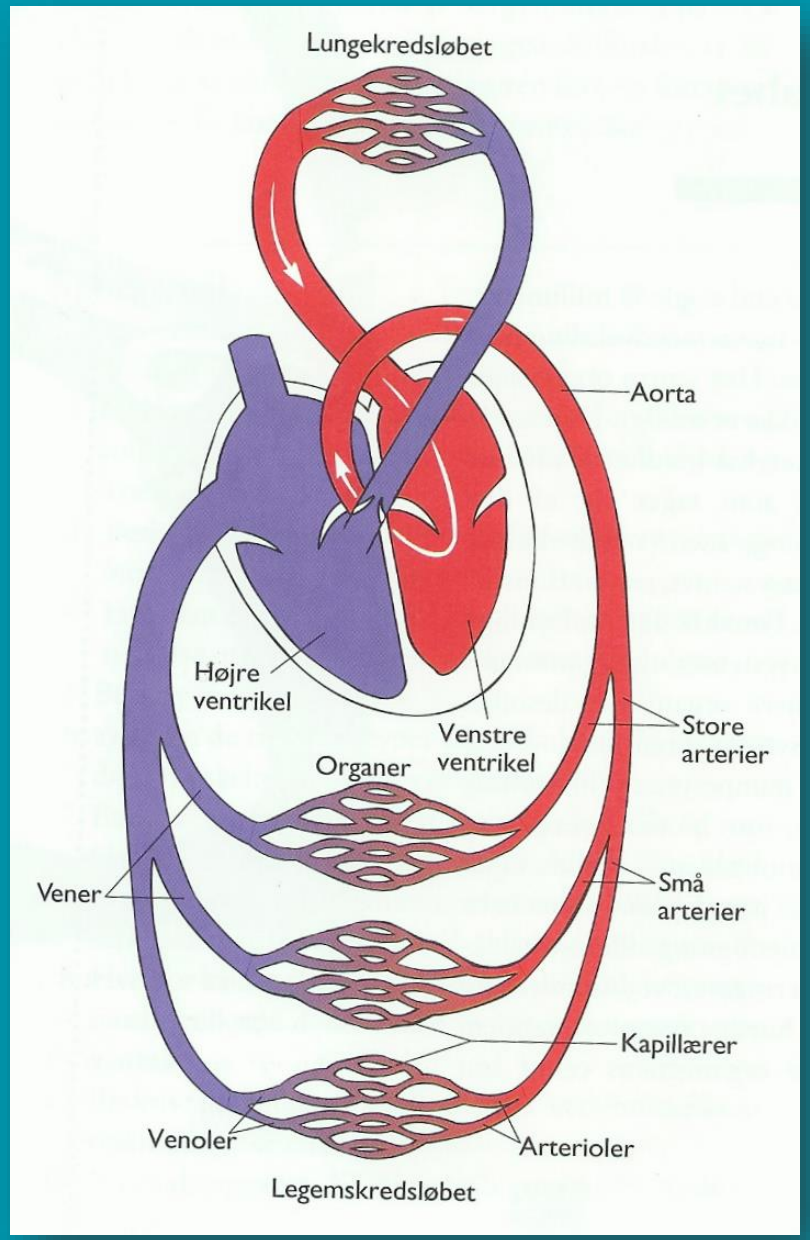
SYSTOLIC VERSUS DIASTOLIC DYSFUNCTION



FRANK-STARLING RELATIONSHIP




Lungekredsløbet
Lunger
Højre ventrikel
Venstre atrium
Højre atrium
Venstre ventrikel
Hjerne
Muskler
Nyrer
Andre organer
Legemskredsløbet


Lungekredsløbet
Aorta
Højre ventrikel
Venstre ventrikel
Store arterier
Organer
Vener
Små arterier
Kapillærer
Venoler
Arterioler
Legemskredsløbet

MEASURING 'PRELOAD'

- PULS?
- CVP?
- Wedge Pressure (PCWP)?
- EKKO? / FATE
- Intra Thoracic Blood Volume (ITBV) ? (PiCCO)
- Thoracic impedance ?
- R. Ventricular End Diastolic Volume (RVEDV)?

ESTIMATING PRELOAD

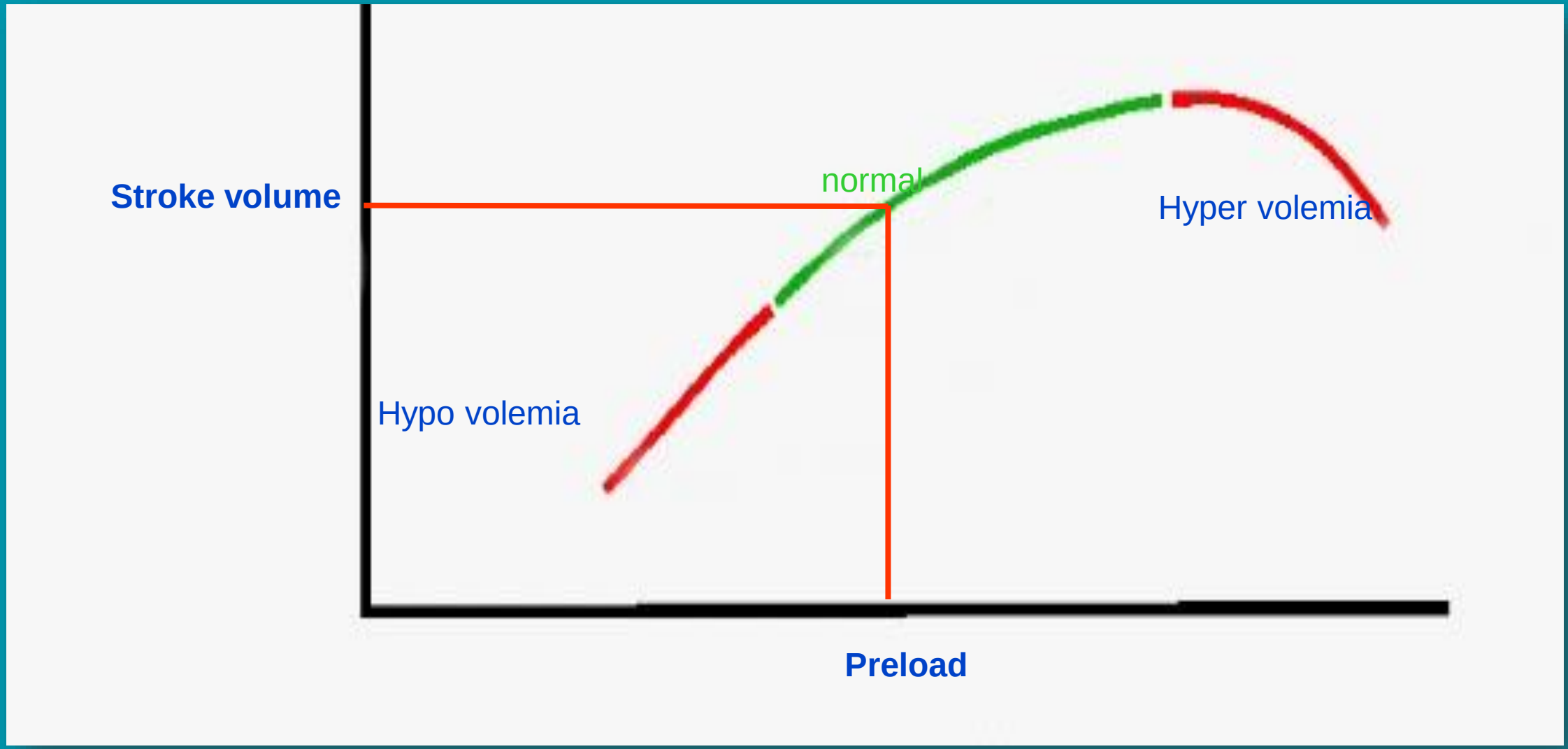
Funktional hemodynamic parameters

- FLUID CHALLENGES / VOLUMENE BOLUS
- PASSIVE LEG RAISING **PLA**
- FATE bedside ??
- STROKE VOLUMEN VARIATION

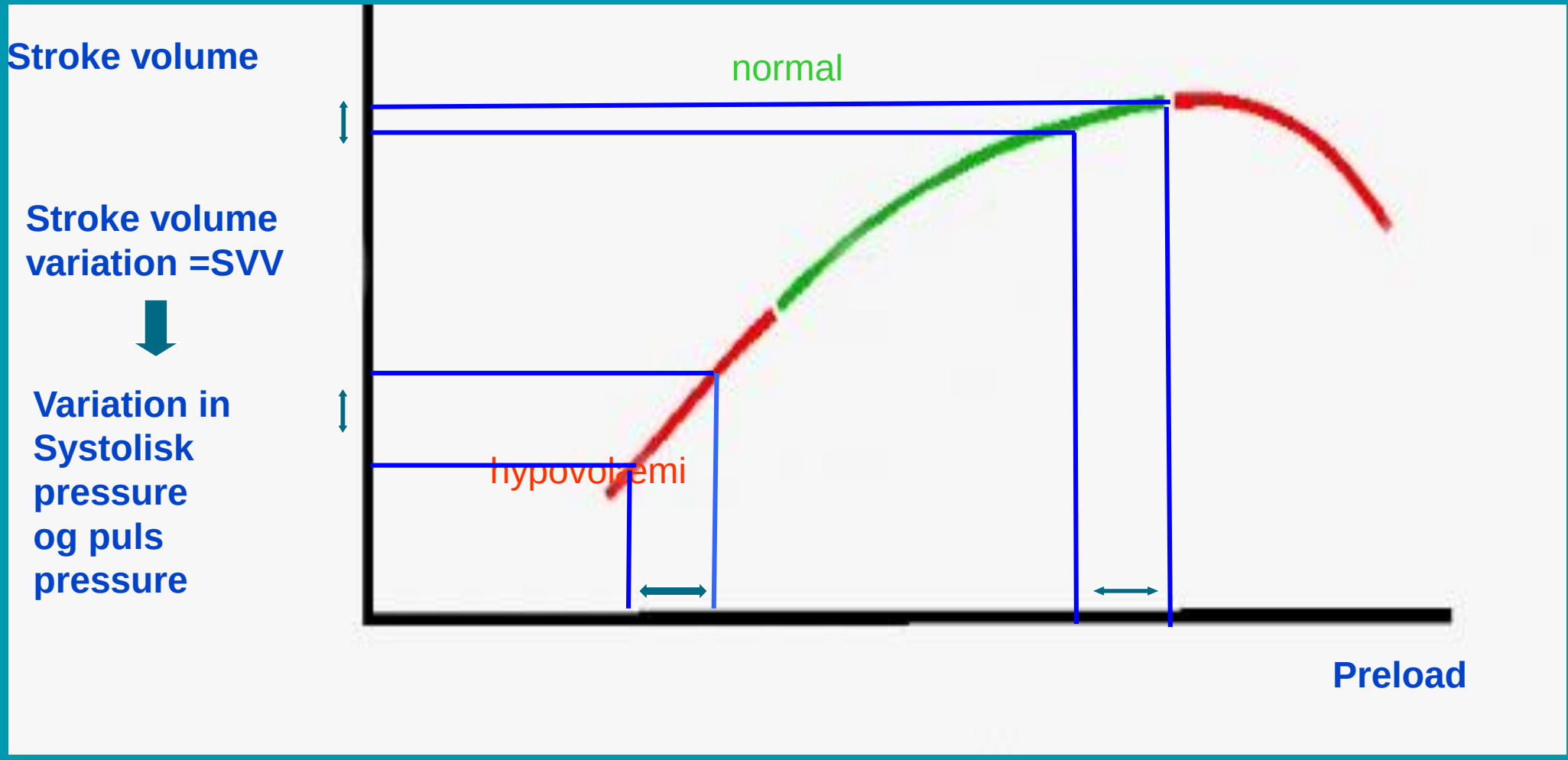
  ⇒SYSTOLISK PRESSURE VARIATION

SYSTOLIC PRESSURE VARIATION

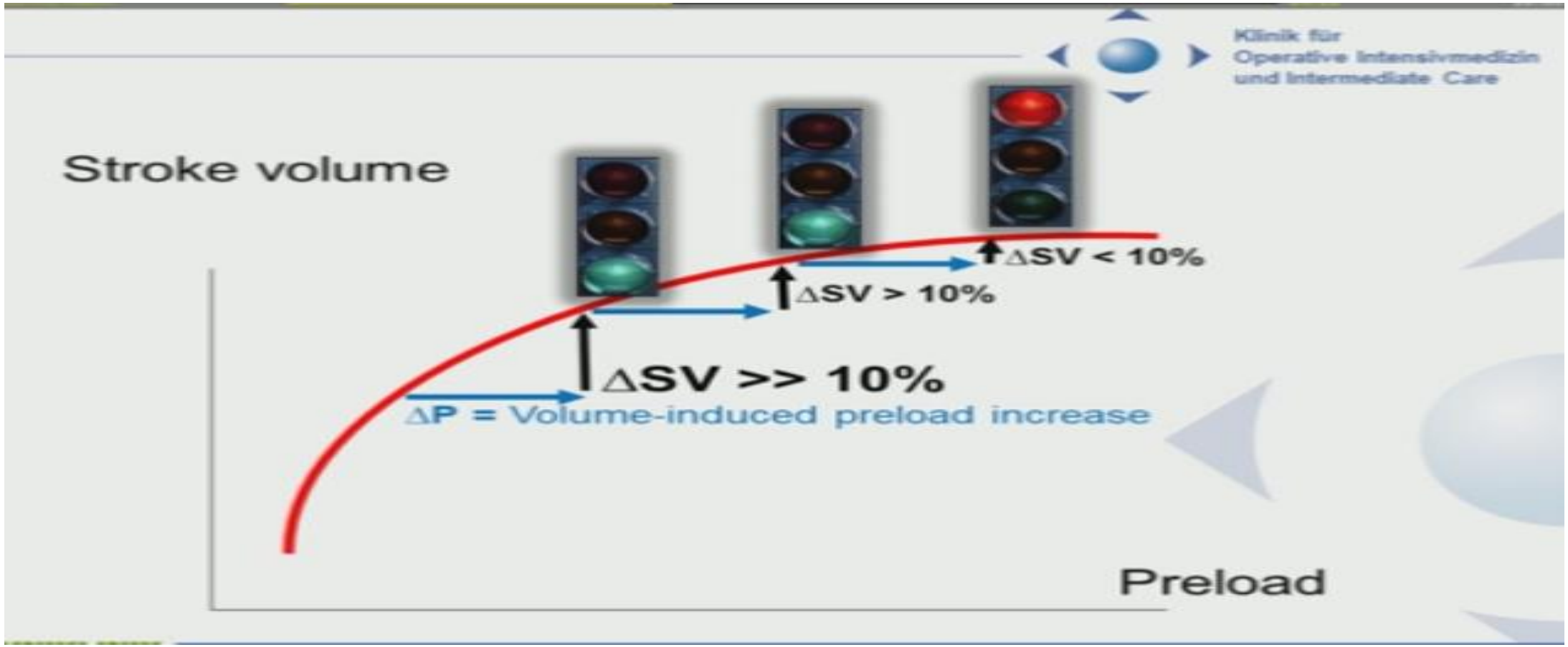
FRANK-STARLING RELATIONSHIP



PULMONARY- CIRKULATORY RELATIONSHIP



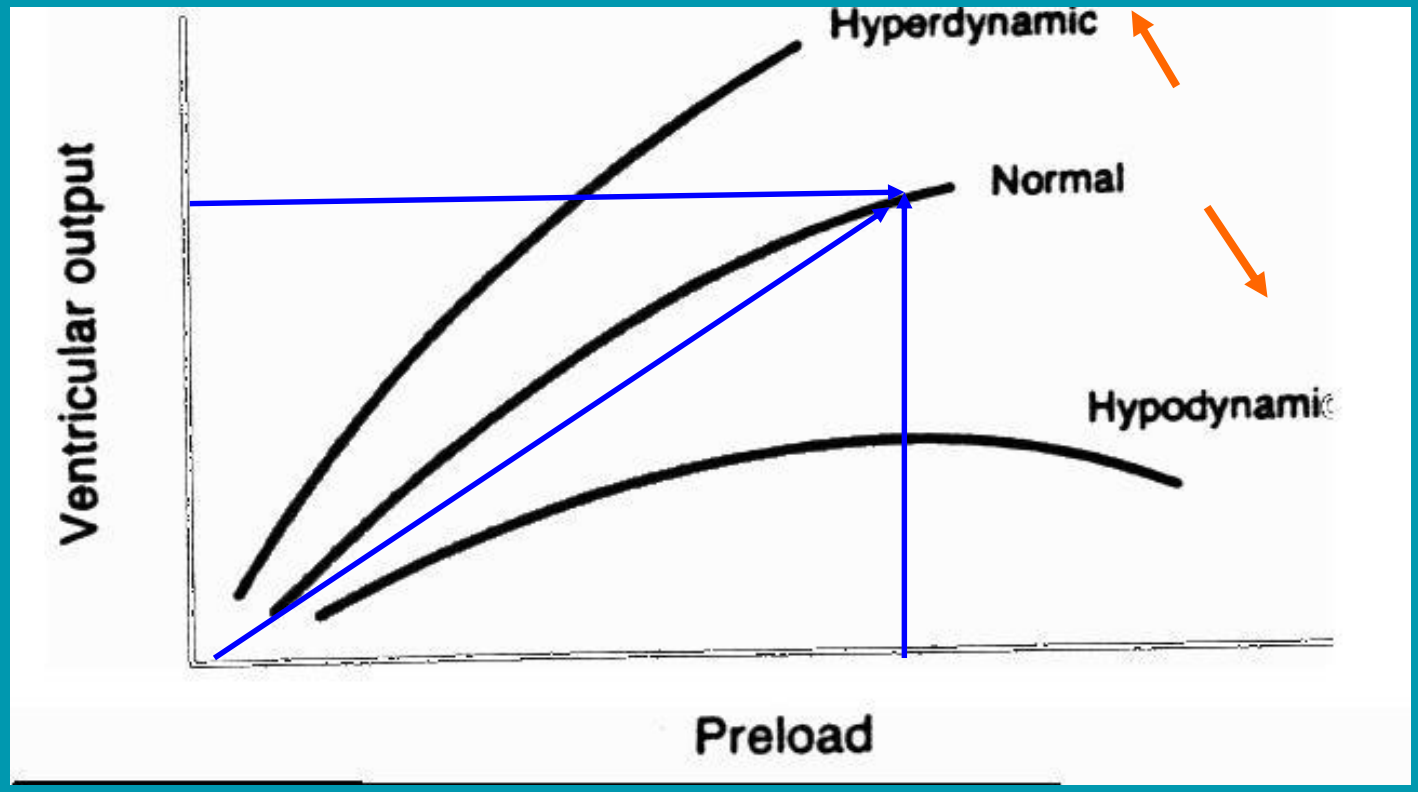
PRELOAD / STROKE VOLUMEN RELATIONSSHIP



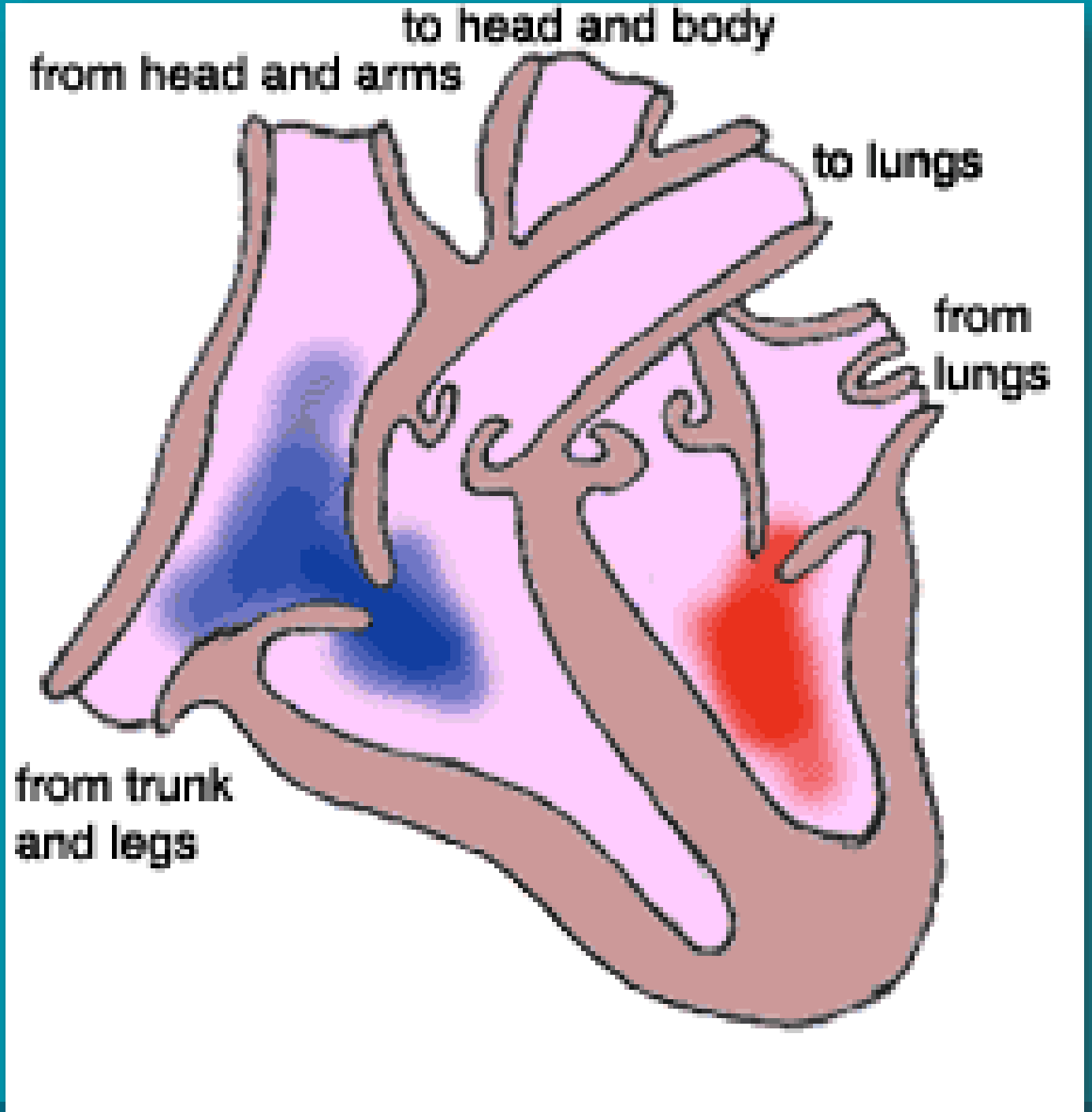
FOCUS ON THE HEART

- ”Heartpump -FUNCTION”
  - Heart rate and Rhytm
  - Contractility
  - Venstre and right heart relationship
  - Restriktiv fyldning
  - Heart valve disease

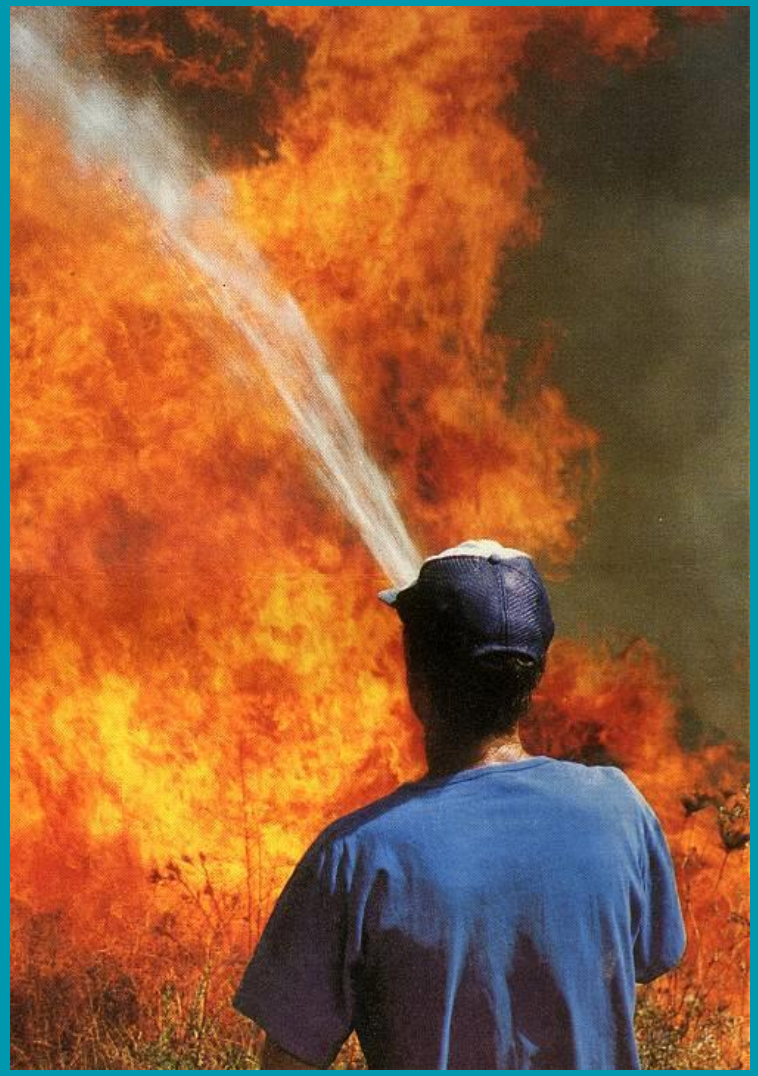
FRANK-STARLING RELATIONSHIP

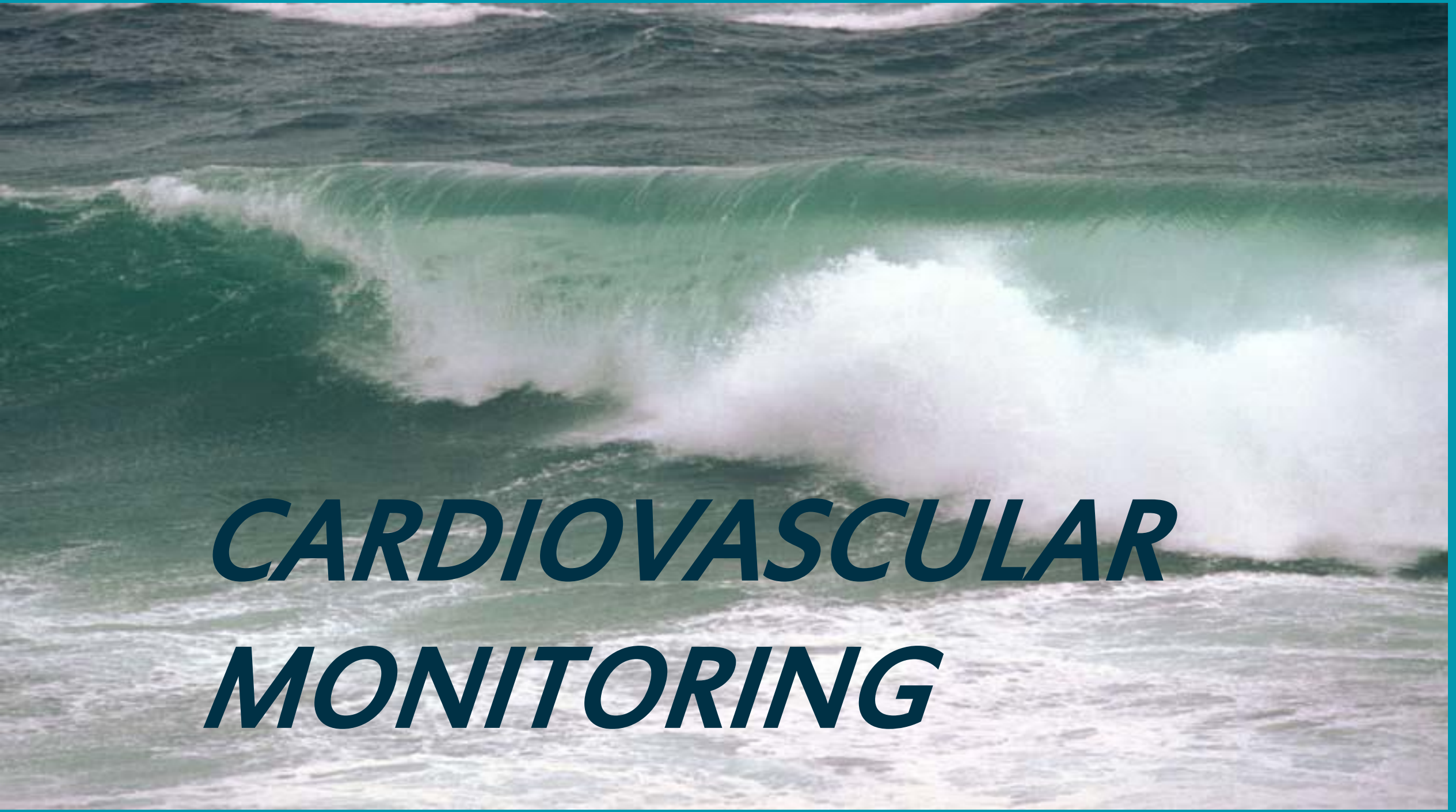


EF = SV / LVEDV


to head and body
from head and arms
to lungs
from lungs
from trunk and legs

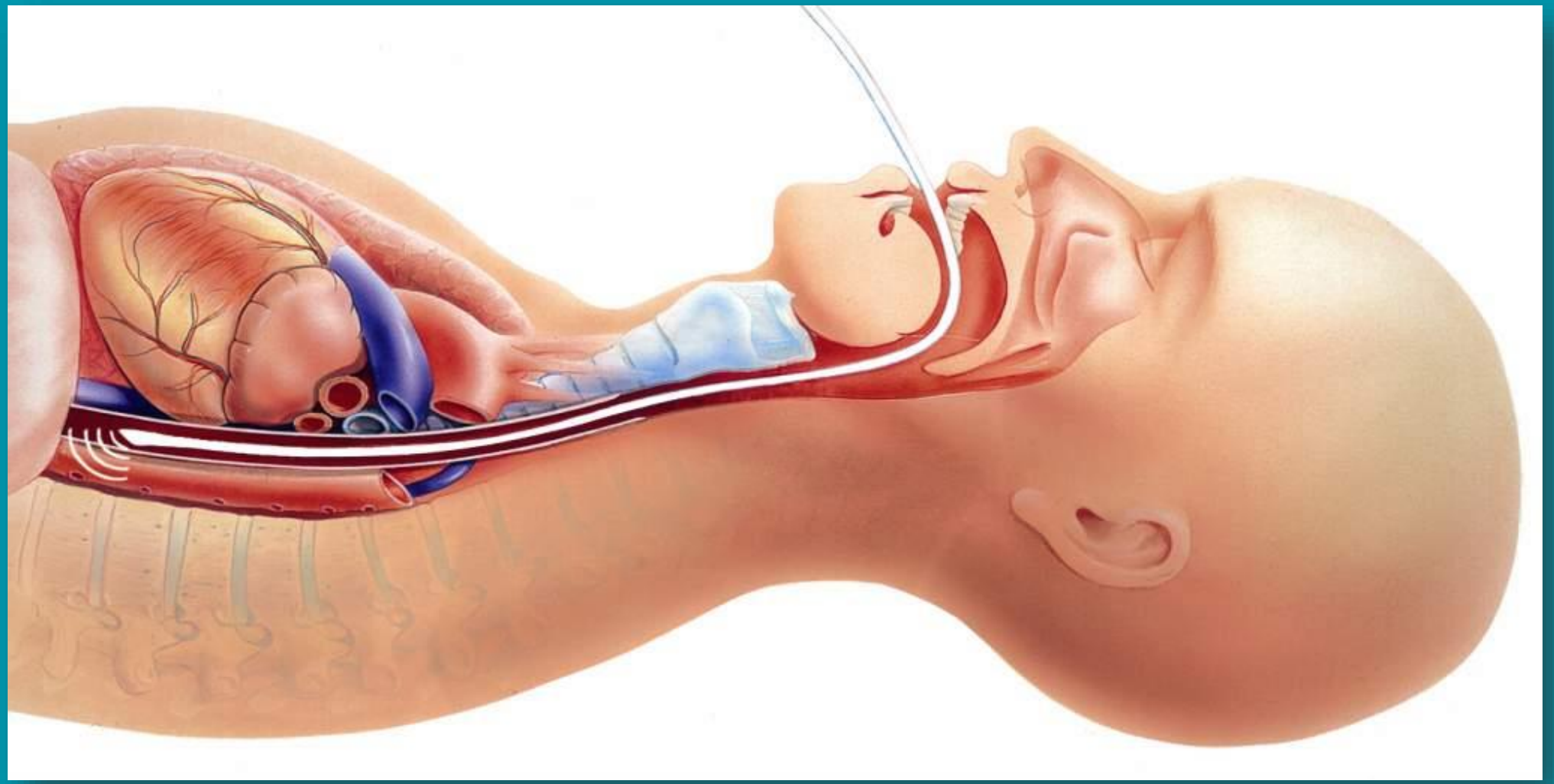
”AFTERLOAD”:



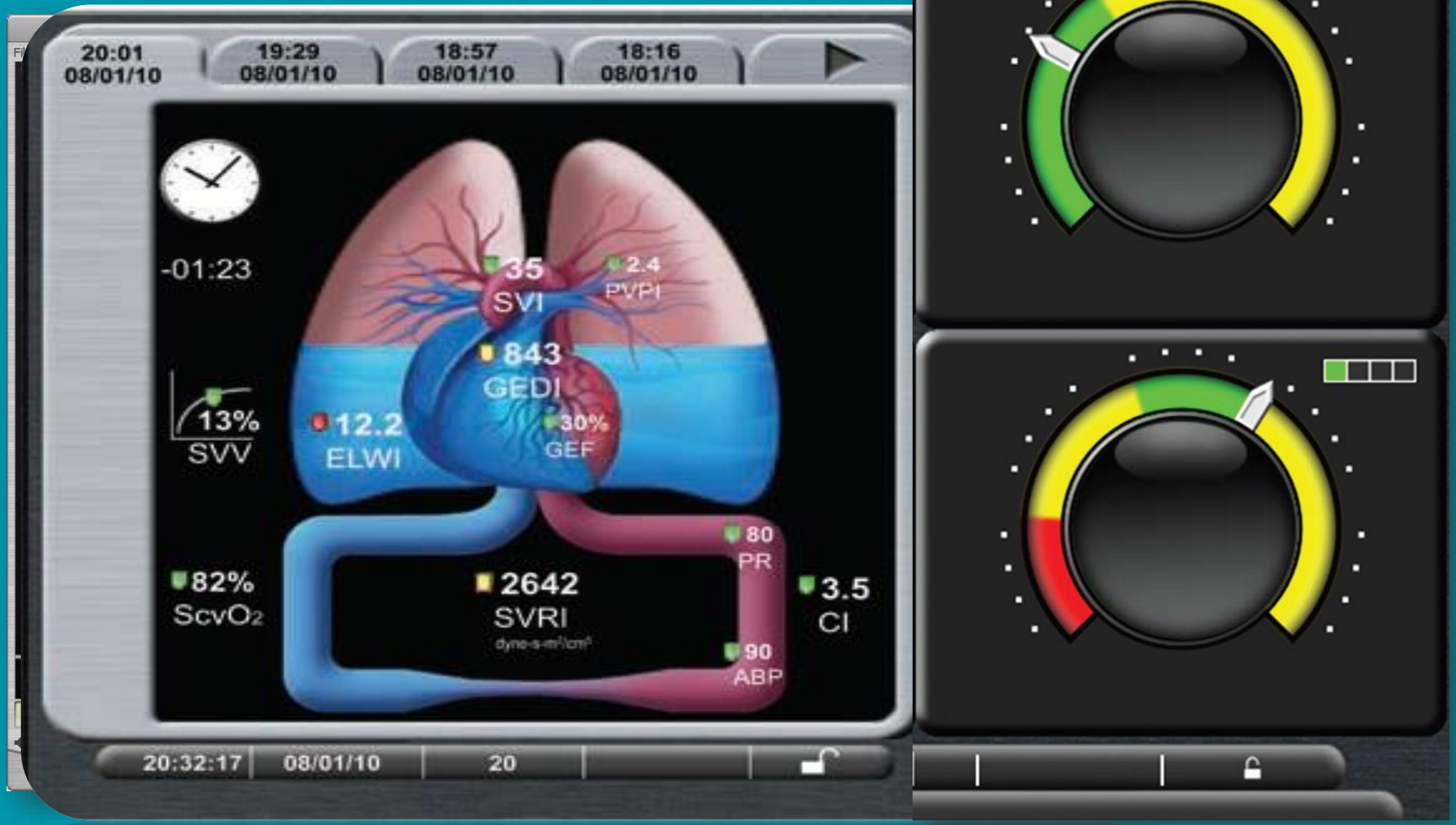

CARDIOVASCULAR
MONITORING

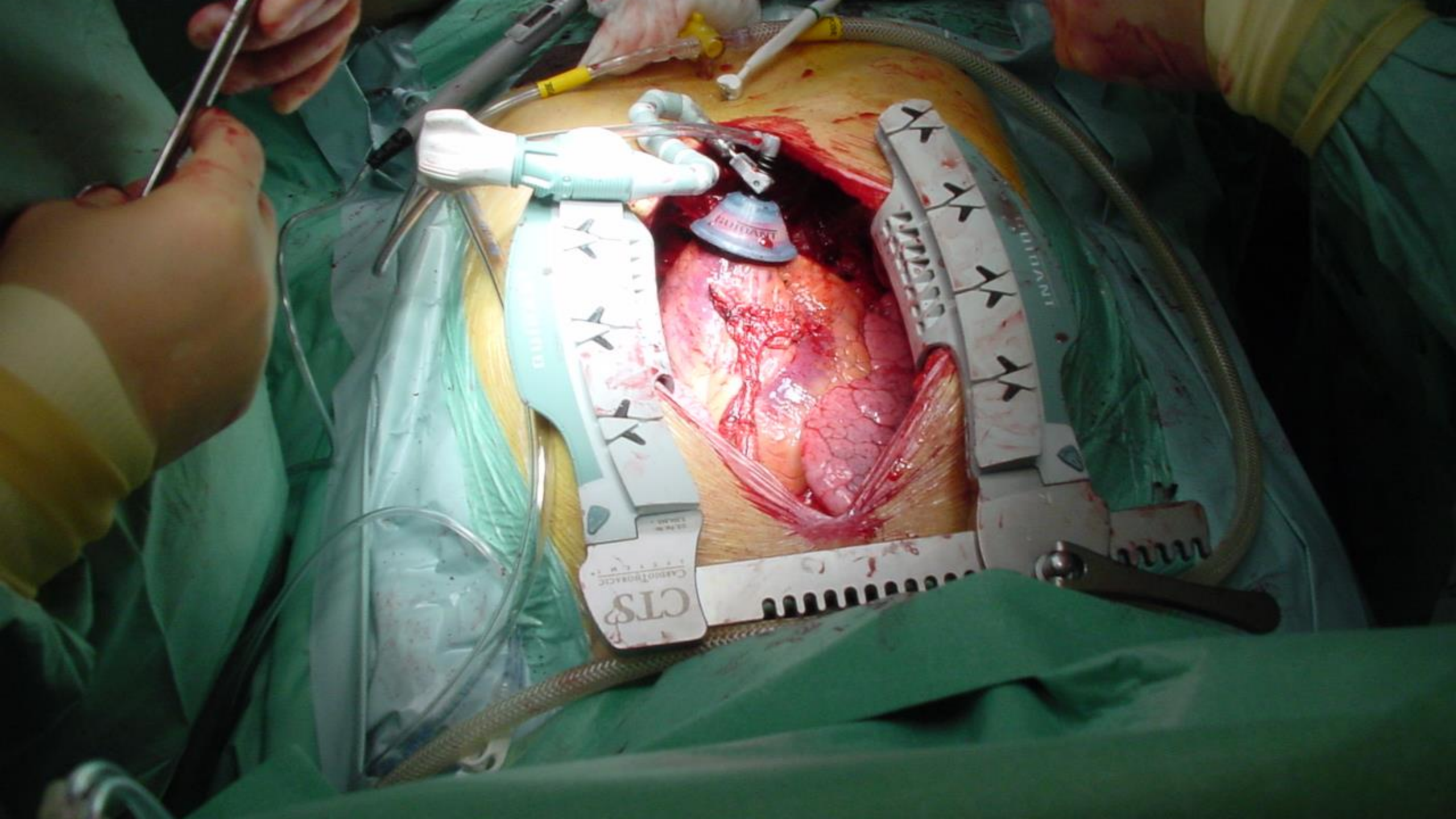
NICE ADVERTICING

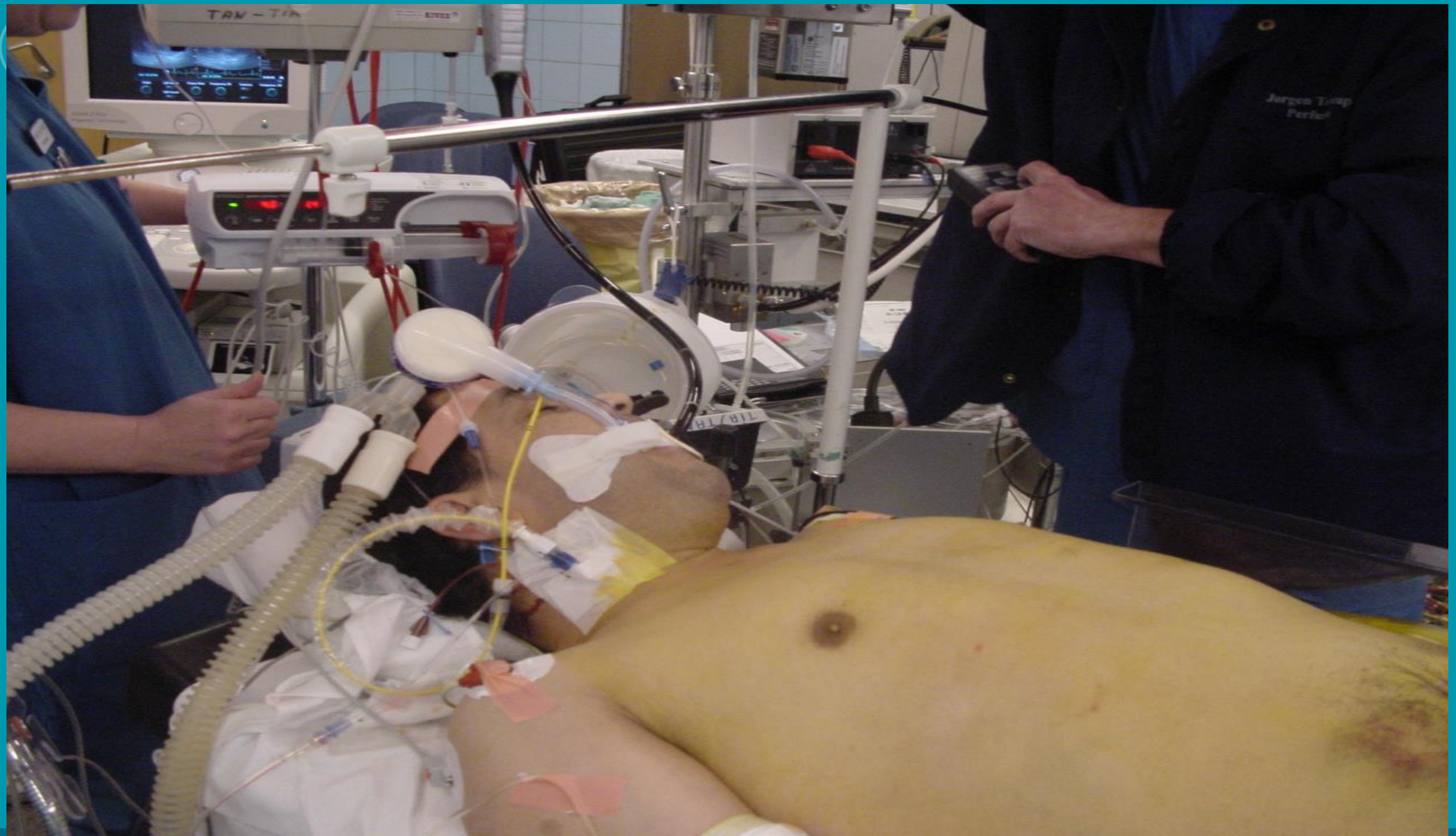
POPPLER



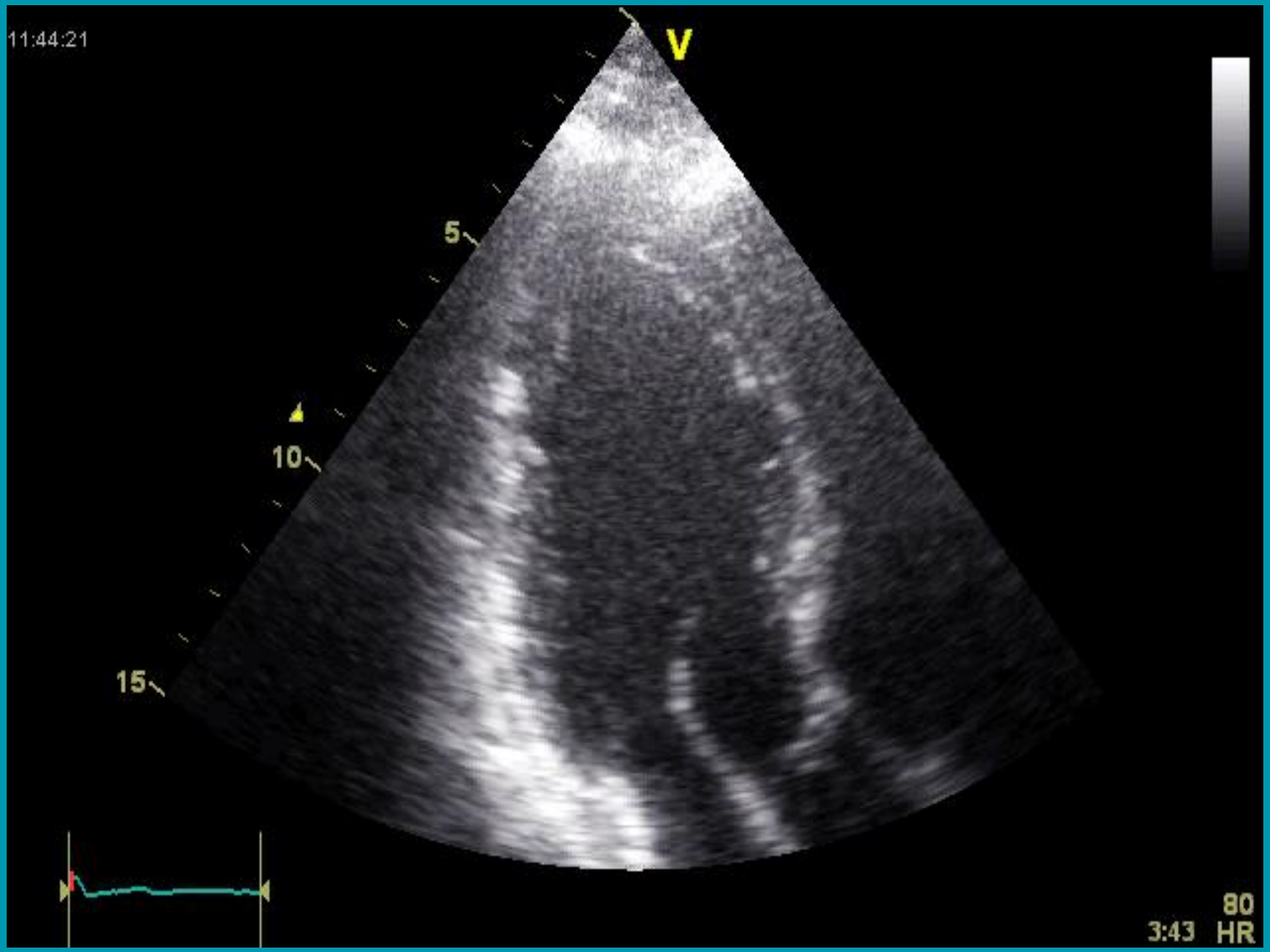
EV1000 CLINICAL PLATFORM




CTS
CardioThoracic
Systems, Inc.

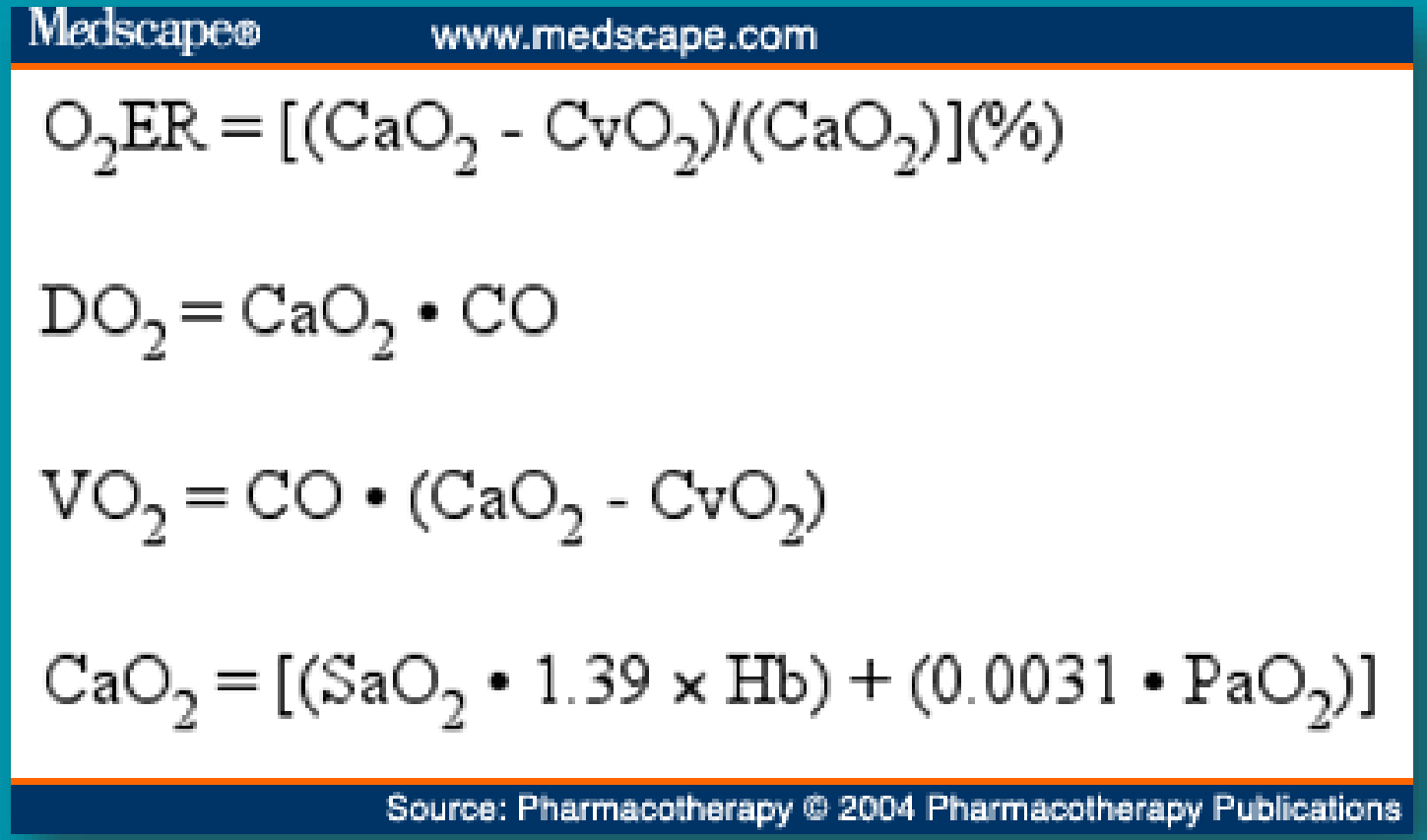


EKKO

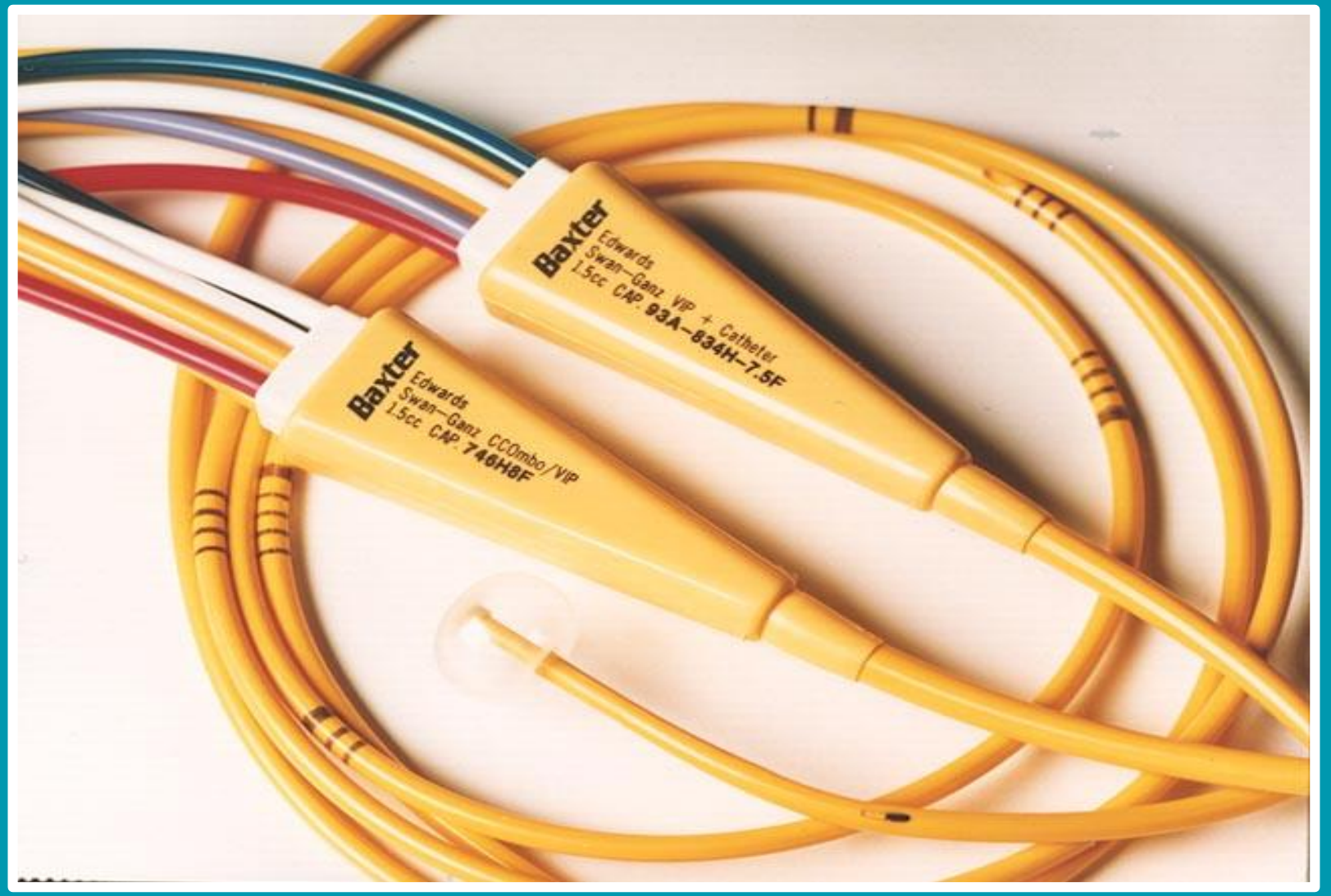


TARGET OXYGEN DELIVERY

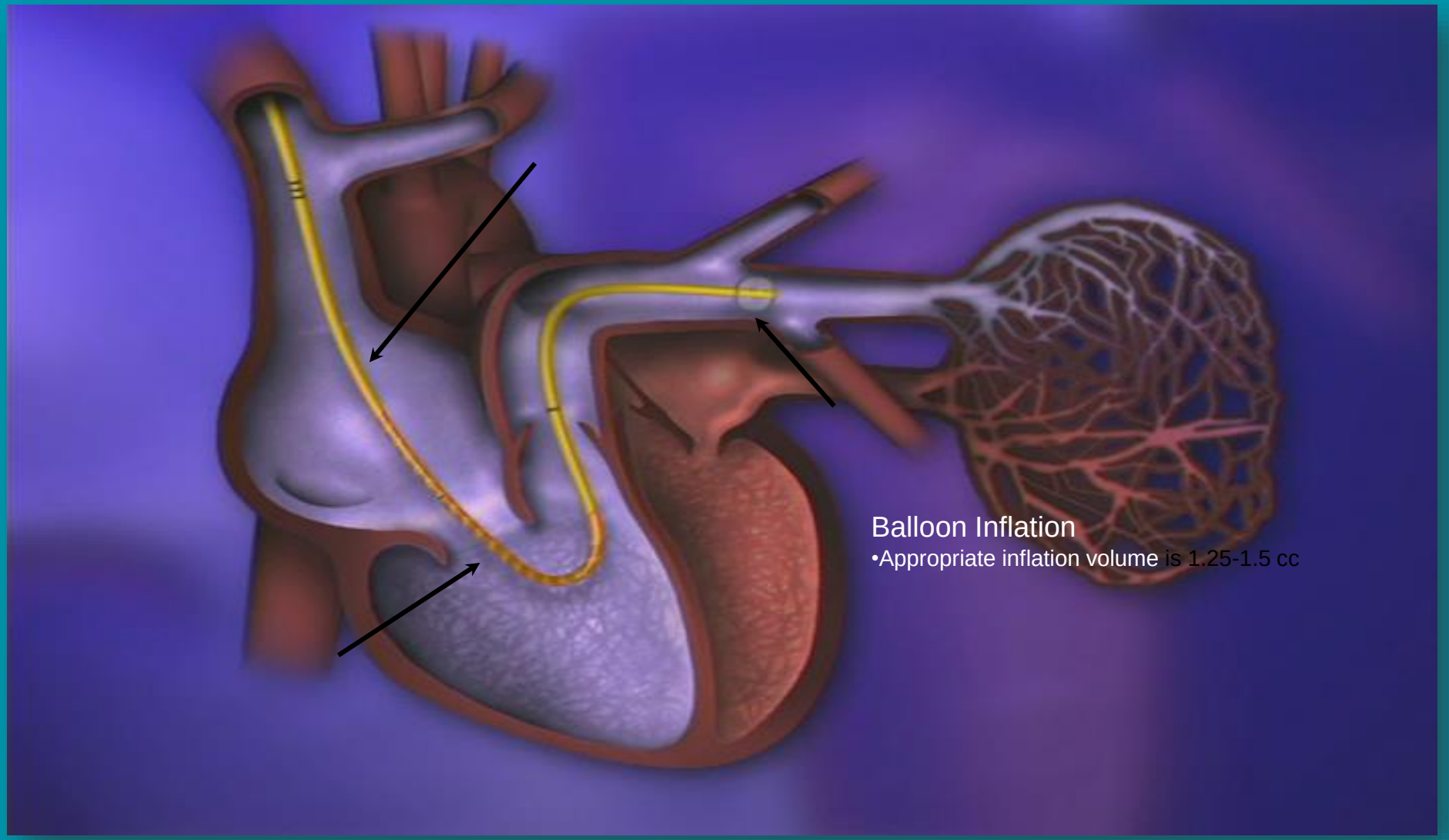
- Haemoglobin
- Arteriel oxygen saturation
- Cardiac output

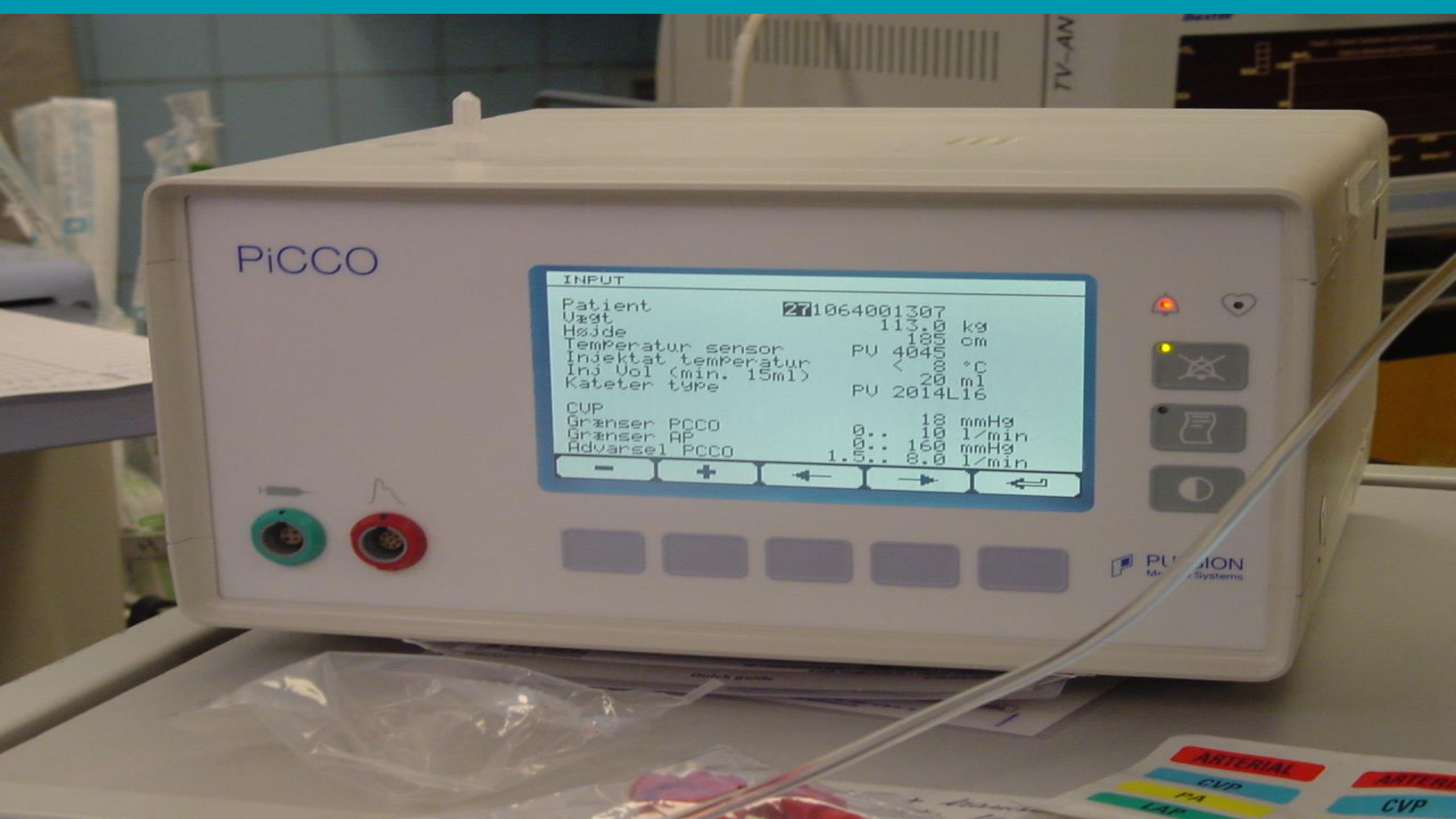


P-A CATHETERS

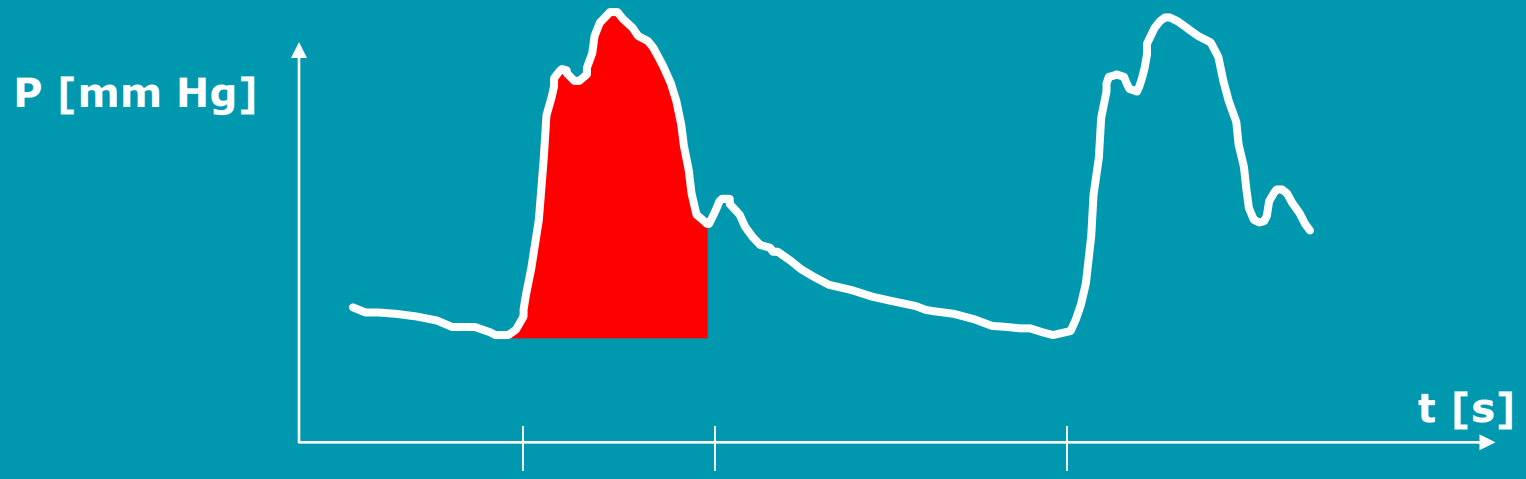


SWAN GANZ

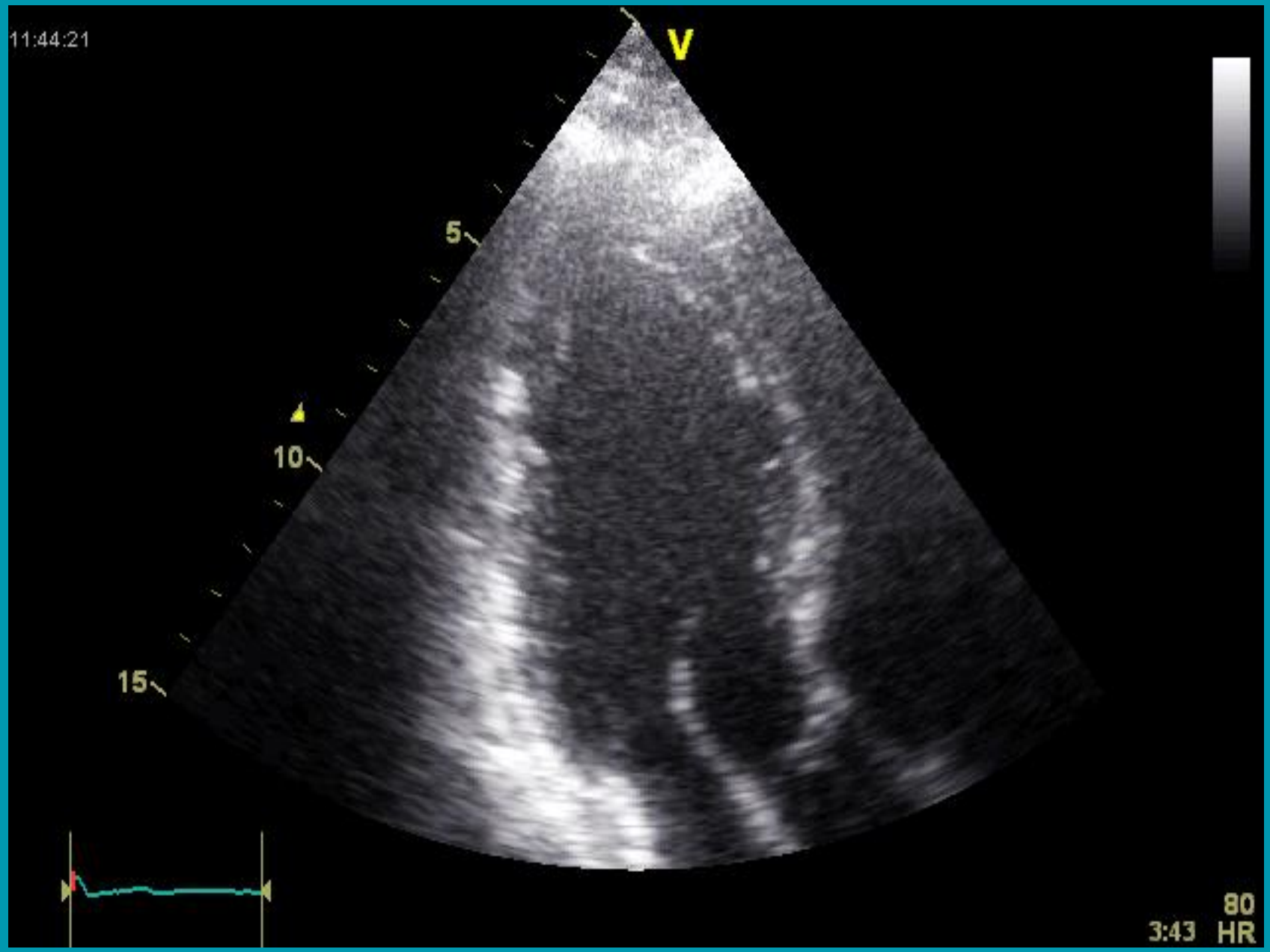

Balloon Inflation
•Appropriate inflation volume is 1.25-1.5 cc


PiCCO
INPUT
Patient 271064001307
Vægt 113.0 kg
Højde 185 cm
Temperatur sensor PV 4045
Injektat temperatur < 8 °C
Inj Vol (min. 15ml) 20 ml
Kateter type PV 2014L16
CVP
Grænser PCCO 18 mmHg
Grænser AP 0.. 10 l/min
Advarsel PCCO 0.. 160 mmHg
1.5.. 8.0 l/min
ARTERIAL
CVP
PA
LAP
CVP

Pulse contour CO



EKKO



Fluid Therapy

- **We recommend an initial fluid challenge in patients with sepsis-induced tissue hypoperfusion with suspicion of hypovolemia to achieve a minimum of 30 mL/kg of crystalloids (a portion of this may be albumin equivalent). More rapid administration and greater amounts of fluid may be needed in some patients. *(Grade 1C)***

Fluid Therapy

- **We recommend that a fluid challenge technique be applied wherein fluid administration is continued as long as there is hemodynamic improvement either based on dynamic (eg, change in pulse pressure, stroke volume variation) or static (eg, arterial pressure, heart rate) variables *(Ungraded).***

Vasopressor Therapy

- **We recommend that vasopressor therapy initially target a mean arterial pressure (MAP) of 65 mm Hg. *(Grade 1C)***

- **We recommend norepinephrine as the first-choice vasopressor. *(Grade 1B)***

Inotropic Therapy

- **We recommend that a trial of dobutamine infusion up to 20 µg/kg/min be administered or added to vasopressor (if in use) in the presence of:**
  - **myocardial dysfunction as suggested by elevated cardiac filling pressures and low cardiac output, or**
  - **ongoing signs of hypoperfusion, despite achieving adequate intravascular volume and adequate mean arterial pressure.** ***(Grade 1C)***

- **We recommend against the use of a strategy to increase cardiac index to predetermined supranormal levels.** ***(Grade 1B)***

Recommendations for Fluid Resuscitation in Acutely Ill Patients.

Fluids should be administered with the same caution that is used with any intravenous drug.

Consider the type, dose, indications, contraindications, potential for toxicity, and cost.

Fluid resuscitation is a component of a complex physiological process.

Identify the fluid that is most likely to be lost and replace the fluid lost in equivalent volumes.

Consider serum sodium, osmolarity, and acid–base status when selecting a resuscitation fluid.

Consider cumulative fluid balance and actual body weight when selecting the dose of resuscitation fluid.

Consider the early use of catecholamines as concomitant treatment of shock.

Fluid requirements change over time in critically ill patients.

The cumulative dose of resuscitation and maintenance fluids is associated with interstitial edema.

Pathological edema is associated with an adverse outcome.

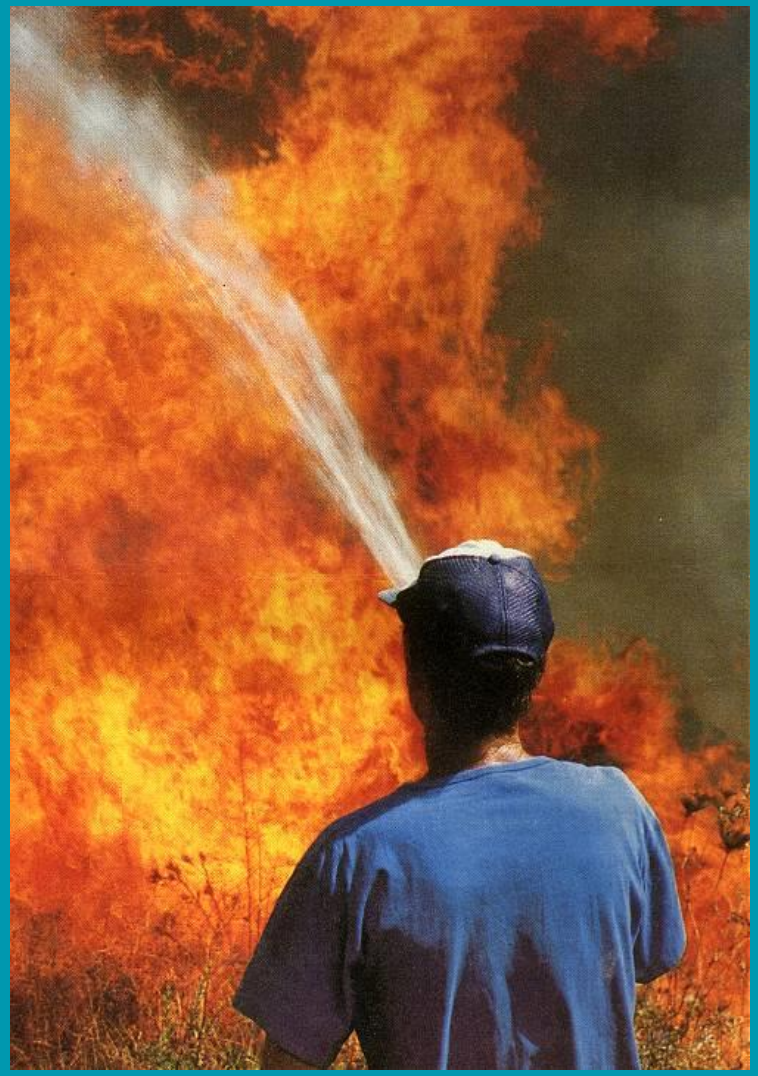
Oliguria is a normal response to hypovolemia and should not be used solely as a trigger or end point for fluid resuscitation, particularly in the post-resuscitation period.

The use of a fluid challenge in the post-resuscitation period (≥24 hours) is questionable.

The use of hypotonic maintenance fluids is questionable once dehydration has been corrected.

PHYSIOLOGICAL PRINCIPLES

- PRE-LOAD
- ”CARDIOVASCULA FUNCTION”
- ”AFTERLOAD” = VASKULÆR TONUS



CONCLUSION

Difficult issue

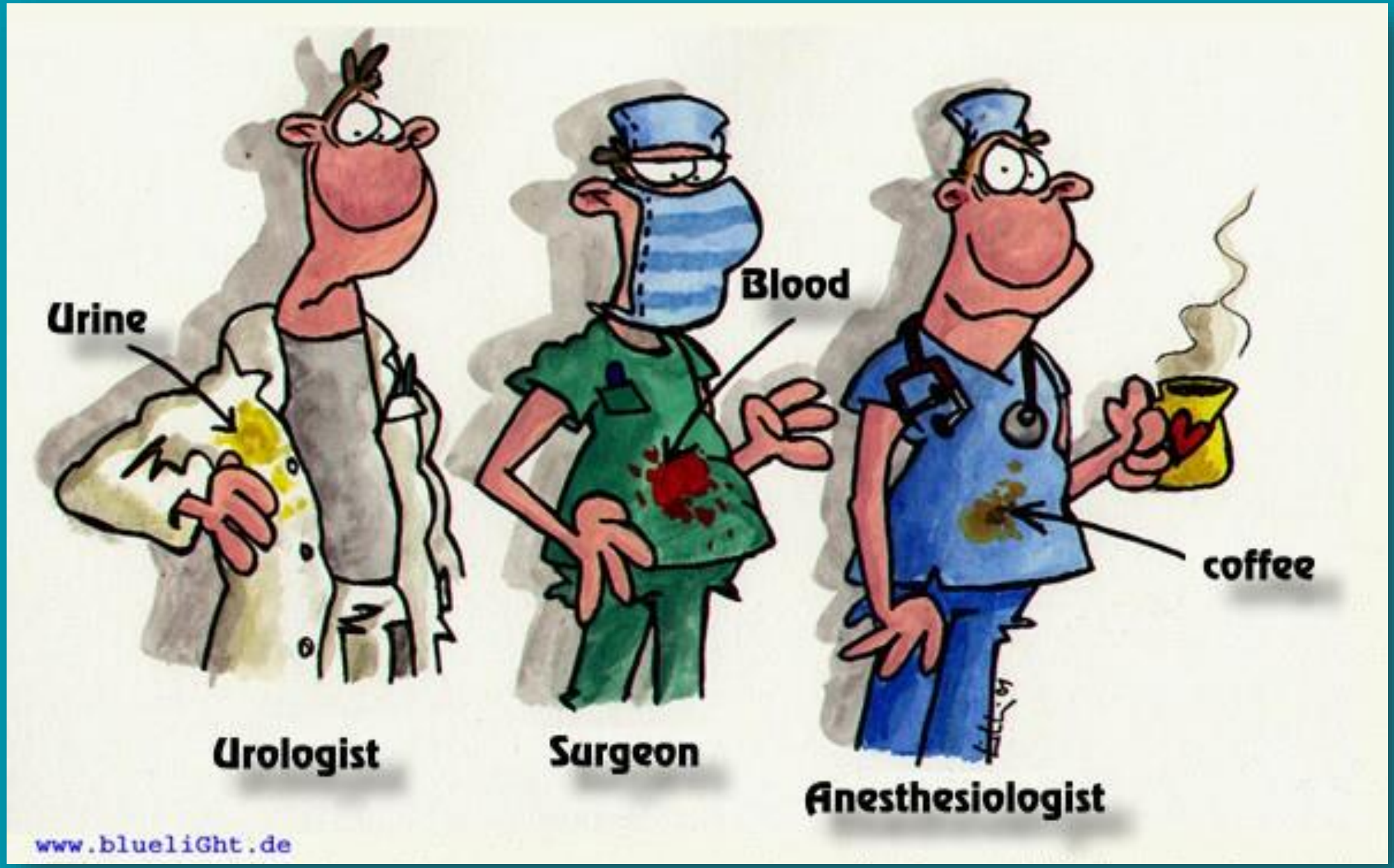
Type and dose

Time is important

Physiological prisciples

Define at treatment goal

Treatment protocol


Urine
Blood
coffee
Urologist
Surgeon
Anesthesiologist
www.blueliGht.de