



# THE RAPIDLY CHANGING LANDSCAPE OF EMS

WE MUST KNOW MORE, DO MORE, AND BE BETTER THAN EVER BEFORE



**NORTHWEST  
COMMUNITY  
EMERGENCY  
MEDICAL  
SERVICES  
SYSTEM**

Northwest Community Hospital  
EMS offices (Behavioral Health/901 Kirchoff Center)  
800 W. Central  
Arlington Heights, IL 60005  
Phone: 847-618-4480  
Fax: 847-618-4489

Date: October 18, 2021  
To: All System members  
From: Matthew T. Jordan, MD, FACEP  
EMS Medical Director  
Connie J. Mattera, MS, RN, PM  
EMS Administrative Director  
RE: **Important System Practice updates:**  
Petition forms; CESSA Act planning; replantation centers; trauma surgeon field response; new preferred IV catheters; and peds pleural decompression needle size specified

**System Memo: #399**

**PLEASE DISTRIBUTE IMMEDIATELY**

We continue operating under IDPH COVID-19 Emergency Guidelines and Standard Capacity

**10 EMS System Goals simply stated:**

- Align all policies, procedures, and practice to laws, rules, standards and guidelines applicable to EMS
- Maintain a Just Culture and Culture of Safety that embraces diversity, equity, and inclusion
- Communicate clearly; minimize misunderstandings
- Meet or exceed benchmarks for performance
- Resolve and remediate errors or inconsistencies in education and/or practice
- Effectively steward and optimize utilization of all resources
- Eliminate waste
- Mitigate risk
- Prevent never events
- Support, empower, educate, credential, and resource System members

To these ends, we've discovered several areas that need immediate attention and/or change:

**INFO to KNOW!**

<b>Petition forms</b>	<ul style="list-style-type: none"><li>The NWC EMSS requirement to complete Petition forms dates back to the 1970s.</li><li>This has been a huge area of misunderstanding and inconsistent practice over the years as each hospital has its own interpretation of what EMS should document. The form was not designed for EMS nor are we responsible for an involuntary committal.</li><li>IDPH Div. of EMS confirms that there is <b>no requirement for EMS to complete these forms in the EMS Act or Rules and it is a System requirement only.</b></li></ul> <p><b>Effective immediately, NWC EMSS personnel shall stop completing Petition Forms.</b></p> <p>Instead, they shall thoroughly execute the provisions of the SOPs and document within ImageTrend software (using all available and applicable worksheets) their risk assessments for violent behavior and/or suicide; the patient's decisional capacity; and their supporting rationale if they believe a patient would "intentionally or unintentionally inflict serious physical harm upon themselves or others in the near future or is unable to provide for his or her own basic physical needs so as to guard himself or herself from serious harm." and needs transport to a hospital for examination by a physician (Ill Mental Health Code).</p>
<b>Community Emergency Services and Support Act (CESSA)</b>	On August 25, 2021, Governor Pritzker signed CESSA into law, which requires emergency response operators to refer calls seeking mental and behavioral health support to a new service that can dispatch a team of EMS or RN and mental health professionals instead of police. We are awaiting emergency rules from IDPH and are working with community partners and mental health professionals to determine the System's response. The law must be implemented by July 2022.
<b>Replantation centers</b>	Amita Alexian Brothers Medical Center (ABMC) has informed us that they are <b>no longer a replantation center for hand injuries.</b> Please transport all patients requiring replantation to your closest Level I Trauma Center.

# HOT OFF THE PRESSES

## SYSTEM MEMO #399

NWC EMSS System Memo #399 SOP and Practice Updates 10-18-21

Page 2

Trauma surgeon scene response	The Region IX Trauma Committee notified us that there is <b>no longer a Region policy or procedure for a trauma surgeon scene response</b> . If you have an entrapped patient that cannot be extricated, contact your nearest System OLMC physician to discuss options. These are extremely rare events as we never used the policy that has been eliminated.																														
IV starts and preferred catheters	<p>PBPI results show that we have an urgent opportunity to improve IV success rates. Members of multiple committees have identified variation in IV catheters available for exchange at hospitals as one root cause of the problem.</p> <p>The R&amp;D Committee did a complete analysis of available catheters and their preferred option. The System endorses their recommendation.</p> <p><b>Effective immediately:</b> The System requests all our agencies and hospitals use up existing IV catheters by attrition and stock the following IV catheters for EMS exchange ASAP:</p> <table><tr><th>Material #</th><th>Material Description</th><th>Unit of Measure</th><th>EA/CA</th><th>Price/EA</th><th>Price/Case</th></tr><tr><td>383531</td><td>Nexiva Dual Port 24ga L0.75in</td><td>Case</td><td>80</td><td>\$ 4.29</td><td>\$ 343.20</td></tr><tr><td>383532</td><td>Nexiva Dual Port 22ga L1in</td><td>Case</td><td>80</td><td>\$ 4.29</td><td>\$ 343.20</td></tr><tr><td>383536</td><td>Nexiva Dual Port 20ga L1in</td><td>Case</td><td>80</td><td>\$ 4.29</td><td>\$ 343.20</td></tr><tr><td>383539</td><td>Nexiva Dual Port 18ga L1.25in</td><td>Case</td><td>80</td><td>\$ 4.29</td><td>\$ 343.20</td></tr></table> <p>Education and competency verification is mandatory before the new catheters may be rolled out at an agency. The manufacturer's rep will contact Provider EMS Coordinators to arrange for education at your location. Approved Peer II or higher educators may conduct the competency measurement for each paramedic/PHRN. Expect to hear from:</p> <p>Paige Gruber Territory Manager; MDS - Vascular Access E: <a href="mailto:paige.m.gruber@bd.com">paige.m.gruber@bd.com</a>   C: 708-912-7244</p>	Material #	Material Description	Unit of Measure	EA/CA	Price/EA	Price/Case	383531	Nexiva Dual Port 24ga L0.75in	Case	80	\$ 4.29	\$ 343.20	383532	Nexiva Dual Port 22ga L1in	Case	80	\$ 4.29	\$ 343.20	383536	Nexiva Dual Port 20ga L1in	Case	80	\$ 4.29	\$ 343.20	383539	Nexiva Dual Port 18ga L1.25in	Case	80	\$ 4.29	\$ 343.20
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Peds pleural decompression needle specified	In keeping with the September CE, we have updated the Procedure Manual and SOPs to differentiate pleural decompression needle sizes for adults and children 12 and younger. <b>Adult: 10 gauge; 3"-3.25" needle or PneumoFix™ / Child 12 &amp; younger: 14-16 gauge 1½" needle</b>																														
SOP, Procedure Manual and Drug & Supply List updates	Because several of these changes directly impact our current SOPs, Drug and Supply List, and Procedure Manual; revised editions are being issued now and posted to our website. <b>Please see the revised documents attached with this memo.</b> <b>A full SOP update for Region IX is in the process of being drafted and will be taught in May 2022 as a mandatory review.</b> Please submit your recommendations for change to Connie Mattera before Jan 1, 2022.																														

If you have any questions on any of these updates, please do not hesitate to reach out to either of us:

Matt Jordan: [mjordan@nch.org](mailto:mjordan@nch.org)

Connie Mattera: [cmattera@nch.org](mailto:cmattera@nch.org)





<https://depositphotos.com/stock-photos/electric-shock.html>

# THIS WILL BE SHOCKING...MAYBE

NWC EMSS NOVEMBER CE



KOURTNEY CHESNEY, RN BSN PARAMEDIC

SUSAN WOOD, RN MSN PARAMEDIC

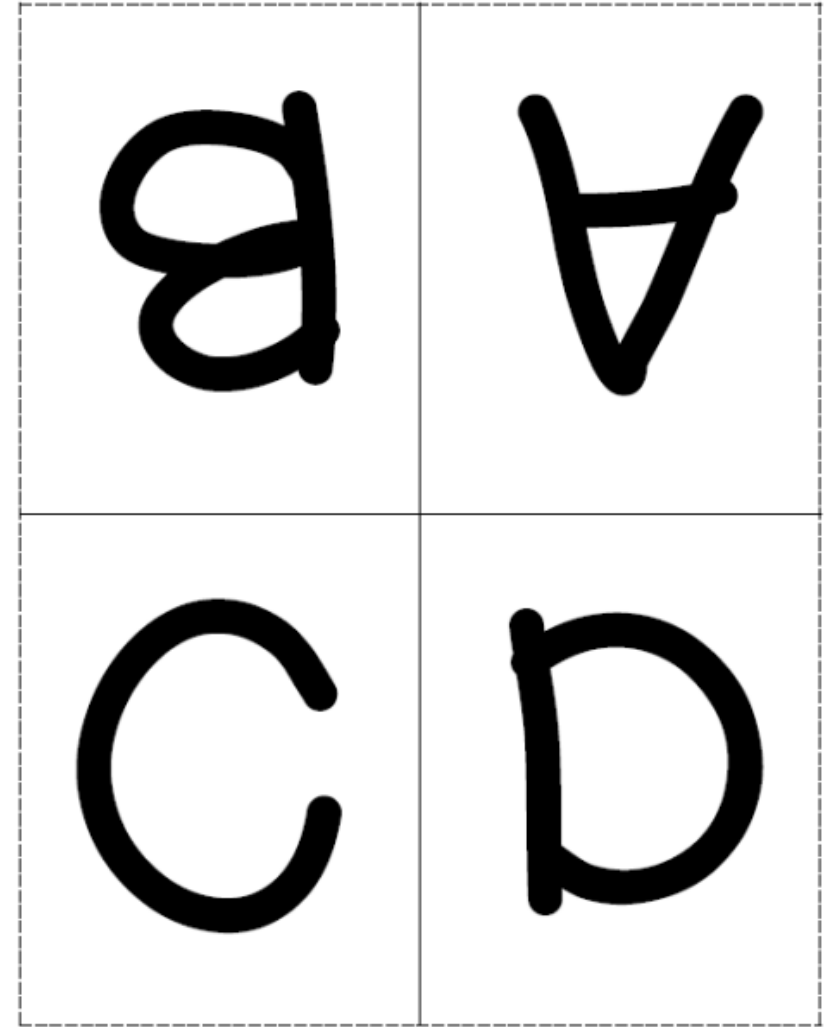


SO *what do we*  
know?

<https://ed.sc.gov/districts-schools/special-education-services/additional-information-and-assistance/dyslexia-and-other-reading-disorders/dyslexia-module-1-what-is-it-and-what-do-we-know-about-it/>

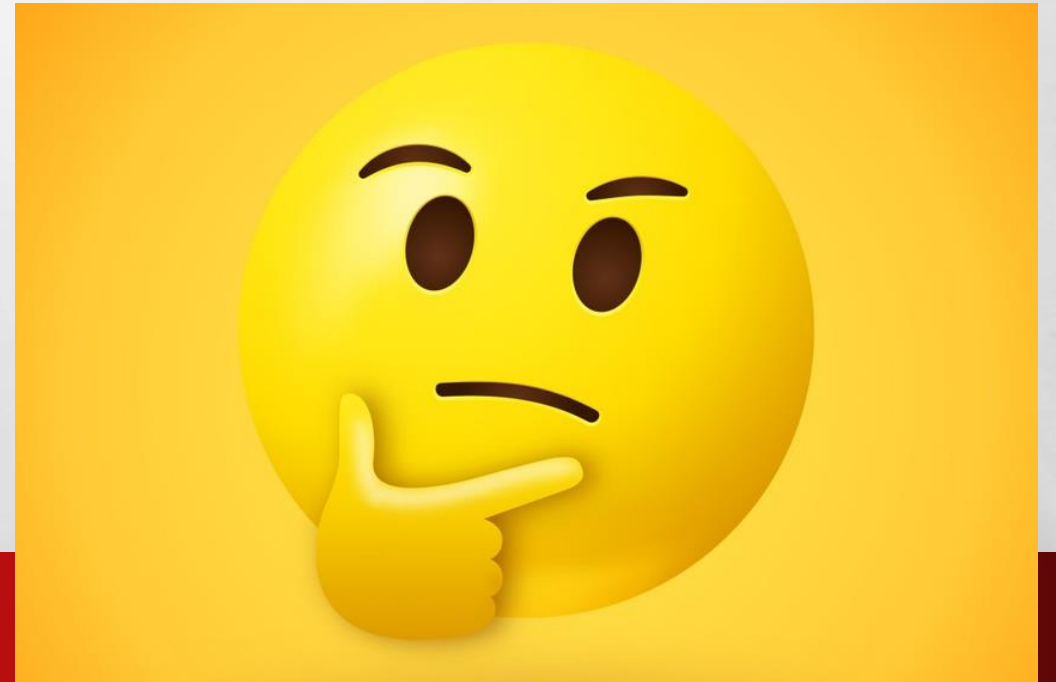
GRAB THE  
PAGE WITH  
THE A-B-C-D

WE WILL BE USING THIS SHEET  
THROUGHOUT THE CLASS



# **1. WHAT IS THE MOST COMMON ETIOLOGY OF SHOCK IN TRAUMA PATIENTS?**

- A. BRAIN INJURY**
- B. HEMORRHAGE**
- C. RESPIRATORY FAILURE**
- D. CARDIAC INSUFFICIENCY**



## **2. ACTIVATION OF THE RENIN-ANGIOTENSIN-ALDOSTERONE SYSTEM (RAAS) CAUSES BLOOD VESSELS TO:**

**A. CONSTRICT**

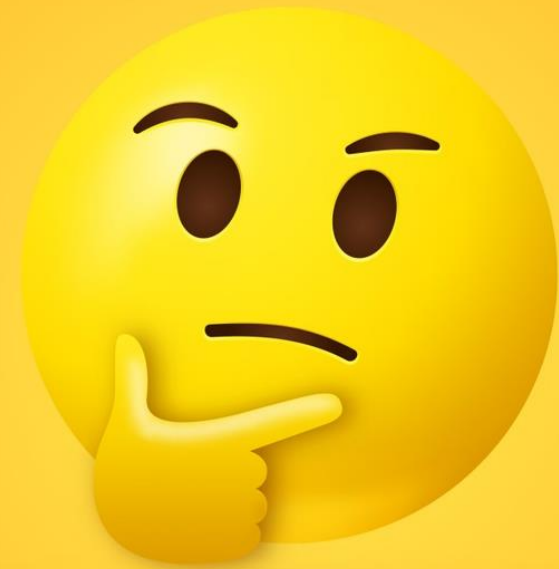
**B. DILATE**





### **3. WHICH OF THESE OCCURS IN ALL CAUSES (ETIOLOGIES) OF SHOCK?**

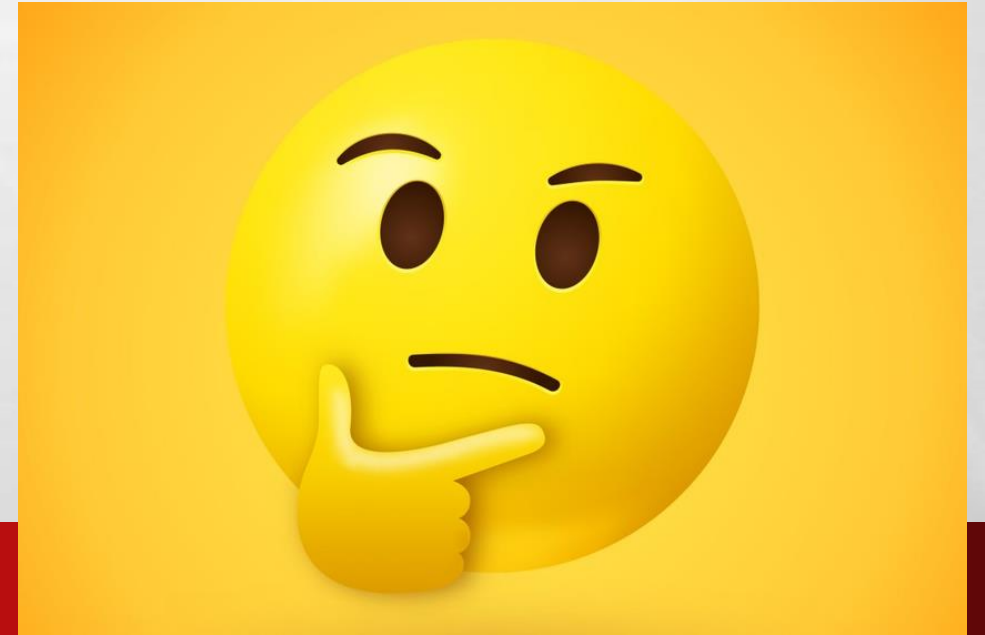
- A. LOSS OF VASCULAR FLUID VOLUME**
- B. DILATED BLOOD VESSELS FROM LOSS OF VASCULAR TONE**
- C. CELLULAR HYPOXIA DUE TO A SUSTAINED PERFUSION DEFICIT**
- D. CARDIAC PUMP DYSFUNCTION DUE TO MYOCARDIAL NECROSIS**





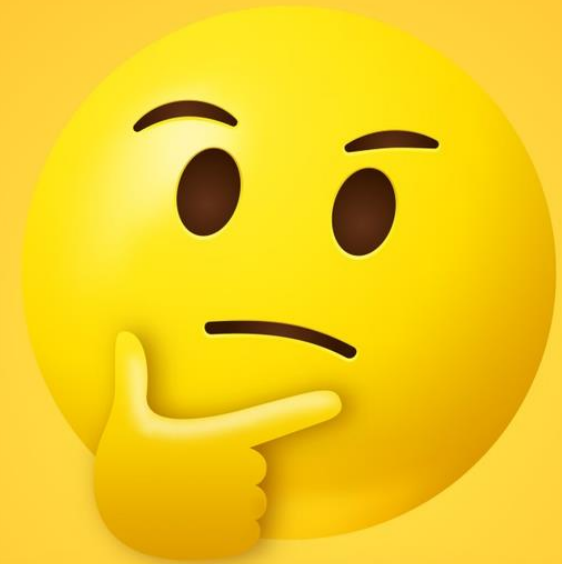
# **4. THE PRIMARY ENERGY SOURCE FOR CELLS IS:**

- A. MAGNESIUM**
- B. EPINEPHRINE**
- C. GLUCOSE**



## **5. WHAT PHYSIOLOGICAL RESPONSE EXPLAINS WHY A PATIENT MIGHT EXPERIENCE LIGHTHEADEDNESS, CP OR SYNCOPAL EPISODE DURING HYPERVENTILATION SYNDROME?**

- A. PCO<sub>2</sub> DILATES CEREBRAL BLOOD VESSELS**
- B. PCO<sub>2</sub> CONSTRICTS CEREBRAL BLOOD VESSELS**
- C. PCO<sub>2</sub> ACTIVATES THE SYMPATHETIC NERVOUS SYSTEM**
- D. PCO<sub>2</sub> ACTIVATES THE PARASYMPATHETIC NERVOUS SYSTEM**



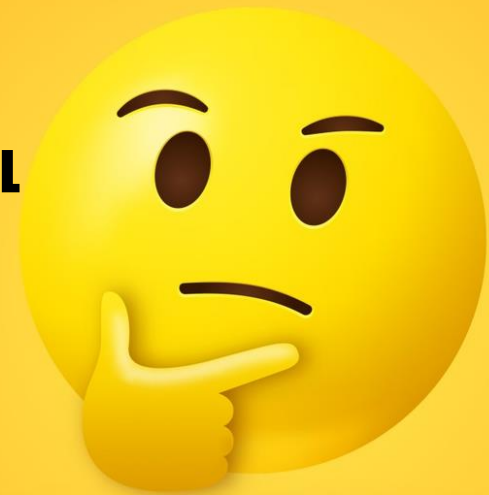
**6. A PATIENT WITH A RECENT HISTORY THAT SUGGESTS INFECTION PRESENTS WITH AN  $\text{ETCO}_2$  OF 30 AND A QSOFA SCORE  $\geq 2$ . WHICH OF THESE IS A CLINICAL PRESENTATION THAT DIFFERENTIATES SEPSIS FROM SEPTIC SHOCK?**

- A. RR > 22**
- B. SBP < 90**
- C. SKIN MOTTLING**
- D. HR BETWEEN 100-110**



**7. WHAT SHOULD A PARAMEDIC SUSPECT WHEN THE PATIENT'S MAP IS <60 MMHG?**

- A. CEREBRAL PERFUSION PRESSURE IS TOO HIGH**
- B. CORONARY ARTERY PERFUSION WILL BE INADEQUATE**
- C. HIGH AORTIC ROOT PRESSURES MAY CAUSE A VALVE PROLAPSE**
- D. THE PATIENT'S CARDIAC OUTPUT WILL BE OPTIMAL DUE TO PRESSURES WNL**





**8. WHICH OF THESE IS THE EARLIEST CLINICAL SIGN THAT THE BODY IS *CHEMICALLY* COMPENSATING FOR AN INCREASE IN ACID BYPRODUCTS DUE TO HYPOVOLEMIC SHOCK?**

- A. CYANOSIS**
- B. COOL, PALE EXTREMITIES**
- C. NARROWED PULSE PRESSURE**
- D. INCREASED VENTILATORY RATE AND DEPTH**



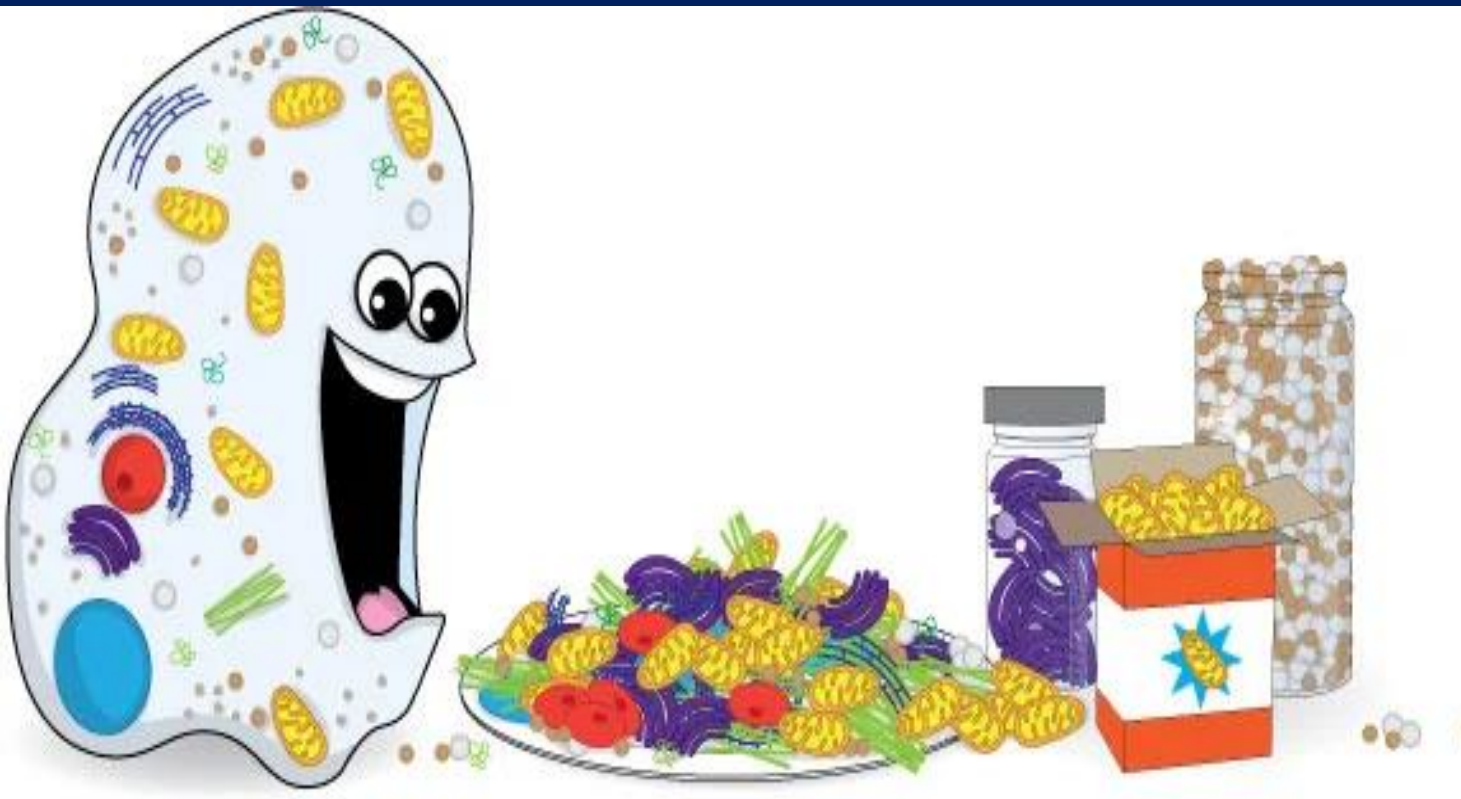
- Cardiogenic - March / April CE
  - MI
  - Cardiomyopathy
  - End stage valvular conditions
- Distributive
  - Anaphylaxis
  - Sepsis
- Neurogenic – August CE
- Hypovolemic – August CE
- Obstructive – September CE
  - PE
  - Cardiac tamponade
  - Pneumothorax

# GOALS FOR TODAY

Upon completion, the participant will:

- identify factors necessary to maintain perfusion.
- generalize the pathophysiology shock.
- state the major clinical compensatory mechanisms of shock.
- explain management priorities for shock.

THIS IS SO BASIC...BUT  
DON'T FORGET



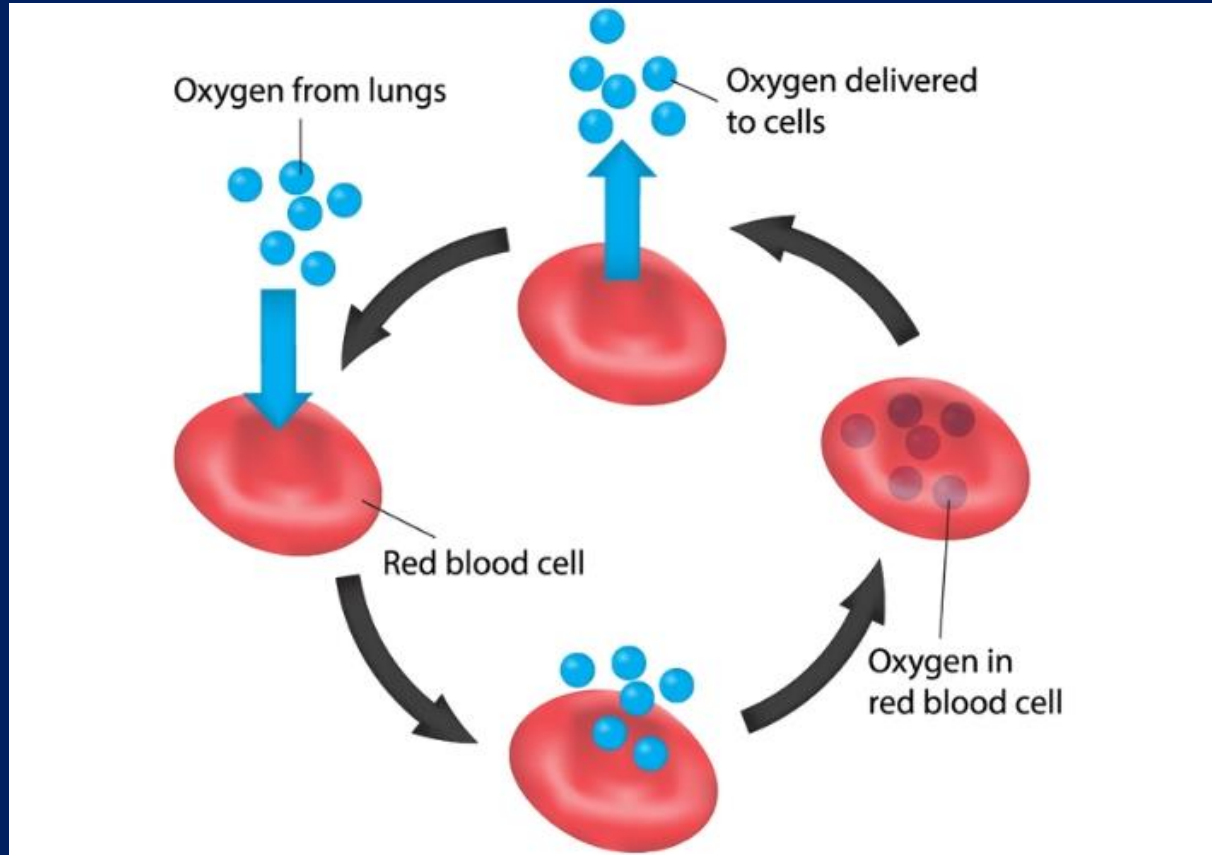
## *CELLS NEED FUEL*

- Oxygen
- Glucose
- Nutrients

Just in time supply is  
provided by the constant  
passage of oxygenated blood  
through the body's tissues =

***PERFUSION***

# DEFINING SHOCK



[https://www.elephango.com/index.cfm/pg/k12learning/lcid/12125/Homeostasis:\\_How\\_Cells\\_Regulate](https://www.elephango.com/index.cfm/pg/k12learning/lcid/12125/Homeostasis:_How_Cells_Regulate)

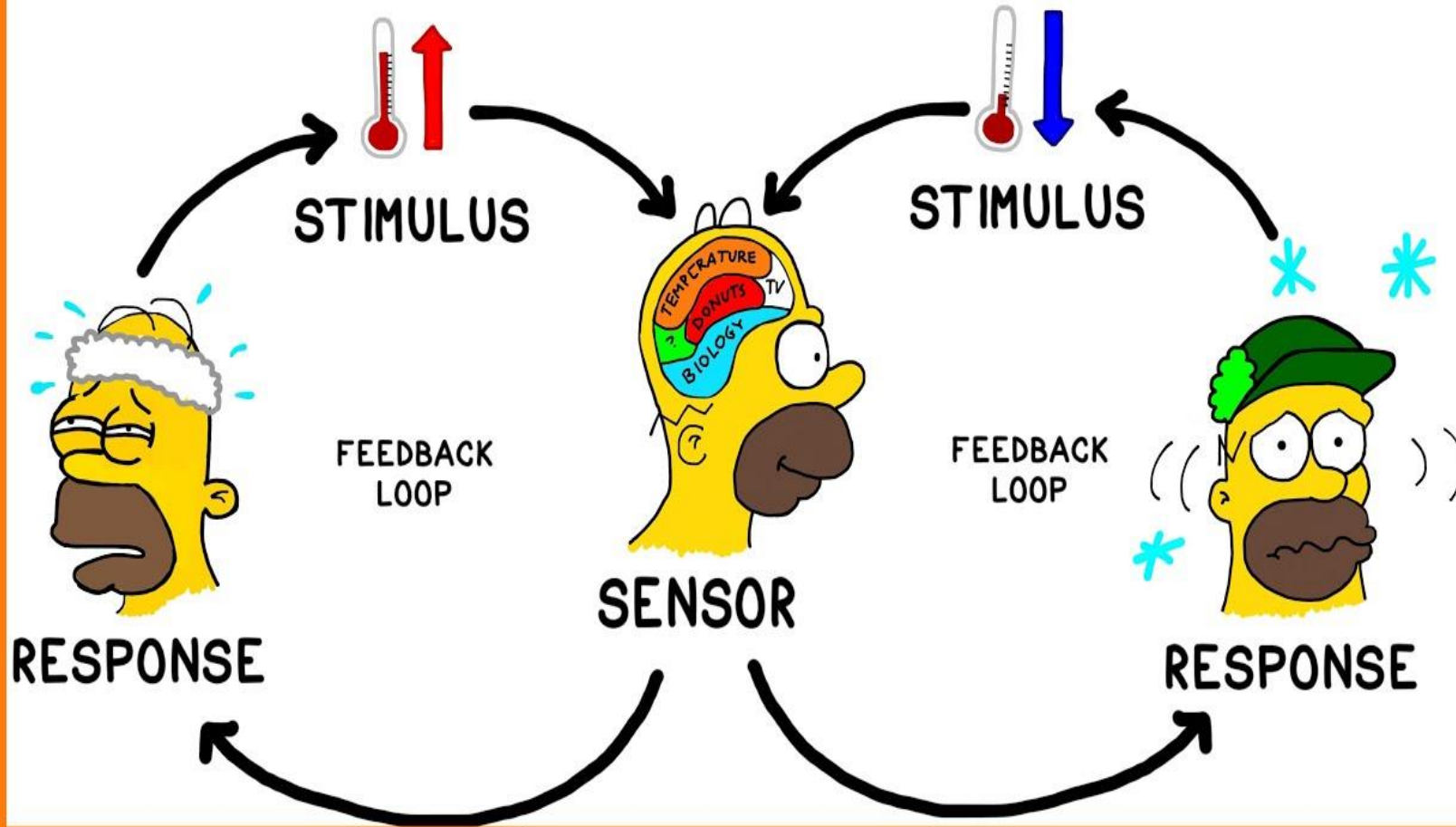
## CELLULAR HYPOXIA

All body cells require a constant supply of fuel in the form of  $O_2$  and other nutrients like glucose

They cannot storehouse  $O_2$  for even a minute when breathing room air.



# HOMEOSTASIS & FEEDBACK

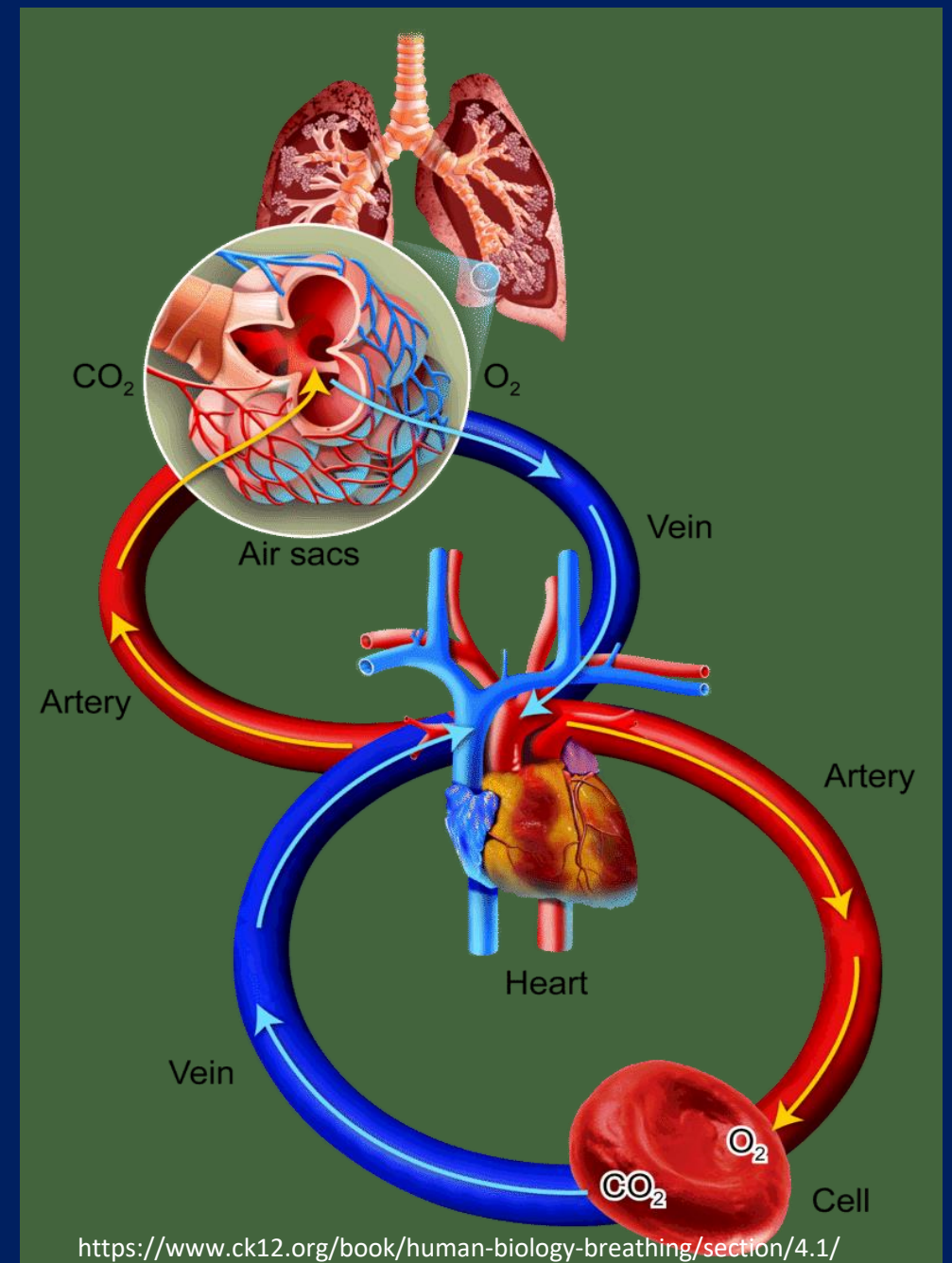


...because all  
shock happens  
on a cellular  
level

ITS A BALANCING ACT

# COMMON DENOMINATOR

Failure of the circulatory system to deliver nutrients necessary for cell survival and to remove waste products despite compensatory mechanisms



# How do we maintain perfusion?

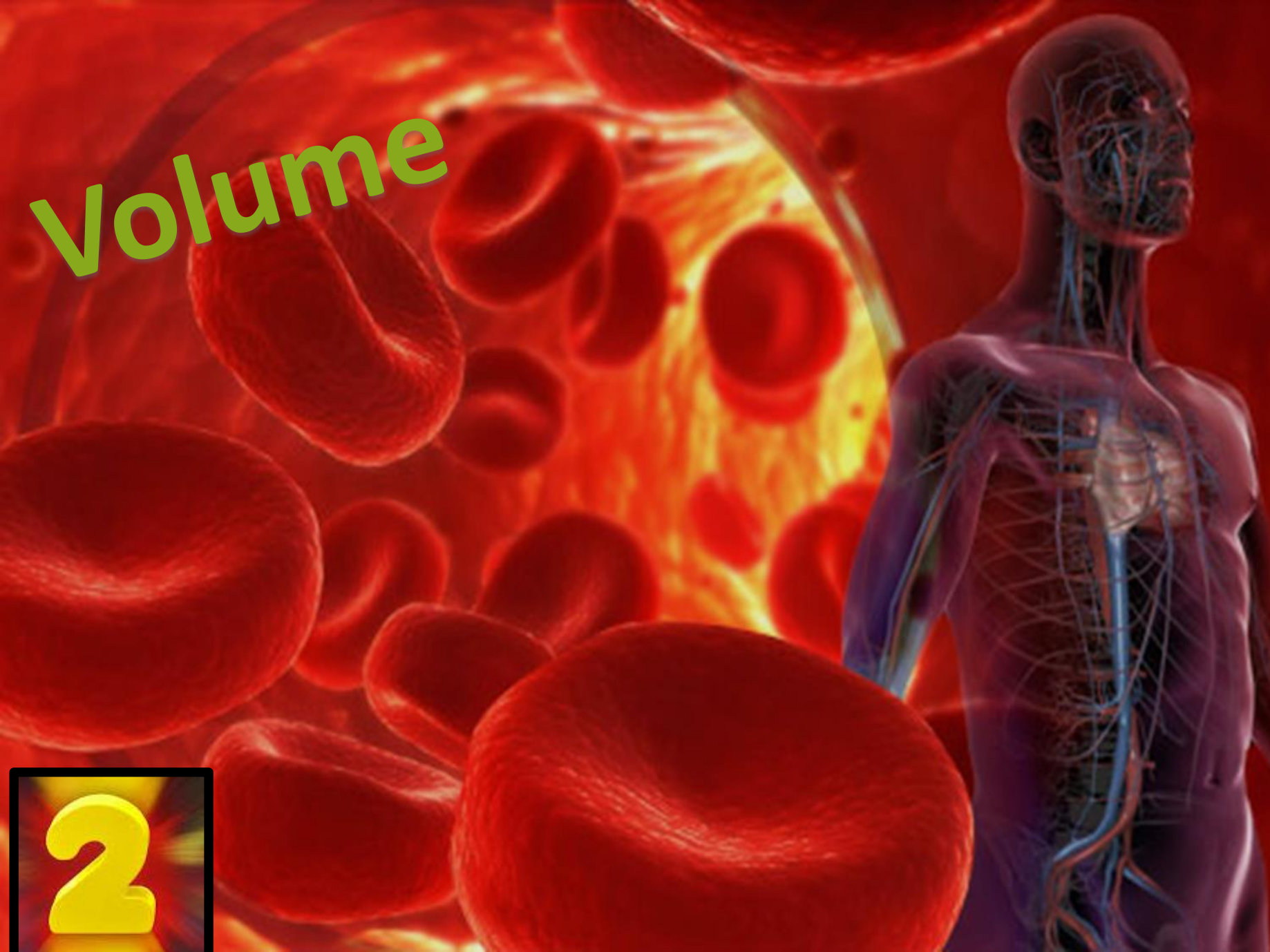


© Trevor James









Must have  
sufficient **blood  
volume** to fill the  
vascular container  
plus

*oxygen carrying  
capacity*

*Release to the  
cells...*

*and remove  
waste products.*

2



The vascular system must be intact and capable of regionalizing blood flow

It responds to autonomic nervous system (ANS) stimulation to change size / caliber to maintain minimum MAP

INTACT PIPES





# BLOOD FLOW AND BLOOD PRESSURE

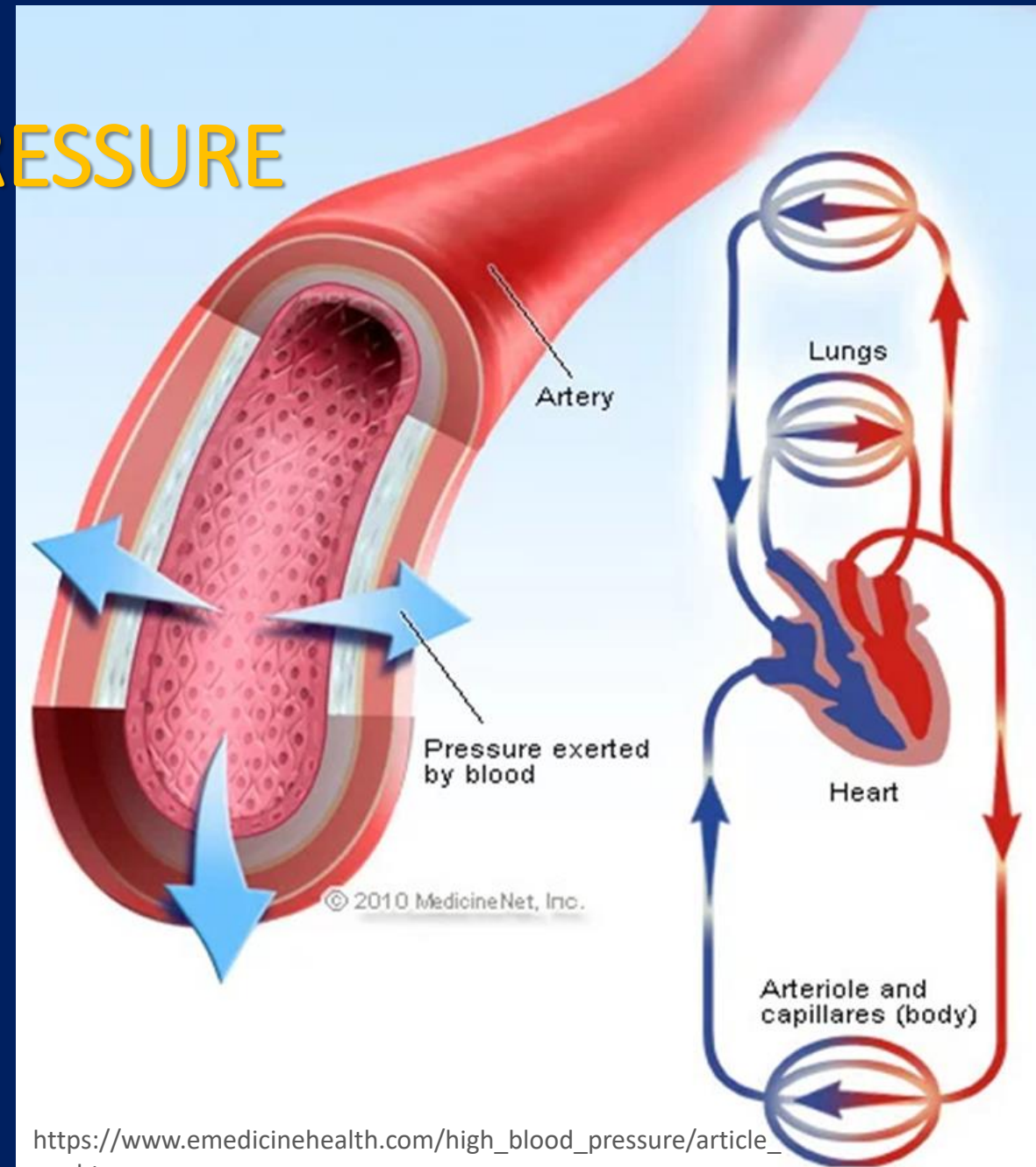
Pressure exerted by blood against vessel walls

## Systolic pressure

- Force generated by LV to eject blood each time it contracts

## Diastolic pressure

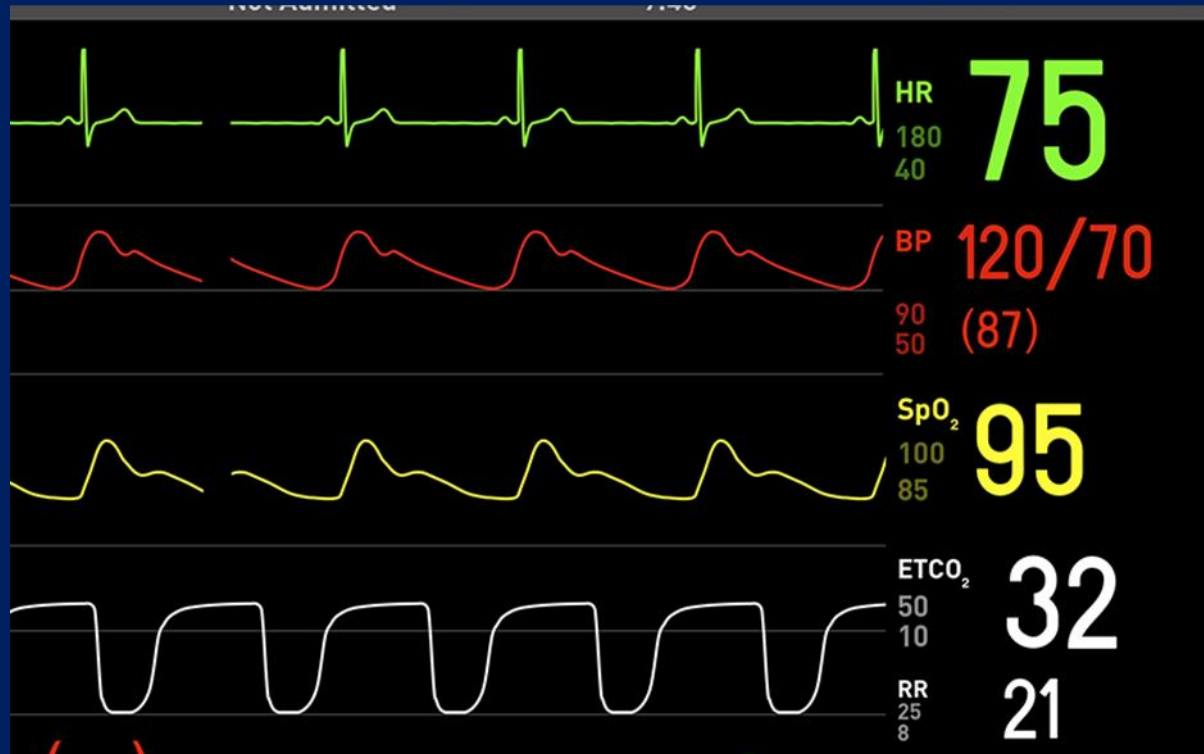
- Pressure in arteries when LV is resting
- Reflects *systemic vascular resistance*



# MAP

At normal, resting HR is calculated as:

$$MAP = DBP + \frac{1}{3} PP (SBP-DBP)$$



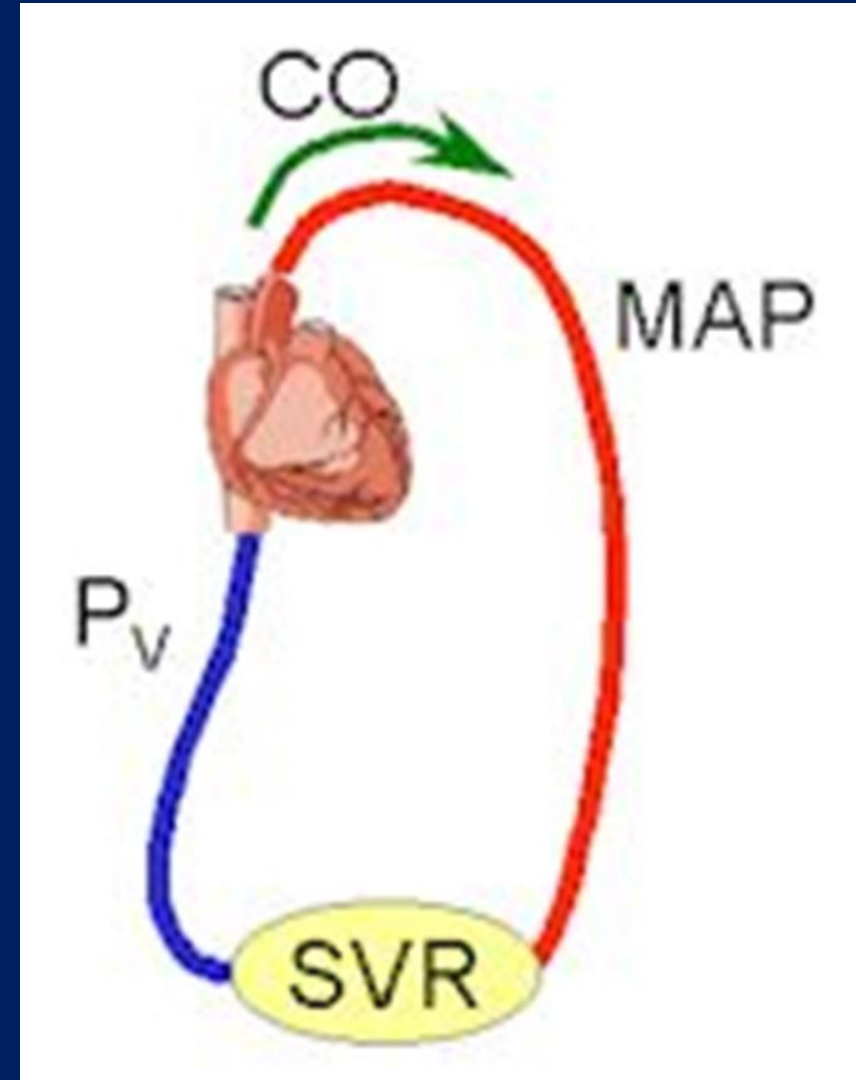
DBP counts 2 x as much as SBP; 2/3 of the cardiac cycle is spent in diastole



# BLOOD FLOW AND BLOOD PRESSURE

*MAP* depends on:

- Blood volume
- Cardiac output
- Systemic vascular resistance (SVR)
- Central venous pressure ( $P_v$ )



# CARDIAC OUTPUT (CO)

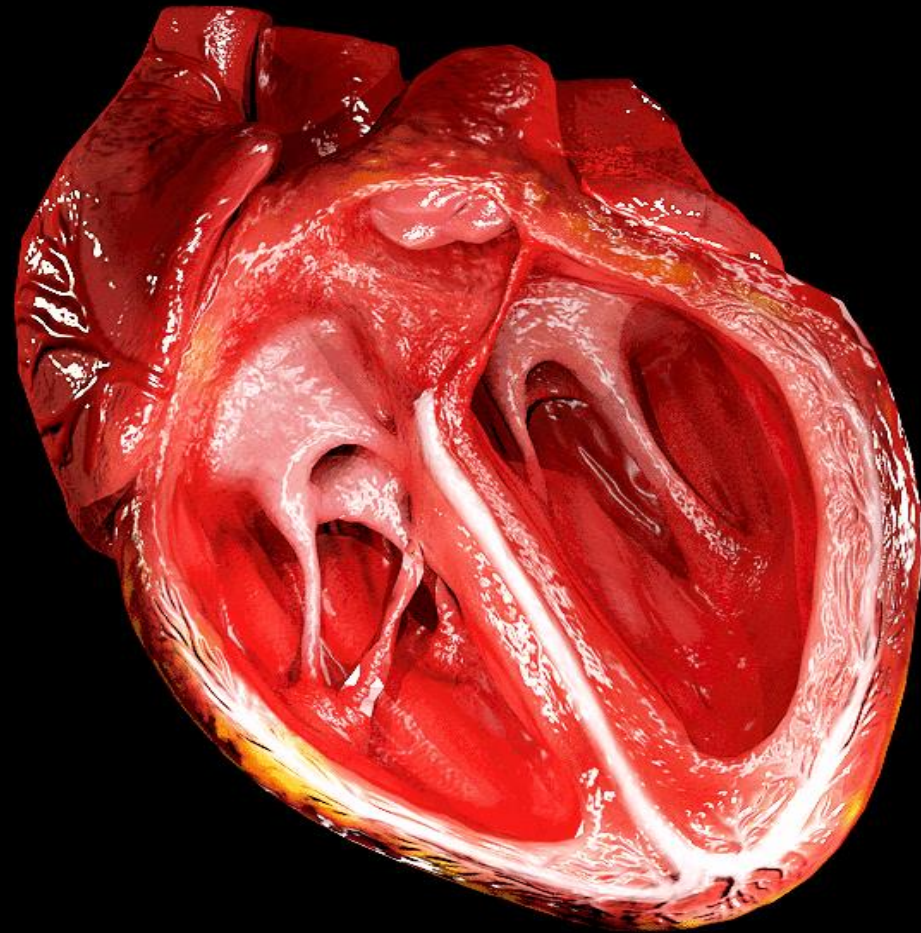
$$CO = HR \times SV$$

**SV:** Amount ejected w/ each contraction (70 mL)

**HR:** 60-100  
(72-75)

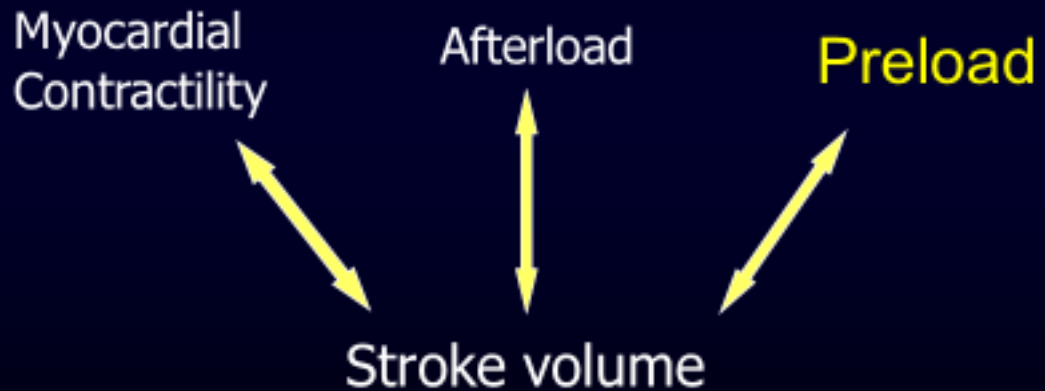
**CO:** 70 X 72 (5 L/min)

*Amount of blood the heart pumps in a given period of time*

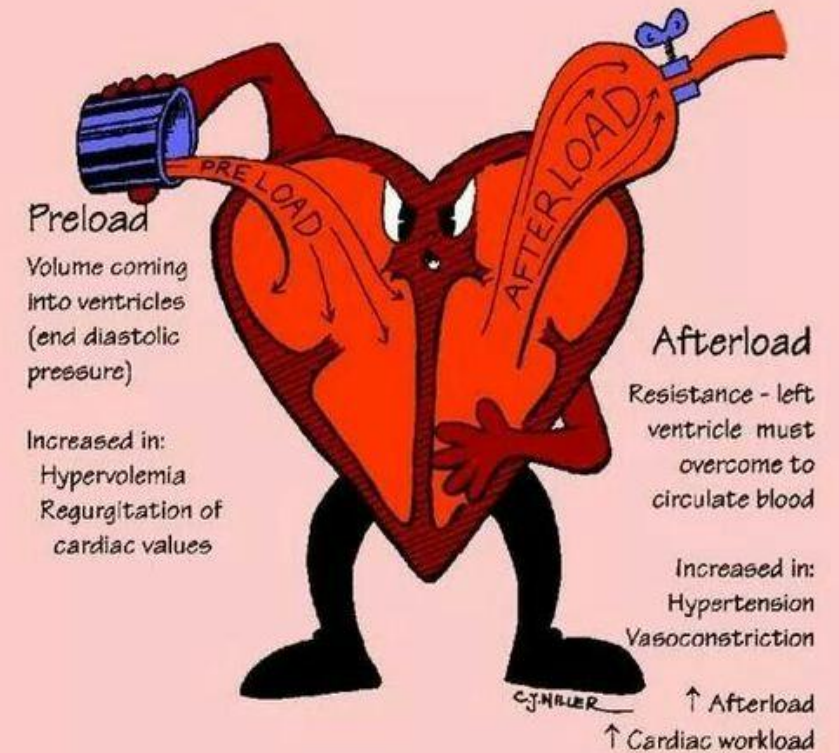


# WHAT DETERMINES STROKE VOLUME?

## Determinants of stroke volume



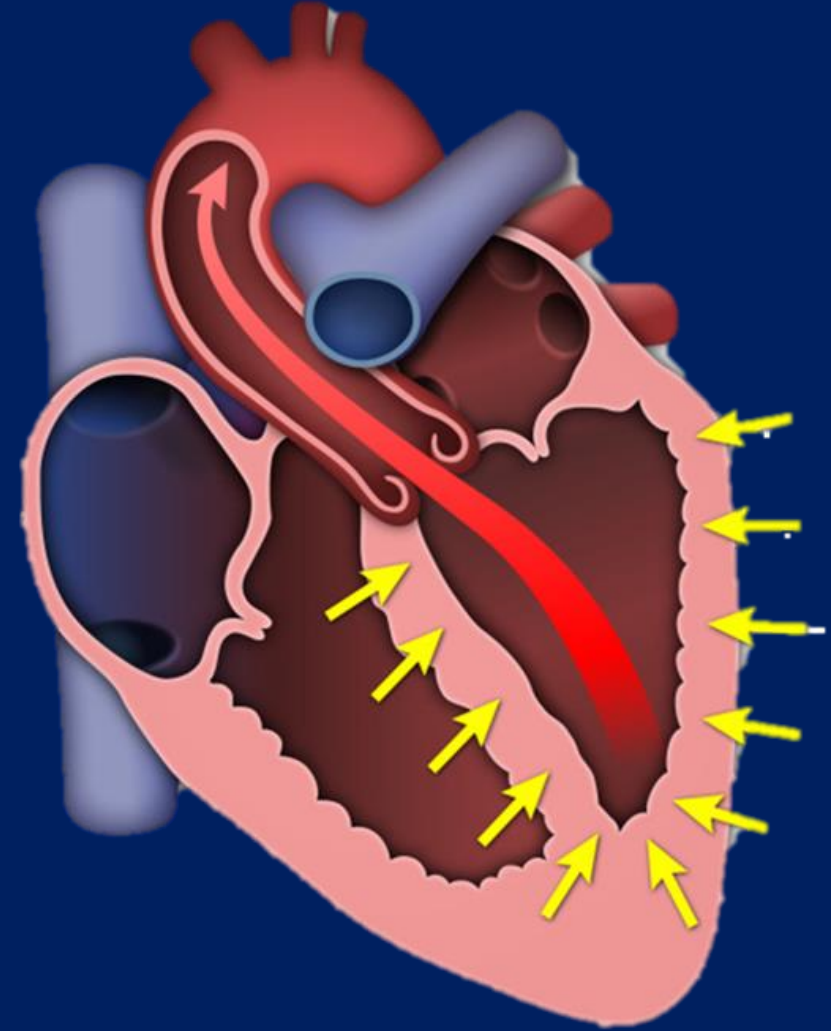
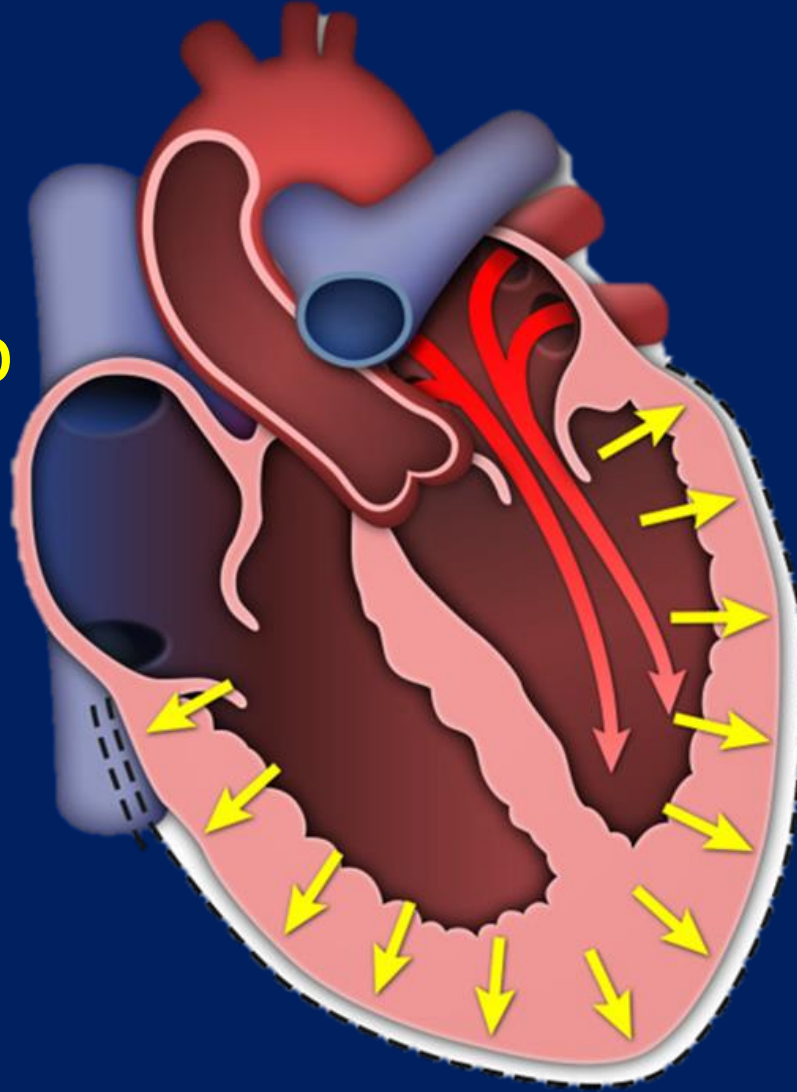
## PRELOAD AND AFTERLOAD





# *WHY IS PRELOAD SO IMPORTANT?*

Determines  
amount of blood  
the ventricle has to  
circulate during  
systole





# ENGINEERS IN THE ROOM!

All pumps must be  
primed (preloaded)  
before they can  
pump anything out



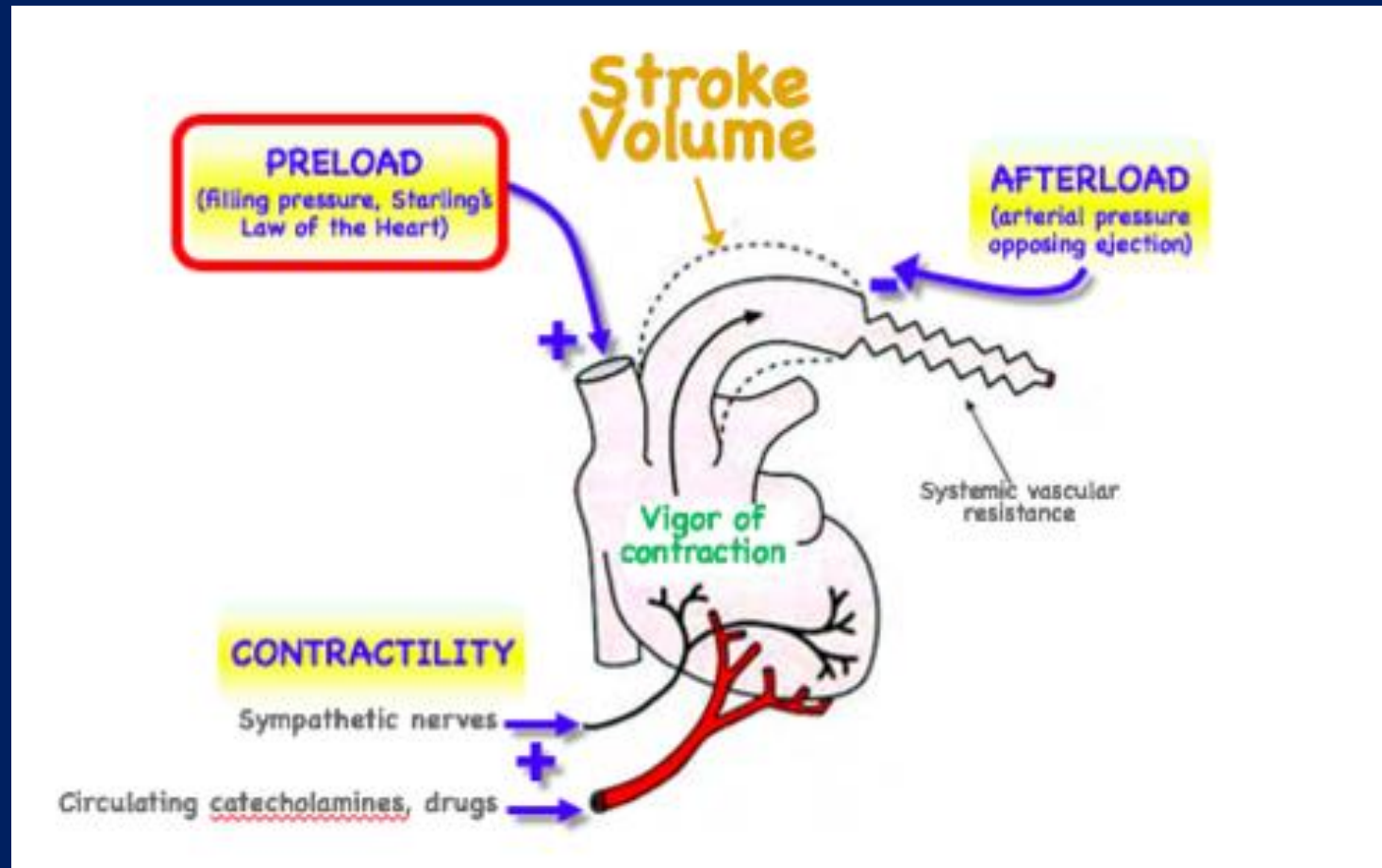
FILL  
THE  
TANK

# WHAT DECREASES PRELOAD (FILLING OF THE HEART)?

- Hemorrhage
- Diaphoresis
- N/V
- 3<sup>rd</sup> spacing
- Dehydration
- Renal failure
- Diuresis
- Obstruction
  - TPtx, CT, PE

# HOW CAN PRELOAD BE INCREASED?

- Fluid retention
- HF
- RF
- IVF

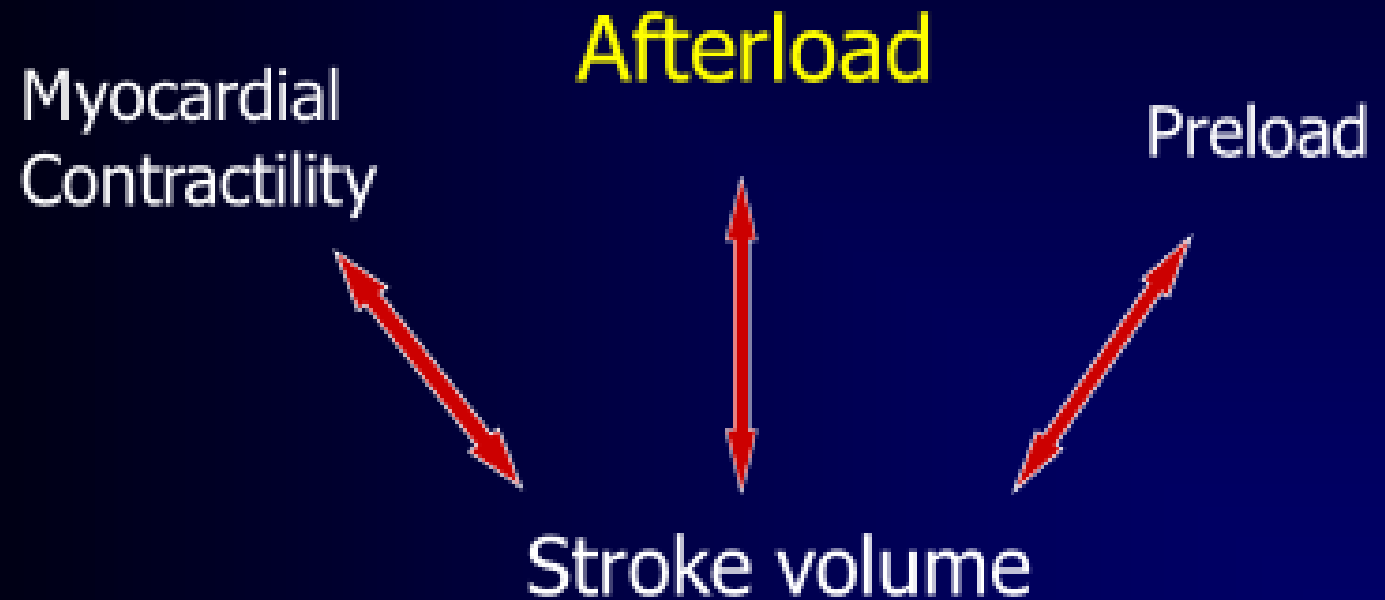


# AFTERLOAD



<https://www.amazon.com/Number-Brass-Numbers-Better-Mailboxes/dp/B00IPLVHZI>

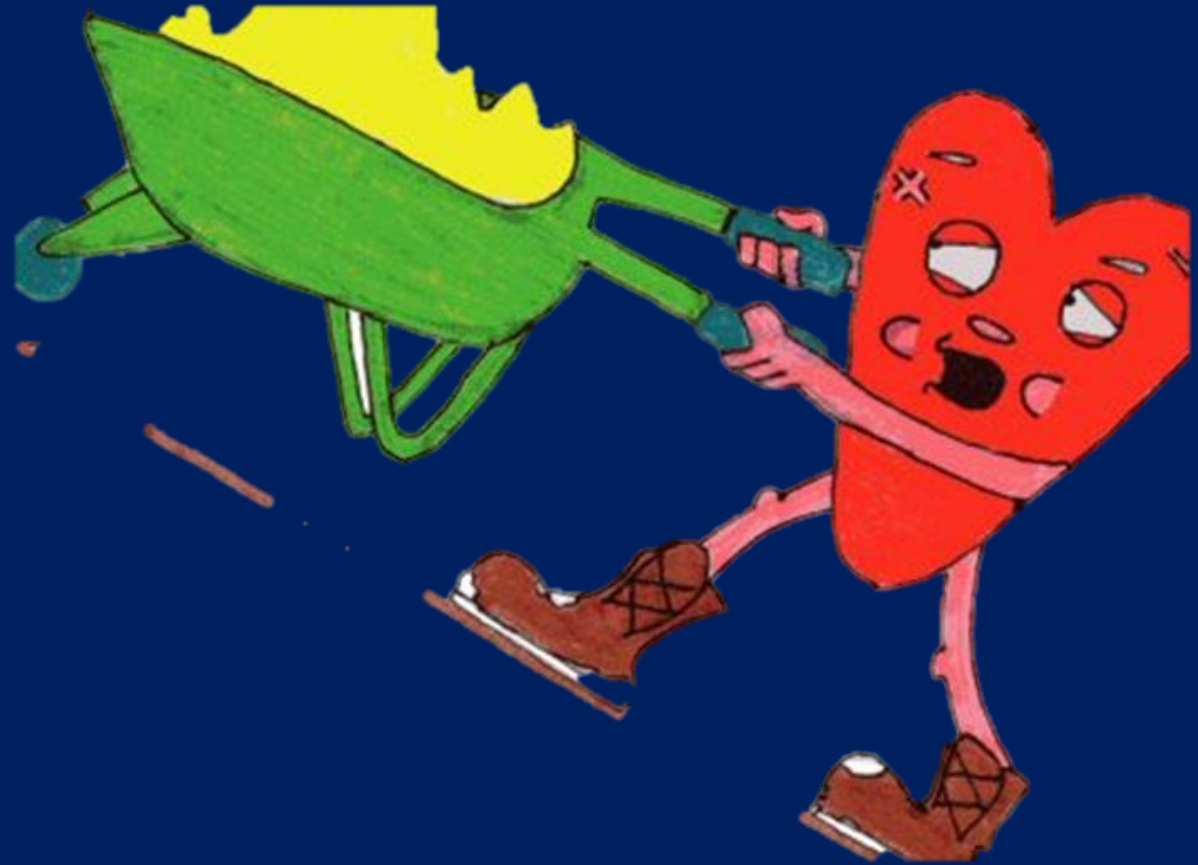
## Determinants of stroke volume



# WHAT IS AFTERLOAD?

Resistance the heart must pump against to eject blood

Determined by vascular resistance + degree of vasoconstriction



Constricted arteries =  $\uparrow$  Resistance

Dilated arteries =  $\downarrow$  afterload =  $\uparrow$  SV



# Determinants of stroke volume

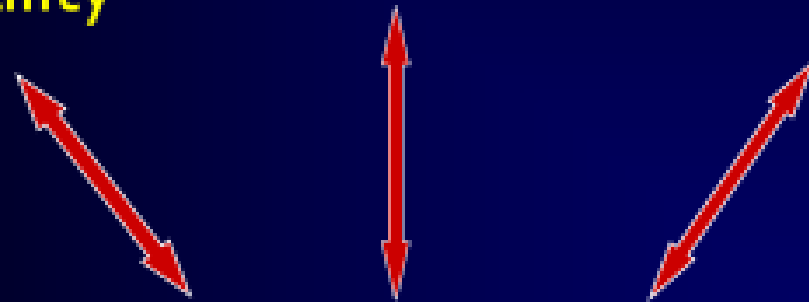


Myocardial  
Contractility

Afterload

Preload

Stroke volume

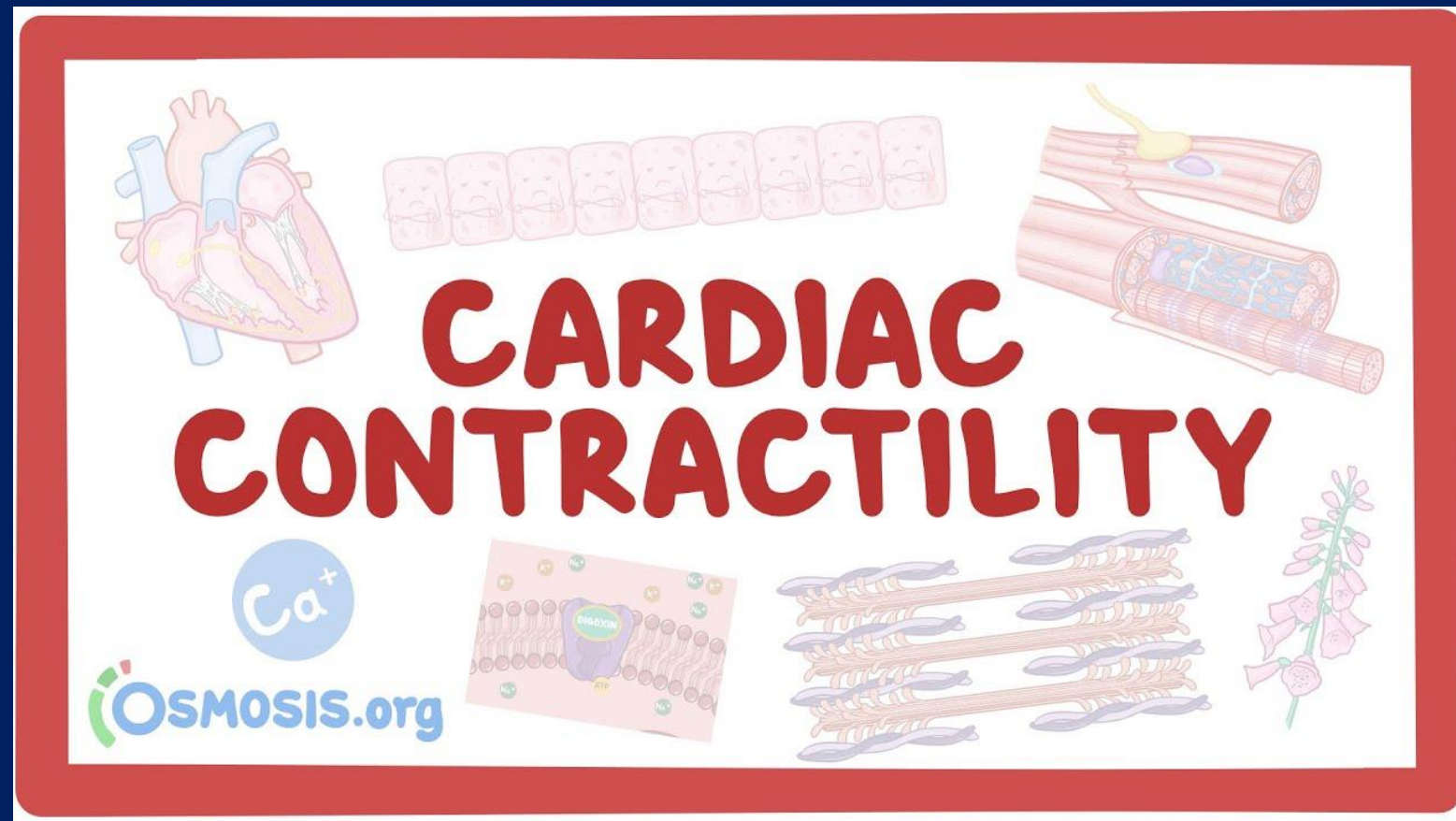


# WHAT DETERMINES CONTRACTILITY?

- Ability of heart to contract (inotropy)
  - Independent of preload and afterload
- SNS activity
- Rate and rhythm of contraction
- Myocardial oxygenation
- Functional myocardium



[https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.crosswalk.com%2Ffaith%2Fbible-study%2Fmeaning-and-significance-of-specific-numbers-in-the-bible.html&psig=AOvVaw22Wx7UL7t7aY42Ks\\_sbRer&ust=1634312929900000&source=images&cd=vfe&ved=0CAwQjhxqFwoTCPD-saugyvMCFQAAAAAAdAAAAABAD](https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.crosswalk.com%2Ffaith%2Fbible-study%2Fmeaning-and-significance-of-specific-numbers-in-the-bible.html&psig=AOvVaw22Wx7UL7t7aY42Ks_sbRer&ust=1634312929900000&source=images&cd=vfe&ved=0CAwQjhxqFwoTCPD-saugyvMCFQAAAAAAdAAAAABAD)



<https://www.youtube.com/watch?v=b6HaCr2Rlaw>

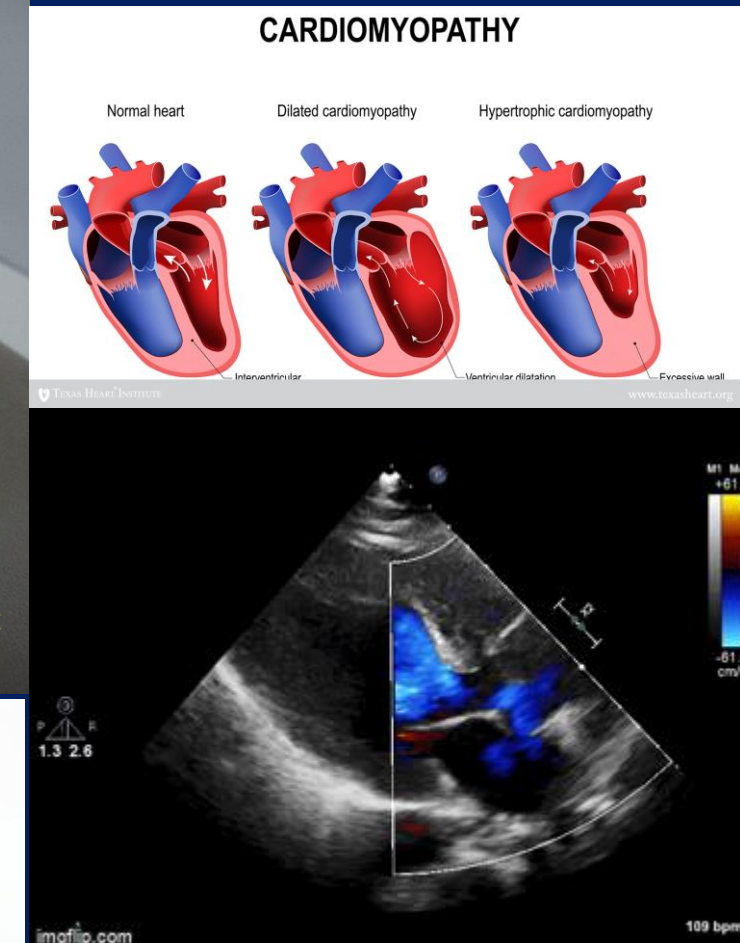
WHAT FACTORS AFFECT  
CONTRACTILITY OF THE  
HEART?

# WHAT INCREASES CONTRACTILITY?

- Inotropes
- Ca Chloride
- Digoxin
- Isuprel



<https://www.texasheart.org/heart-health/heart-information-center/topics/hypertrophic-cardiomyopathy/>



<https://www.swjpcc.com/imaging/2020/10/2/medical-image-of-the-month-severe-left-ventricular-hypertrop.html>

# WHAT DECREASES CONTRACTILITY?



- ventilation/perfusion abnormalities
- occurs in early shock & ↓ contractility
- In late shock it worsens and becomes "malignant" or irreversible because of the low perfusion state

# HYPOXEMIA

# ACIDOSIS

- anaerobic metabolism releases lactate and acids
- decreased renal perfusion
- Myocardial ischemia develops when arterial pressure falls and further decreases contractility
- situation intensifies in patients with pre-existing coronary artery disease

Negative inotropes like  
barbiturates, beta blockers,  
calcium blockers, ganglionic  
blockers, and lidocaine



<https://healthyhumanlife.com/blogs/news/risk-for-electrolyte-imbalance>

# DRUGS, INJURY, ELECTROLYTES

Electrolyte imbalances

Myocardial remodeling (following MI)

# HYPOTENSION IS HOW WE DEFINE SHOCK IN SOP

What  
causes  
low BP?

- Cardiac insufficiency
- Hypovolemia
- Vasodilation (relative hypovolemia seen in distributive or low resistance shocks, vasovagal reactions)
- Dysrhythmias (tachycardia/bradycardia)
- Must always try to detect if CV compromise is due to a rate, rhythm, volume, vascular, or pump problem and treat the inciting cause

Isolated readings are not nearly as important as trends

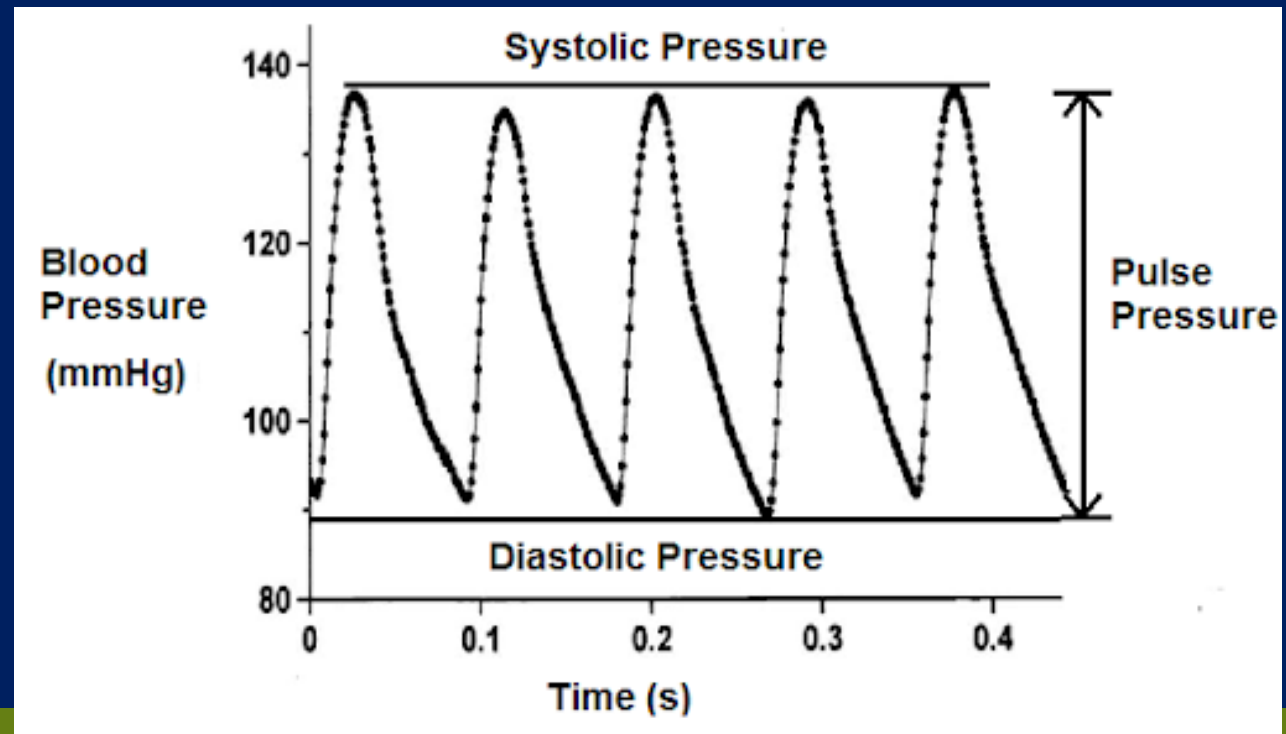
# Abnormal findings:

- Widened pulse pressure: >50 mmHg;
  - Ex: ICP
- Narrowed pulse pressure: <30 mmHg. Indicates ↓CO in the face of peripheral vasoconstriction (compensatory response)
- Tension pneumothorax; cardiac tamponade
- Volume deficit of 15% or greater

# PULSE PRESSURE

- Difference between the systolic & diastolic pressures

*Normal: 30-50 mmHg*





AND NOW A WORD  
FROM OUR SPONSORS



Gallifrey Public Radio

Dr. Jordan's video

# SHOCK IS DISCUSSED BASED ON ETIOLOGY

- Cardiac
- Volume
- Distributive
- Neurogenic
- Obstructive



<https://daily.wordreference.com/2020/01/06/basic-word-of-the-day-shock/>

## Cardiogenic

MI

Cardiomyopathy

End stage valvular conditions

Hypovolemic –trauma

## Distributive

Anaphylaxis

Sepsis

Neurogenic –trauma

Obstructive - trauma

PE

Cardiac tamponade

Pneumothorax

See SOP p. 42

# SCENARIO #1 AND DISCUSSION



<https://my.clevelandclinic.org/departments/ems>

## SCENARIO #2 AND DISCUSSION



<https://my.clevelandclinic.org/departments/ems>



## SCENARIO #3 AND DISCUSSION



<https://my.clevelandclinic.org/departments/ems>

# SCENARIO #4 AND DISCUSSION



<https://my.clevelandclinic.org/departments/ems>



# Checking for Understanding

A PATIENT WITH RECENT HISTORY SUGGESTING INFECTION PRESENTS WITH AN ETCO<sub>2</sub> OF 30 AND QSOFA SCORE ≥2. WHICH OF THESE IS A CLINICAL PRESENTATION THAT DIFFERENTIATES SEPSIS FROM SEPTIC SHOCK?

- A. RR > 22
- B. MAP < 65
- C. Skin mottling
- D. HR between 100-110





WHICH OF THESE IS INDICATED FOR A PT IN CARDIOGENIC SHOCK WITH RESPIRATORY FAILURE AND CRACKLES?

- A. Nitroglycerine 0.4 mg SL
- B. O<sub>2</sub> / C-PAP at 5 cm PEEP
- C. 0.9% NS IVF in 200 mL increments
- D. Norepinephrine 8 mcg/min (2mL/min)



WHICH OF THESE SUGGEST A CLASS II  
HEMORRHAGE WITH A VOLUME LOSS OF 15-30%?

- A. HR 110
- B. RR > 35
- C. BP 90/70
- D. Lethargy, coma



# WHAT SHOULD A PARAMEDIC SUSPECT WHEN THE PATIENT'S MAP IS <60 MMHG?

- A. Cerebral perfusion pressure is too high
- B. Coronary artery perfusion will be inadequate
- C. High aortic root pressures may cause a valve prolapse
- D. The patient's cardiac output will be optimal due to pressures WNL





# WHICH OF THESE SIGNALS THE TRANSITION FROM COMPENSATED TO DECOMPENSATED SHOCK?

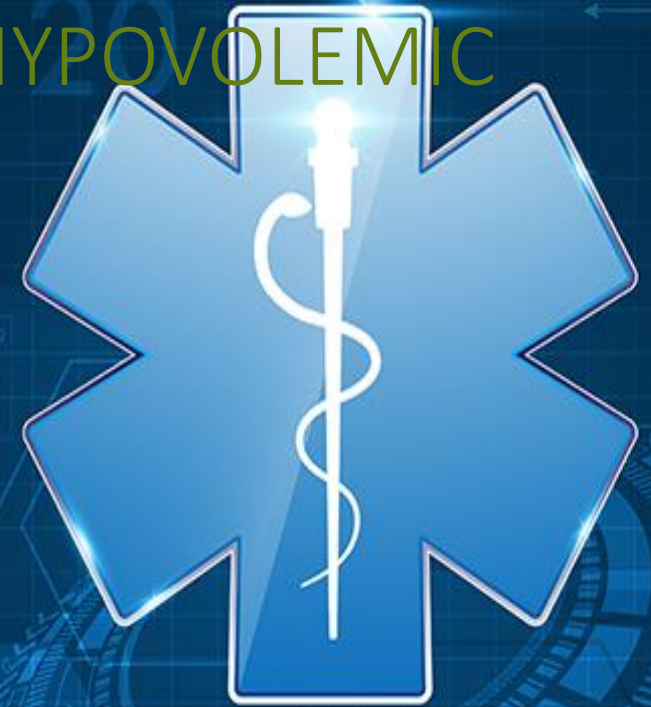
- A. Dilated pupils
- B. Heart rate > 110
- C. Systolic BP less than 100
- D. C/O feeling cold and shivering





WHICH OF THESE IS THE EARLIEST CLINICAL SIGN THAT THE BODY IS CHEMICALLY COMPENSATING FOR AN INCREASE IN ACID BYPRODUCTS DUE TO HYPOVOLEMIC SHOCK?

- A. Cyanosis
- B. Cool, pale extremities
- C. Narrowed pulse pressure
- D. Increased ventilatory rate and depth



# WHICH OF THESE CAN CAUSE OBSTRUCTIVE SHOCK?

- A. LV hypertrophy
- B. Arteriosclerosis
- C. Cardiac tamponade
- D. Systemic histamine release



WHICH OF THESE IS ACCURATE REGARDING ELDERLY PATIENTS IN SHOCK AND MAY BE HELPFUL WHEN INTERPRETING THE SEVERITY OF THEIR CLINICAL PRESENTATION?

- A. Medications may prevent expected tachycardia from volume losses
- B. Existing HTN will allow the BP to compensate as well as other healthy adults
- C. Estimate acuity on their mental status as all baseline VS will likely be abnormal
- D. Increased reserves in all systems allow them to compensate for a long time before crashing





NOW THAT  
WAS A HAIR  
RAISING  
EXPERIENCE



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