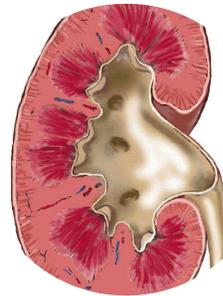


# PCCN & CCRN CERTIFICATION REVIEW COURSE

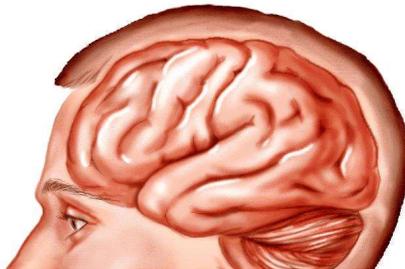
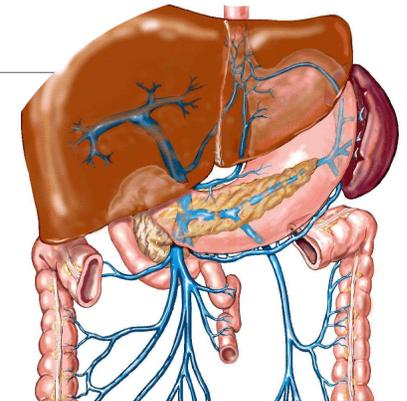
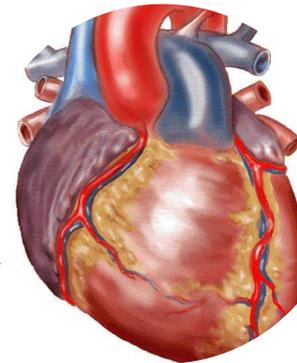


**BETH POPPAS, MSN, RN,  
CCRN, PCCN, NPD-BC, GERO-BC, CNECL, CV-BC**

**CLINICAL NURSE EDUCATOR  
ARLINGTON, VIRGINIA**

**[BETH.POPPAS@OUTLOOK.COM](mailto:BETH.POPPAS@OUTLOOK.COM)**

**703-568-3270**



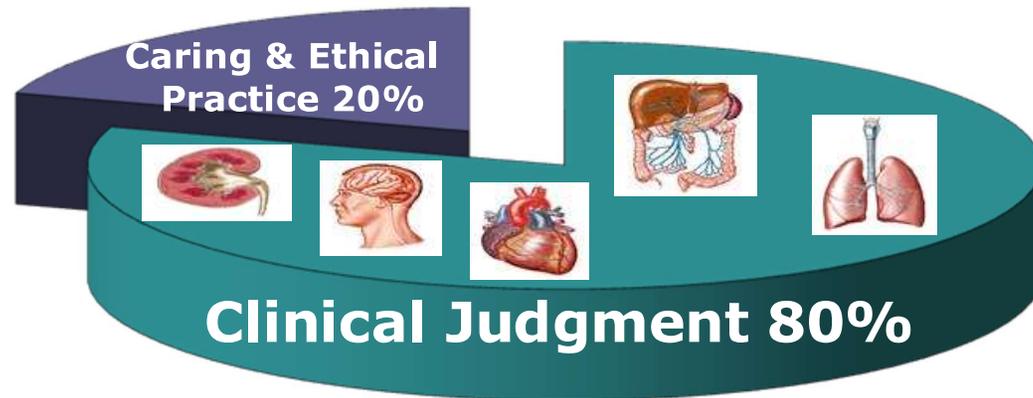
# Exam Blueprint

150 Questions

Time limit: 3 hours

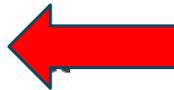
**HAVE TO ANSWER ALL  
QUESTIONS**

**AACN.ORG**



# of CRITICAL-CARE NURSES

Education Nursing Excellence **Certification**



Overview

Get Certified



Verify Certification

Preparation Tools & Handbooks

Renew Certification

Advanced Practice

## CCRN (Adult)

Direct Care Pathway

Acute/Critical Care Nursing

- For RNs or APRNs providing direct care to acutely/critically ill adult patients
- Eligibility based on verifiable clinical practice hours and current, unencumbered U.S. RN or APRN license
- Role(s): bedside nurse, APRN, educator, preceptor, manager

## CCRN (Adult)

Knowledge Professional Pathway

## CCRN (Adult)

Tele-critical Care Pathway

TeleICU Acute/Critical Care Nursing

## AACN Members

\$255

## Nonmembers

\$370

## PCCN (Adult)

Direct Care Pathway

Progressive Care Nursing

- For RNs or APRNs providing direct care to acutely ill adult patients
- Eligibility based on verifiable clinical practice hours and current unencumbered U.S. RN or APRN license
- Role(s): bedside nurse, APRN, educator, manager, preceptor

## PCCN (Adult)

Knowledge Professional Pathway

### Two-Year Option

Practice as an RN or APRN for 1,750 hours in direct care of **acutely/critically ill** adult patients during the previous two years, with 875 of those hours accrued in the most recent year preceding application

OR

### Five-Year Option

Practice as an RN or APRN during the previous five years with a minimum of 2,000 hours in direct care of **acutely/critically ill** adult patients, with 144 of those hours accrued in the most recent year preceding application

**Each exam has its own handbook**

#### CCRN Exam Handbook

##### Direct Care Pathway

- Detailed Eligibility Requirements
- Test Plan/Testable Nursing Actions
- Sample Questions
- Products for CCRN Exam Preparation

#### Exam Policy Handbook

- Exam Rescheduling and Cancellation
- What to Expect on the Day of Your Exam
- Name and Address Changes
- Code of Ethics/Upholding the Value of Certification

## Testing Options

Two computer-based options by which to take your exam are offered – at a testing center or via live remote proctoring. At the time of your exam scheduling, you will be asked to choose one of these options. Please review the following to assess which option will best meet your needs.

### ▶ Testing Center

Exams are administered by AACN's testing service partner, PSI, at more than 300 locations across the U.S. To locate the testing center nearest you, please explore [PSI's Testing Center Map](#). For details, check out this [PSI Testing Center Experience](#) video.

Discounted pricing for computer-based testing is available to groups of 10 or more who submit their applications together; for information, visit [www.aacn.org/certdiscounts](http://www.aacn.org/certdiscounts).

For additional information about what to expect on your exam day, refer to [pages 13 and 14](#).

### ▶ Live Remote Proctoring (LRP)

Secure live remote proctoring (LRP) allows you to take your exam from your own computer/desk in a quiet and private location, such as your home office. The location must be free from distractions, and your computer must meet specific compatibility requirements. Please carefully review the following information to determine if a remote proctored exam is right for you. For details, check out PSI's [Remote Proctored Exam Experience](#) video.

# CCRN & PCCN Exam Statistics

2023

Exam	Candidates Tested	First Time Pass Rate	Total Certificants	Renewed	Total Failed	New Certificants
CCRN (Adult)	17,279	81.20%	92,725	18,666	5,585	11,765
PCCN	3,477	70.30%	20,930	4,340	1,436	2,014

Previous Version

# CCRN & PCCN Exam Statistics

Exam	Total # of Items on Exam	# of Scored Items on Exam	Passing (Cut) Score	Score	Effective Date
CCRN (Adult)	150	125	83	66.4%	03/25/2020
PCCN	150	125	82	65.6%	01/31/2024

### **Handbooks With Test Plan**

Document featuring the test plan, testing/policy details, sample questions, bibliography and more

[More ▶](#)

### **Practice Questions**

Practice questions aligned with current test plans, including correct answer rationales

[More ▶](#)

### **Practice Exams**

Online practice exams providing realistic test experience and offering correct answer rationales and exam scores

[More ▶](#)

### **Review Courses**

In-depth certification reviews presented by national experts, with CE available upon completion

[More ▶](#)

### **Bookstore Resources**

A rich array of clinical references and products to assist you in preparing for certification

### **Testing Information**

Details about testing options, exam scheduling, ADA accommodations and exam day experience

### **Schedule of Events**

Find local programs and events, including regional certification reviews

### **Continuing Education**

Access and track a wide variety of CE/CERP activities for certification renewal

## **Additional Resources for Study**

	Free Trial	Basic	Premium
Days of Access	7-day Access	30-day Access	180-day Access
Features	<ul style="list-style-type: none"> <li>• 30 questions with correct answer rationales</li> <li>• Exam scores</li> </ul>	<ul style="list-style-type: none"> <li>• 150 questions with correct answer rationales</li> <li>• Printable practice questions, answers and rationales</li> <li>• Exam scores</li> </ul>	<ul style="list-style-type: none"> <li>• Hundreds of questions with correct answer rationales</li> <li>• Content-area exams</li> <li>• Printable practice questions, answers and rationales</li> <li>• Exam scores</li> <li>• New questions added regularly</li> </ul>
Price	Free One-Time Trial	<b>\$30 Member</b> \$35 Nonmember	<b>\$70 Member</b> \$80 Nonmember

# Certification

## Exam

## Tips

Look for key points such as age, medical diagnosis, time frame, and comorbidity.

Look for key words such as: except, always, first, and best

Thoroughly read each question and all choices before answering

All information needed to answer each question is always provided; never assume information that is not given

Answer the easy questions first; flag the questions left unanswered and return to them later

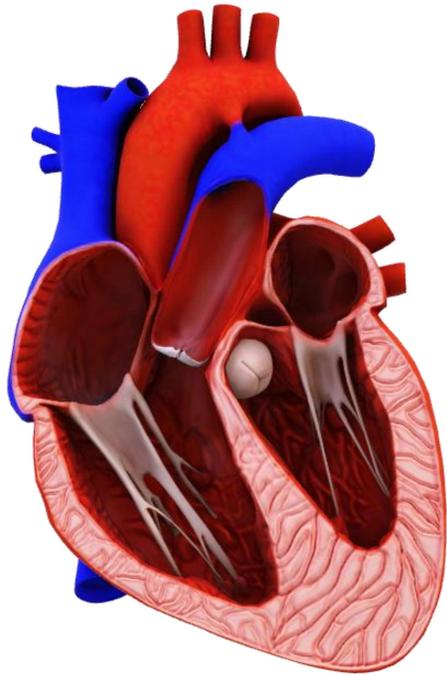
Answer **ALL** questions

**TRUST YOURSELF!**

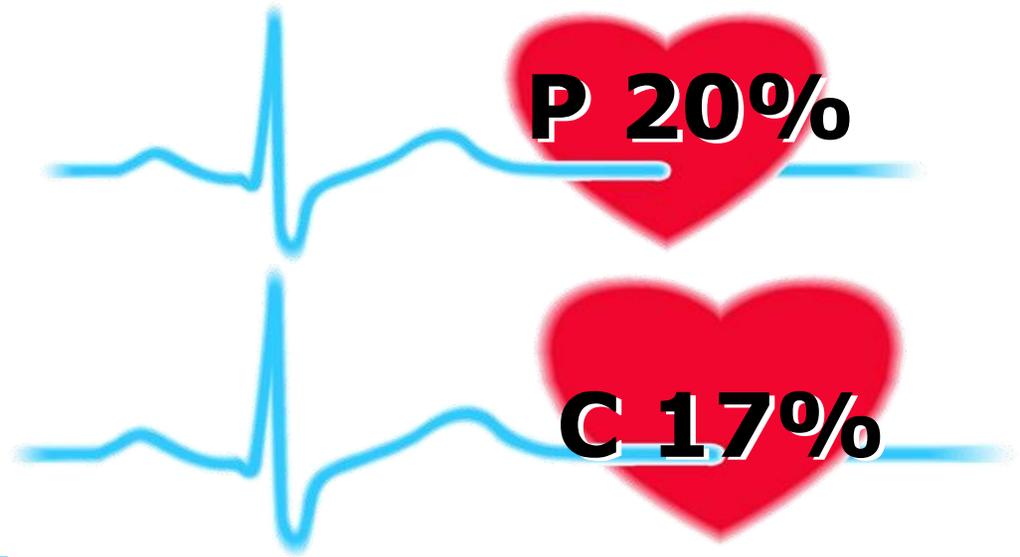
# Combo Day 1 Schedule

<b>0800-0920</b>	<b>PCCN CCRN Exams &amp; Test Construction Cardiovascular</b>
<b>0920-0930</b>	<b>Break</b>
<b>0930-1035</b>	<b>Cardiovascular Continued</b>
<b>1035-1045</b>	<b>Break</b>
<b>1045-1200</b>	<b>Cardiovascular Continued</b>
<b>1200-1230</b>	<b>Lunch</b>
<b>1230-1345</b>	<b>Multisystem</b>
<b>1345-1355</b>	<b>Break</b>
<b>1355-1455</b>	<b>General Medical Content: Endocrine, Heme, Renal &amp; GI</b>
<b>1455-1505</b>	<b>Break</b>
<b>1505-1600</b>	<b>General Medical</b>

# Introduction

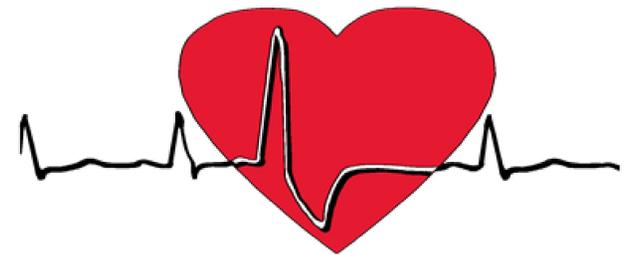


## Cardiac



# CV Blueprint

- ♥ **Structural Heart Defects**
- ♥ **Heart Failure**
- ♥ **Cardiomyopathy**
- ♥ **ACS**
- ♥ **Cardiac Pharmacology**
- ♥ **Cardiac Complications**
- ♥ **Vascular Disease/Inflammatory Disease**
- ♥ **Valvular Heart Disease**
- ♥ **Dysrhythmias**
- ♥ **Hemodynamic Monitoring/Trauma**



**CCRN Only**

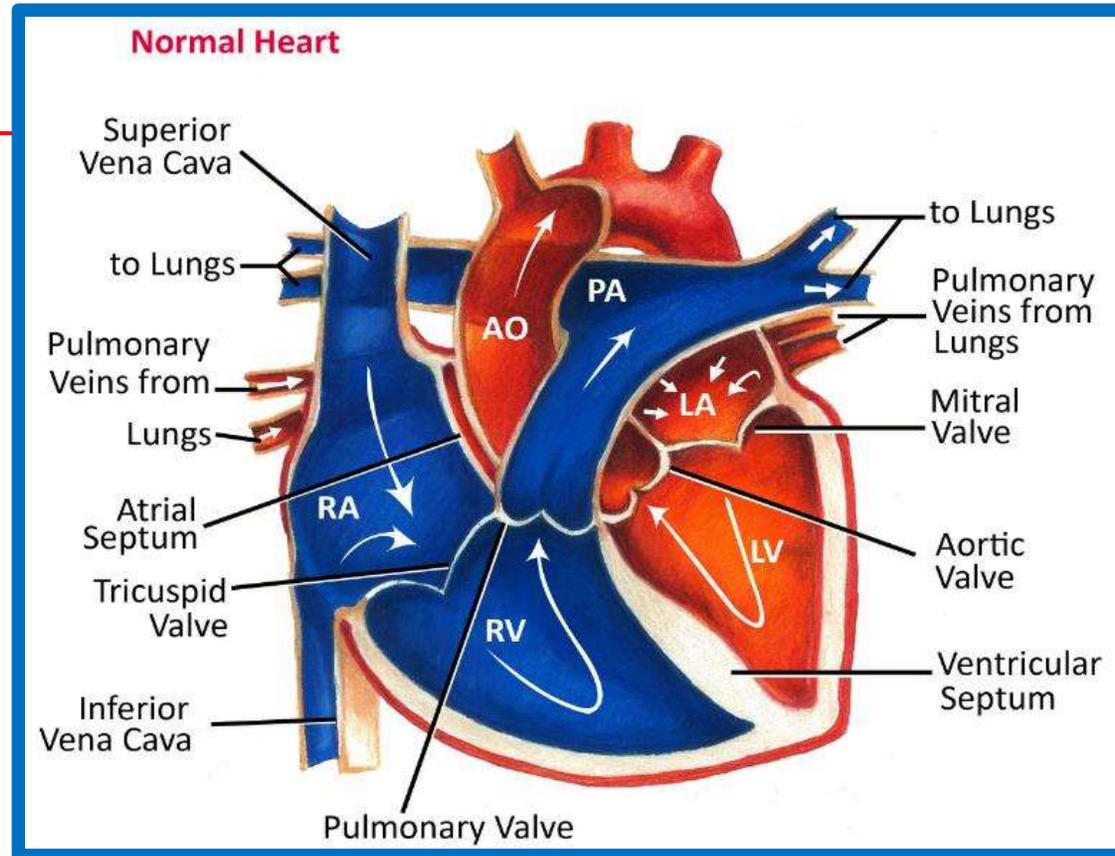
# CCRN Testable Actions

- **Cardiac rhythms: 12 lead, etc.**
- **Manage patients with:**
  - **Arterial catheter**
  - **Cardiac catheterization/PCI**
  - **Defibrillation/Cardioversion**
  - **Invasive hemodynamic monitoring**
  - **IABP**
  - **Pacing**
  - **ST & QT segment monitoring**
  - **Endovascular stenting**

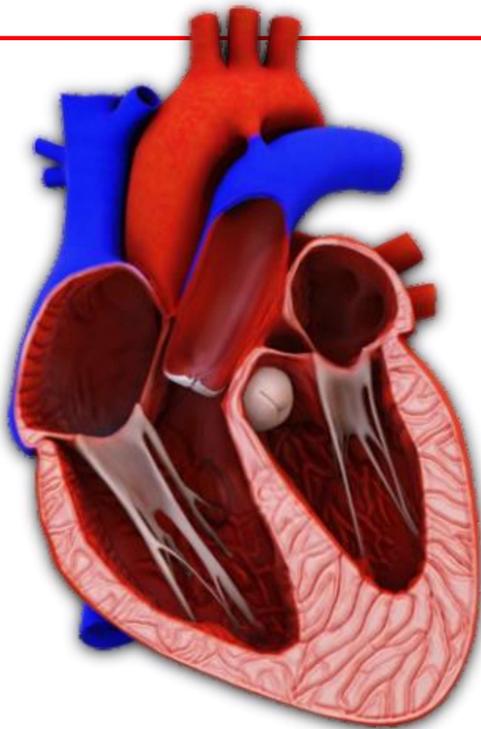
# PCCN Testable Actions

- Cardiac rhythms: 12 lead, etc.
- Manage patients with:
  - Ablation
  - Arterial closure devices
  - Arterial/venous sheaths
  - Cardiac catheterization/PCI
  - Defibrillation/Cardioversion
  - **Non-invasive hemodynamic monitoring**
  - **CVP/Arterial lines**
  - TEE
  - Ventricular assist devices
  - Pacing
  - ST & QT segment monitoring
  - **Titrate: Dobutamine, Dopamine, Nitroglycerine**

# Cardiac Function Anatomy



# Cardiac Function Anatomy



## During Atrial Contraction:

**AV Valves Open**  
**Semilunar Valves Closed**

## During Ventricular Contraction:

**AV Valves Closed**  
**Semilunar Valves Open**

# Comparing the 3rd and 4th heart sounds

LearnTheHeart.com

<b>S3 - "ventricular gallop"</b>	<b>S4 - "atrial gallop"</b>
Occurs in early diastole	Occurs in late diastole
Occurs during passive LV filling	Occurs during active LV filling
May be normal at times	Almost always abnormal
Requires a very compliant LV	Requires a non-compliant LV
Can be a sign of systolic CHF	Can be a sign of diastolic CHF

# Additional Assessment Concerns



**Geriatric:** Polypharmacy could mask cardiac compensatory symptoms

Challenges: Fear of caring for themselves after MI & additional chronic health problems



**Females:**

May **not** have typical chest pain

More likely to experience “feeling funny”

High risk for underdiagnosis

Black women have higher occurrence of comorbidities

Stress and depression are prevalent among women after MI

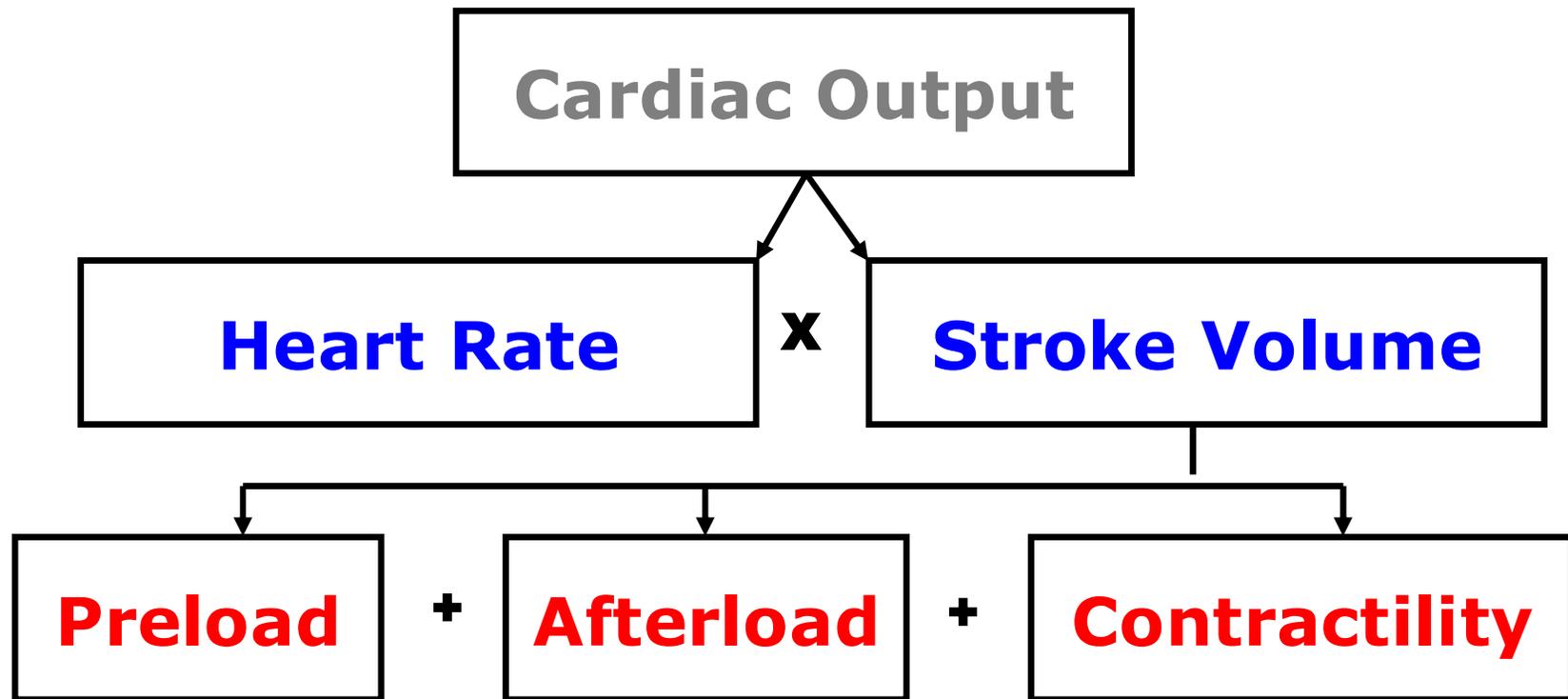


**Racial and Ethnic disparities-**

Less likely to be treated urgently- may lead to worse outcomes.

Cultural competency training necessary to address health disparities.

# Cardiac Physiology



## Factors Affecting Preload

Measured with:

**CVP**  
(2-8 mmHg)

**PAOP**  
(8-12 mmHg)

**Heart rate**

**Atrial contraction**

**Venous pressure**

Blood Volume  
Venous Return

**Valve resistance**

**Compliance of ventricles**

## Factors Affecting Afterload

Measured with:

**PVR**

**100-250 dynes-s/cm**

**SVR**

**800-1200 dynes-s/cm**



**Right ventricle**

**Pulmonary pressure**



**Left ventricle**

**Aortic pressure**  
**Systemic vascular resistance**



**Valve resistance**

# Factors Affecting Contractility



**Decreased:**

**Parasympathetic stimulation**

**Negative inotropes**

**Metabolic states**



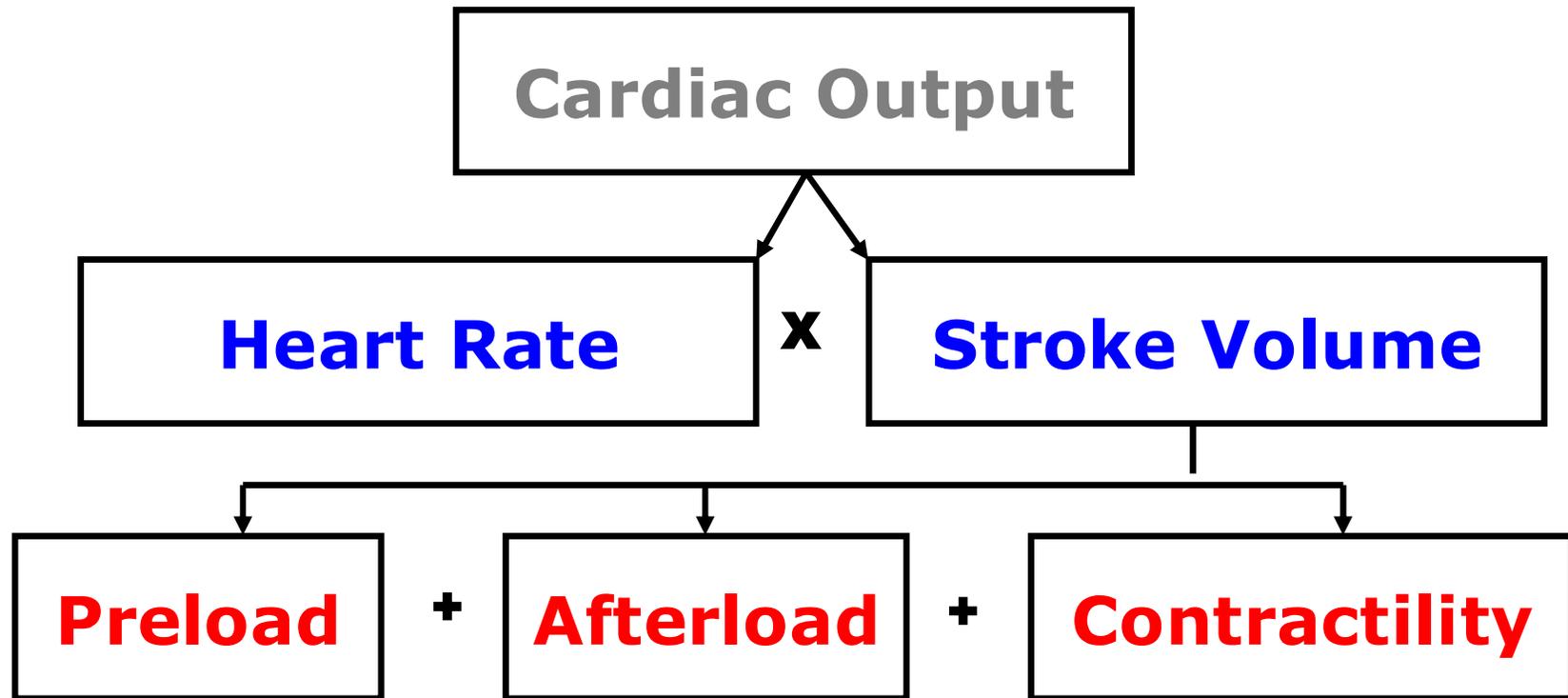
**Increased:**

**Sympathetic stimulation**

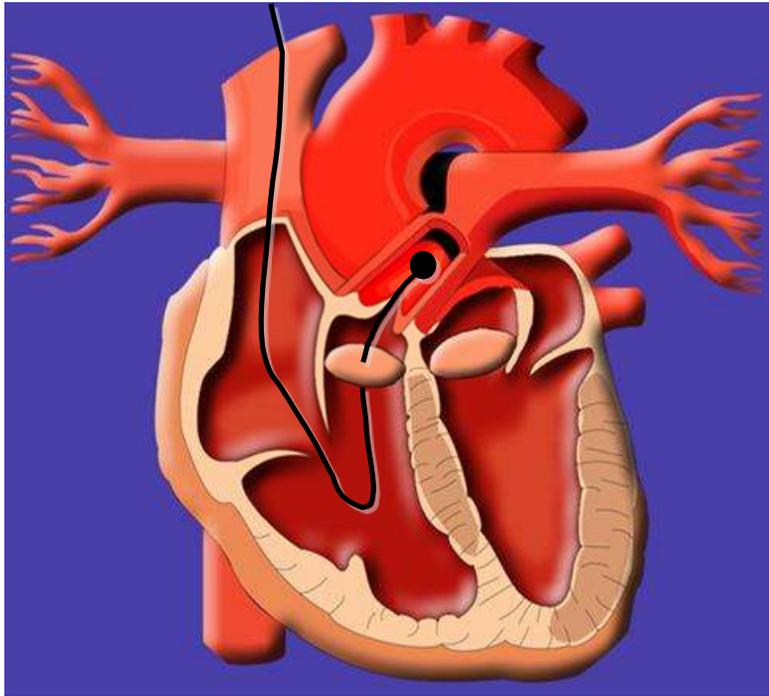
**Positive inotropes**

**Metabolic states**

# Cardiac Physiology



# Hemodynamic Monitoring

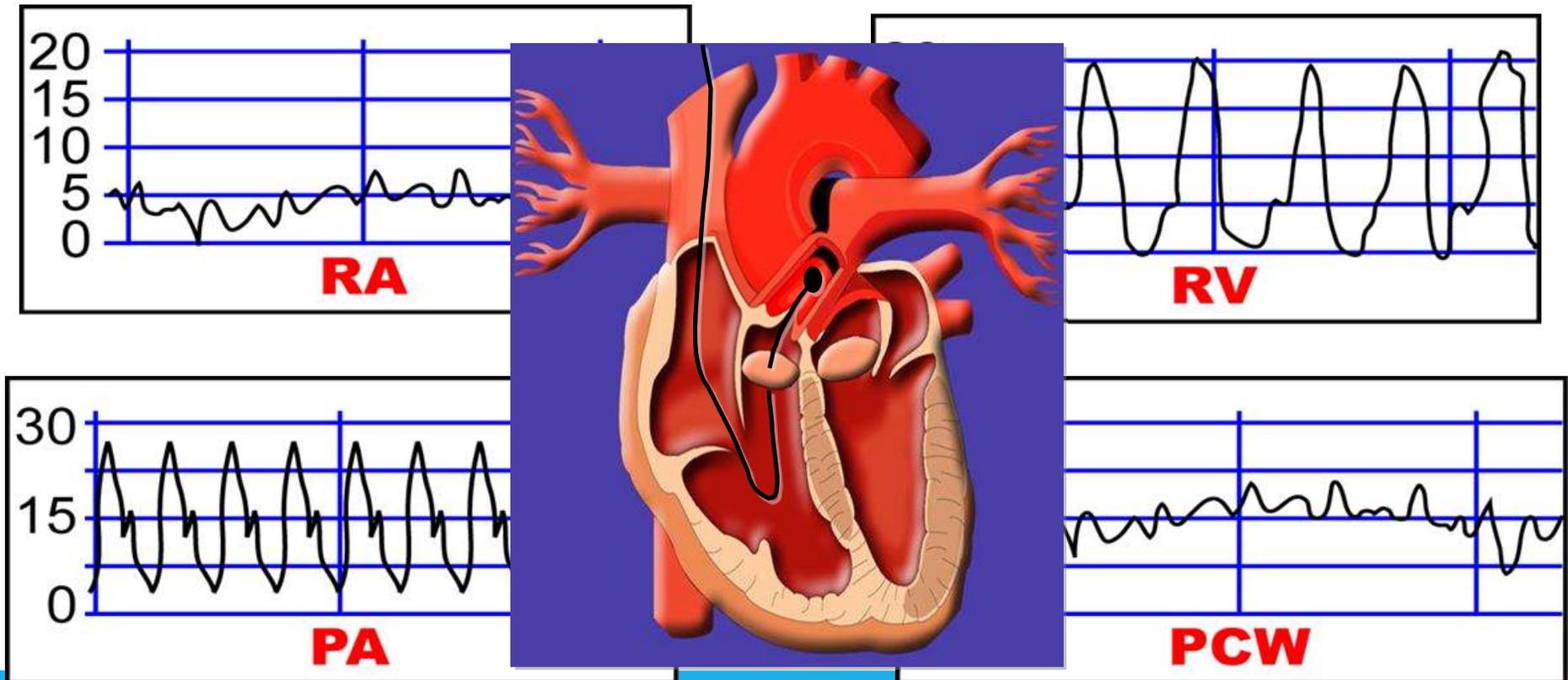


<https://www.edwards.com/gb/devices/Hemodynamic-Monitoring/swan-ganz-catheters>

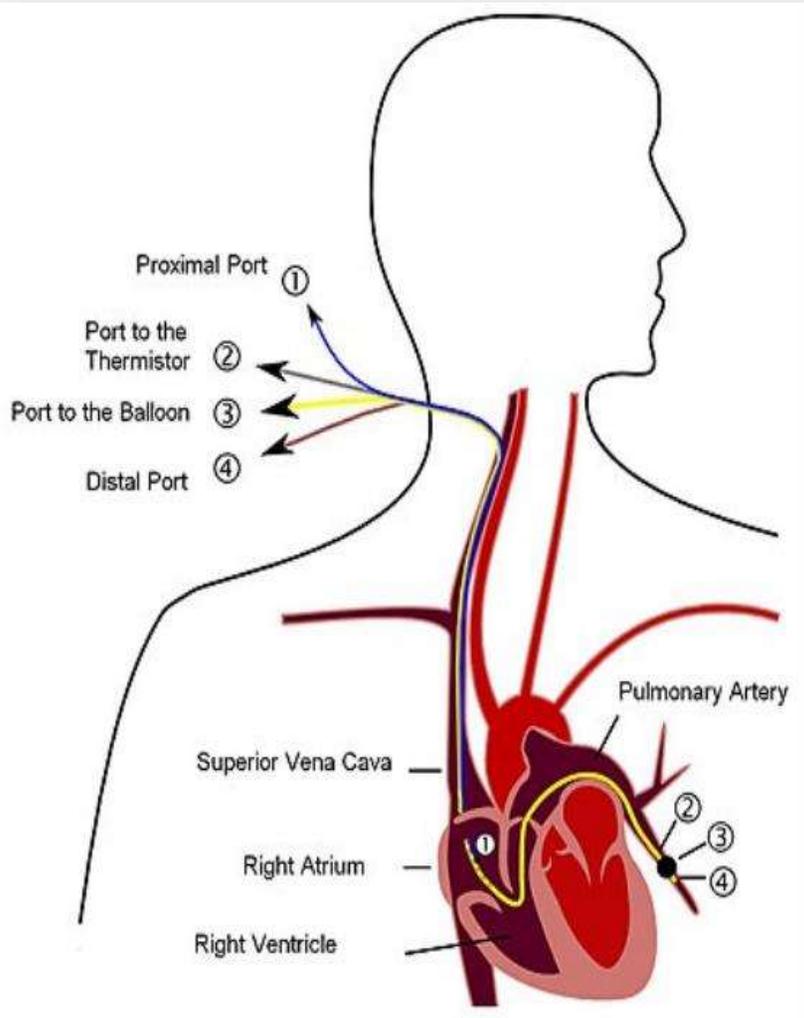
**CCRN ONLY**

# Hemodynamic Monitoring

CCRN ONLY



# PA Catheter: Potential Insertion Complications



Arrhythmia  
(ventricular  
tachycardia)\*

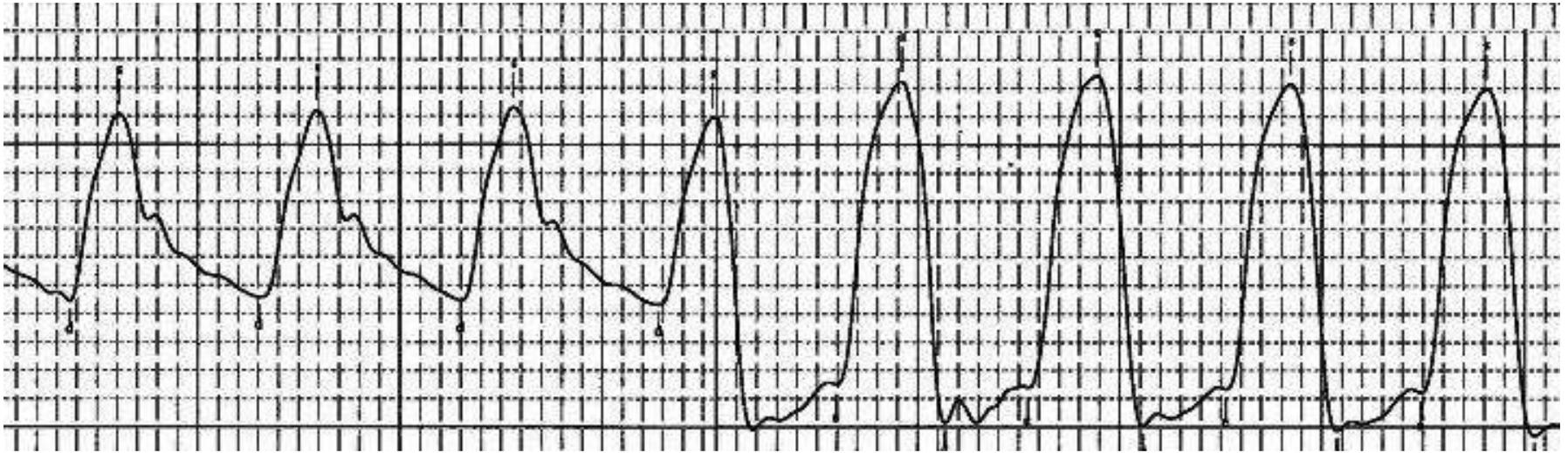
New right  
bundle branch  
block

Pneumothorax  
or hemothorax

Pulmonary  
artery rupture

Valvular trauma  
to tricuspid or  
pulmonic valve

Air embolism



# Hemodynamic Monitoring

## Additional Options

---

### **Less-invasive hemodynamic monitoring**

- Peripheral arterial/venous catheters with additional technology (pulse-wave contour analysis)
- Esophageal Doppler

### **Non-invasive hemodynamic monitoring**

- Photoplethysmography
- Thoracic Electric Bioimpedance

**Gold standard is  
invasive  
monitoring**

**Non-invasive has  
most research in  
surgical  
populations**

# Acute Heart Failure



**Abrupt inability to meet tissue demands**

**Often occurs without sufficient time for activation of compensatory mechanisms**

# Causes

**Organic  
or  
Systemic Problem**

**New Event  
or  
Progression  
of Pre-Existing  
Failure**

**Cardiac Anatomical**

**Cardiac Physiological**

**Non-Cardiac**

**Mechanism  
of  
Failure**

**Drop in CO → Drop in EF**

**↑ EDV → Fiber Stretch of  
Ventricles**

**Initial  
Adaptation  
to  
Low CO**

**↑ Contractility**

**Activation of Neurohormonal  
System**

**Mechanism  
of  
Failure**



**HR**

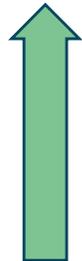
**Contractility**

**Vasoconstriction**

**Na<sup>+</sup> & H<sub>2</sub>O Retention**

**Adrenergic  
System**

**Activation of  
Neurohormonal  
System**



**CO**

**BP**

**Renin- Angiotensin-  
Aldosterone System**



**Mechanism  
of  
Failure**

**Progressive  
Heart  
Failure**

 **Demand**

 **Function**

**Continued activation of SNS**

 **Afterload**

**Release of ANP & BNP**

**Release of Cytokines**

**Cardiac  
Hypertrophy/Remodeling**

**Reflex response of  
Baroreceptors & Stretch  
Receptors**

# Classifications of Heart Failure

- **Right vs. Left**
- **Systolic: Reduced EF (HFrEF)**
- **Diastolic: Preserved EF (HFpEF)**
- **High-Output vs. Low-Output**
- **Compensated vs Decompensated**
- **NYHA Classifications of CHF**
- **ACC/AHA Evolution & Progression Classification System**

# Right Heart Failure



**S/S of Hepatic congestion**



**Dependent edema**



**Ascites**



**Increased R sided heart pressures**



**S3- early sign**



**S4- may also hear**



**Pansystolic murmur LLSB- stretching of tricuspid ring**

# Left Heart Failure

**S/S of Pulmonary Congestion**

**Pulmonary edema**

**Atrial Arrhythmias due to Atrial distention**

**Pulsus Alternans**

**Dyspnea/Cough**

**S3, occasionally S4**

**Pansystolic murmur at apex- mitral regurgitation**

**Heart Failure**  
with **Reduced** Ejection Fraction  
(**HFrEF**)

“**Pumping problem**”

**Systolic** heart failure

LV EF  $\leq 40\%$

Impaired contractility

Increased chamber volume

Dilated ventricle with thin wall

**Heart Failure**  
with **Preserved** Ejection Fraction  
(**HFpEF**)

“**Filling problem**”

**Diastolic** heart failure

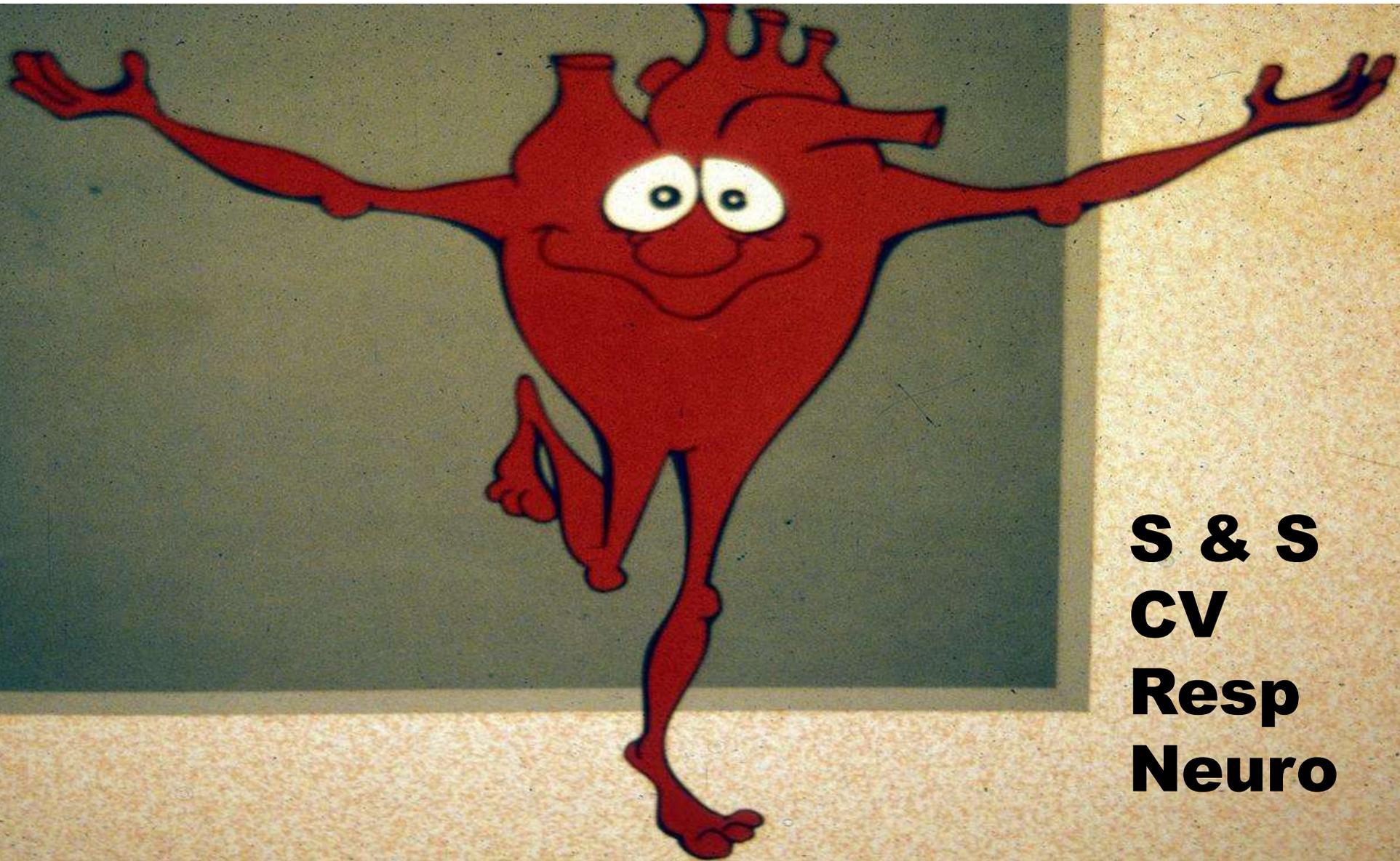
LV EF  $\geq 50\%$

Increased filling pressures

Ventricular hypertrophy, less compliant

**Heart Failure**  
**Borderline** Ejection Fraction  
(**HFbEF**)

LV EF 41-49%



**S & S**  
**CV**  
**Resp**  
**Neuro**

1. A patient presents with dizziness & a "racing heart." Assessment reveals A-fib at 141b/min, JVD, & bilateral peripheral edema. These symptoms would be consistent with:

A. Right ventricular failure

B. Left ventricular failure

C. Congestive heart failure

D. Diastolic heart failure

2. A patient c/o chest pain. The nurse assesses them to be tachycardic at 127/min, SOB with SpO<sub>2</sub> 87%, diaphoretic & nauseated.

The nurse should anticipate:

- A. Chest Xray, IV fluids, Albuterol breathing treatment
  - B. Put HOB flat, 4L O<sub>2</sub> via nasal cannula, obtain cardiac markers
  - C. O<sub>2</sub> 4L via nasal cannula, Morphine and NTG IV, Aspirin chewed
  - D. Heparin IV gtt, HOB elevated, spiral CT scan
- 

3. An elderly diabetic female c/o of nausea & "gen weakness." The RN gets a 12 lead which reveals 3mm ST segment (J point) elevation in leads II, III & AVF. After informing the team & preparing for transport to the cath lab, the RN monitors closely for:

- A. Bradycardia and heart blocks
  - B. A-Flutter with a Rapid Vent Response
  - C. Torsades de Pointes
  - D. Pulseless Electrical Activity (PEA)
- 

4. The nurse is caring for an ICU patient who has a PA catheter. When using passive leg raise to assess the patient's potential fluid responsiveness, the nurse knows that the patient would benefit from more volume administration when the:

- A. Stroke volume improves
  - B. Heart rate goes up
  - C. Blood pressure goes down
  - D. Pulse pressure widens
- 

# Passive Leg Raise Maneuver (PLR)

*“Fluid challenge  
without the  
fluid”*

- Moving the patient from HOB elevated to torso flat position with legs elevated 30-45 degrees
- Autotransfusion approx. 300-500 ml of blood from LE into central circulation
- Reversible as soon as legs are lowered
- Primary outcome: Change in SV or CO
- May be used with:
  - Arrhythmias
  - Patients spontaneously breathing
  - Mechanical ventilation

# **Heart Failure**

## **Goals of Management**

- 1. Prevent &/or Reverse Cause of Failure**
  - Revascularization**
  - Surgically Repair Anatomical Problem**
  - Treat: CAD, HTN, Dysrhythmia, DM**

# Heart Failure

## Goals of Management

### **2. Pharmacological Treatments are the Major Modalities**

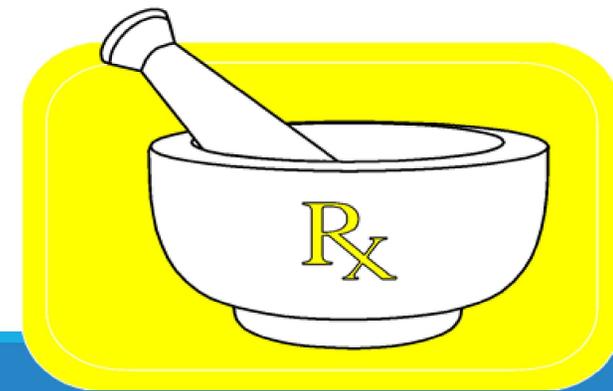
#### **♥ Vasodilators**

- **ACE Inhibitors**
- **Angiotensin-receptor blockers (ARBs)**
- **Angiotensin receptor/Neprilysin inhibitor (ARNI)**

#### **♥ Diuretics**

#### **♥ Positive Inotropes**

#### **♥ Negative Inotropes**



# Heart Failure Goals of Management

## **3. Decrease Demands**

♥ **IABP, Impella**

♥ **VAD**

✓ **Recover/Rest: S/P Cardiectomy or AMI**

✓ **Bridge to Transplant**

✓ **Permanent Support**

# **Heart Failure Goals of Management**

## **4. Decrease Ectopy &/or Maintain Electrical Stability**

- ♥ Approx. 1/2 of HF Deaths Occur Suddenly**
- ♥ Oral Antidysrhythmic Agents**
- ♥ Pacemakers**
- ♥ Implantable Cardioverter Defibrillator**

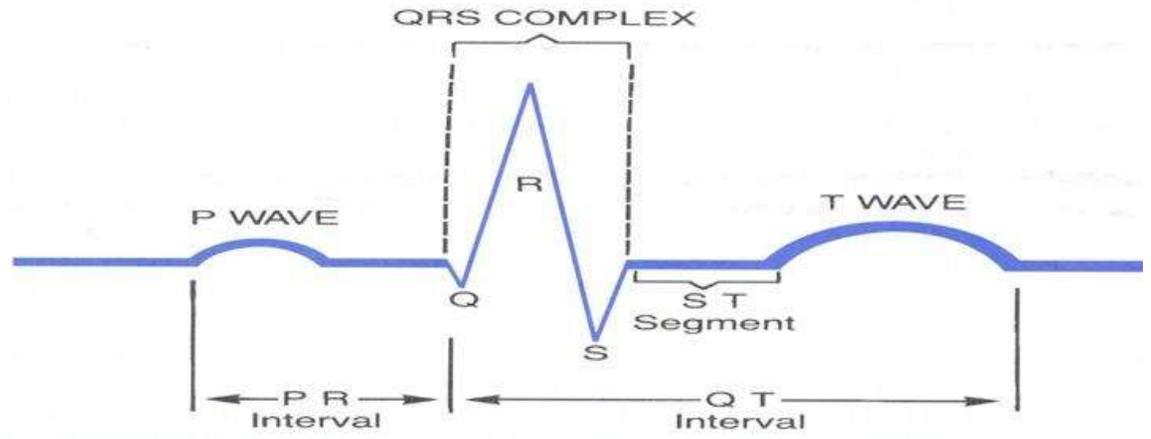
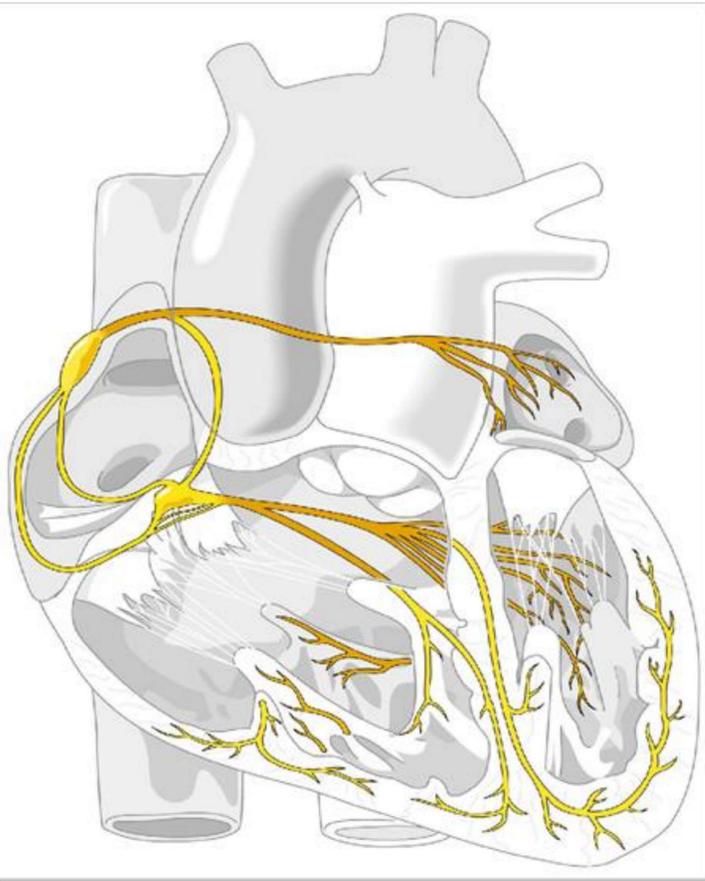
# Heart Failure Goals of Management

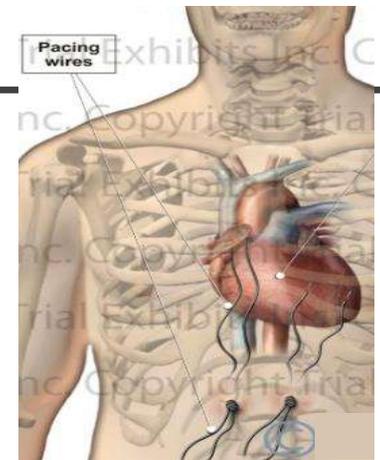
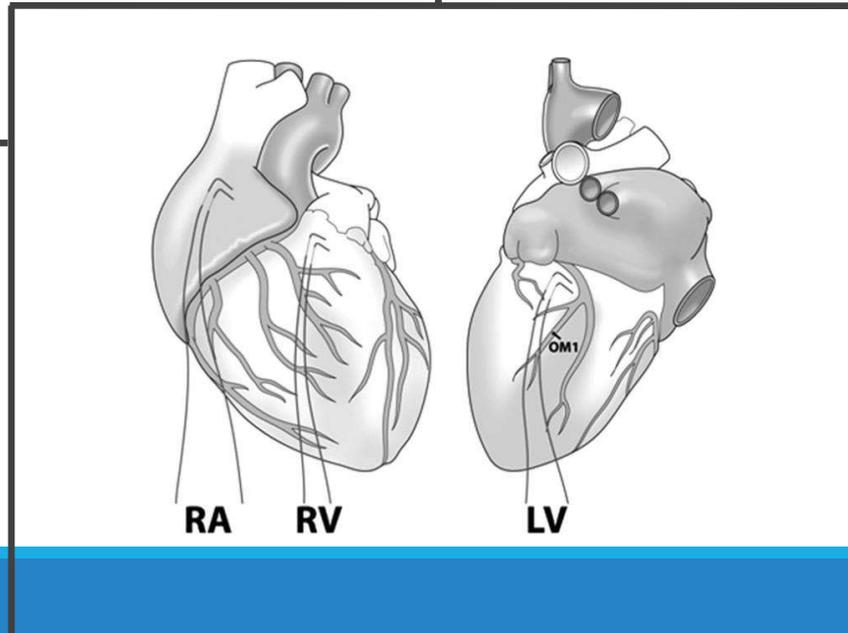
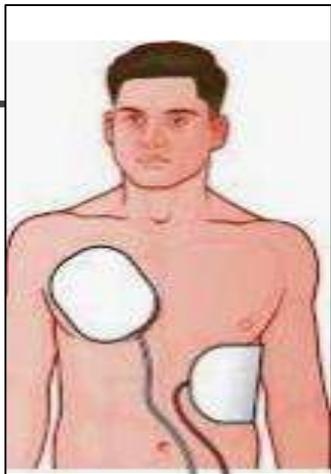
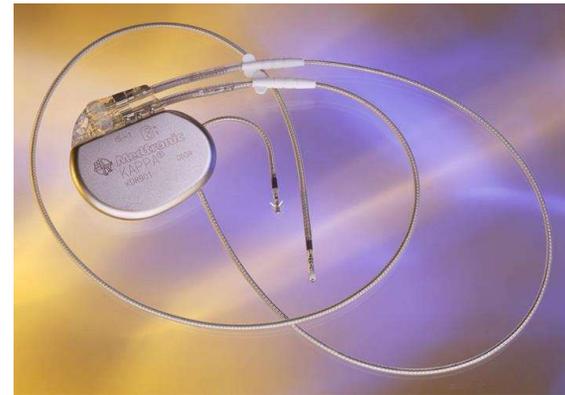
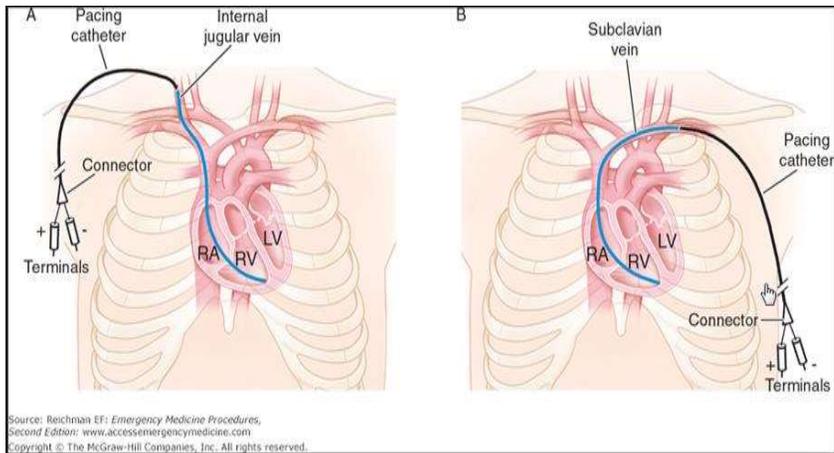
## **5. Goals of Therapy**

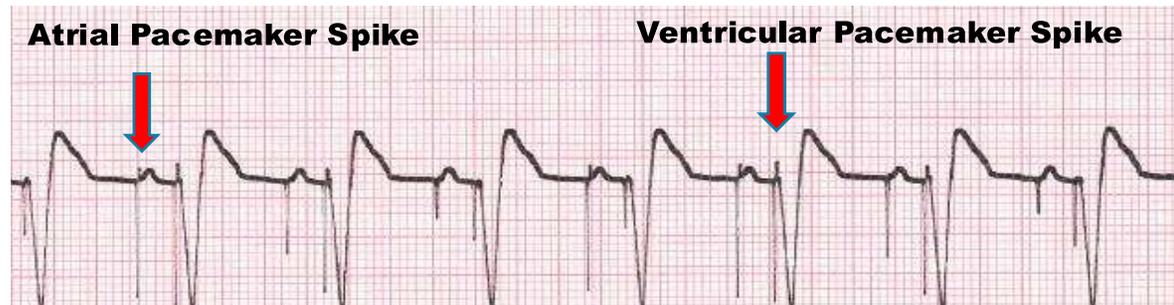
- ♥ **Focus on Quality of Life**
- ♥ **Cardiac Transplantation**



# **Temporary Pacemakers**





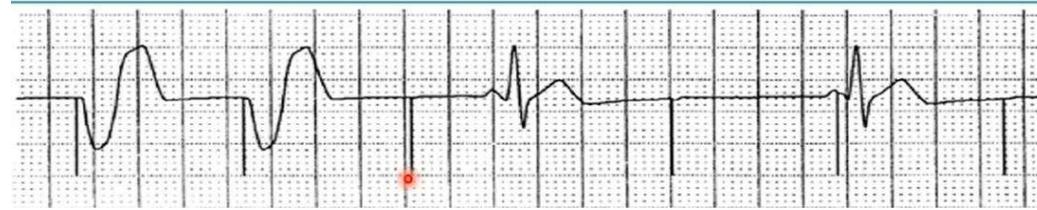


I - Chamber Paced	II - Chamber Sensed	III - PM response to sensed event
O - None	O - None	O - None
A - Atria	A - Atria	I - Inhibit
V - Ventricle	V - Ventricle	T - Triggered
D - A + V	D - A + V	D - I + T

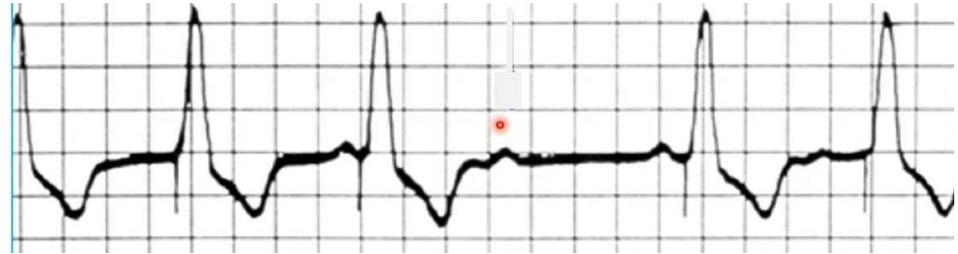
♥ **Ex: DDD**

# Pacemaker Troubleshooting

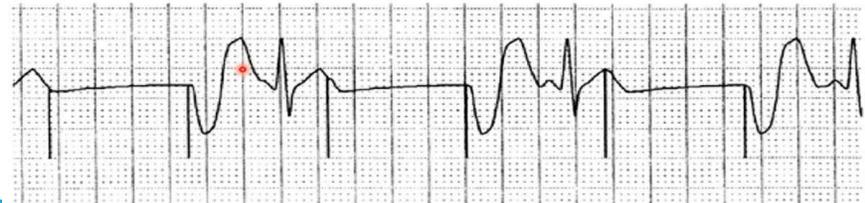
♥ Failure to Capture



♥ Failure to Fire



♥ Failure to Sense



5. A patient admitted with an inferior wall MI (IWMI) has symptomatic second-degree heart block & the nurse places a transcutaneous pacer.

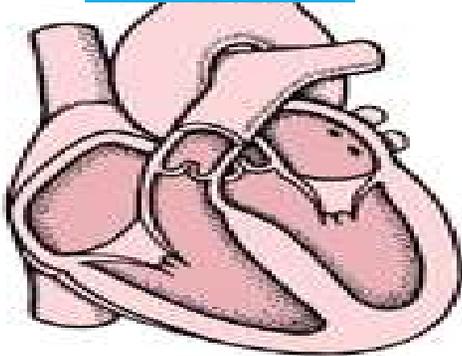
Pacer spikes are seen on the monitor but are not followed by a ventricular depolarization. The nurse should:

- A. Move the pacemaker pads to a new location on the chest
  - B. Administer 0.5 mg Atropine IVP
  - C. Increase the MA on the pacemaker
  - D. Increase the HR on the pacemaker
- 



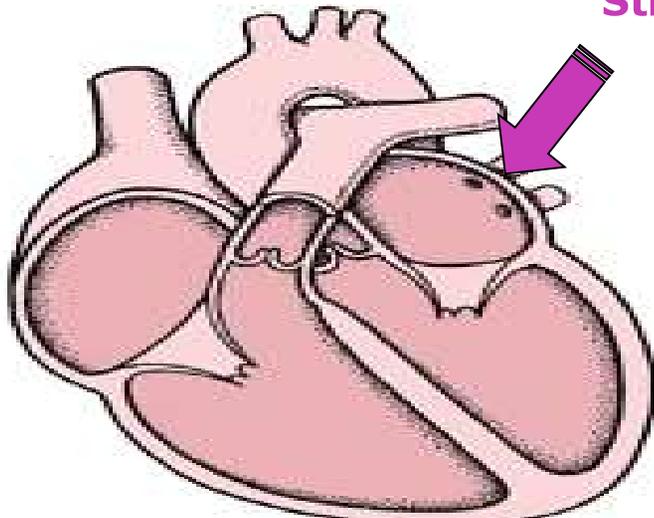
# Cardiomyopathy

**Normal**

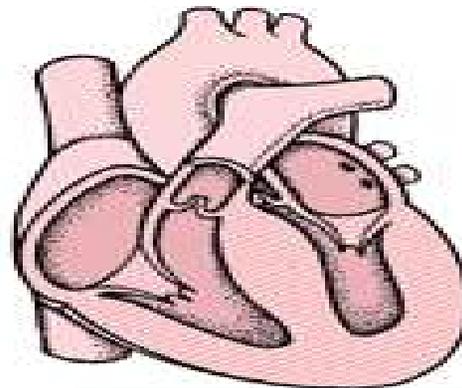


# Cardiomyopathy

Ischemic  
Non-Ischemic  
Stress Induced (Takotsubo)

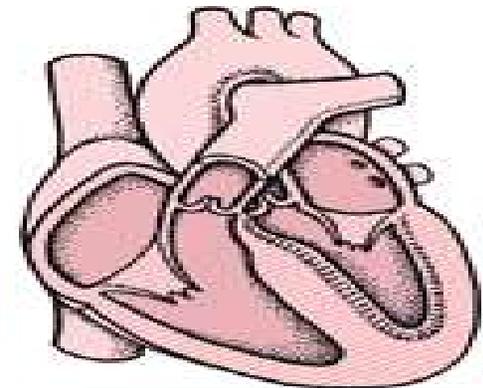


**Dilated**



**Hypertrophic**

**IHSS**



**Restrictive**

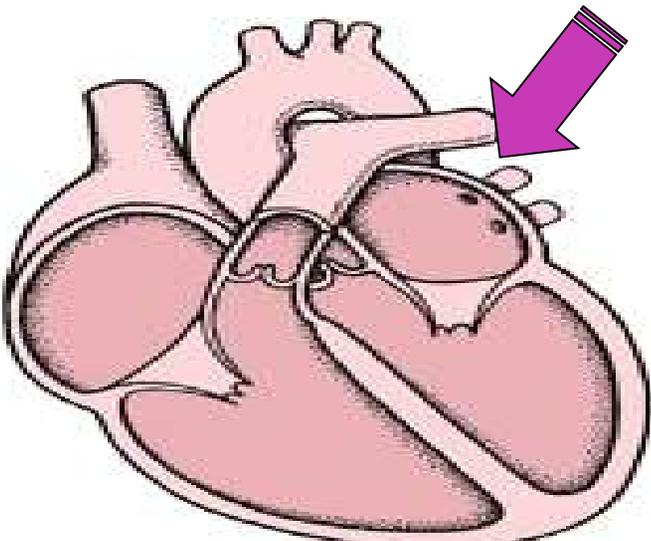
**Normal**



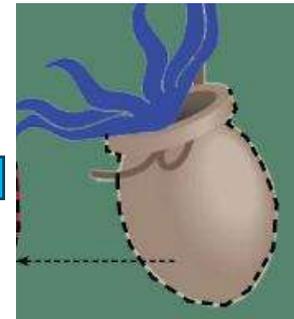
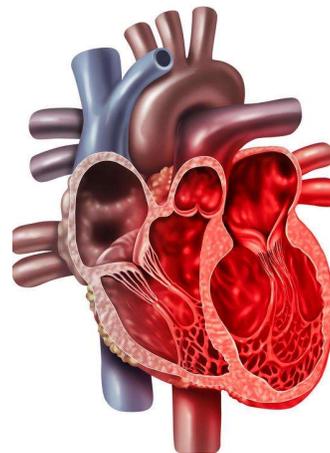
# Dilated Cardiomyopathy

**Ischemic  
Non-Ischemic**

**Stress Induced  
(Takotsubo)**

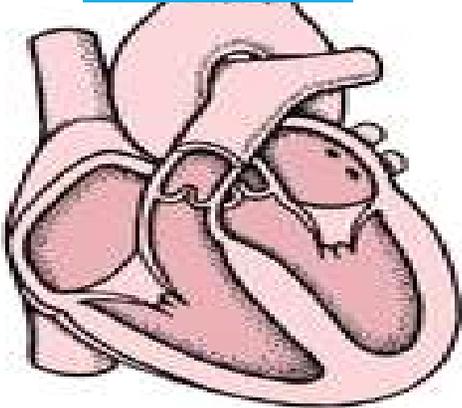


**Dilated**



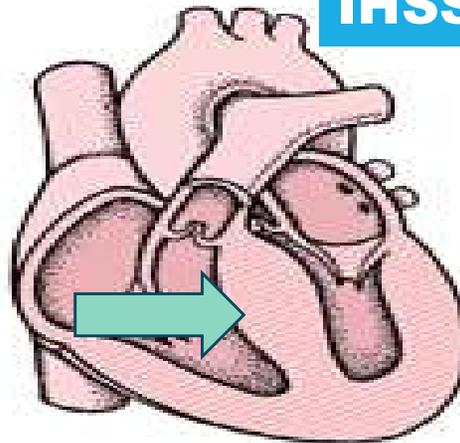
<https://www.istockphoto.com/photo/broken-heart-syndrome-gm1446160245-484333889?phrase=takotsubo+cardiomyopathy#>

**Normal**



# Hypertrophic Cardiomyopathy

**IHSS**

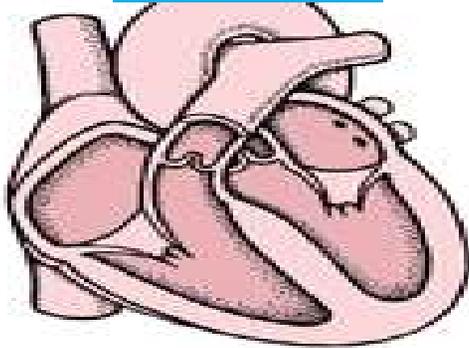


**Hypertrophic**

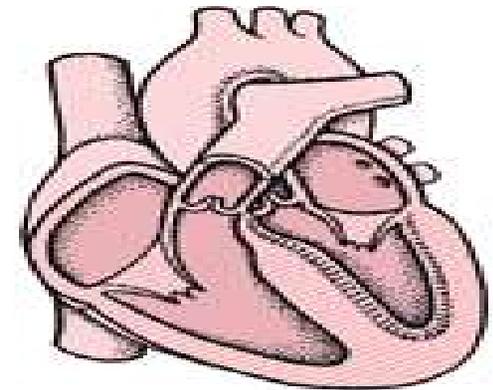
- ♥ Septum disproportionately enlarged
- ♥ Can obstruct sub aortic outflow tract
- ♥ Ventricular wall becomes rigid →
- ♥ Increased LVEDP, L atrial pressure
- ♥ Backward flow and pulmonary congestion



**Normal**



# Restrictive Cardiomyopathy



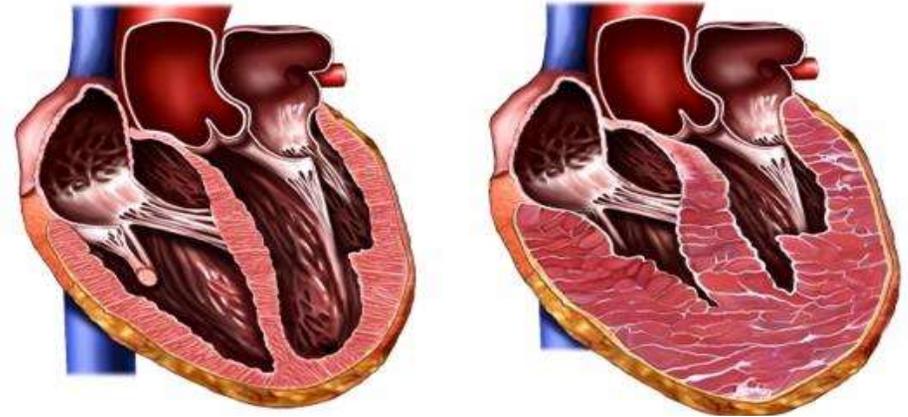
**Restrictive**

# Cardiomyopathy

## Treatment

- ♥ **Treat the Causative Factors**
- ♥ **Rest Heart**
- ♥ **Relieve Congestion**
- ♥ **Prevent Thromboembolic Events (DCM)**
- ♥ **Antidysrhythmic Agents/Pacer/ICD**
- ♥ **Assist Devices**
- ♥ **Consider Transplant**

# Cardiomyopathy



## Pharmacology

- ♥ **Digitalis** \*\* (know Toxicity S/S, Reversal = Digibind)
- ♥ **Diuretics**\*
- ♥ **Inotropic Agents**\*
- ♥ **Beta-Blockers, Ace Inhibitors**
- ♥ **Vasodilators**
- ♥ **Antidysrhythmic**

\* **Caution with HCM**  
\* **Caution with Restrictive**

6. Which of the following assessment data would be most consistent with a diagnosis of dilated cardiomyopathy?

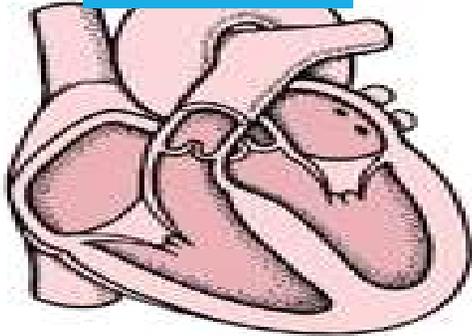
A. Tachycardia and LV hypertrophy on 12 lead, HTN and weak distal pulses

B. Second degree heart block and LBBB on 12 lead, HTN and cool extremities

C. Bradycardia and diffuse ST changes on 12 lead, wide aortic arch on chest X-ray and flat jugular veins

D. A-fib and low amplitude QRS on 12 lead, orthostatic hypotension and pulmonary congestion

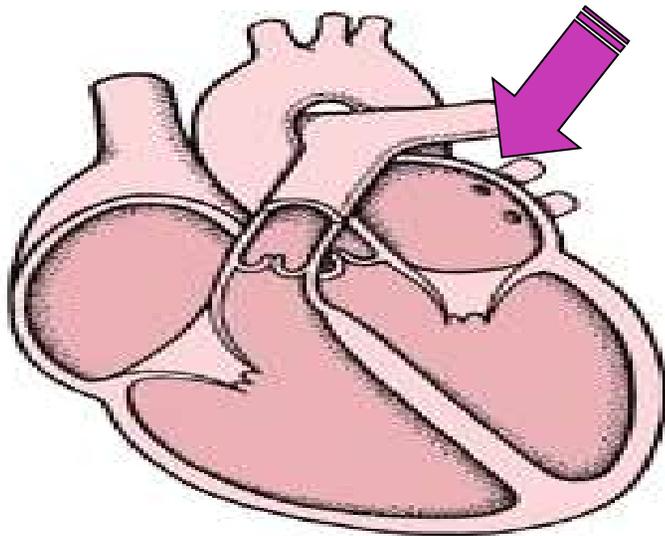
**Normal**



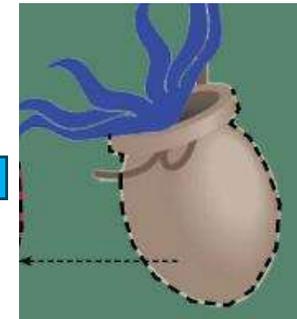
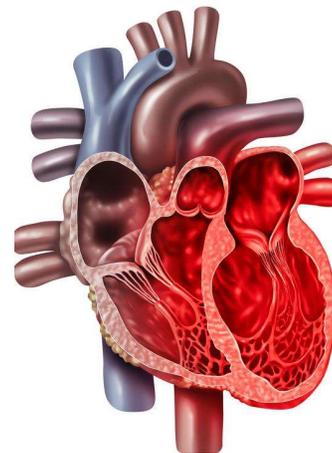
# Dilated Cardiomyopathy

**Ischemic  
Non-Ischemic**

**Stress Induced  
(Takotsubo)**



**Dilated**



<https://www.istockphoto.com/photo/broken-heart-syndrome-gm1446160245-484333889?phrase=takotsubo+cardiomyopathy#>



# **Acute Coronary Syndrome**

**Unstable Angina**

**AMI**

# Chest Pain



**Angina Pectoris: Myocardial Anoxia**



**Printzmetal angina: Vasospasm**



**Exertional Angina: 4 E's**

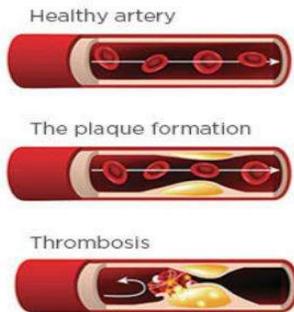
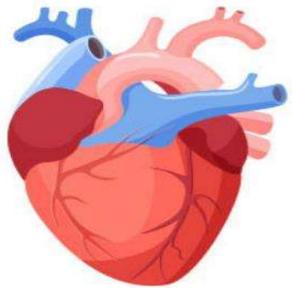
**E**xercise

**E**mootional States

**E**xtrême Temperature

After **E**ating

# Angina



## Stable Angina

**Consistent &  
Treatable Symptoms**

**More Common**

**Attacks  
have a trigger**

## Unstable Angina

**Recent onset  
< 2 months**

**Newly occurs at  
rest or lasts >  
20 min**

**Differs from  
“Typical  
Exertional Angina”**

# Chest Pain Questions



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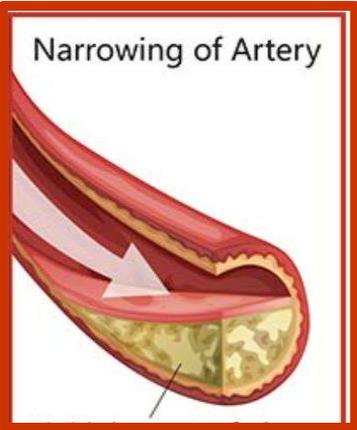
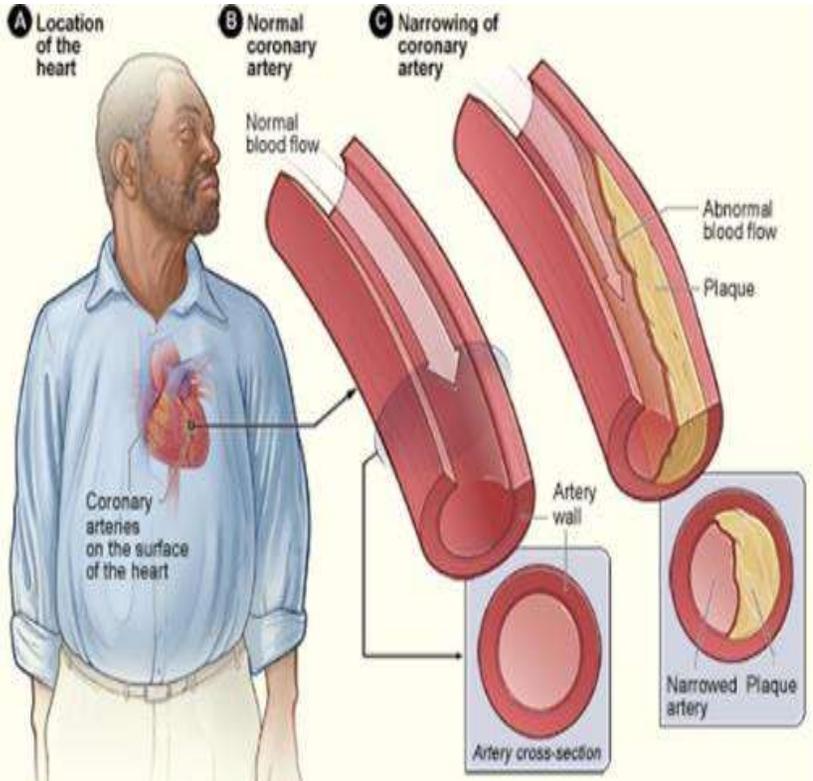
Is it Cardiac or Not?

If it is Cardiac- Is it Ischemic or Not?

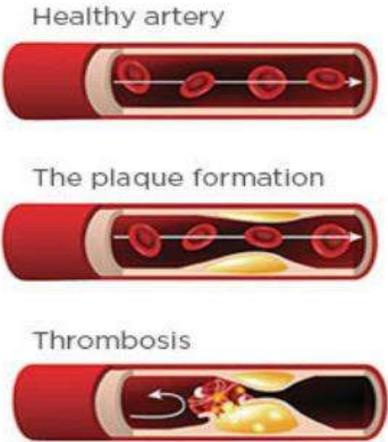
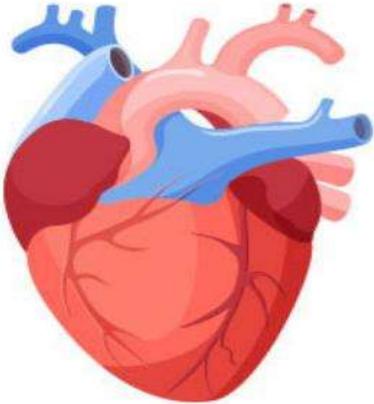
If it is Ischemic-Is it Stable or Not?

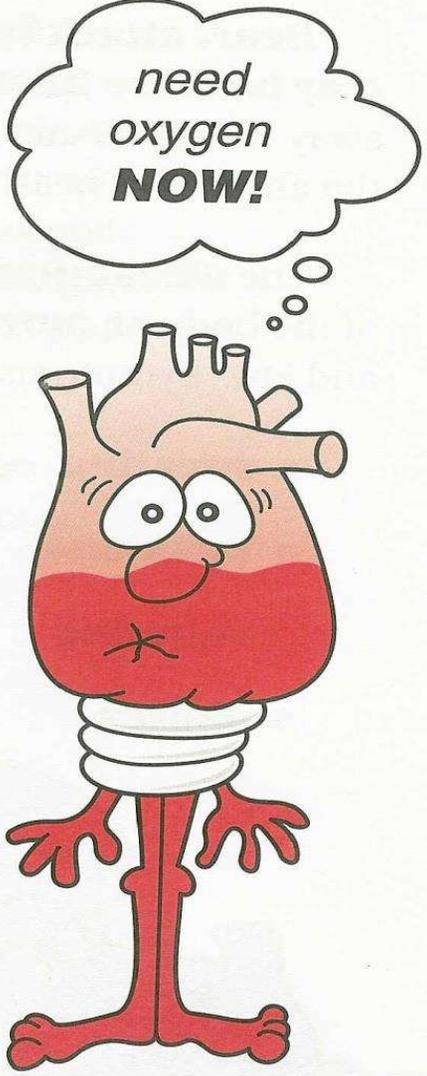
If it is Unstable- Where are They?

# Cardiac Disease



**Lipid Deposit**

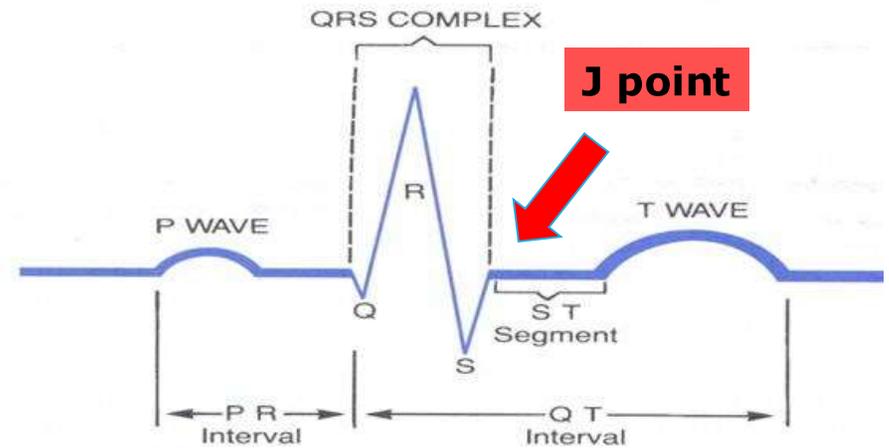




**T  
S  
R  
Q  
P**

# Unstable Angina Assessment

## 12-Lead ECG



Ischemia: ST Depression



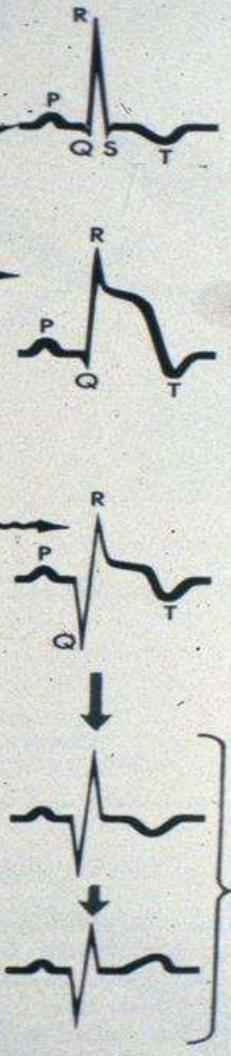
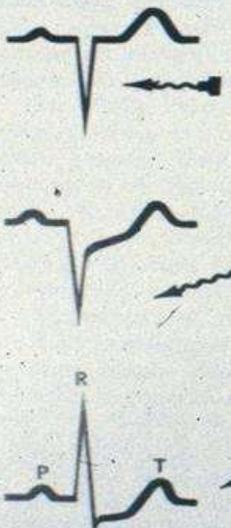
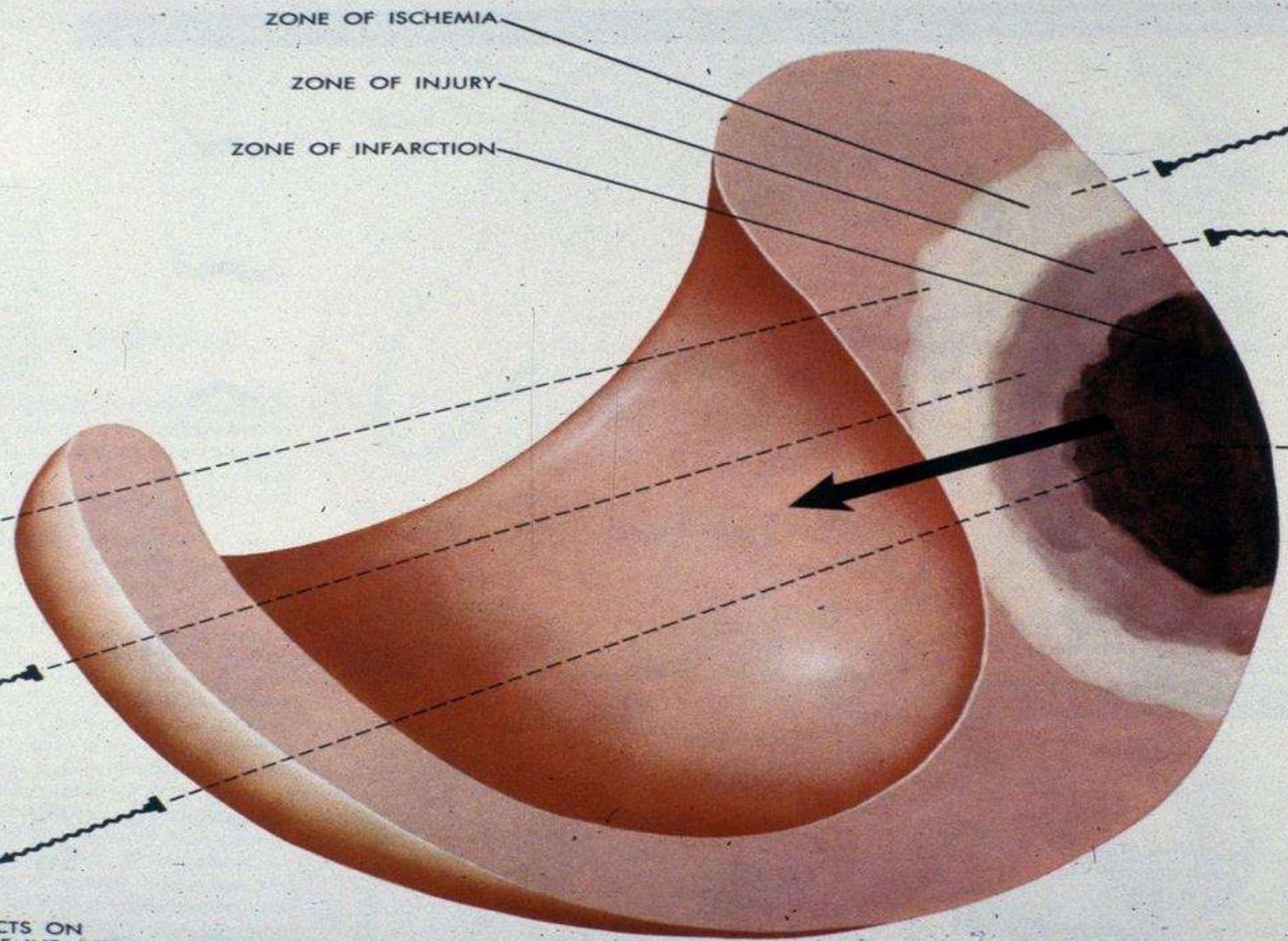
Injury: ST Elevation



Infarction: Q Waves

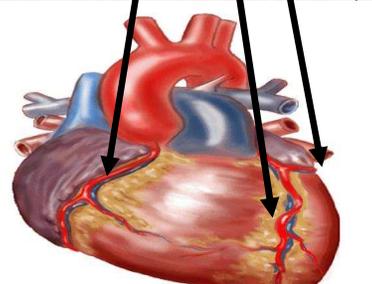
*F. Netter M.D.*  
© CIBA

ZONE OF ISCHEMIA  
ZONE OF INJURY  
ZONE OF INFARCTION



RECIPROCAL EFFECTS ON OPPOSITE SIDE OF INFARCT.

Location	Indicative Leads	Reciprocal Leads	Coronary Arteries	Major Complications
<b>Anterior</b>	Leads V1, V2, V3, V4	Leads II, III, aVF	LAD	Cardiogenic Shock Bundle Branch Blocks Vent Dysrhythmias
<b>Inferior</b>	Leads II, III, aVF	Leads I, aVL	RCA	Bradycardia Heart Blocks
<b>Lateral</b>	Leads I, aVL, V5, V6	Leads II, III, aVF	Circumflex	Heart Blocks in some



# Treatment

♥ **ASAP: Time is Muscle**

♥ **While Assessing/Diagnosing:**

- **Aspirin 162-325mg Chewed**
- **O<sub>2</sub> 4L/min (If Needed, SpO<sub>2</sub>  $\leq$  90%)**
- **NTG 0.4mg SL Q 5min x 3**
- **Morphine IV (if pain not relieved by NTG)**
- **Consider P2Y12 Inhibitors:**
  - Clopidogrel (Plavix)**
  - Prasugrel (Effient)**
  - Ticagrelor (Brilinta)**



# Acute Coronary Syndrome

## STEMI: ST elevation MI

- **Complete obstruction of blood flow**
  - Q wave MI
  - Non-Q wave MI

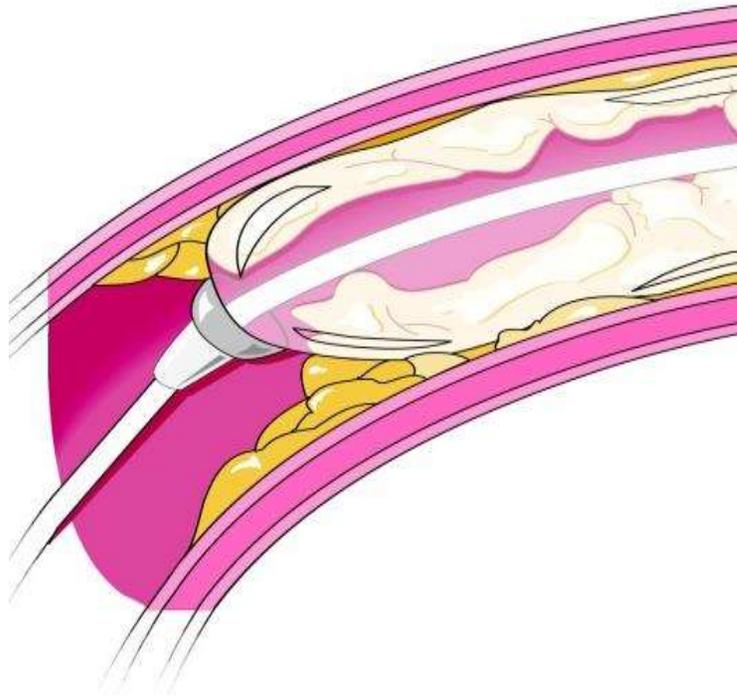
## NSTEMI: Non-ST Elevation Acute Coronary Syndrome

- **Partial obstruction of blood flow**
  - Ischemic chest pain

May have imaging evidence of loss of myocardium or wall-motion abnormalities  
Intra-coronary thrombus detected on angiography (or autopsy)

- Non-ST Elevation MI**
  - Q wave MI
  - Non-Q wave MI

**\*\*NSTEMI has lower immediate mortality than STEMI, but may have higher long-term mortality\*\***



LMWH if NOT going to cath lab

Bivalirudin ONLY for cath lab

# Acute MI

## ♥ Treatment

**Triple Anti-Thrombin Therapy**

**If STEMI- Evaluate for Reperfusion?**

**Anti-ischemic therapy:**

**Beta Blockers**

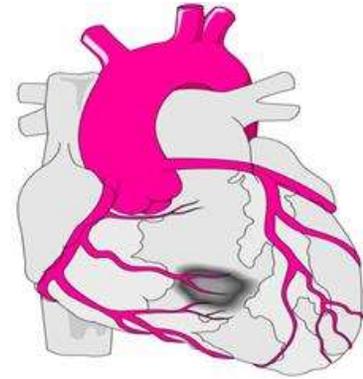
**Nitrates**

**Ca<sup>+</sup> Channel Blockers**

**Adjunct Therapy**

**ACE Inhibitors**

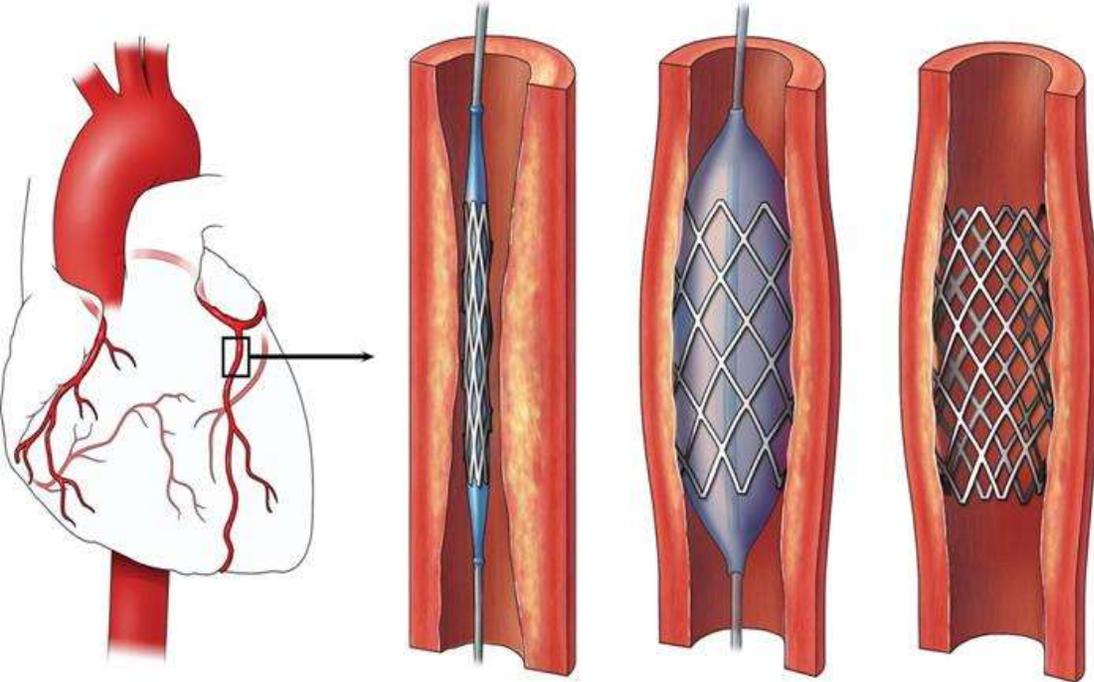
# Reperfusion Treatment



- **Cardiac Catheterization**
- **PCI**
- **Thrombolytics**
- **Coronary Artery Bypass Surgery**

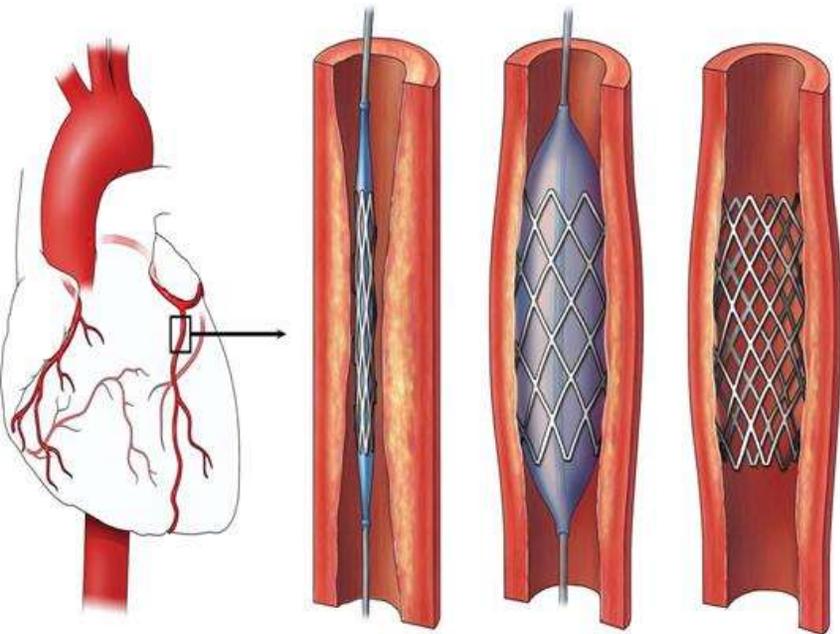
# Cardiac/Vascular Catheterization

Time is Muscle!  
Goal: first medical  
contact to balloon:  
90 minutes



- ♥ Cardiac Cath
  - ♥ Diagnostic
  - ♥ Interventional
- ♥ Stent Placement
- ♥ Angioplasty

# Cardiac/Vascular Catheterization: Nursing Concerns



## ♥ Pre-Procedure

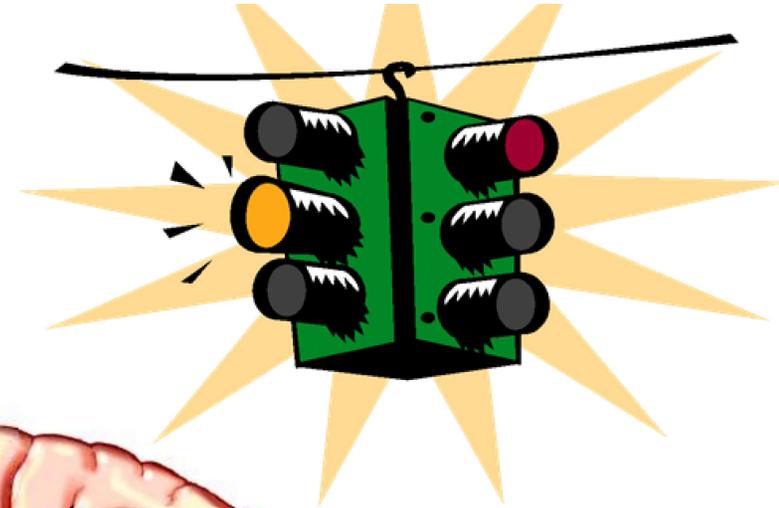
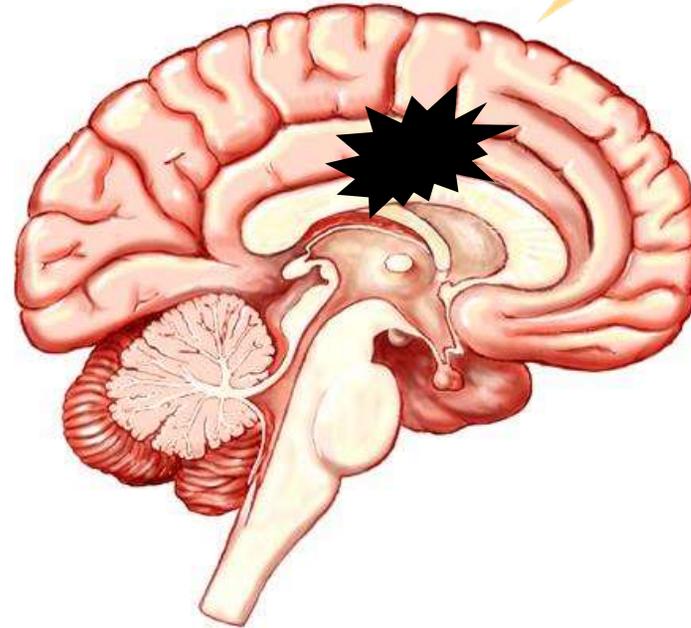
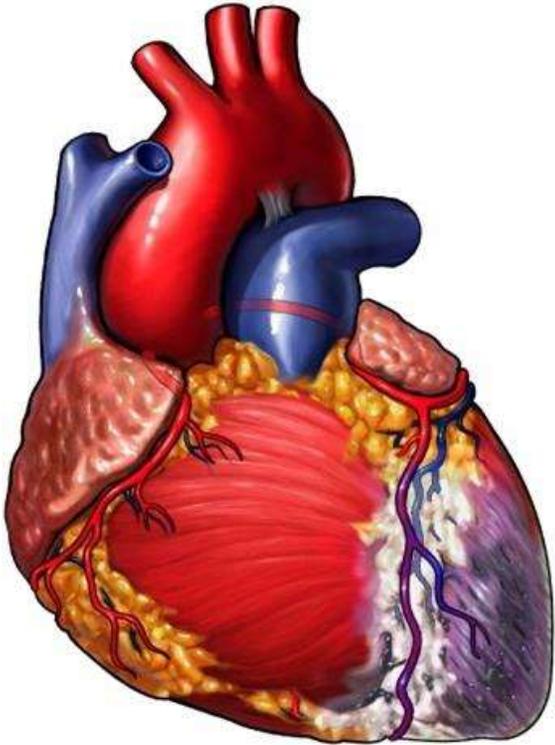
## ♥ Post-Procedure

### Monitor for other complications:

- Arrhythmias
- Stroke
- Allergic reaction
- Symptom reoccurrence
- Contrast-induced nephropathy

## ♥ D/C Education

# Thrombolytic Agents



# STEMI Thrombolytics: Management

---

Reperfusion option if PCI unavailable within 120 minutes

- Only indicated for STEMI
  - NOT: NSTEMI, new LBBB, Posterior wall MI
- Screen for contraindications (bleeding risk)

## **Monitor for improvement**

- Resolution of CP, ST segment elevation
- Reperfusion arrhythmias common

## **Plan for PCI**

- Immediate if unsuccessful
  - Delayed if successful
- 

# Thrombolytic Agents

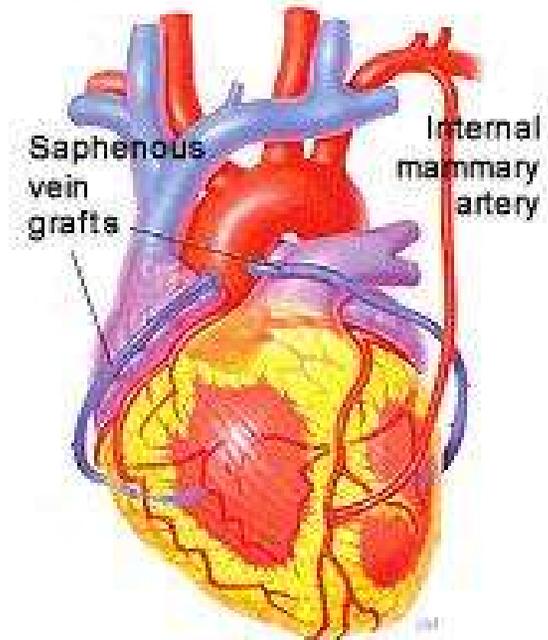
- **Adverse Effects:**
  - Bleeding
  - **IF Major Bleeding Occurs:**
    - Stop infusion and other anticoagulants
    - Anticipate immediate head CT if ICH suspected
    - Administer cryoprecipitate, FFP, platelets
    - Aminocaproic acid (Amicar)

# CABG

♥ Indications

♥ Procedure

♥ Graft Options

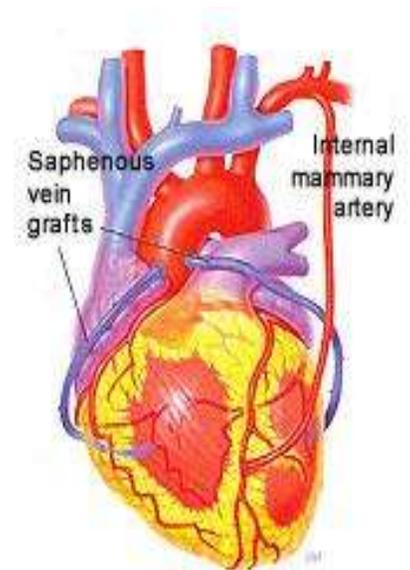


# CABG

## ♥ Post Op Care

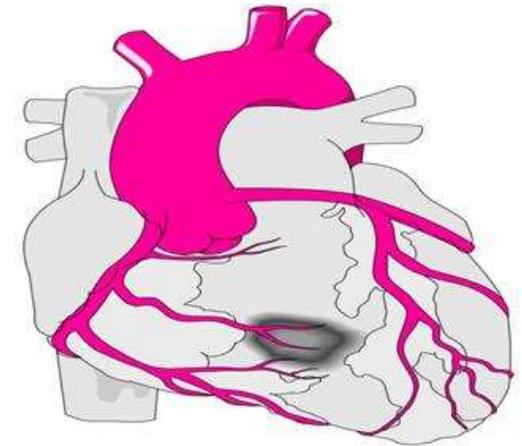
- Hemodynamic stability
- Ventilation & Oxygenation
- Monitor for complications

## ♥ Additional Nursing Concerns



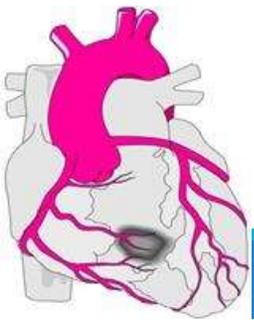
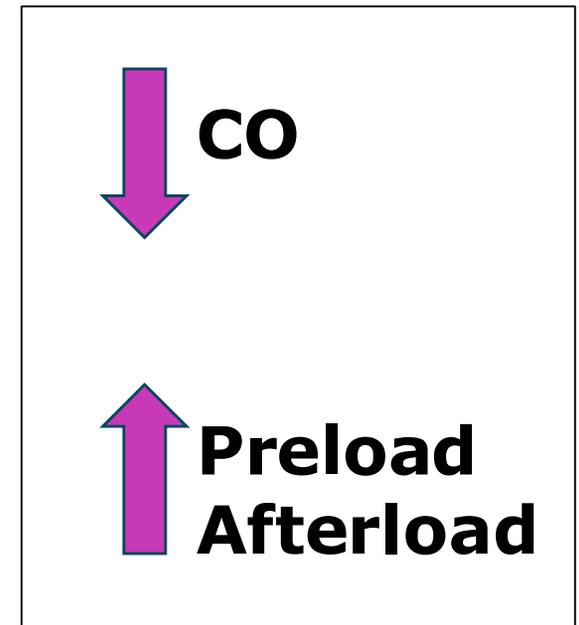
# Acute MI Complications

- ♥ **Arrhythmias**
- ♥ **Structural issues**
- ♥ **Pericarditis**
- ♥ **Cardiogenic Shock**



# Cardiogenic Shock

- Hypotension
- Pulmonary Edema
- Decreased Contractility
- Dysrhythmias
- S & S of Poor Perfusion



# Cardiogenic Shock

**Treatment Goal:  
Improve O<sub>2</sub> delivery to tissues**

 **Preload: Diurese  
Afterload: Dilate**

 **Contractility**

# Cardiogenic Shock

## Medications (in addition to ACS drugs)

- Oxygen – may need positive pressure ventilation
- Inotropic support
- Diuresis

Reperfusion!

Mechanical Circulatory Support: IABP, Impella, ECMO

# Chest Pain Standards

- High-Sensitivity Troponins when possible
  - Early care for acute symptoms
  - Share decision making with patient
  - Testing when indicated
- 
- Pathways for clinical decisions
  - Accompanying symptoms – especially in women
  - Identify best testing options



# Therapeutic Goals

Assist  
Contractility

Alleviate Cause  
of Failure

Fluids

Pharmacological  
Agents

Coronary  
Reperfusion

Mechanical  
Assist

7. After an ischemic event like a myocardial infarction, a rupture of which type of muscles anchoring the atrioventricular valves can lead to increased patient mortality?

A. Semilunar

B. Papillary

C. Pectoral

D. Thoracic

8. Where would the RN palpate a thrill and auscultate a holosystolic murmur caused by papillary muscle rupture after a MI, causing mitral regurgitation?

A. Aortic

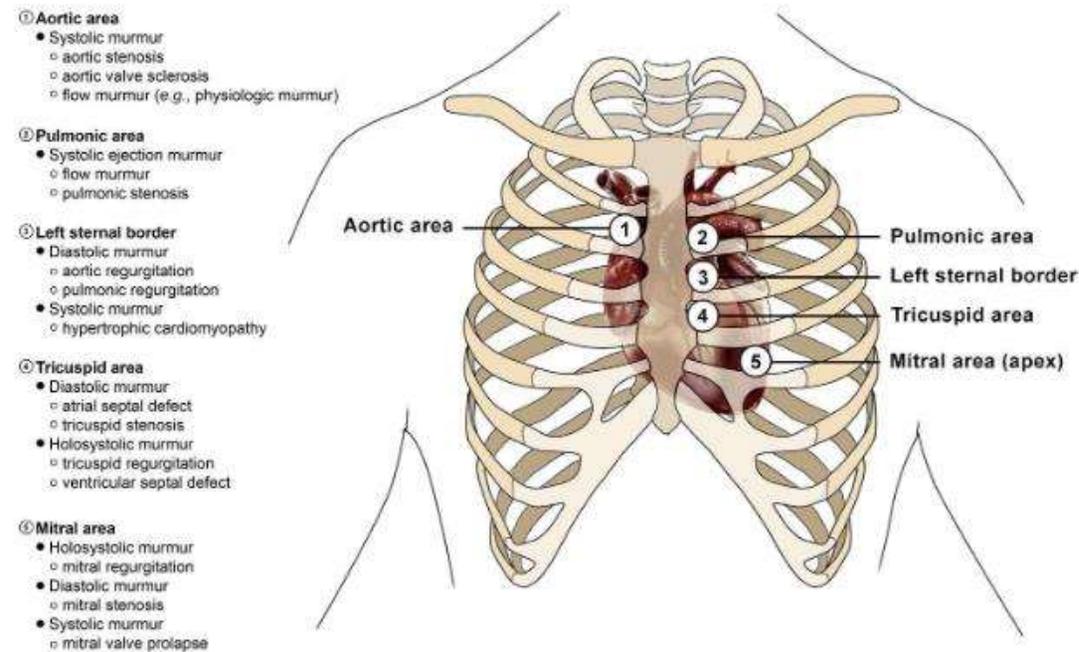
B. Pulmonic

C. Apical

D. Tricuspid

## Cardiac Auscultation

# Areas for Cardiac Auscultation



9. What is possibly one way that a female patient might present differently from a male when experiencing angina from a MI?

A. Left shoulder pain

B. Diaphoresis

C. Crushing substernal chest pain

D. Symptoms that begin days to weeks before the actual MI



# **Vasoactive & Inotropic Agents**

	<b>SYMPATHETIC</b>	<b>PARASYMPATHETIC</b>
<b>Purpose to Regulate Autonomic Function</b>	<b>Activation: Flight or Fight Responses</b>	<b>Conservation: Energy Maintain Organ Function "Rest &amp; Digest"</b>
<b>Motor Neurons</b>	<b>Large and Diffuse</b>	<b>Narrow and Specific</b>
<b>Neurotransmitter(s)</b>	<b>Norepinephrine Epinephrine</b>	<b>Acetylcholine</b>
<b>Receptors</b>	<b>Adrenergic: Alpha Beta (throughout body)</b>	<b>Cholinergic: Nicotinic Muscarinic (specific areas)</b>
<b>Innervation</b>	<b>Heart, Blood Vessels, Glands, Visceral Organs &amp; Smooth Muscles</b>	<b>Heart, Glands, &amp; Visceral Organs</b>

# **Sympathetic**

**Heart  
Lungs**

**Vessels**

**Bladder**

**GI  
Motility  
Sphincter  
Kidneys**

**Liver**



10. Which of the following agents might be indicated in a patient with low CO, tachycardia and elevated BP?

(CCRN Only)

- A. Norepinephrine (Levophed)
- B. Phenylephrine (Neosynephrine)
- C. Epinephrine
- D. Milrinone (Primacor)

11. A patient is receiving an infusion of Diltiazem (Cardizem) at 5mg/hr. Which of the following assessment findings would indicate that the drug is effective?

- A. The blood pressure is going up
- B. The heart rate is coming down
- C. The central venous pressure is going up
- D. The cardiac output is coming down

12. A pt receiving 4mcg/min of Norepinephrine, 7mcg/kg/min of Dobutamine, 0.6mg/h of Nitroglycerine & 10mg/h of Lasix has the following assessment data. What should the RN consider doing?

- A. Increasing the Norepinephrine
- B. Decreasing the Dobutamine
- C. Decreasing the Nitroglycerine
- D. Increasing the Lasix

Assessment	1 Hr Ago	Now
HR	92	127
BP	122/84	117/80
RR	20	22
Temp	37.1	37.0
CO/CI	4.1/2.3	3.0/1.6
UO	150	70

# Vasopressors & Inotropes

Dopamine

Norepinephrine

Epinephrine

Vasopressin

Phenylephrine

Angiotensin II\* *Giapreza*

Dobutamine

Milrinone

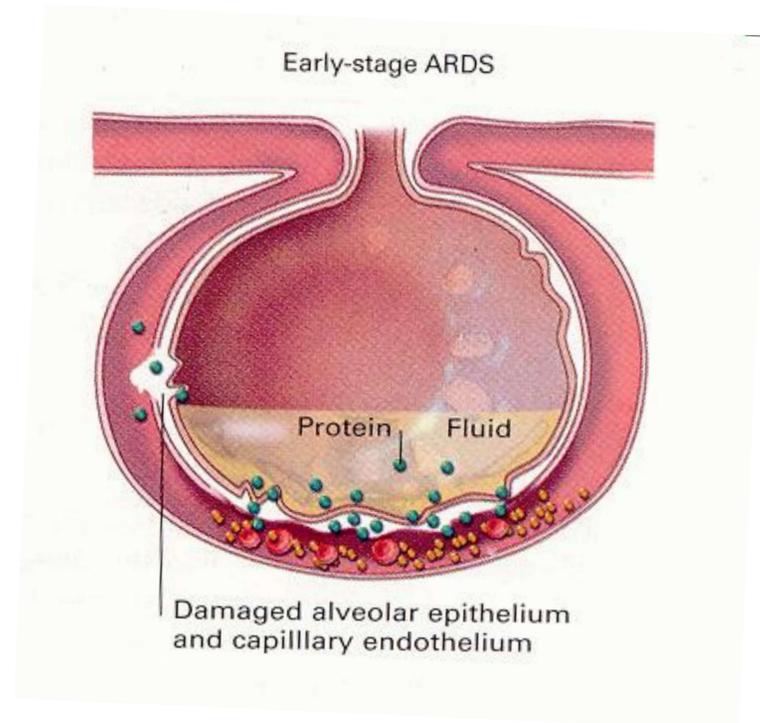
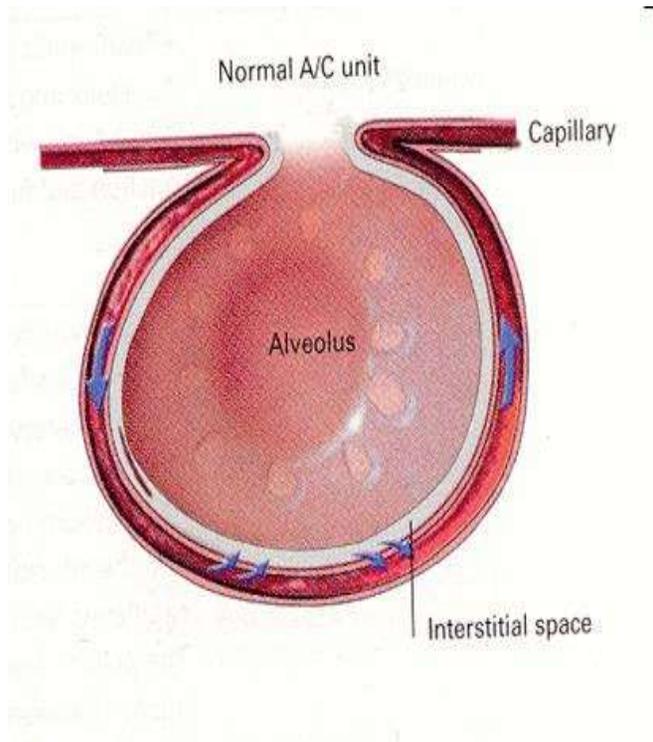


**Only  
on  
PCCN  
Test Plan**



# **Acute Pulmonary Edema**

# Fluid Dynamics



# Causes of Cardiogenic Pulmonary Edema

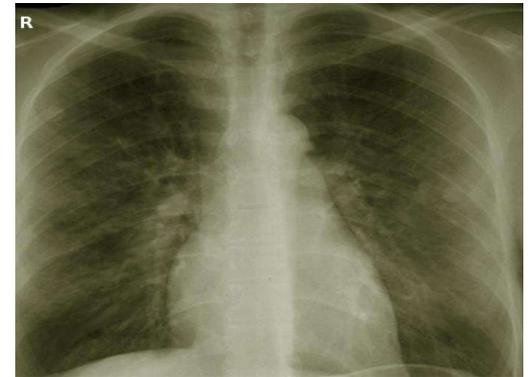
- Heart Failure
- Myocardial Infarction
- Cardiac Ischemia
- Acute Mitral Regurgitation
- Cardiac Tamponade
- Tachy Dysrhythmias
- Hypertensive Crisis



# Causes of Non-Cardiogenic Pulmonary Edema

## NOT CARDIAC

- **N:** near drowning
- **O:** O<sub>2</sub> therapy/post-intubation pulmonary edema
- **T:** trauma/transfusion (TRALI: transfusion-related acute lung injury)
- **C:** CNS: neurogenic pulmonary edema
- **A:** allergic alveolitis
- **R:** renal failure
- **D:** drugs
- **I:** inhaled toxins
- **A:** altitude: high altitude pulmonary edema (HAPE), ARDS
- **C:** contusion



**Sepsis is #1 Cause**

# CARDIOGENIC

- **Opacity in PA area due to enlargement of pulmonary vasculature**
- **Upper lobe diversion**
- **Kerly B lines in periphery**
- **LV enlargement**
- **R sided pleural effusion**
- **Hilum may be distended**

# NON-CARDIOGENIC

- **Diffuse bilateral, fluffy infiltrates**
- **Periphery & central portions equally involved**
- **Large diffuse infiltrates**
- **Normal cardiac size**
- **Clinical symptoms appear faster than X-ray changes**

# Diagnosis

## Chest X-Ray

- **Helpful But Not Conclusive**
- **Cardiogenic:  $\Delta$ s Day to Day, or After treatment**
- **Non-Cardiogenic: ARDS**



# Diagnosis

## Laboratory Data

- **ABG**
  - **Low O<sub>2</sub> Saturation**
  - **Respiratory Alkalosis**
  - **Refractory Hypoxemia**

# **Treatment Options**

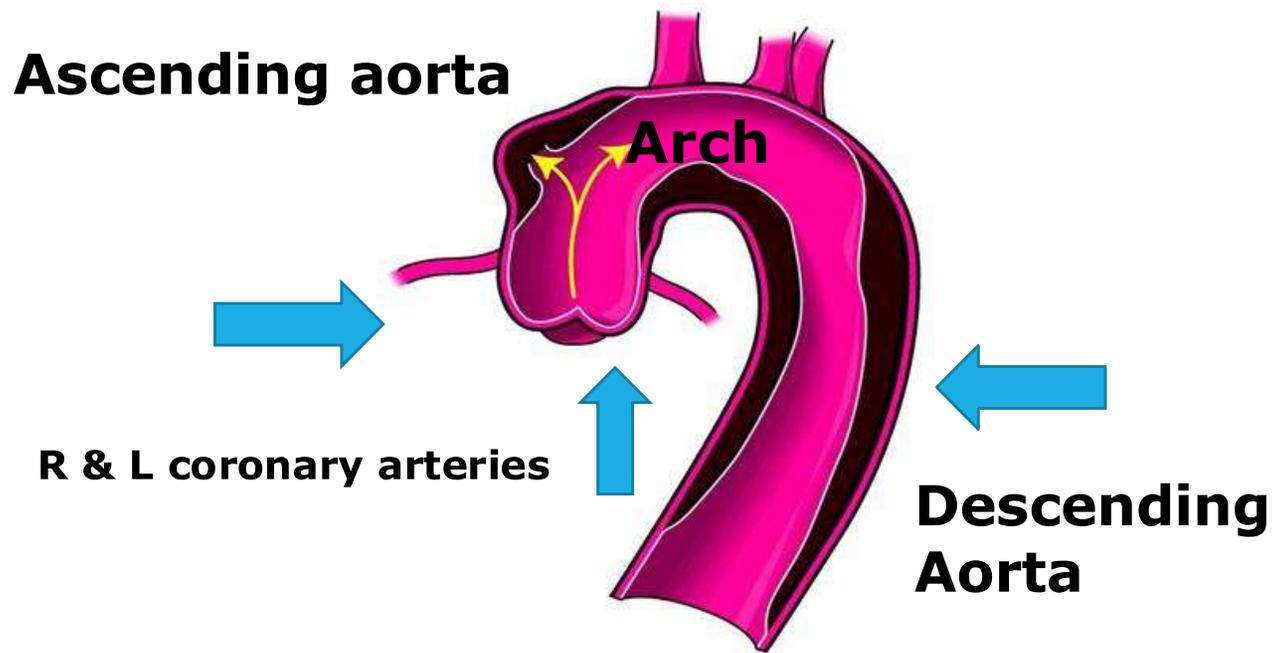
## **Cardiogenic Pulm Edema**

- **Treat like Heart Failure**
  - **Diuretics**
  - **Analgesics**
  - **Preload Reduction**
  - **BP Management/Control**
  - **Oxygen/Intubation**
- 



# **Acute Aortic Dissection & Aortic Aneurysms**

# Acute Aortic Dissection & Aortic Aneurysms



# Classifications

## DeBakey System

**Type I**



**Type II**



**Type III**

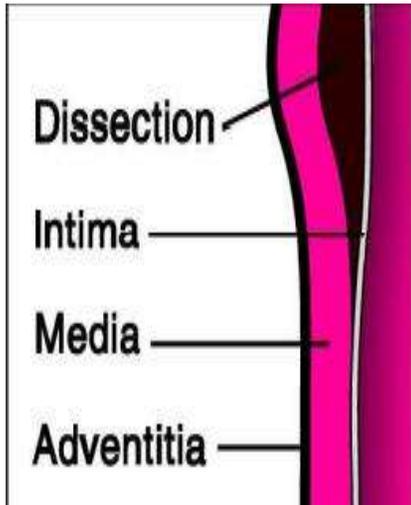


**Stanford System**

**Type A**

**Type B**

# Aortic Dissection Diagnosis & Presentation



**The  
Great  
Imitator**

# Tests

**Chest X-Ray**

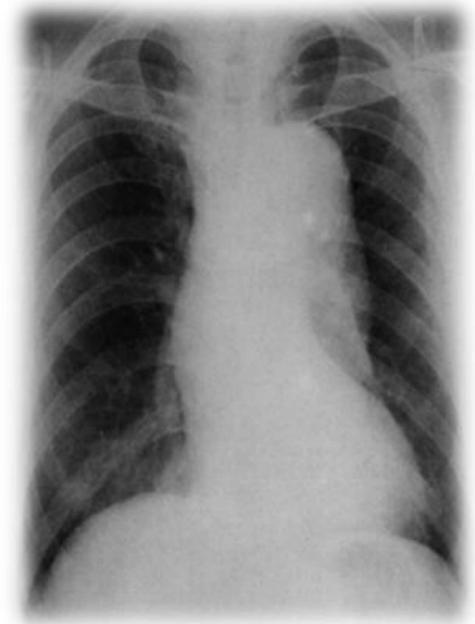
**ECG: LVH, AMI**

**Chest CT\***

**Echo: TEE or TT\***

**MRI\***

**Aortography**



**\*Most helpful**

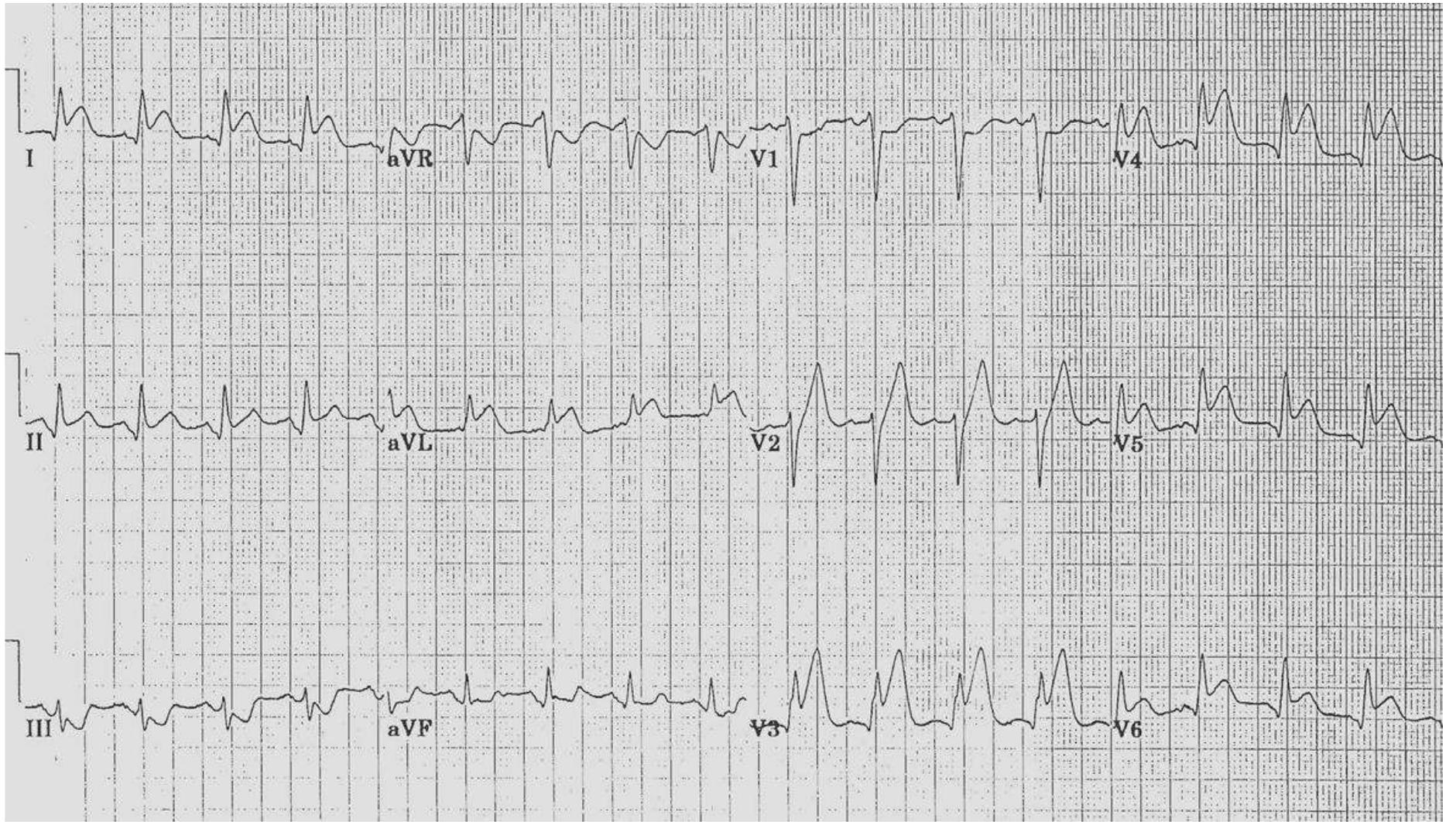
# Treatment

## Primary Objectives:

**Pain Relief  
Anxiety Relief  
BP Management**

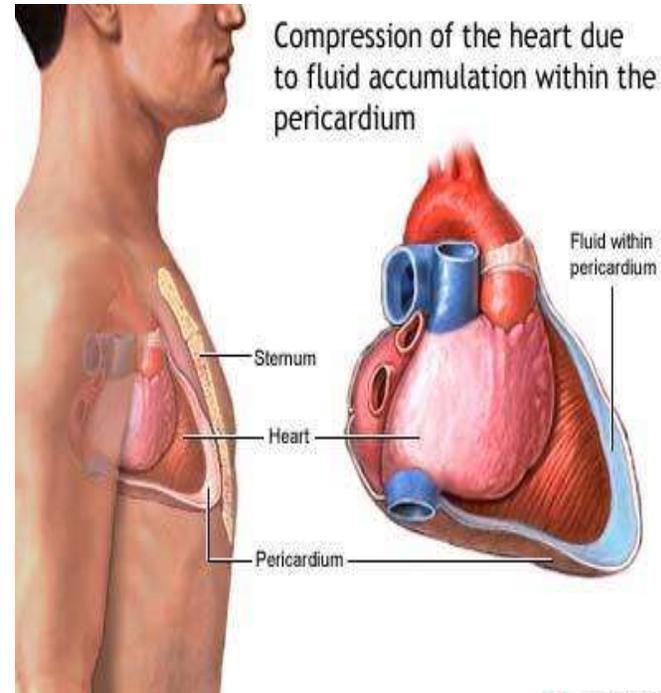
## Adequate BP Management

- **Labetalol: Alpha & Beta Blocker**
- **Nicardipine Hydrochloride (Cardene): Calcium Channel Blocker**
- **Descending Dissection: Meds preferred treatment**
- **Treat Pain & Anxiety**



# Cardiac Tamponade

- **Cardiac Effusion**
- **Cardiac Tamponade**



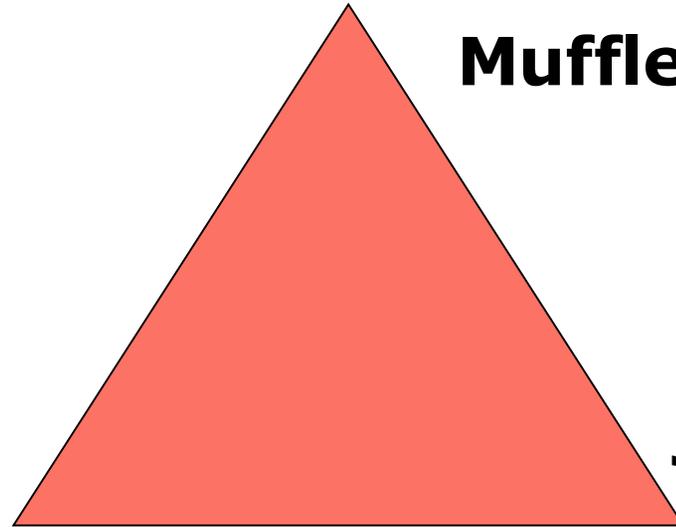
# Presenting S & S

- Chest Pain
- Anxiety
- Tachycardia
- Tachypnea
- Diaphoresis
- Bibasilar Rales
- Pericardial Friction Rub\*
- Fever\*
- Unstable BP
- S&S of Shock

# Presenting S & S

## Beck's Triad

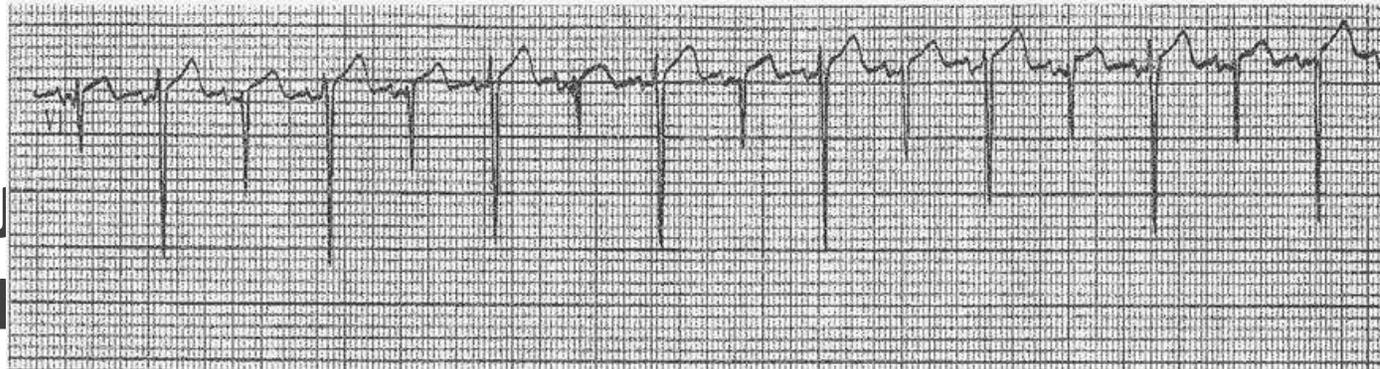
**Muffled Heart Sounds**



**Hypotension  
&  
Narrowing Pulse  
Pressure**

**Jugular  
Vein  
Distention**

# Drooping COC



- Pulsus Paradoxus
- Chest X-Ray
- ECG Changes
  - Electrical Alternans
  - Low Amplitude

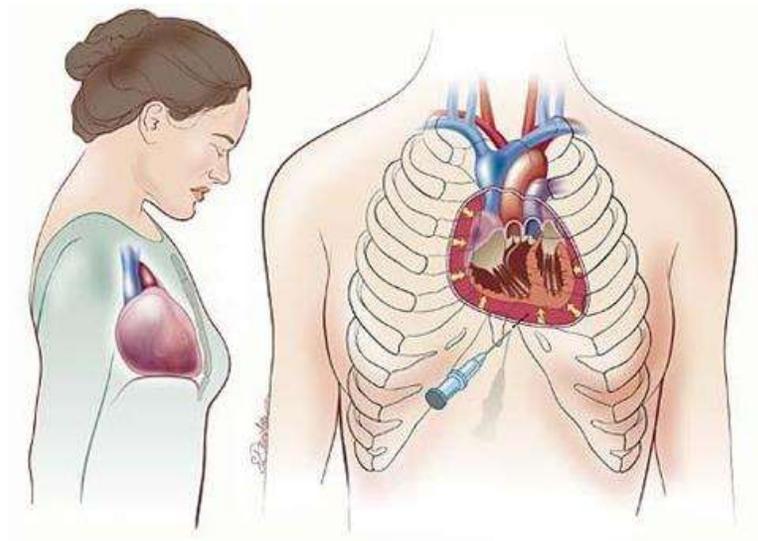


# Diagnosis

- **Echocardiography**
  - **Non-Invasive**
  - **Available**
  - **TEE or Transthoracic?**
  - **Most Sensitive**
  - **Most Specific**

# Treatment

- **Pericardiocentesis**
  - **Needle Aspiration of Effusion**
- **Surgery**
- **VATS**



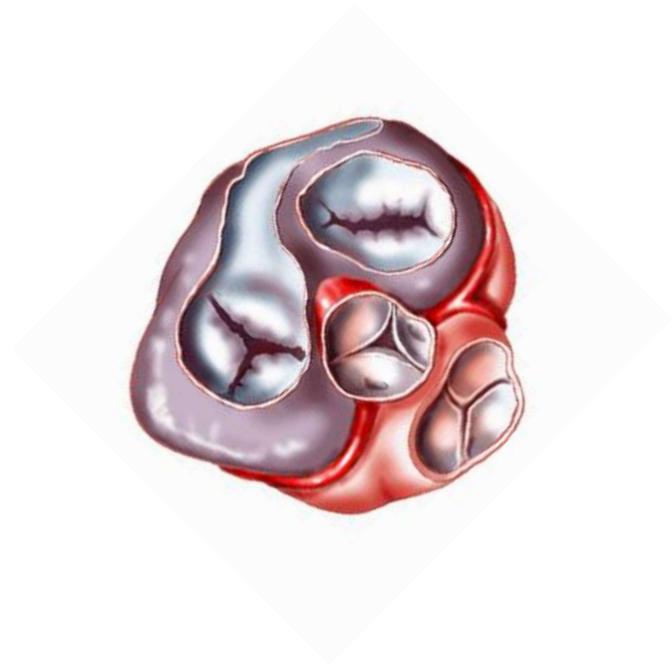
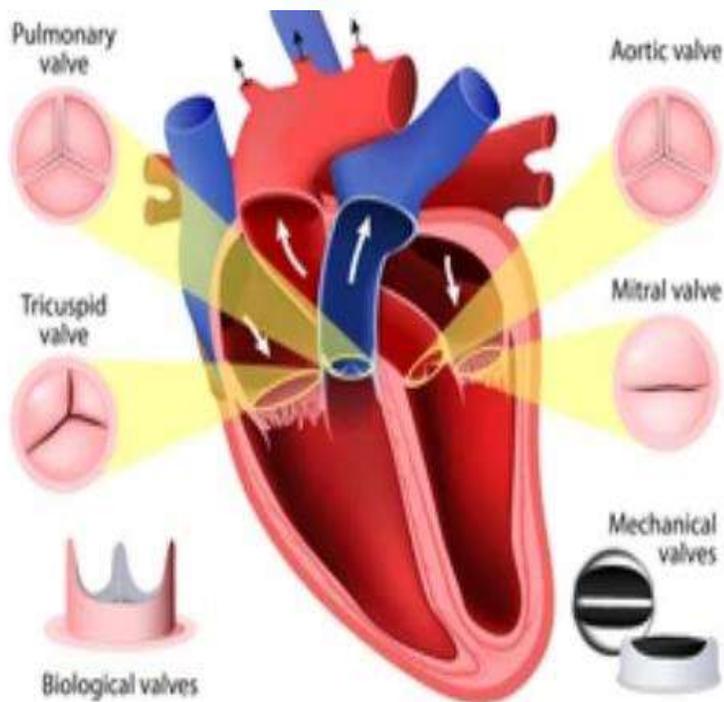


# **Valvular Defects**

## **Structural Heart Defects**

# Valvular Defects

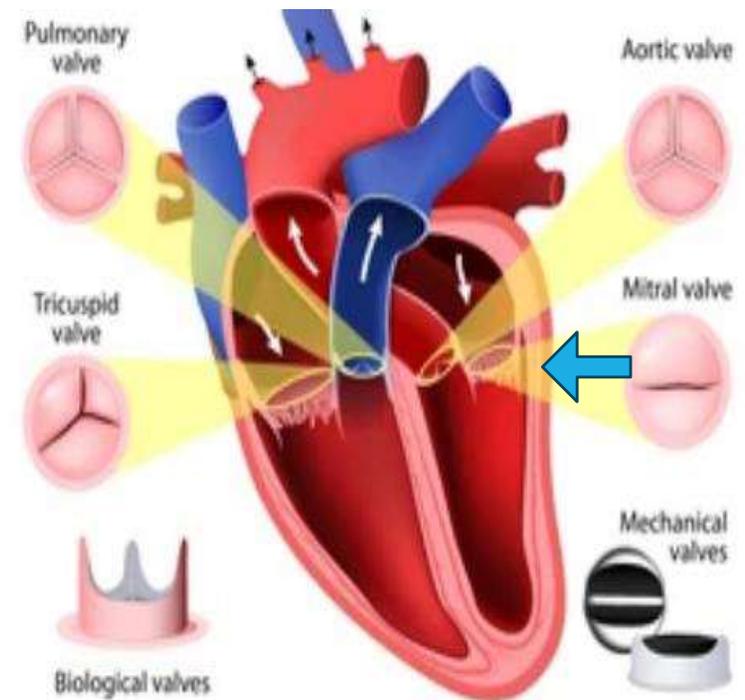
## Structural Heart Defects



# Valvular Defects

## Stenosis:

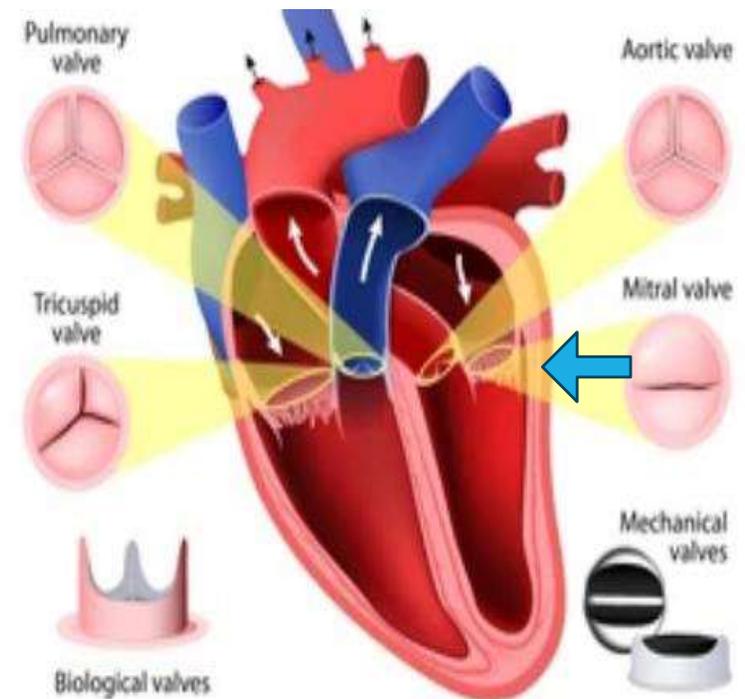
- **Orifice narrows obstructing blood flow**
- **Pressure increases in chamber behind valve**
- **Myocardial fibers hypertrophy**



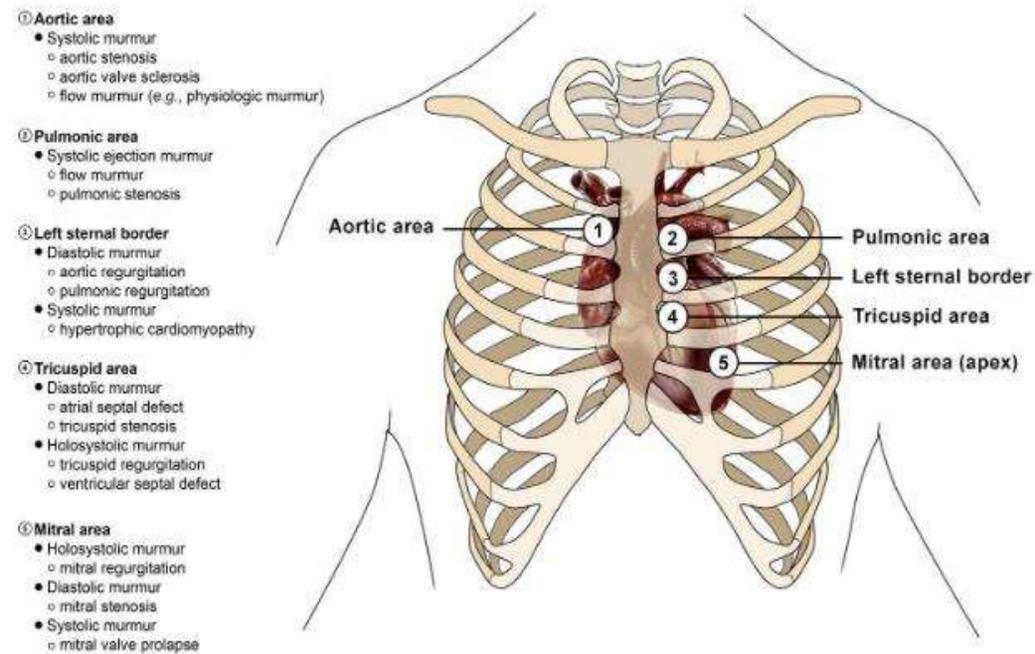
# Valvular Defects

## Insufficiency/Regurgitation:

- **Backwards blood flow**
- **Dilation of chamber receiving blood flow**
- **Myocardial fibers hypertrophy**



## Cardiac Auscultation



# Areas for Cardiac Auscultation

**Easy Way  
to  
Remember  
Type  
of  
Murmurs**

---

**Think of 2 Patients:**

---

***MR. ASS-***

---

**Mitral Regurgitation**

---

**Aortic Stenosis**

---

**Systolic murmurs**

---

***MS. ARD***

---

**Mitral Stenosis**

---

**Aortic Regurgitation**

---

**Diastolic murmurs**

Auscultate  
5<sup>th</sup> ICS MCL

# Mitral Valve Defects

## Stenosis:

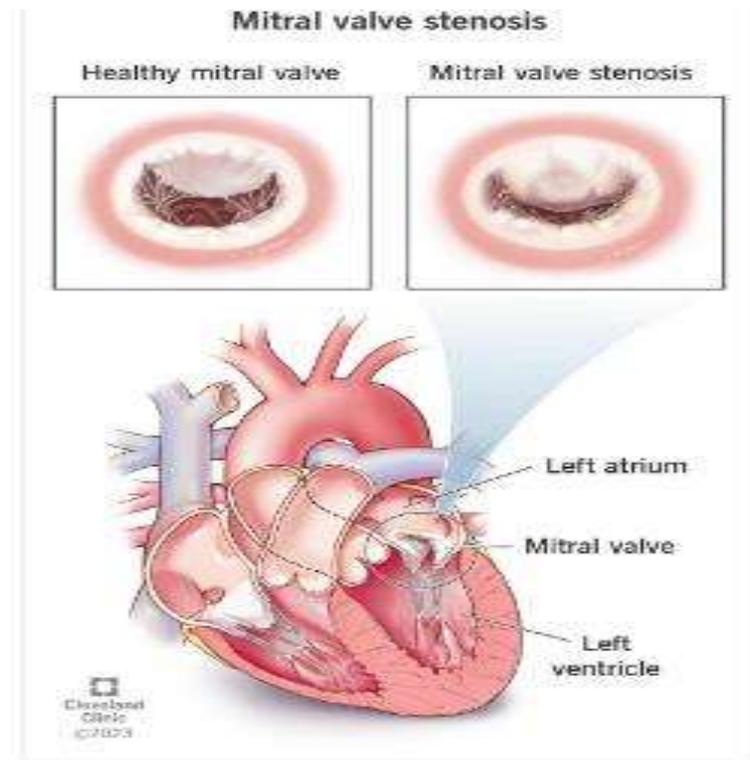
- **Diastolic** murmur 5<sup>th</sup> ICS MCL

## Insufficiency/Regurgitation:

- **Systolic** murmur 5<sup>th</sup> ICS MCL

## Heart failure:

- **L atrial volume overload**



Auscultate  
2nd ICS  
RSB

# Aortic Valve Defects

## Stenosis:

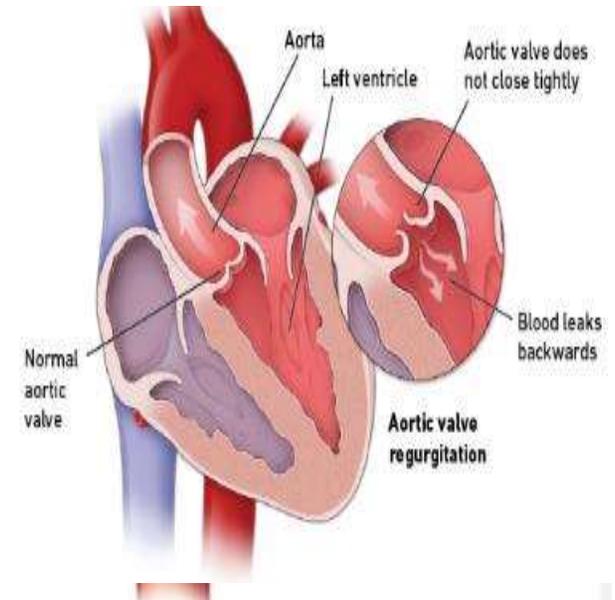
- **Systolic** murmur @ 2<sup>nd</sup> ICS RSB
- **TAVR- Assess for stroke & heart blocks**

## Insufficiency/Regurgitation:

- **Diastolic** murmur @ 2<sup>nd</sup> ICS RSB

## Heart failure:

- **L ventricular volume overload**



# Valve Repair or Replacement

## Surgical:

- Repair existing valve
- Insertion of mechanical or biological valve

## Transcatheter:

- Mitral clip
- Balloon valvuloplasty
- TAVR

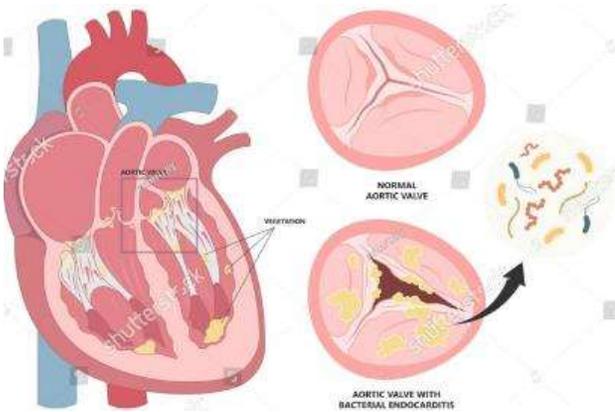
## Potential complications:

- Conduction disturbances
- Manage preload
- Anticoagulation needs
- Infection

# Endocarditis

## Clinical Assessment

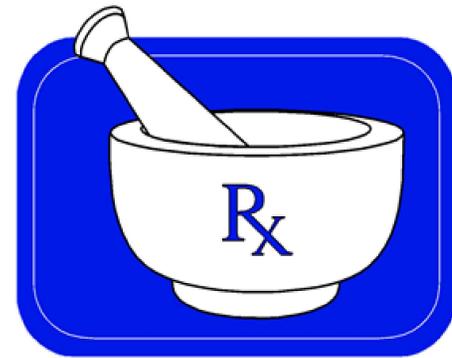
- Fever
- Splenomegaly
- Hematuria
- Stabbing/sharp pain
- SOB, Cough
- JVD
- Petechiae
- Friction Rub
- Cardiac Murmurs
- Fatigue
- Osler Nodes
- Janeway Lesions
- Splinter Hemorrhages in Nail Beds



# Endocarditis

## Treatment

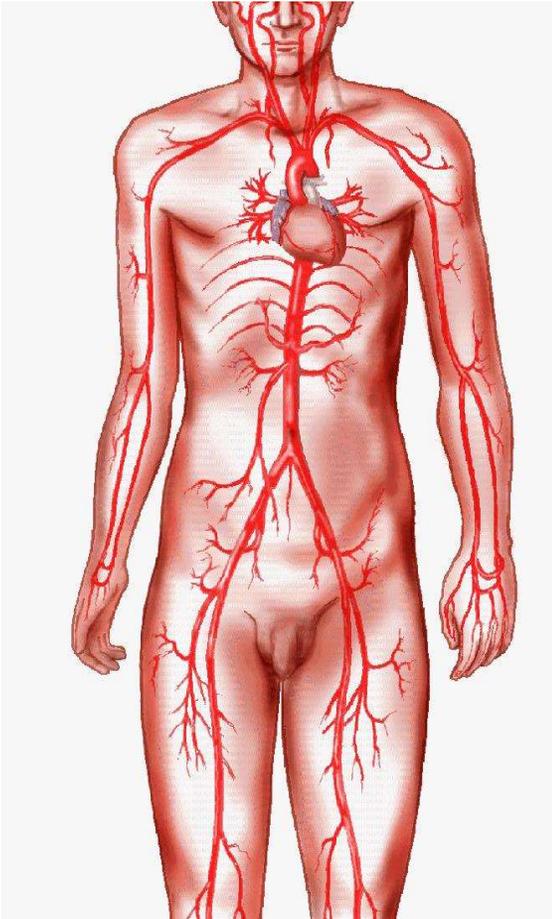
- **Prevention**
- **Resolve Infection**
- **Long Antibiotics Course**
- **Surgery**





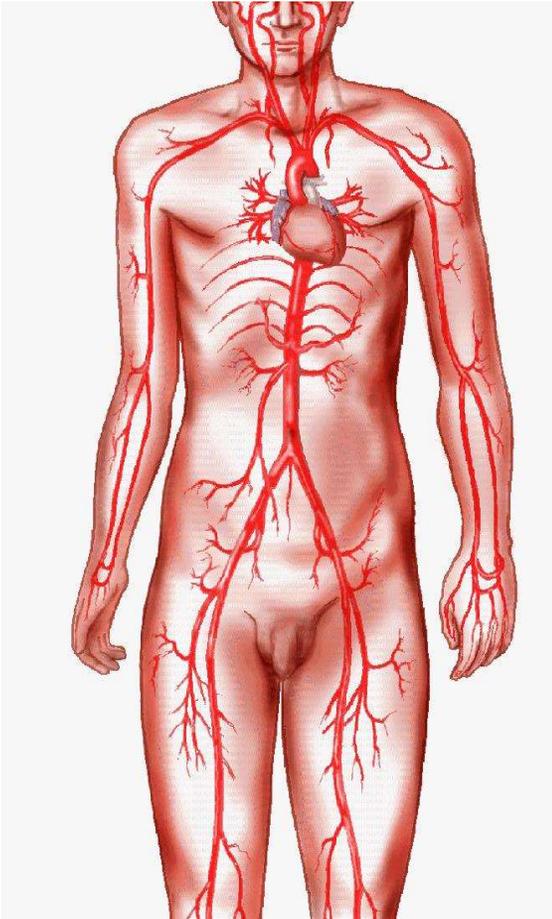
# **Peripheral Vascular Disease**

# Peripheral Vascular Disease & Surgery



- **Risk Factors:**
  - **Smoking**
  - **HTN**
  - **DM**
  - **Lipid Disorders**
  - **Family History**
  - **Hyperhomocysteinemia**

# Peripheral Vascular Insufficiency



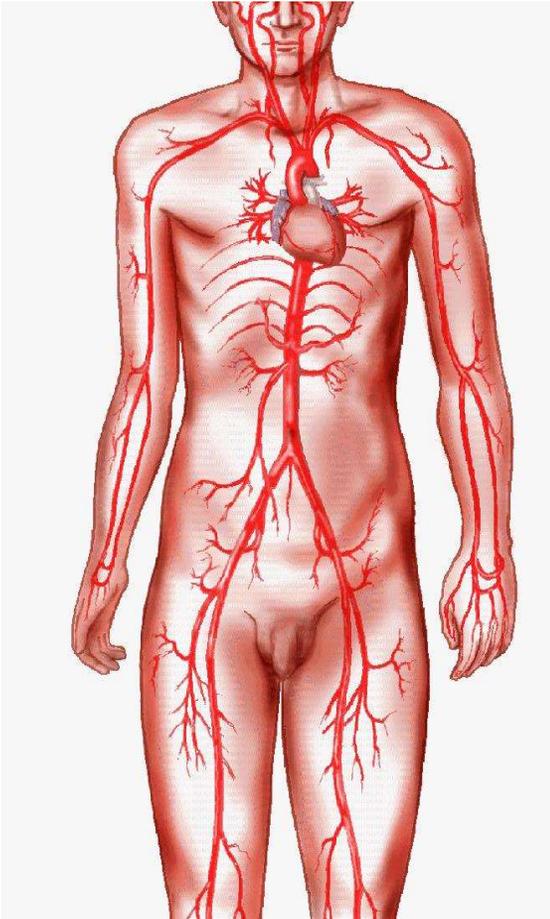
- **Acute Limb Ischemia:**
  - **Pain**
  - **Pressure**
  - **Pulselessness**
  - **Pallor**
  - **Paresthesia**
  - **Paralysis**

**6 P's**

# Peripheral Vascular Insufficiency

<b>Arterial</b>	<b>Venous</b>
<b>Cool extremity</b>	<b>Warm extremity</b>
<b>Pulseless</b>	<b>Pulse often present</b>
<b>Often no edema</b>	<b>Edema</b>
<b>Pallor</b>	<b>Hyperpigmentation Non-healing wounds</b>
<b>INTERMITTENT CLAUDICATION</b> <b>Sharp Severe Pain worse with walking or legs elevated</b>  <b>Critical Limb Ischemia (CLI)-pain at rest</b> <b>6Ps</b>	<b>Dull Pain/heaviness worse when standing or legs dependent</b>

## Peripheral Vascular Insufficiency



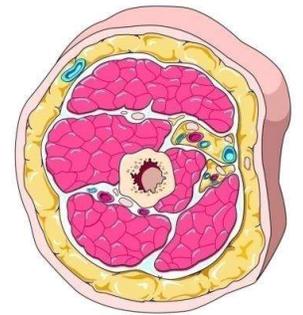
- **Management & Treatment:**
  - **Risk Factor Modification**
  - **Stop Smoking!**
  - **Vasodilators**
  - **Antiplatelets**
  - **Exercise**
  - **Angioplasty/Stents**
  - **Vascular Bypass Surgery**

# Peripheral Vascular Insufficiency

## Compartment Syndrome:



- **Ischemia, Injury, Necrosis**
- **Signs & Symptoms:**
  - **Throbbing Pain**
  - **Firmness**
  - **Altered Sensation**
  - **Pulselessness**
  - **Decreased Movement**

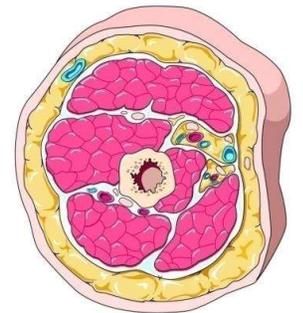


# Peripheral Vascular Insufficiency

## Compartment Syndrome:



- **Treatment:**
  - **Eliminate the Cause**
  - **Do Not Elevate**
  - **Pain Management**
  - **Fasciotomy**



13. Which action by a nurse would be first in a patient with ventricular tachycardia, HR 135/min, RR 32/min, BP 90/48 mmHg, conscious with complaints of dizziness, shortness of breath and a recent K<sup>+</sup> level of 3.4?

- A. Emergent defibrillation
- B. Emergent cardioversion
- C. Amiodarone IVP
- D. Hang the ordered 10 mEq KCL/50ml

14. A patient was admitted for medical management for a diagnosis of an ascending thoracic aortic aneurysm. Which new finding would alert the RN to prepare for emergent cardiac surgery?

- A. Diastolic murmur at 2nd ICS, right sternal border
  - B. Virchow's Triad positive findings
  - C. Systolic murmur at 3rd ICS, Left sternal border
  - D. Positive Cullen's sign
- 

15. A patient with a PA catheter is in the ICU & receiving several continuous IV meds to maintain hemodynamic stability. The RN is preparing to start a Heparin drip, that isn't compatible with any of the other meds. What is the best way to give the Heparin IV?

- A. The distal port of the PA catheter
  - B. The proximal port of the PA catheter
  - C. A new peripheral IV
  - D. As a secondary infusion connected to the maintenance fluid
- 

16. A patient presents with SOB, fever, a petechial rash on both forearms & a recent umbilical piercing. The pt. states they have been on a corticosteroid for an upper respiratory infection. These assessment findings alert the RN to the potential diagnosis of:

A. Pneumonia

B. Varicella Zoster

C. Endocarditis

D. Autoimmune disorder

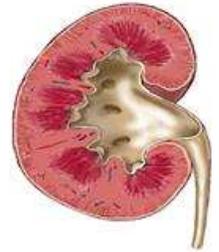
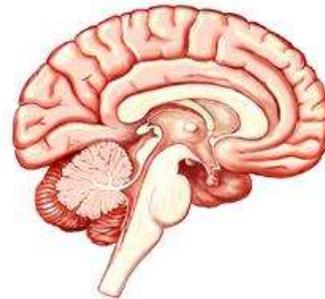
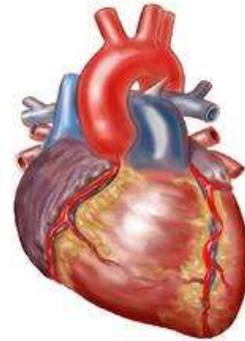
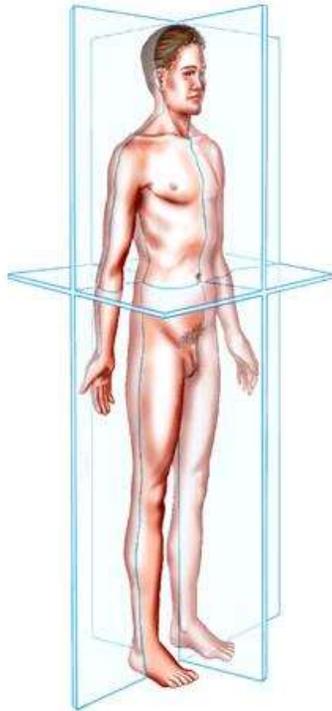


# Hypertensive Emergencies

# Hypertensive Crisis

- **Hypertensive Crisis**
  - **SBP > 180 and/or DBP >120mmHg**
  - **Global, Does Not Denote Physiological Response**
- **Hypertensive Emergency**
  - **BP > 180/120mmHg w/ Acute or Ongoing End Organ Damage**
  - **Immediate Reduction is Required**
- **Hypertensive Urgency**
  - **BP > 180/120mmHg w/o End Organ Damage.**
  - **Reduction Important But Not Emergent**

# Assessment



Target Organ	Organ Damage	Clinical Manifestations
Heart	Acute heart failure Acute coronary syndrome	Chest pain Dyspnea JVD
Aorta	Aortic dissection or aneurysm (thoracic or abdominal)	Chest, abdominal, or back pain Syncope Neuro deficits Limb ischemia
Brain	Encephalopathy Intracranial hemorrhage	Headache/Altered mental status Seizures Visual disturbance
Kidneys	Acute Renal Failure	Decreased urine output Increased creatinine Electrolyte imbalances

# HTN Emergency Treatment Goal

- **Reduce MAP by 25% in 1<sup>st</sup> 1-2 hrs**
- **Controlled, Predictable & Safe Fashion**
- **Then- ↓ 160/100 mmHg in 2-6 hrs**
- **Goal- Normal BP over next 24-48 h**

# HTN Emergency Treatment

- **IV Calcium Channel blockers**
- **IV Vasodilators**
- **IV Adrenergic Inhibitors**
- **Diuretics (Avoid):**

***Pressure-induced natriuresis***

# HTN Emergency Treatment

## ABCD Mnemonic

### **A:** Arteriole/Venous Dilator –

- Sodium Nitroprusside
- Nitroglycerin
- Hydralazine

### **B:** Beta Adrenergic Blockers

- Esmolol
- Labetalol

### **C:** Calcium Channel Blockers *dihydropyridines*

- Clevidipine
- Nicardipine

### **D:** Diuretics Don't do it!

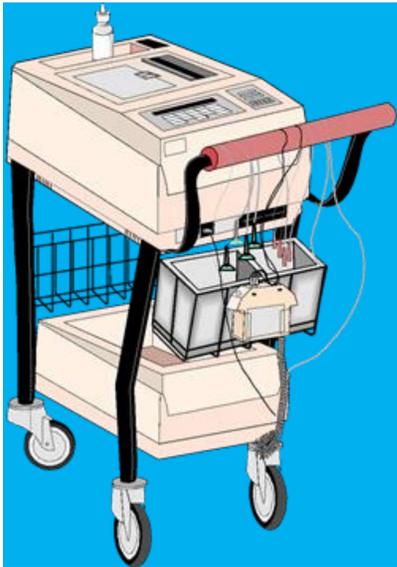
- Unless fluid overload or acute pulmonary edema

# HTN Urgency Treatment

- **Goal:**

- **BP Lowered in 24 - 48hr**
- **Oral Agents Adequate**
- **ACE Inhibitors**
- **Ca<sup>+</sup> Channel Blockers**
- **Alpha<sub>2</sub> Adrenergic Stimulators**

# Dysrhythmias



# Cardiovascular Blueprint

Structural Heart  
Defects

Heart Failure

ACS

Pharmacology

Cardiac  
Complications

Dysrhythmias

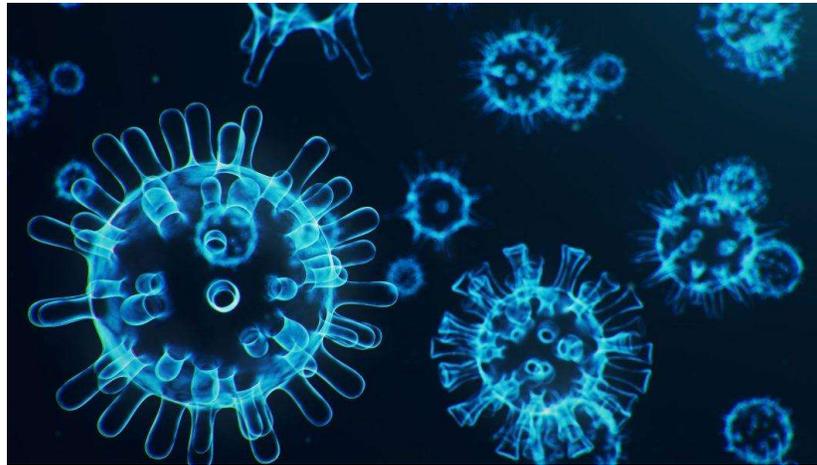
Invasive  
Hemodynamic  
Monitoring

CCRN ONLY

# Multisystem

PCCN 15%

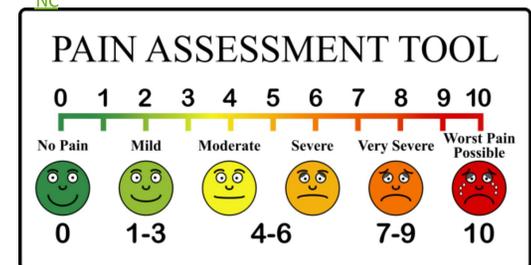
CCRN 14%



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# Multisystem Blueprint

- End of Life/Palliative Care
  - Healthcare-associated conditions (e.g., VAE, CAUTI, CLABSI)
  - Bariatric Complications
  - Pain
  - Pandemic Management
  - Sepsis
  - Shock
  - Toxic Ingestion
- 
- **PCCN ONLY:**
  - Rhabdomyolysis (Part of Musculoskeletal/Covered in Renal module)
  - Shock (**Anaphylactic & Hypovolemic only**)
  - Pressure Injuries
- 
- **CCRN ONLY:**
  - Multisystem Trauma
  - Multiorgan Dysfunction Syndrome (MODS)
  - **Neurogenic Shock**
  - Life-threatening maternal/fetal complications (eclampsia, HELLP syndrome, postpartum hemorrhage, amniotic embolism)
  - Thermoregulation

# **PCCN Testable Actions**

- **Administer/monitor medications for procedural sedations**
  - **Differentiate types of wounds, pressure injuries**
  - **Manage patients with complex wounds (e.g., fistulas, drains and vacuum-assisted closure devices)**
  - **Manage patients with hypertonic solution**
  - **Manage patients with infections**
  - **Screen for SIRS, sepsis, severe sepsis**
- 

# CCRN Testable Actions

- Provide end-of-life & palliative care
- Recognize risk factors/manage **malignant hyperthermia**
- Manage patients:
  - Undergoing continuous/intermittent/procedural sedation
  - Neuromuscular blockage agents
  - Continuous temperature monitoring
  - Targeted temperature management

# Physiologic Basis for Pain



**Somatic Pain**

Cutaneous or Deep Skin, Bone or Muscles



**Visceral Pain**

Organs



**Referred Pain**

Ex. Lt Arm Pain w ACS



**Neuropathic**

Damage to Nerves



# Nurse as Advocate

**Palliative  
&  
Hospice  
Care**

# End of Life Care

## Dimensions of EOL Care

- **Physical**
- **Psychological**
- **Social**
- **Spiritual**

## **Palliative Care**

Any stage of disease

Same time as curative treatment

Typically happens in the hospital

## **END-OF-LIFE CARE**

Prognosis  $\leq$  6 months

Excludes curative treatment

May happen wherever the patient calls home

# Multisystem Care Complications

- **Healthcare Acquired Infections (HAI)**
- **Infectious Diseases**
- **Sleep Deprivation**
- **Bariatric Complications**
- **Targeted Temp Management\***
- **Anoxic Injury\***

**\*CCRN only**

# HAI Prevention Strategies

- Contact precautions (when indicated)
- Antibiotic stewardship
- Antimicrobial prophylaxis
- Patient positioning
- Subglottic suction
- Strict asepsis with central line insertion
- Limiting devices
- Decontamination bathing with CHG



# Thermoregulation

## Normothermia vs. Hypothermia

**Normothermia: maintain 36 degrees Celsius**

**Hypothermia: maintain 32-34 degrees Celsius**

**CCRN Only**

**Hyperthermia after anoxia** = worse outcomes

**Hypothermia brings about increased risks:**

- Bradycardia
- Platelet dysfunction
- WBC dysfunction

**Outcomes differ:**

Shockable rhythm

Onset of CPR

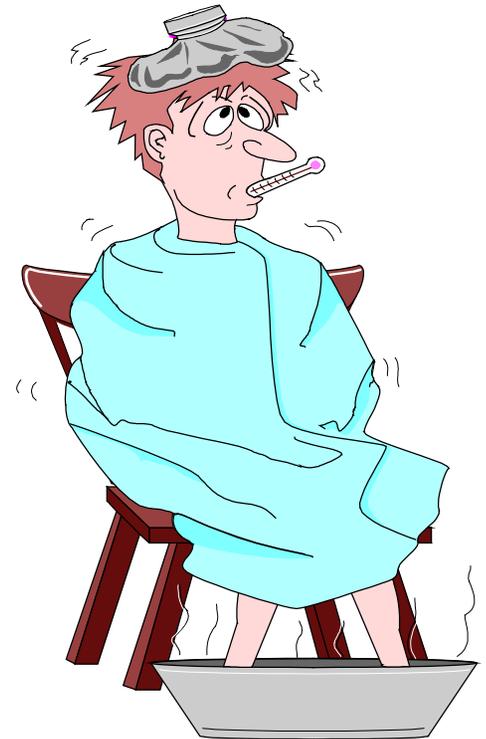
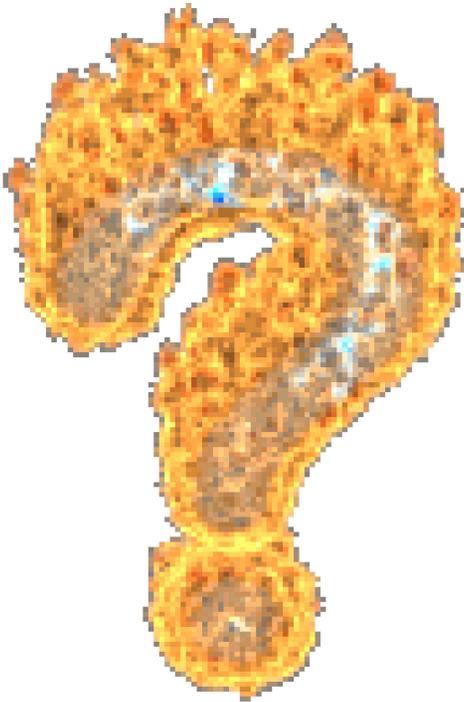
# Thermoregulation

- **Tight temperature control priority in neurocritical patients (stroke, traumatic brain injury, meningitis)**
  - Hypothermia not been proven helpful
  - Close monitoring to ensure normothermia improves outcomes
- **Anesthesia/surgery-induced hypothermia requires close attention**
  - External warming blankets
  - Warmed IV fluids
- **Hypothermia during surgery**

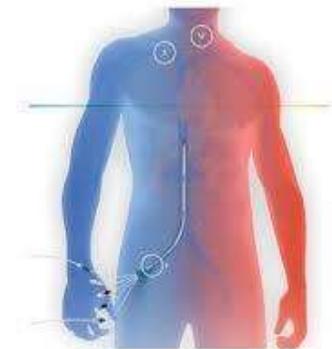
**CCRN Only**

# Thermoregulation

## Targeted Temp Management



CCRN Only



Picture 1: Consulting with address of the GDCI, Therapeutic XP Integration Management System, Miami, USA

1. A post cardiac arrest patient is admitted to the ICU. There are orders to begin the hypothermia protocol and prepare to take the patient to the cath lab. The appropriate response to these 2 orders would be to: (CCRN Only)

A. Take the patient to the cath lab & begin hypothermia upon return to the ICU

B. Take the patient to the cath lab & begin hypothermia immediately after PCI in the cath lab

C. Begin the hypothermia in the ICU & take the patient to the cath lab

D. Begin hypothermia & take the patient to the cath lab during rewarming

2. The new graduate orientee ask the preceptor why Foley catheters are only allowed to stay in 24hr post-surgery. The best response from the senior nurse would be?

A. "There is a clear correlation between Foley catheter use and incidence of UTI."

B. "Removing the Foley catheter promotes early ambulation"

C. "The daily weight is a better indication of I & O."

D. "Early Foley removal is a CMS mandate for all Medicare patients."



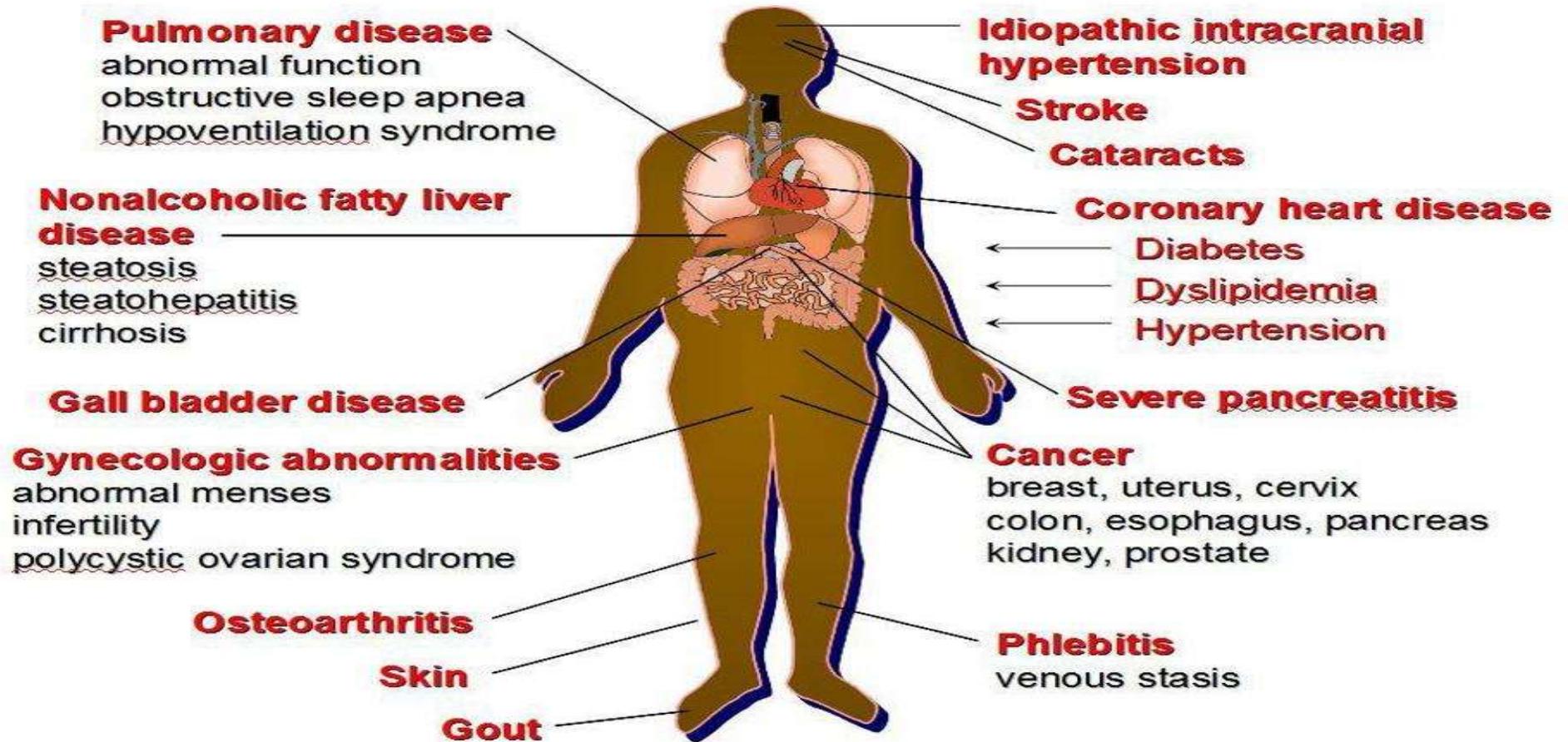
## **Medical Complications of Obesity**

**Chronic pro-inflammatory  
state**

**Insulin resistance**

**Hypercoagulability**

# Medical Complications of Obesity



Source: [http://www.asyouage.com/19\\_Medical\\_Complications\\_of\\_Obesity.html](http://www.asyouage.com/19_Medical_Complications_of_Obesity.html)

# Clinical Challenges Caring for Patients with Obesity

**Airway  
&  
Ventilation**

**Cardiovascular**

**GI:  
ACS,  
aspiration**

**Hematological  
(DVT/PE)**

**Pharmacological  
dosing**

**Endocrine:  
Glucose  
control/nutrition**

**Diagnostic testing**

**Vascular access  
placement**

**Skin:  
Pressure  
ulcers/pressure-  
induced  
rhabdomyolysis**

**Sensitive care  
challenges**

3. Which of the following statements regarding feeding a bariatric patient is true?

A. It is acceptable to delay feeding on an obese patient because catabolism takes longer

B. Indirect calorimetry has demonstrated that bariatric patients have decreased metabolic needs

C. When calculating caloric need (20-30 kcal/kg/day), total body weight should be used

D. Obese patients have increased insulin levels which make them more prone to hypoglycemia when critically ill

4. The nurse explains Palliative Care to the patient who is critically ill and their family. Which of the following statements is most correct?

A. Palliative Care focuses on providing emotional support & management of symptoms for patients who are critically ill

B. Palliative care is basically the same as end-of-life care

C. Only truly critically ill patients can receive palliative care

D. Palliative care is given in place of treatment focused lifesaving type of treatments

# Pandemic Management



- **Phases of Emergency Management**
  - **Mitigation**
  - **Preparedness**
  - **Response**
  - **Recovery**

**PCCN ONLY**

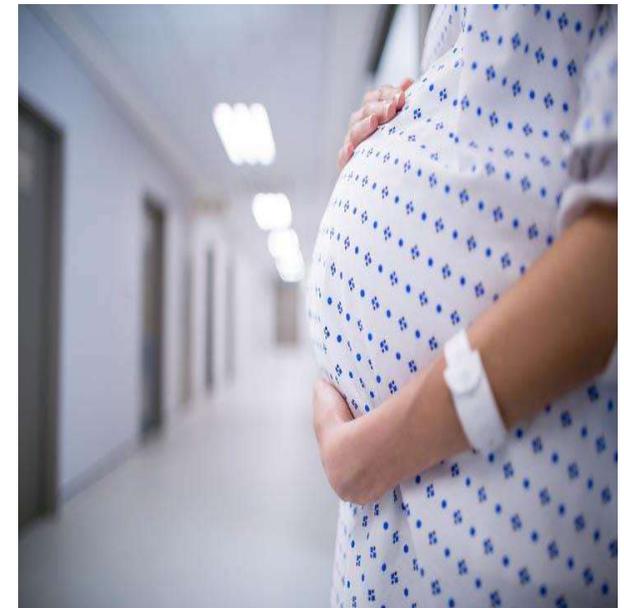
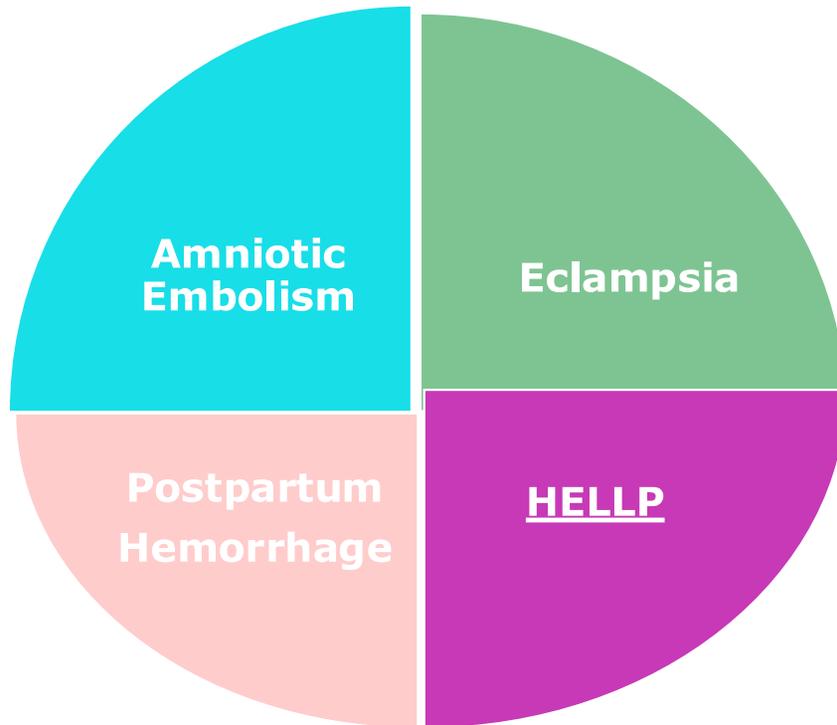
# Pandemic Management

- **Goals**



- **Optimizing Patient Flow**
- **Safety**
- **High-Quality Patient-Centered Care**
- **Resilience**
- **Infection Control**

# Maternal Fetal Complications



**CCRN Only**

# HELLP

**H**emolysis  
**E**levated  
**L**iver Enzymes  
**L**ow **P**latelets

## Risk Factors:

- **Pregnancy-Induced HTN\***
  - **66% 2<sup>nd</sup> trimester**
  - **33% Post-Partum**
- **70% between 27-37 wks gestation**
  - **Older maternal age (>34 yo)**
    - **Multiparas**



**CCRN Only**

# **HELLP**

## **Severe Complications**

- **Placenta Abruptio**
- **Postpartum Hemorrhage**
- **Liver Hematomas with Liver Rupture**
- **Acute Renal Failure**
- **Cerebral Hemorrhage**
- **ARDS**
- **Fetal Mortality**
- **Cardiac Arrest**



# HELLP Treatment

Prevent Seizures

Fluids and Electrolytes

Blood Products if Needed

Control BP

Deliver the Baby

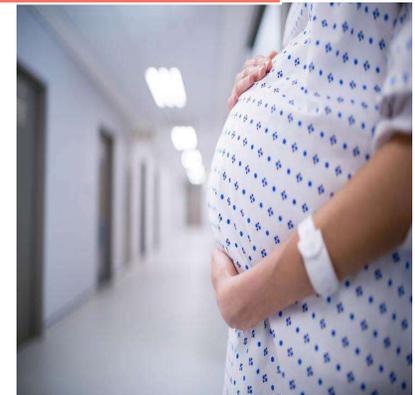
Dexamethasone

Monitor Liver & Renal Function

Plasma Exchange?

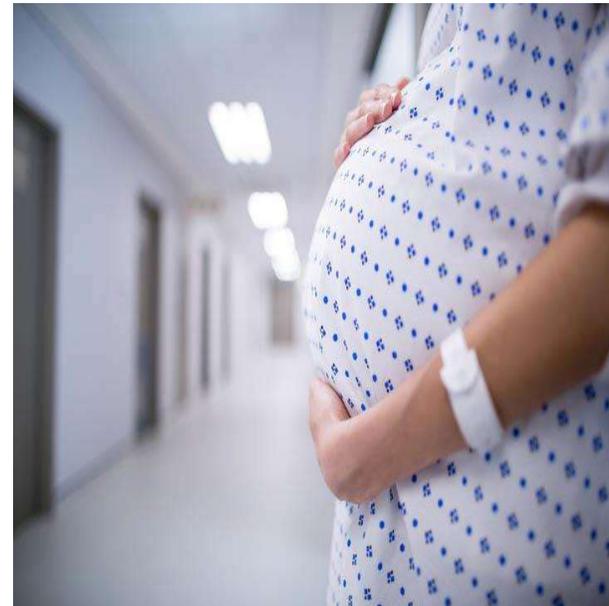
Liver Transplant?

Future Pregnancies?



# Maternal/Fetal Key Principles

- **ABCDEF**
- **Late Shock S&S**
- **OB Consult**
- **Left Side**
- **C-Section**
- **Rhogam**



5. A 9-month pregnant woman presents to the emergency department with eclampsia. Which IV medication will be given to prevent seizures?

A. Potassium

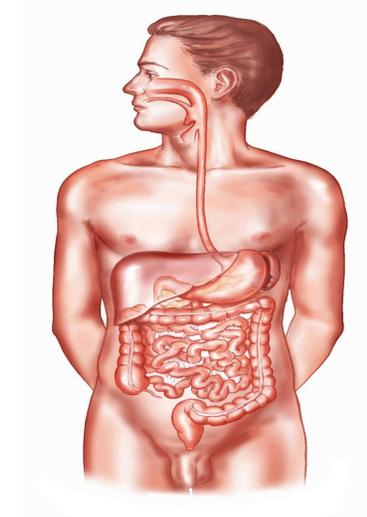
B. Magnesium sulfate

C. Lactated ringers

D. Dextrose 50

# Toxic Exposure Assessment

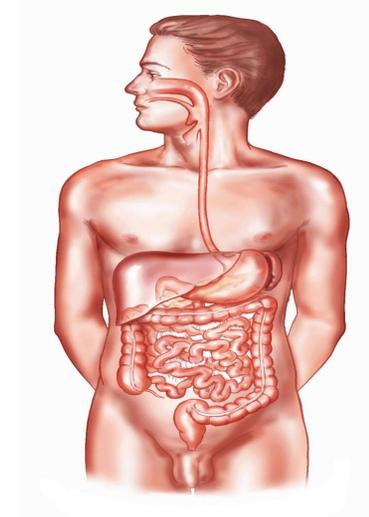
- ABCs
- Poison Control
- Secondary Survey
- Vital Signs
  - LOC, HR, RR, BP
  - Temperature:
    - ↑ Salicylates & Cocaine
    - ↓ Barbiturates & Opiates



# **Toxic Exposure**

## **Treatment Options**

- **Antidote**
- **Prevent Absorption**
- **Enhance Elimination**
  - **Oral Gastric Lavage**
  - **Emetics NOT Recommended**
  - **Activated Charcoal**
  - **Diuresis**
  - **Whole Bowel Irrigation**
  - **Hemodialysis**



# Toxic Exposure

## Common Toxins

**Acetaminophen**

**Liver Failure**

**N-Acetylcysteine  
(NAC) (Mucomyst)**

### Assessment

**N/V**

**RUQ Pain**

**Bleeding**

**Increased LFTs**

### Treatment

**NAC**

**Gastric Lavage**

**Charcoal**

# **Toxic Exposure**

## **Common Toxins**

**Cocaine**

**Sympathetic  
Response**

**No Antidote**

**Assessment**  
**Hypoxia, Stroke,  
Head Injury,  
Inc Temp, MI**

**Treatment**  
**Benzo-Sedation  
Vasodilators  
ACS Tx  
Cooling  
Seizure Tx**

6. When assessing a patient with suspected cocaine intoxication, The nurse would expect to see:

- A. Chest pain, hypothermia & hypoxia
- B. Tachycardia, chest pain & hyperthermia
- C. Hyperthermia, hypotension & drowsiness
- D. Anxiety, hypertension, bloody urine

# Shock

**Pathophysiology  
Pathogenesis  
&  
Classifications**

# Clinical Definition

**The Inability of The Circulatory System to Supply Oxygen & Nutrients to The Cells of The Body**

**Oxygen Demands Are Greater  
Then The Supply**



# Classifications of Shock

**Distributive or Vasodilatory:**  
**Inadequate tissue perfusion caused by systemic  
vasodilation**

**Inflammation & Capillary leak**

**Sepsis\***  
**Anaphylaxis\***  
**Neurogenic**

# Classifications of Shock

## **Obstructive:**

**Inability to produce adequate CO**

**Despite normal intravascular volume & myocardial  
function**

**Tension Pneumothorax\***  
**Cardiac Tamponade\***  
**Pulmonary Emboli**

# Hypovolemic Shock

- **Most Common**
- **Easiest to Treat**
- **Blood Volume Insufficient to Fill Intravascular Space**
- **Preload Deficit**
- **Decrease in Cardiac Output**

# Causes

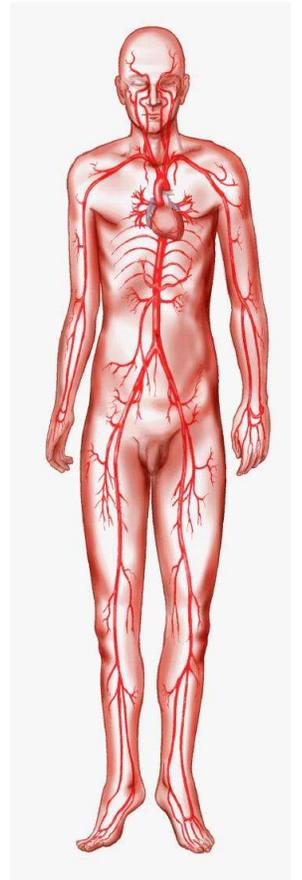
## Absolute/Direct Loss of Volume

External Hemorrhage

Gastrointestinal Volume Losses

Renal Volume Losses

Plasma Losses



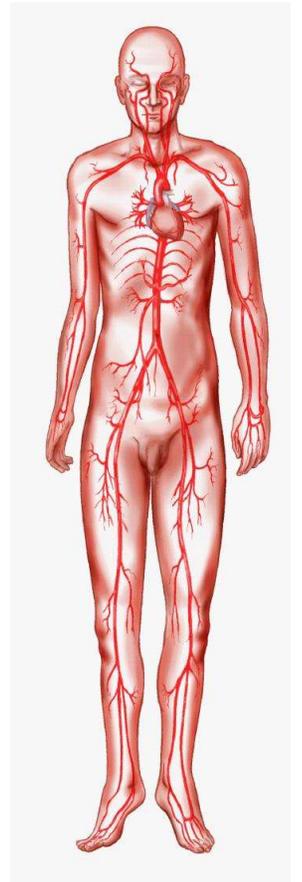
# Causes

## Relative/Indirect Loss of Volume

Sequestration of Fluid

Internal Hemorrhage/Volume Losses

Plasma Losses



# Hypovolemic Shock

## **Patient Presentation Depends On:**

- 1. Percentage of Volume Loss**
- 2. Duration of Hypovolemia**
- 3. Activation & Response of Compensatory Mechanisms**

### **Clinical Presentation**

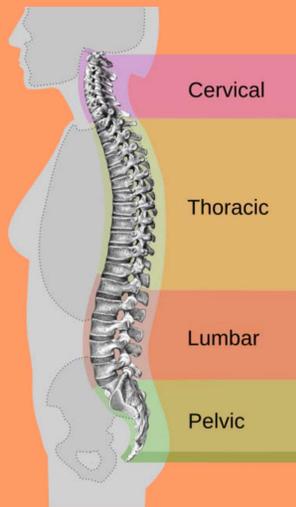
- **Blood Loss**
- **Vital Signs**
- **UOP**
- **LOC**
- **Lactic Acidosis**
- **Hyperglycemia**

### **Therapeutic Goals**

- **Restore Intravascular Volume**
- **Stop Losses**

CCRN ONLY

# Neurogenic Shock



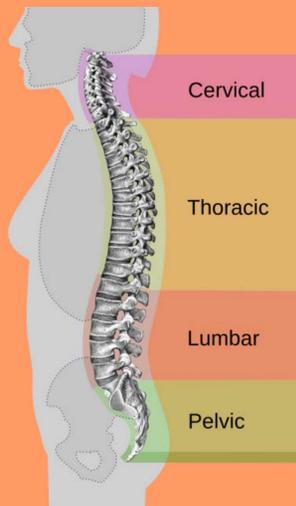
- **Loss of Vasomotor Tone Secondary to Inhibition of Neural Output**
- **Parasympathetic System Dominates**
- **Clinical Presentation:**
  - **Warm, Flushed Skin**
  - **Hypotension**
  - **Bradycardia**
  - **Temperature Dysregulation**
    - **Hypothermia**

Distributive Shock

**CCRN ONLY**

# Neurogenic

## Shock



- **Causes:**
  - **Spinal Cord Injury @ or above T6\***
  - **Deep General Anesthesia**
  - **Spinal Anesthesia**
  - **Brain Damage/Medullary Ischemia**
  - **CNS Problems**

## Therapeutic Goals

- **Stop Cause**
- **Spine Stabilization**
- **Airway Protection**
- **Volume Administration**
- **Beta Stimulation to ↑ HR**
- **Alpha Stimulation- Vasoconstriction**

# Anaphylactic Shock



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- **Massive Vasodilation**
- **Antigen-Antibody Reaction**
- **Activates Mast Cells & Triggers Basophils**
- **Vasodilation**
- **Increased Capillary Permeability**
- **Hypotension**
- **Relative Hypovolemia**



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# Anaphylactic Shock



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- **Clinical Presentation:**
  - **Hypotension**
  - **Generalized Edema**
  - **Laryngeal Edema/Angioedema**
  - **Severe Bronchoconstriction**
  - **Rash/Itching**
  - **Anxiety**

## Therapeutic Goals

- **Identify & Stop Cause**
- **Airway Protection**
- **Block Vasoactive Mediators**
- **Anti-Histamines**
- **Vasoconstrictors**
- **Bronchodilators**
- **Fluid Resuscitation**

7. Which of the following symptoms best describes the clinical assessment found with hypovolemic shock?

A. Tachycardia, hypotension, oliguria

B. Tachycardia, hyperthermia, hypotension

C. Hypertension, bradycardia, pitting edema

D. Hypotension, hyperglycemia, bibasilar rales

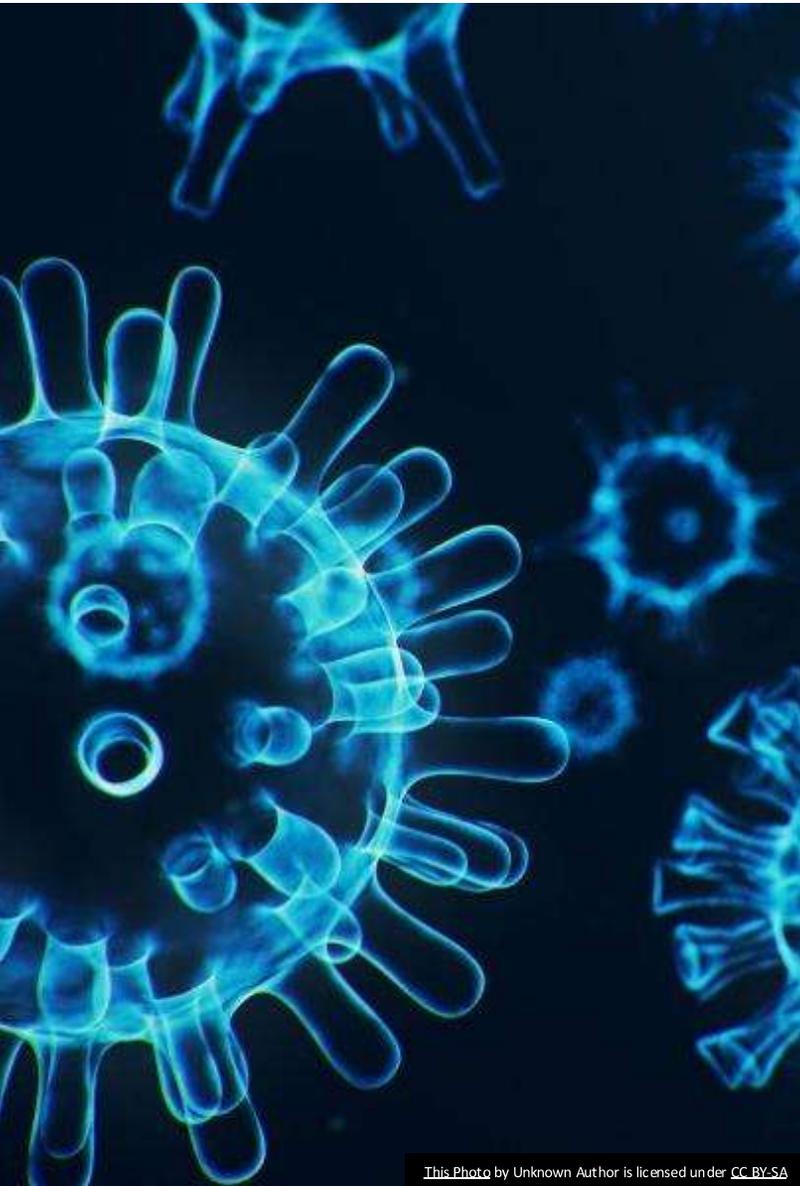
8. Which assessment data would help to differentiate neurogenic from anaphylactic shock?

A. Hypotension

B. Bradycardia

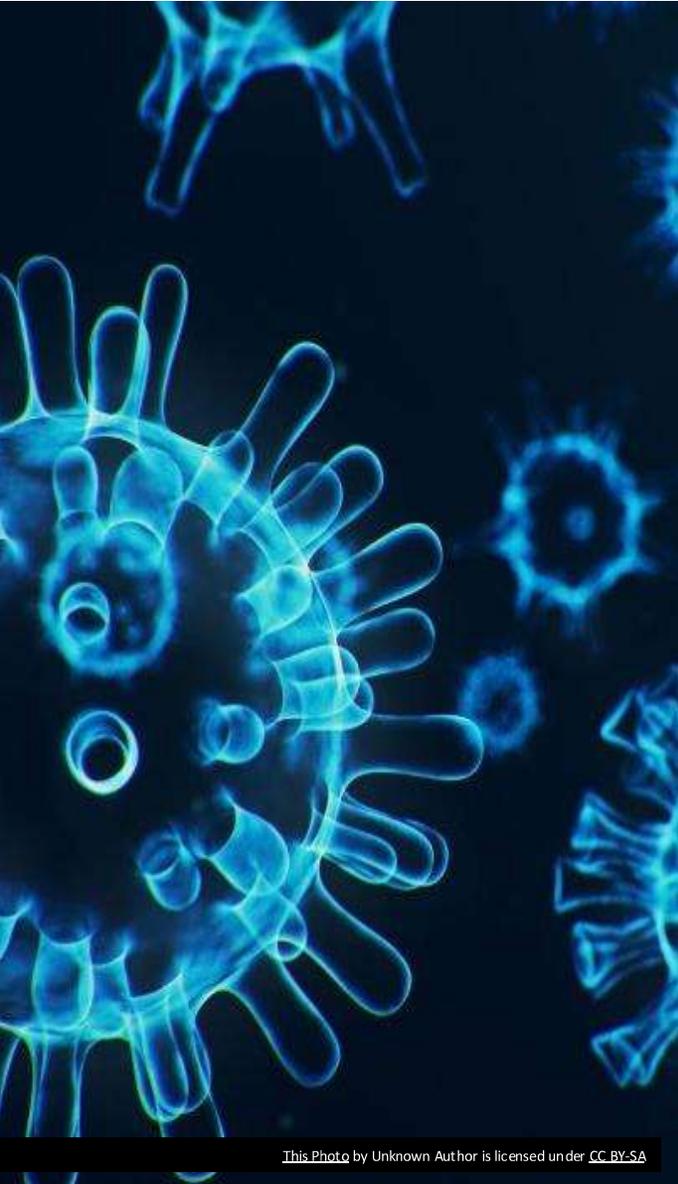
C. Low urine output

D. Low central venous pressure (CVP)



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# Septic Shock

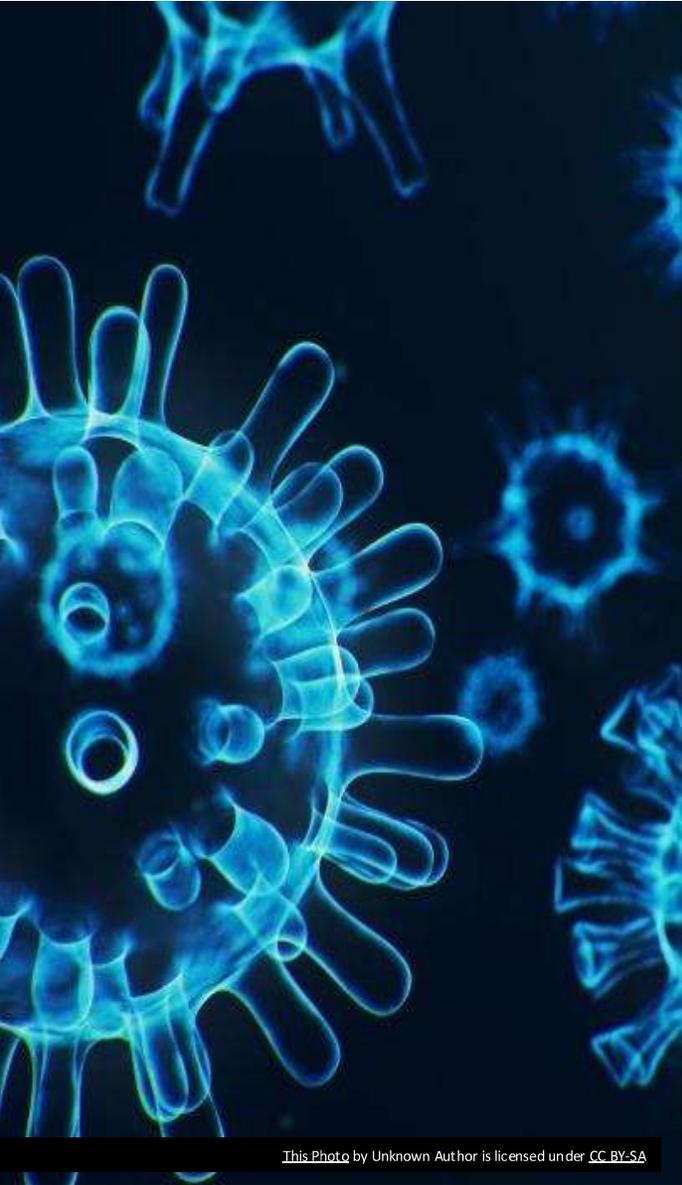


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# Definitions

- **Sepsis**: Life-threatening organ dysfunction caused by a dysregulated host response to infection.
- **Septic Shock**: Subset of sepsis
- Profound underlying circulatory & cellular/metabolic abnormalities
- Substantially increase mortality
- **Sepsis**
- **Persisting hypotension requiring vasopressors**
- **Serum lactate > 2.0**

Surviving Sepsis  
Campaign



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# Definitions

## **SIRS**

**(Systemic Inflammatory Response Syndrome)**

- **Widespread inflammation**
- **Leaky vessels**
- **Reduced flow to organs**
- **Organ dysfunction**



## **SIRS Clinical Signs:**

**Temperature dysregulation (hyper or hypo)**

**Tachycardia**

**Tachypnea**

**WBC- leukocytosis or leukopenia**

# Early Recognition!

- **SIRS criteria**
- **Cultures**
- **CBC**
- **Lactate**
  - **> 2 mmol/L- inadequate oxygen delivery**
- **C-Reactive Protein (CRP)**
  - **Non-specific inflammatory marker**
- **Procalcitonin (PCT)**
  - **High levels suggest bacterial infection**

Surviving Sepsis  
Campaign

## Causes

**Infection: Bacteria, Virus,  
Fungal**

**Local → Systemic → Sepsis**



**Septic Shock**



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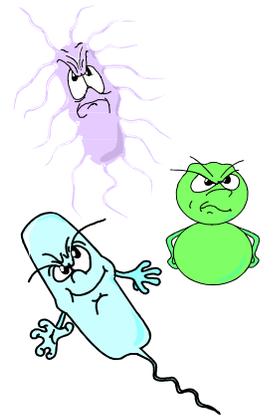
# Septic Shock Clinical Presentation

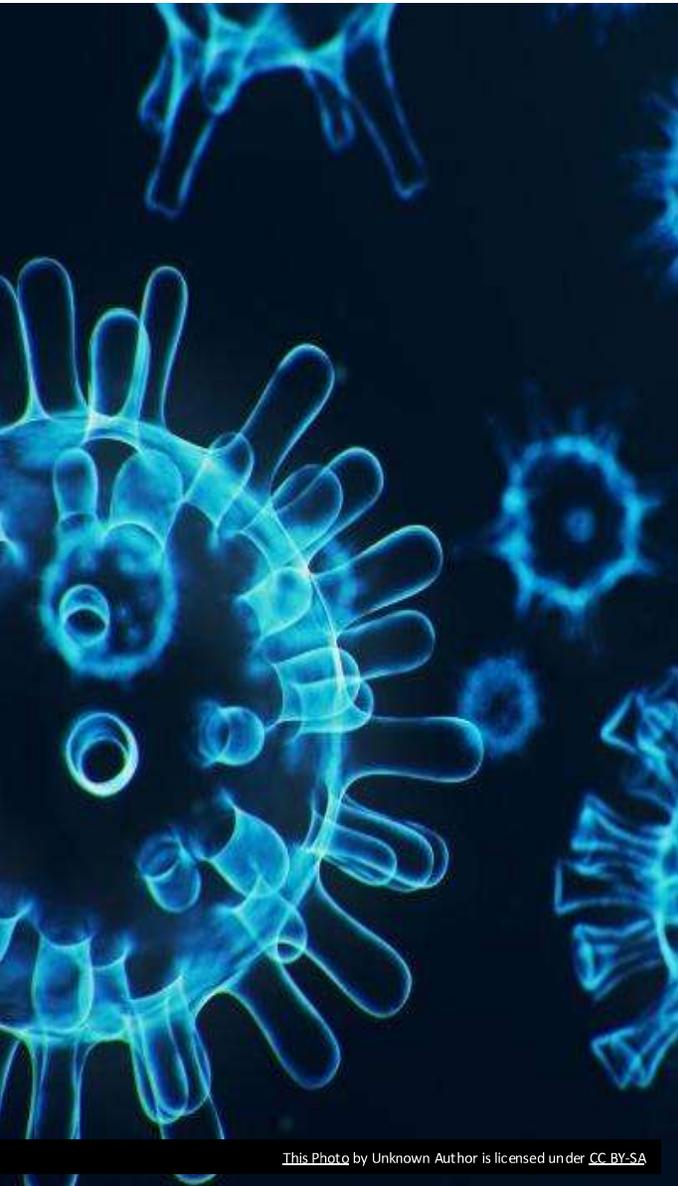
- **Systemic Reaction**
- **Endotoxin & Mediators**
- **Inflammation**
- **Inadequate O2 Delivery**
- **MASSIVE VASODILATION**

# Septic Shock

## Clinical Presentation

- **Pulmonary Capillary Leak → ARDS**
- **Complement System Activation  
→ Microthrombi**
- **Platelet Abnormalities**
- **Gluconeogenesis & Insulin Resistance**





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# Therapeutic Goals

- **Identify & Stop Cause**
- **Block Effects of Inflammatory Mediators**
  - **Antibiotics**
  - **Fluid Resuscitation**
  - **Vasopressors (MAP > 65mm Hg)**
  - **Ventilation & Oxygenation**

## Restore Hemopoietic Balance

*Critical Care Medicine 49 (11): p. 1974-1982, Nov 2021*



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# Stages of Shock

- All Cause Hypoperfusion
- Inadequate  $O_2$  Supply/CO
- Aerobic  $\longrightarrow$  Anaerobic Metabolism
- Lactic Acidosis
- Compensation for Perfusion Deficit

# Stages of Shock

## Compensatory Stage

- Neural
- Hormonal
- Chemical

## Decompensatory Stage

## Irreversible Stage

# **Multiorgan Dysfunction Syndrome (MODS)**

**Progressive failure of multiple organs**

- **Supportive care:**
  - **Vasopressors**
  - **Dialysis**
  - **Mechanical ventilation**
  - **Antibiotics**
  - **Nutritional needs**

9. A post op patient has a temp 38.0 C (101 F), HR 97, BP 90/40 mmHg, RR 26, & SpO<sub>2</sub> of 92% on 40% FM. The nurse should anticipate:

A. Norepinephrine infusion

B. Dopamine infusion

C. D5 0.45 NS w 20 K at 150 mL/hour

D. 30 mL/kg NS bolus

10. The RN is caring for an elderly female patient who presents to the ED with acute confusion and is diagnosed with a urinary tract infection (UTI).

VS: BP 100/58, HR 122, RR 24, SpO2 96% on room air, and T 101.8 F.

Which order is the priority?

- A. Administer 30 mL/kg NS bolus
- B. CT scan without contrast to rule out a stroke
- C. Obtain 2 sets of blood cultures
- D. Administer broad spectrum antibiotics

11. The RN is caring for a patient with acute urinary retention secondary to multiple traumatic injuries. Which of the following are risk factors for the patient developing a healthcare-acquired infection?

- A. Mechanically intubated, & patient is tolerating being OOB to chair 3 times daily and to the bedside commode PRN
- B. External urinary catheter placed 48 hours ago and the patient is refusing to turn, cough & deep breathe
- C. Indwelling foley catheter and a central venous catheter placed 48 hours ago
- D. The patient is able to eat a regular diet and using their incentive spirometry 4 times a day

12. If Dopamine does not adequately maintain the BP in a patient with cardiogenic shock, which medication will be considered?

A. Nitroglycerine

B. Lidocaine

C. Milrinone

D. Norepinephrine

# Multisystem Blueprint

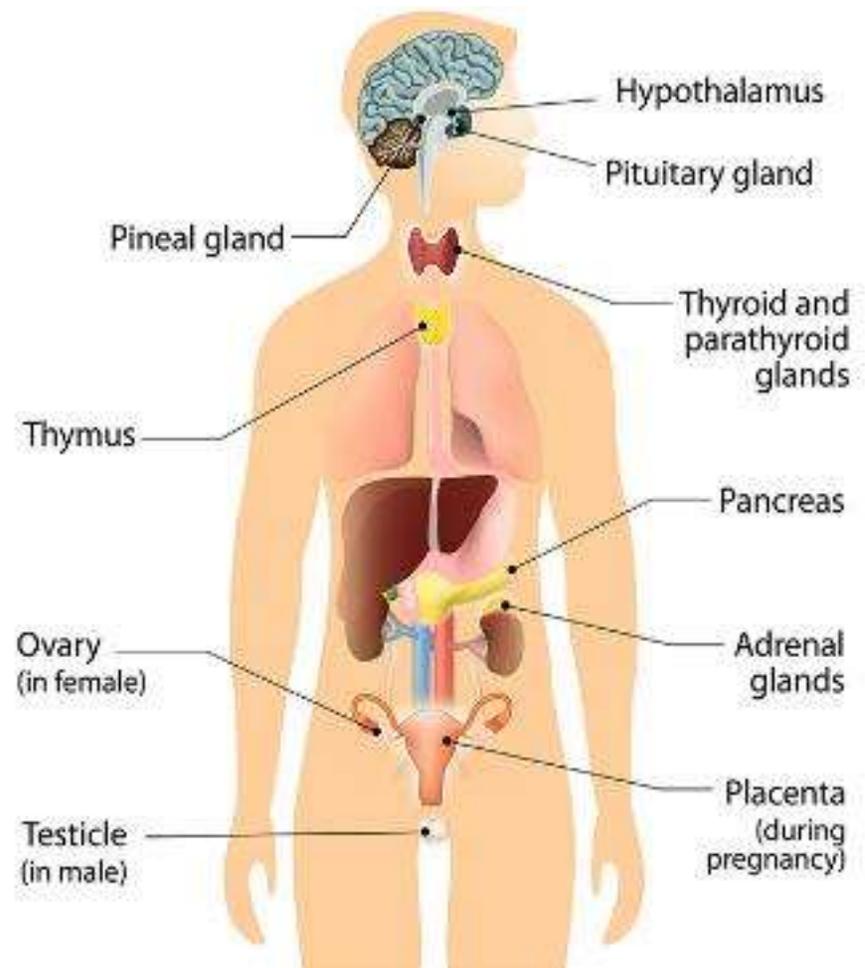
- End of Life/Palliative Care
  - Healthcare-associated conditions (e.g., VAE, CAUTI, CLABSI)
  - Bariatric Complications
  - Pain
  - Pandemic Management
  - Sepsis
  - Shock
  - Toxic Ingestion
- 
- **PCCN ONLY:**
  - Rhabdomyolysis (Covered in Renal)
  - Shock (Anaphylactic & Hypovolemic)
  - Pressure Injuries
- 
- **CCRN ONLY:**
  - Multisystem Trauma
  - Multiorgan Dysfunction Syndrome (MODS)
  - Neurogenic Shock
  - Life-threatening maternal/fetal complications (eclampsia, HELLP syndrome, postpartum hemorrhage, amniotic embolism)
  - Thermoregulation

# Endocrine Disorders & Emergencies

**PCCN 6%**

**CCRN 20%**

(Gen Med: GI, Renal, Heme, Endocrine & Skin)



<https://www.lybrate.com/topic/endocrine-system-image>

# Endocrine Blueprint

- **Diabetes**
- **DKA**
- **HHS**
- **DI**
- **SIADH**
- **Thyroid Disorders**
- **Adrenal Insufficiency**

**PCCN Testable Action:  
(CCRN Implied)**

**Manage & Titrate Insulin Infusions**

**CCRN ONLY**

1. A patient received their AM Novolin insulin before an NPO order was written for a procedure. Early afternoon in addition to getting a blood glucose level the nurse will look for clinical signs such as:
    - A. Thirst, confusion and hypotension
    - B. Anxiety, dehydration and warm/flushed skin
    - C. Irritability, tachycardia, pale/cool skin
    - D. Hunger, bradycardia, increased urinary output
- 

2. A patient was admitted in DKA 3 hrs ago with Glucose 575, pH of 7.27, K 4.9.

After insulin bolus, gtt & 2L of NS- Glucose 227, pH 7.32, K 4.2.  
The most appropriate action would be to:

- A. Switch NS infusion to D5.45 NS
  - B. Increase the insulin infusion by 2 U/h
  - C. Administer 1 amp Na Bicarb
  - D. Administer 10 mEq Potassium IV piggyback
- 

3. A patient is admitted with a suspected diagnosis of DKA. The nurse would expect which lab abnormalities?

- A. Hypoglycemia, acidosis, hyperkalemia, positive ketones
  - B. Hyperglycemia, alkalosis, hypokalemia, negative ketones
  - C. Hypoglycemia, alkalosis, hypokalemia, negative ketones
  - D. Hyperglycemia, acidosis, hyperkalemia, positive ketones
- 

# Diabetic Ketoacidosis (DKA)

Metabolic derangement resulting from absolute or relative insulin deficiency

Often affects Type I DM

Blood glucose > 250 mg/dl

pH < 7.3

HCO<sub>3</sub> < 18

Anion gap > 12

+ Urine ketones

Azotemia

Elevated BUN

## Signs & Symptoms

Hypotension

Neuro changes

Tachycardia

Tachypnea

Kussmaul's respirations

Decreased skin turgor

Dry mucous membranes

Possible N & V, abd pain

Treatment: Fluid Therapy  
Restore circulating volume

1-2 L isotonic saline in 2 h

D 5 1/2 NS after glucose < 250

May receive 8-10 L in first 24 hrs

Treatment: Drug Therapy  
Regular IV Insulin- continuous or bolus  
Goal:

Lower no more than 100 mg/dl/h

Monitor K<sup>+</sup> levels

Bicarb may be needed for severe acidosis

# Hyperosmolar Hyperglycemic Syndrome (HHS)

Hyperosmolar state from  
severe hyperglycemia  
without ketosis

**Primarily seen in older  
adults and Type II DM**

Glucose > 600 mg/dl

Ketones negative

pH > 7.3

HCO<sub>3</sub> > 15

Serum Osmolality > 320

in absence of severe  
ketosis

Severe dehydration

## Signs & Symptoms

Hypotension

Tachycardia

Tachypnea

Altered LOC

Severe dehydration

Polyuria

Possible

N & V, abd pain

## Treatment:

### Fluid Therapy

2 L of NS in 1 hour  
typical

Followed by fluid  
replacement

### Treatment: Drug Therapy

IV Insulin per  
protocol  
Monitor K<sup>+</sup> closely

# Comparison of DKA vs. HHS

Findings	DKA	HHS
Type of Diabetic	Type 1	Type 2
Mortality Rate	Approx. 1%	5-10%
Glucose Level	> 250	> 600
Ketones?	Yes	No
Acid/Base Balance	Metabolic Acidosis	Normal to potentially mild acidosis
Anion Gap?	Yes (>15)	No
Osmolality	Elevated (295-330)	Severely Elevated (330-450)
Fluid Deficit?	≥ 5 Liters	Average ≥ 10 L

# Anti-Diuretic Hormone (ADH)

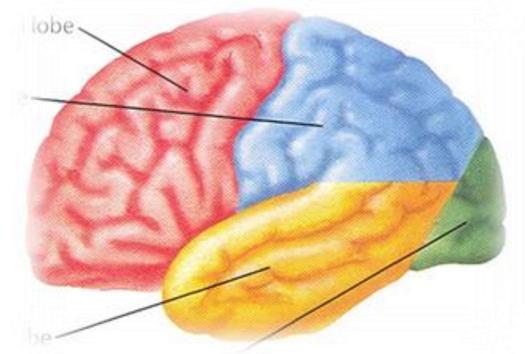
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Released by posterior pituitary in response to

- Low blood volume
- Low blood pressure
- High sodium (increased serum osmolality)

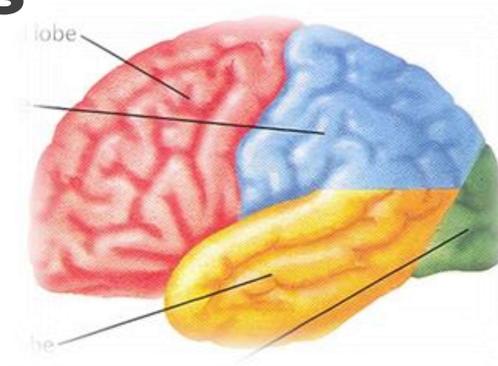
Causes kidneys to reabsorb more water

- Raises blood volume
- Raises blood pressure
- Dilutes serum sodium



# Diabetes Insipidus

**Impaired  
H<sub>2</sub>O Conservation  
by  
the Kidneys**



- **Polyuria**
- **Low Urine SG**
- **Hypernatremia**
- **Fluid Deficit  
Dehydration**

# Causes of Diabetes Insipidus

## Neurogenic or Central

- Hypothalamus may not be able to tell the posterior pituitary gland to release ADH  
OR
- Posterior pituitary not able to make ADH
- Normal regulatory mechanisms not functioning
- Causes:
  - Idiopathic – autoimmune
  - Head trauma
  - Ischemic encephalopathy
  - Neurosurgery
- Signs & Symptoms:
- Hypovolemia, dehydration and high serum sodium level

## Nephrogenic

- Kidneys are not able to respond and conserve free water
- Causes:
  - Osmotic agents or states
  - Renal failure
  - Decreased osmotic pressure
  - Pregnancy

**There is ADH, but the kidneys do not respond to it**

# Laboratory Data Diabetes Insipidus

<b>Serum Osmolality</b> Normal 275-295	<b>High &gt; 295 mOsm/kg</b>
<b>Serum Sodium</b>	<b>Normal or &gt; 155 mEq/L</b>
<b>Urine Osmolality</b> Normal 300-900	<b>Low &lt; 150 mOsm/kg</b>
<b>Urine Specific Gravity</b>	<b>Low &lt;1.005 (normal 1.005-1.030)</b>

# **Syndrome of Inappropriate Antidiuretic Hormone SIADH**

**Release of too much  
ADH**

**Stimulates the kidneys  
to retain water**

**Water Intoxication**

- **Overhydration**
- **Hyponatremia\***
- **Low Serum\*  
Osmolality**
- **High Urine\*  
Osmolality**
- **Weight gain**
- **Edema**

# SIADH

## Causes

- **Malignancies**
- **Meningitis**
- **Brain abscess or tumor**
- **Head injury**
- **Mechanical Ventilation**
- **Medications**

## Treatment

- **Correct Underlying Cause**
- **Fluid Restriction**
- **Give Sodium- normal or hypertonic saline**
- **Diuretic Treatment**
- **Vasopressin Antagonist (Vaptans)**

4. A patient with TBI has a change in their UOP over the last 24hr. A diagnosis of DI is suspected, & the anticipated osmolarity would be:

- A. Decreased serum and urine osmolarity
  - B. High serum and low urine osmolarity
  - C. Low serum and high urine osmolarity
  - D. Increased serum and urine osmolarity
- 

5. A patient on the vent with end stage lung cancer appears to be going into SIADH. The IV fluid order is most likely going to be switched to:

A. D5W .45NS with 20KCL at 125ml/hr

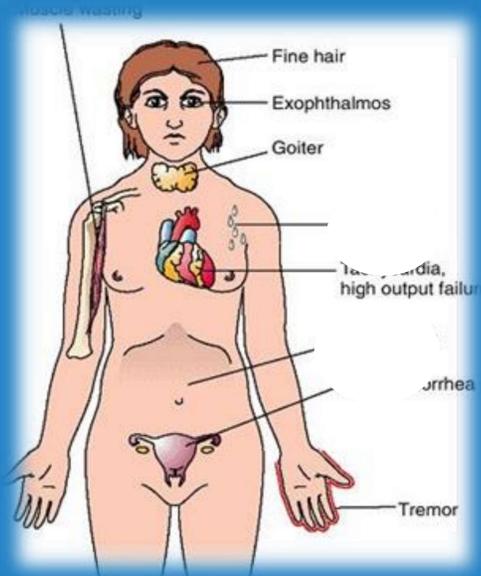
B. LR at 250 ml/h

C. 0.9 NS at 50 ml/h

D. D5W at 75 ml/h

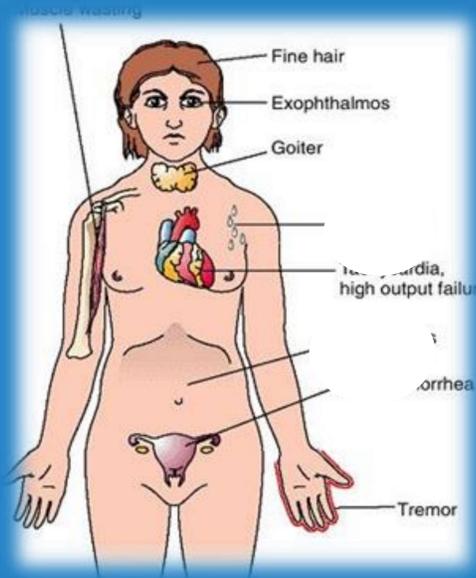
# Thyroid Abnormalities

## Hyperthyroidism



- **Primary vs. Secondary**
- **HypER Metabolic symptoms:**
  - **Tremors**
  - **Weight loss**
  - **Palpitations**
  - **Anxiety**
  - **Insomnia**
  - **Heat intolerance**
  - **Muscle weakness**
  - **Hyperreflexia**
- **Acute: Thyroid Storm**
- **Chronic: Graves Disease**

# Thyroid Abnormalities

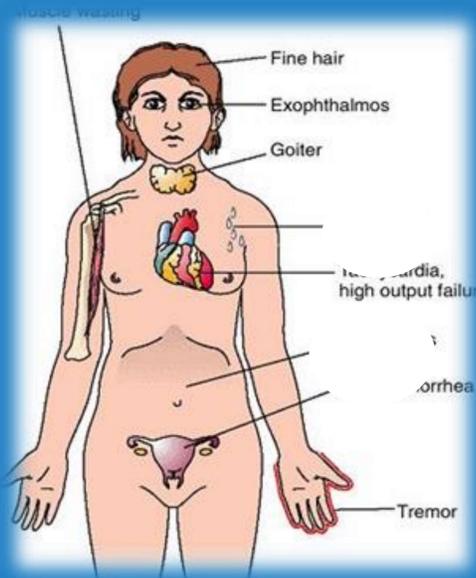


## Hyperthyroidism

- Labs indicate overactive thyroid:
  - **Low TSH:** Thyroid Stimulating Hormone
  - **High T3, T4 (Free T3/T4)**
- Treatment:
  - Antithyroid medication
  - Dexamethasone
  - Radioactive iodine
  - Thyroidectomy

Hyperthyroidism occurs when thyroid glands produce an excess of T3 and T4

# HyperThyroid Emergency



## Thyroid Storm Thyrotoxic Crisis

- **Symptoms:**
  - **Fever**
  - **Hypertension**
  - **Tachyarrhythmias**
  - **Respiratory distress**
  - **CNS abnormalities**
  - **Heart failure**
- **Treatment:**
  - **Antithyroid medication (PTU, Methimazole)**
  - **Beta Blockers (Esmolol, Propranolol)**
  - **Glucocorticoids**
  - **Iodine preparations**
  - **Bile acid sequestrants**

# Thyroid Abnormalities



## Hypothyroidism

- **Causes: Primary vs. Secondary**
- **HypO Metabolism symptoms:**
  - **Fatigue**
  - **Weight gain**
  - **Cold intolerance**
  - **Cognitive dysfunction**
  - **Bradycardia**
  - **Dry skin**
  - **Constipation**
  - **Delayed tendon reflex relaxation**
- **Acute: Myxedema Coma**
- **Chronic: Hashimoto Disease**



# Hypothyroidism

## Thyroid Abnormalities

Labs indicate underactive thyroid:

**High TSH** Thyrotropin: Thyroid Stimulating Hormone

**Low T3, T4**

- **Treatment:**
  - **Hormone replacement**
  - **Balanced diet**
  - **Exercise**

Hypothyroidism occurs when the thyroid does not produce enough T3 and T4



# HypoThyroid Emergency

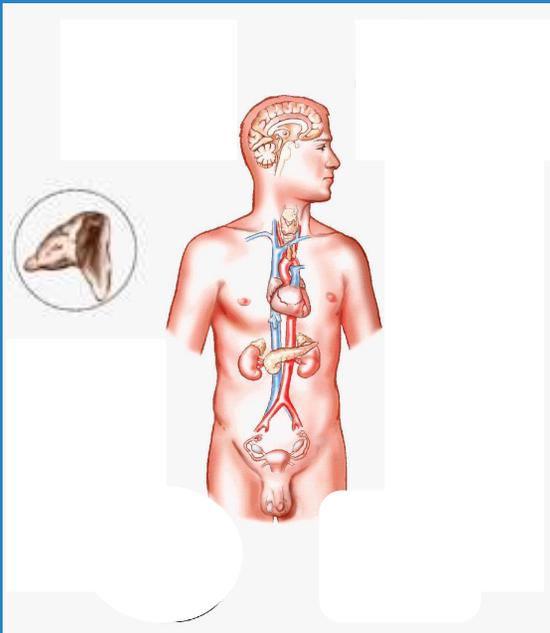


## Myxedema Coma/Crisis

- **SEVERE Hypothyroidism**
- **Symptoms:**
  - Hypotension**
  - Hypothermia**
  - Heart failure**
  - Bradycardia**
  - Confusion, lethargy, coma**
  - Reflexes with slow relaxation phase**
- **Treatment:**
  - **Thyroid hormone replacement (T3 & T4)**
  - **Glucocorticoid therapy possibly**

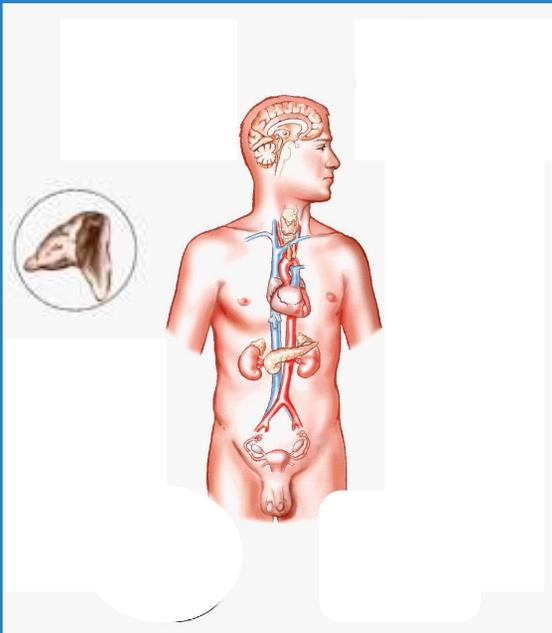
# Adrenal Glands

- **Positioned on top of kidneys**
- **Regulate cortisol- glucocorticoid hormone**



**CCRN ONLY**

# Adrenal Insufficiency

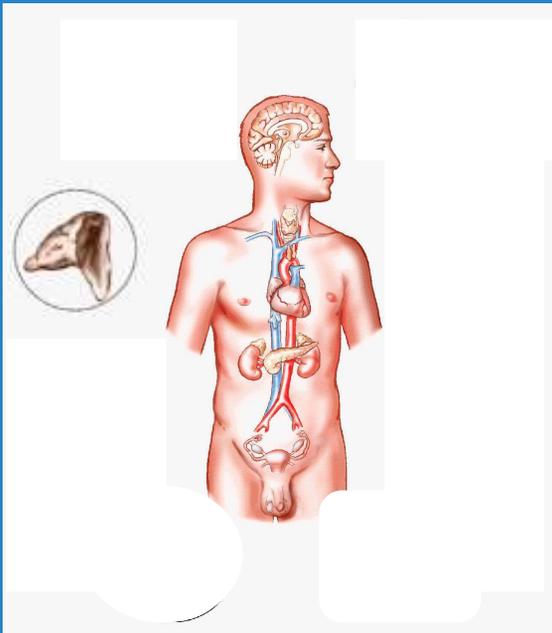


## Cushing Syndrome: **Excess cortisol**

- **Causes:**
  - **Supplementation**
  - **Hormone-secreting tumor (rare)**
- **S & S:**
  - **Fever, Confusion**
  - **Weak, Tired**
  - **Decreased BP**
  - **Tachycardia/pnea**
  - **Vent Dysrhythmias**
  - **Low BS, Na, Cortisol**
  - **High K, Ca, BUN, Cr**
- **Treatment**

**CCRN ONLY**

# Adrenal Insufficiency



## Adrenal Crisis: **Cortisol deficiency**

- **Primary:** adrenal gland failure
- **Secondary:** hypothalamus or pituitary disorders
- **Tertiary:** hypothalamic region affected or glucocorticoid supplementation (and withdrawal)
  
- **Signs & Symptoms**
  - Hypotension
  - Fatigue
  - Electrolyte dysfunction
  - Weight loss
  
- **Treatment**
  - Fluids
  - Steroids

**CCRN ONLY**

6. The difference between DI and SIADH is:

A. In DI, the patient retains H<sub>2</sub>O & in SIADH they lose it

B. In SIADH there is not enough ADH and in DI there is too much

C. In DI the patient has an excessive loss of H<sub>2</sub>O & in SIADH the patient has water intoxication

D. In SIADH the patient typically has hypernatremia and in DI they have hyponatremia

7. A female patient undergoes a thyroidectomy for thyroid cancer. Following surgery, the pt c/o numbness & tingling in her fingers and has muscle spasms. The RN should anticipate an order for:

- A. Check serum potassium level and PO or IV Potassium administration
  - B. Check serum calcium level & PO or IV Calcium administration
  - C. Check serum magnesium level and PO or IV magnesium administration
  - D. Check serum sodium level and PO or IV sodium administration
- 

# Endocrine Blueprint

Diabetes

DKA

HHS

DI

SIADH

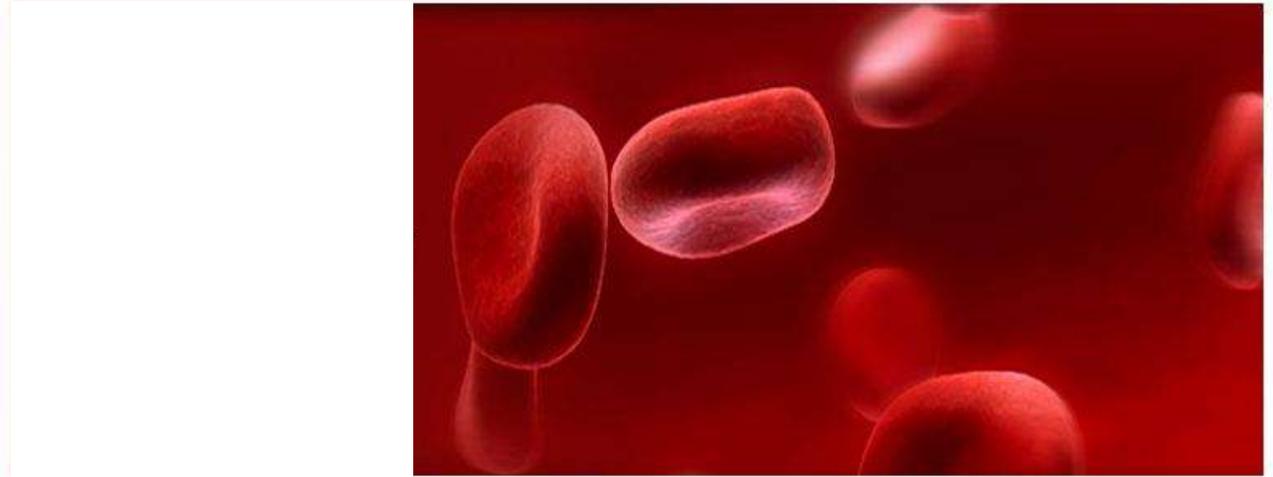
Thyroid  
Disorders

Adrenal  
Insufficiency  
CCRN ONLY

# Hematology Immunology Oncology

PCCN 3%

**CCRN 20%**  
(Gen Med: GI, Renal, Heme,  
Endocrine & Skin)



<https://www.lybrate.com/topic/endocrine-system-image>

# Hematology Blueprint

- Anemia

- **PCCN ONLY:**

- Coagulopathies: Medication Induced (Coumadin, Platelet Inhibitors, Heparin HIT)

- Autoimmune Disorders (Lupus, Guillain-Barre Syndrome, ALS, Multiple Sclerosis)

- **CCRN ONLY:**

- Coagulopathies (e.g., ITP, DIC)

- Immune deficiencies

- Leukopenia

- Oncologic complications (e.g., Tumor lysis syndrome, pericardial effusion)

- Thrombocytopenia

- Transfusion reactions

# **PCCN Nursing Actions**

- **Administer blood products & monitor response**
  - **Manage patients:**
    - **Requiring plasmapheresis**
    - **Who refuse blood products**
    - **Oncological emergencies**
- 

# CCRN Nursing Actions

- **Administer blood products & monitor response**
  - **Manage patients:**
    - **Pre-, Intra-, Post-intervention (plasmapheresis, etc.)**
    - **Blood conservation**
- 

# Anemia



## Etiologies:

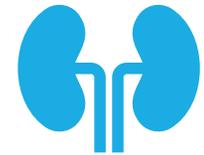
**Blood loss**

**Lack of or  
underproduction of  
RBC**

**Destruction of RBC or  
hemolysis**



## Clinical Presentation



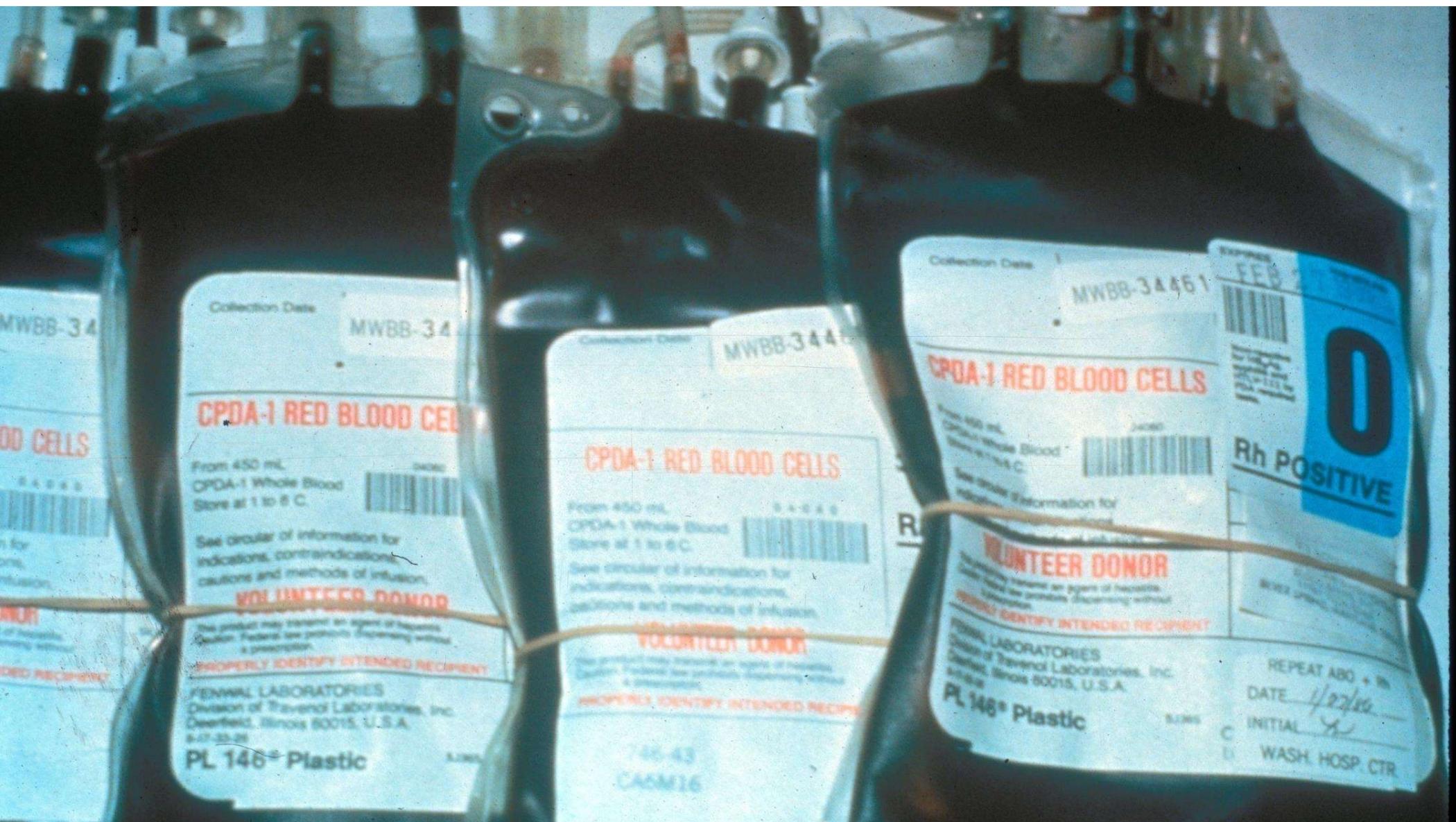
## Treatment:

**Treat underlying  
cause**

**Increase oxygenation  
of blood**

**Blood conservation**

**Transfusion- maintain  
Hgb 7-8 (nonbleeding)**



Collection Date MWBB-34

**CPDA-1 RED BLOOD CELLS**

From 450 mL  
CPDA-1 Whole Blood  
Store at 1 to 6 C.

See circular of information for  
indications, contraindications,  
cautions and methods of infusion.

**VOLUNTEER DONOR**

The product may transmit an agent of hepatitis  
B. Federal law prohibits dispensing without  
a prescription.

**PROPERLY IDENTIFY INTENDED RECIPIENT**

FENWAL LABORATORIES  
Division of Travenol Laboratories, Inc.  
Deerfield, Illinois 60015, U.S.A.  
8-17-55-26

PL 146 Plastic

Collection Date MWBB-344

**CPDA-1 RED BLOOD CELLS**

From 450 mL  
CPDA-1 Whole Blood  
Store at 1 to 6 C.

See circular of information for  
indications, contraindications,  
cautions and methods of infusion.

**VOLUNTEER DONOR**

The product may transmit an agent of hepatitis  
B. Federal law prohibits dispensing without  
a prescription.

**PROPERLY IDENTIFY INTENDED RECIPIENT**

746-43  
CASM16

Collection Date MWBB-34461

**CPDA-1 RED BLOOD CELLS**

From 450 mL  
CPDA-1 Whole Blood  
Store at 1 to 6 C.

See circular of information for  
indications, contraindications,  
cautions and methods of infusion.

**VOLUNTEER DONOR**

The product may transmit an agent of hepatitis  
B. Federal law prohibits dispensing without  
a prescription.

**PROPERLY IDENTIFY INTENDED RECIPIENT**

FENWAL LABORATORIES  
Division of Travenol Laboratories, Inc.  
Deerfield, Illinois 60015, U.S.A.  
8-17-55-26

PL 146 Plastic

REPEAT ABO + Rh  
DATE 1/27/66  
INITIAL W  
WASH. HOSP. CTR



# Transfusion Complications

- Febrile/Non-hemolytic reaction
- Allergic/Anaphylactic reaction
- Hemolytic reaction
- Infection transmission
- TACO
- TRALI



## Transfusion Complication Treatment

- Stop Transfusion
- Infuse NS
- Notify Blood bank- Return bag and Tubing
- Collect Urine & Blood Samples
- Possible Medications:
  - Epinephrine
  - Diphenhydramine
  - Acetaminophen
  - Diuretics
  - Steroids

## Possible Side Effects of Massive Transfusions



- Coagulation Disorders
- Metabolic Derangements
- Risk of Disease Transmission
- Risk of Bacterial Sepsis
- Risk of ARDS
- Increased Intravascular Viscosity

CCRN only

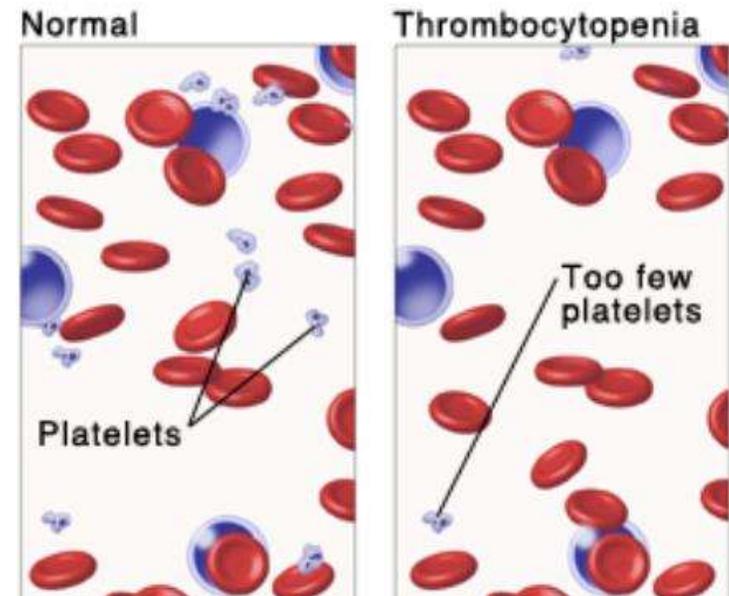
# Exchange Transfusion



- **Exchange of RBCs or plasma**
- **Indications:**
  - **Sickle cell crisis**
  - **Toxin exposures**
  - **Hemolytic disease (TTP, hemolytic anemia)**

# Thrombocytopenia

- **PLT count < 150,000**
- **Causes:**
  - Underproduction
  - Used up: DIC
  - Therapy-induced
  - Destroyed
- **Treatment:**
  - Prevent bleeding
  - Administer PLT
  - Stop the cause



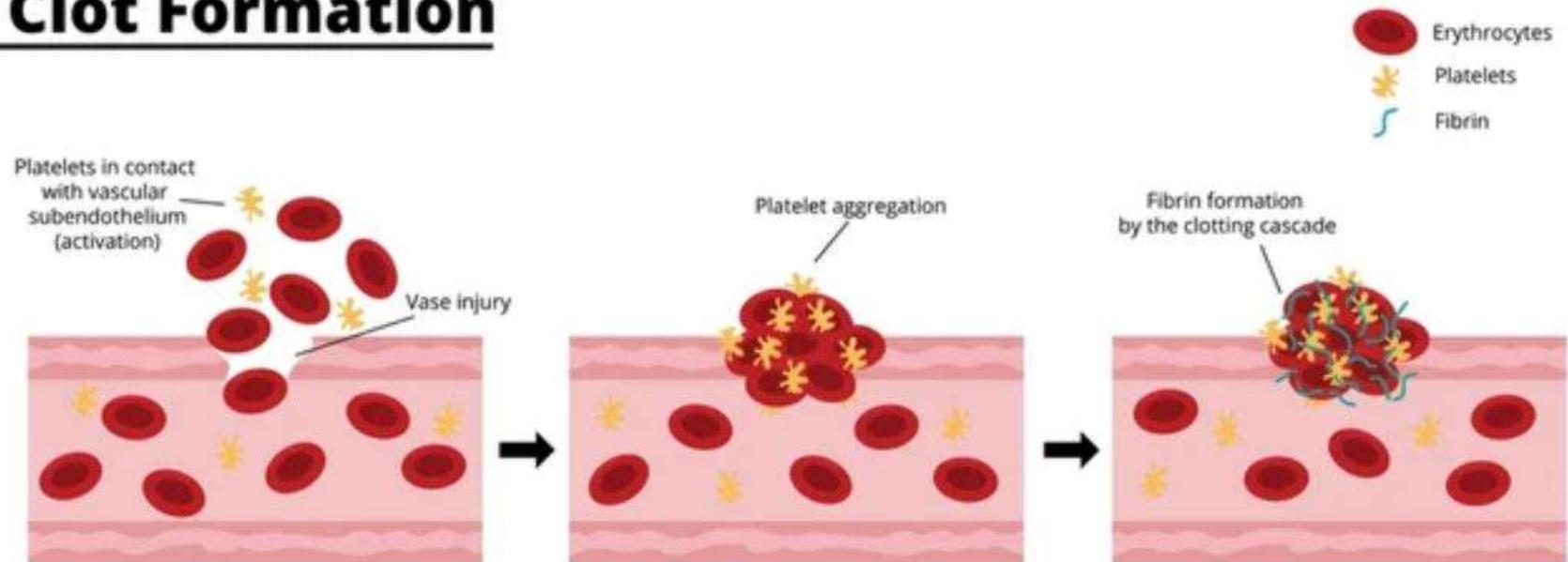


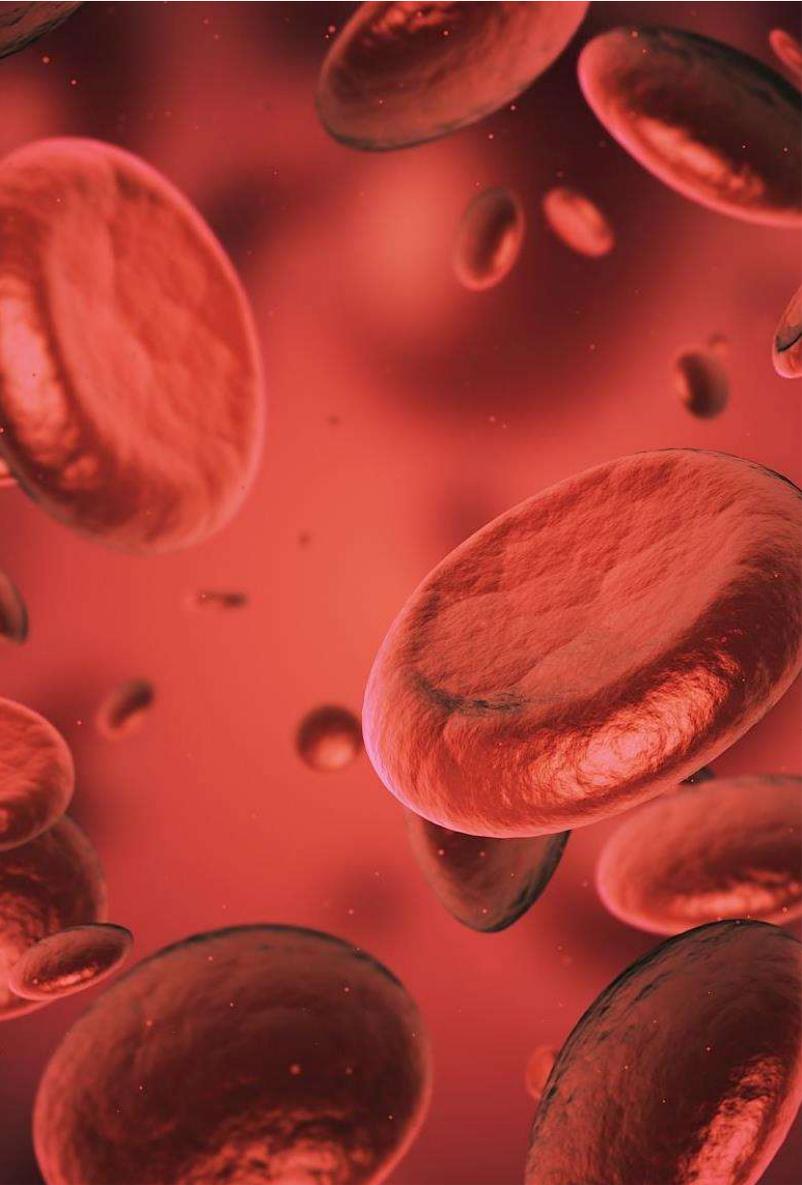
# **Bleeding Disorders**

***Why Do People Bleed?***

# Physiological Process of Clotting

## Clot Formation

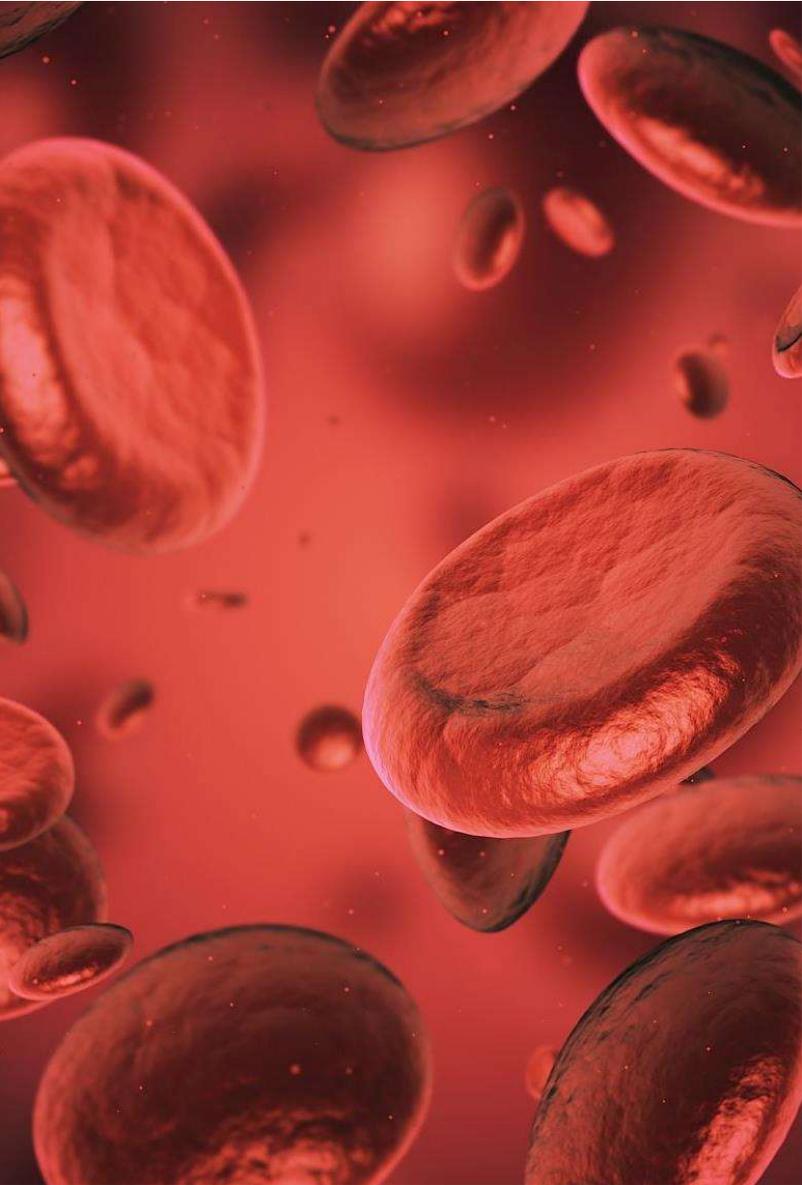




# **DIC**

## **Disseminated Intravascular Coagulation**

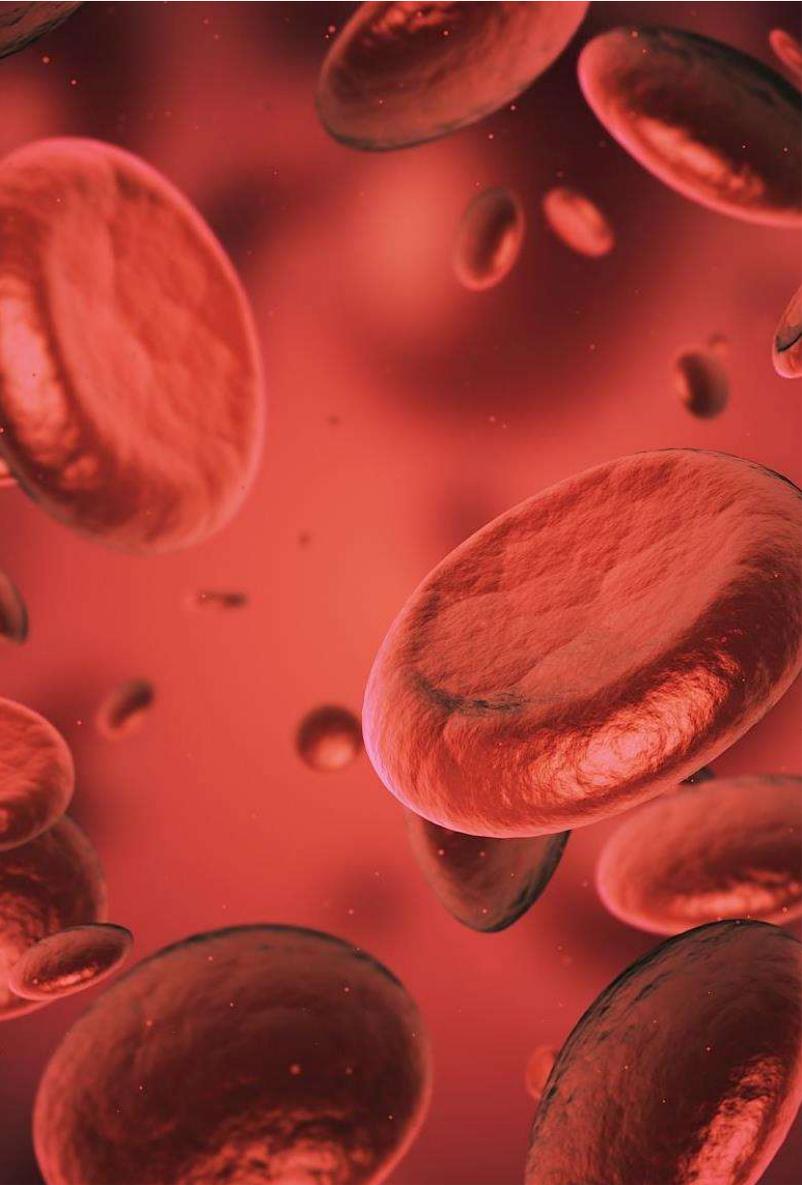
- ◆ **Secondary Disorder**
- ◆ **Over Stimulation of **Both** Bleeding & Thrombosis**
- ◆ **Life Threatening**
- ◆ **Acute & Chronic Syndromes**
- ◆ **Cause: Tissue Damage**



## **DIC Pathophysiology**

- 🔴 **Tissue Damage**
- 🔴 **Healing is Stimulated (Clotting)**
- 🔴 **Microvascular Thrombi**
- 🔴 **Fibrinolytic Mediators Released**

**Hemopoietic Chaos**



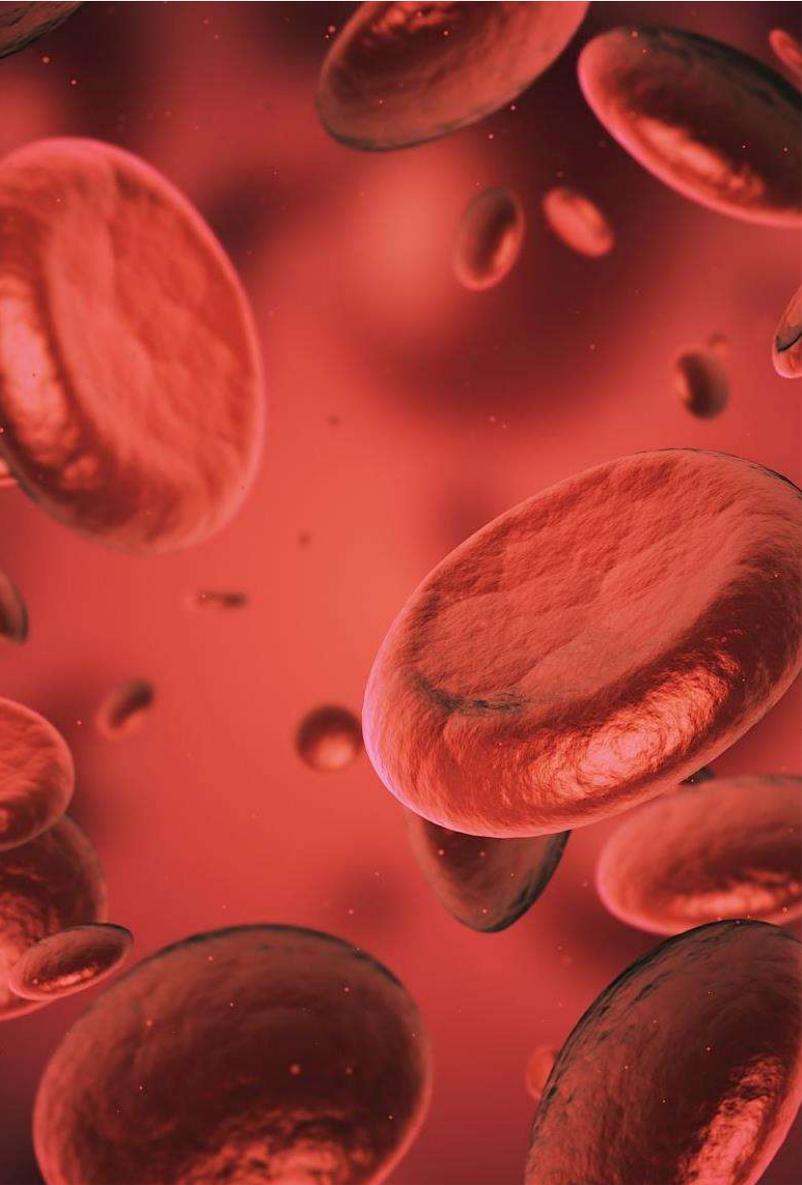
## **DIC Pathophysiology**

- 🔴 **Lyse all Clots**
- 🔴 **Ability to Clot is Lost**
- 🔴 **Bleeding State**
- 🔴 ***Consumptive Coagulopathy***



# Lab Values

<b>Test</b>	<b>Elevated</b>	<b>Decreased</b>
<b>Hgb</b>		
<b>HCT</b>		
<b>Platelet Ct</b>		
<b>PT</b>		
<b>PTT</b>		
<b>Fibrinogen</b>		
<b>FDP/FSP</b>		
<b>D-Dimer</b>		



# **DIC Treatment**

- ◆ **Support/Treat Primary Problem**
- ◆ **Early Recognition**
- ◆ **Decrease Bleeding Risk**
- ◆ **Transfusion**
- ◆ **Vitamin K**
- ◆ **Heparin**
- ◆ **General Critical Care Management**

1. A patient with TBI is suspected to be going into DIC. Lab results consistent with this diagnosis would be:

- A. Low PT & aPTT, high platelet count & fibrinogen
- B. Low bleeding time & Hgb, high PT & aPTT
- C. Low platelet count & fibrinogen, high PT & aPTT
- D. Low fibrinogen & FSP, high platelet count & hemoglobin

2. A patient who received 4 units of PRBC in the last 7 hrs is now c/o SOB & generalized muscle cramping. Lung auscultation reveals inspiratory & expiratory wheezing. Which laboratory value should the nurse expect?

- A. Hypokalemia
  - B. Hypomagnesemia
  - C. Hypocalcemia
  - D. Hyponatremia
- 

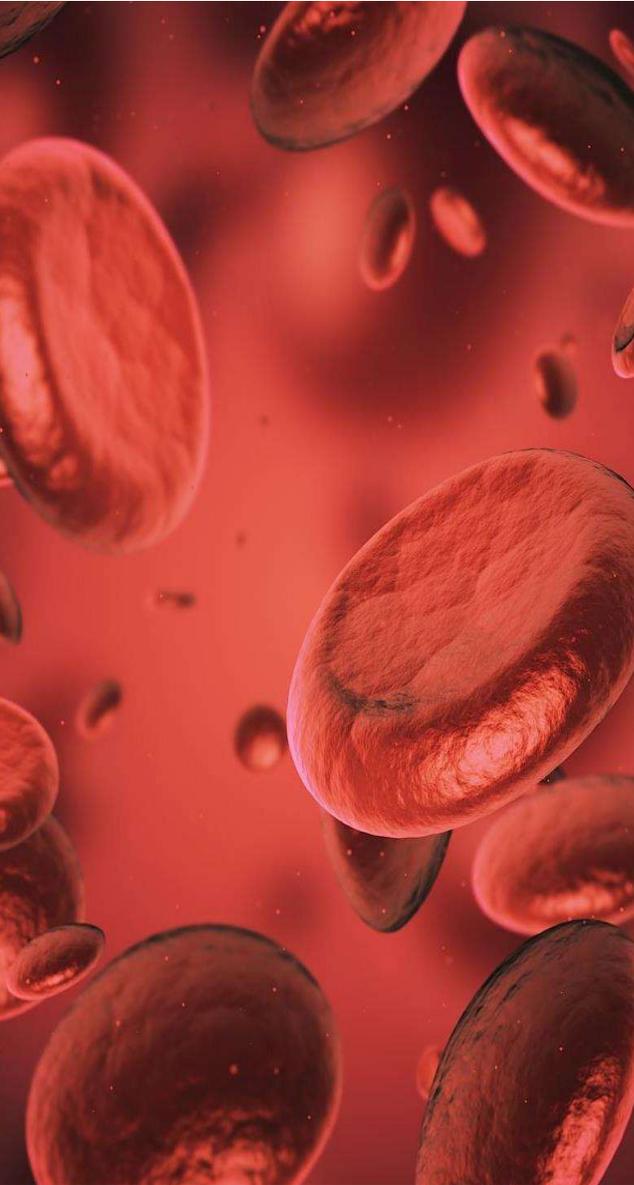
3. Which of the following assessment info would be consistent with a low platelet count from HIT?

- A. The presence of metabolic acidosis
  - B. The presence of acute thrombosis development
  - C. Elevation in ALT and AST
  - D. Decrease in neutrophils
- 



## **HIT** **Heparin Induced** **Thrombocytopenia**

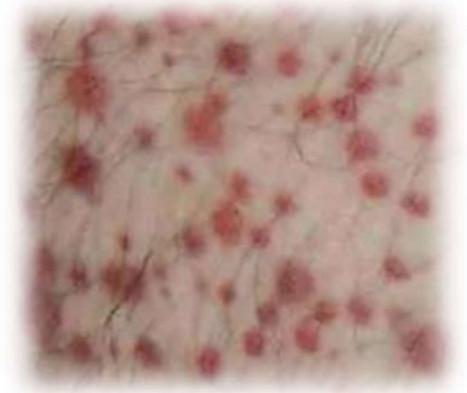
- ◆ **Acquired Allergy to Heparin**
- ◆ **Heparin Antibodies**
- ◆ **Platelet Count Drops  
(approx. 50%)**
- ◆ **Platelet Plug**
- ◆ **Assessment**
- ◆ **Treatment**
- ◆ **Prevention**



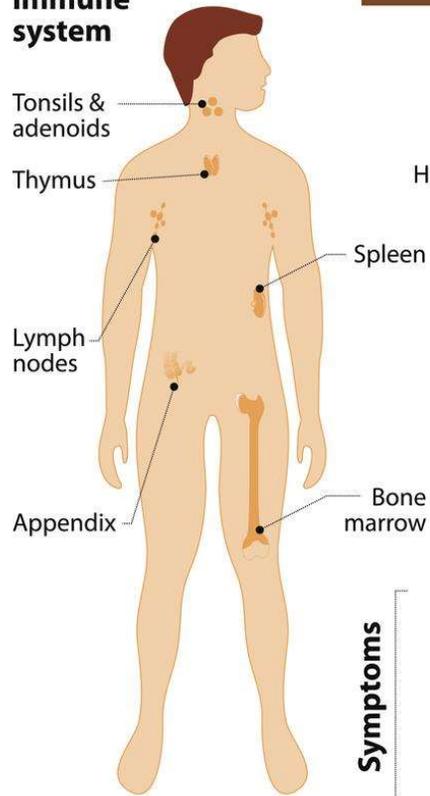
# **ITP**

## **Immune Thrombocytopenic Purpura**

- 🔴 **Autoimmune Platelet Destruction**
- 🔴 **Diagnosis of Exclusion**
- 🔴 **Treatment Goals:**
  - 🔴 **Prevent Bleeding**
  - 🔴 **PLT Only if Bleeding**
- 🔴 **Stop Cause**
  - 🔴 **Initial Treatment: Glucocorticoids & IVIG**
  - 🔴 **Thrombopoietin Receptor Agonists**



## Organs of the immune system



## Autoimmune disease



Heredity



White blood cells



Lifestyle



Hormone influence

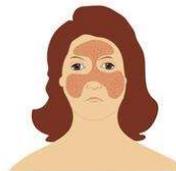


Environmental factors



Damaged myelin

Multiple sclerosis



Systemic lupus erythematosus

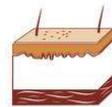


Rheumatoid arthritis

## Symptoms



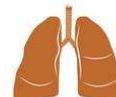
Myocarditis



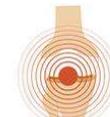
Skin rash



Impaired vision



Pulmonary fibrosis



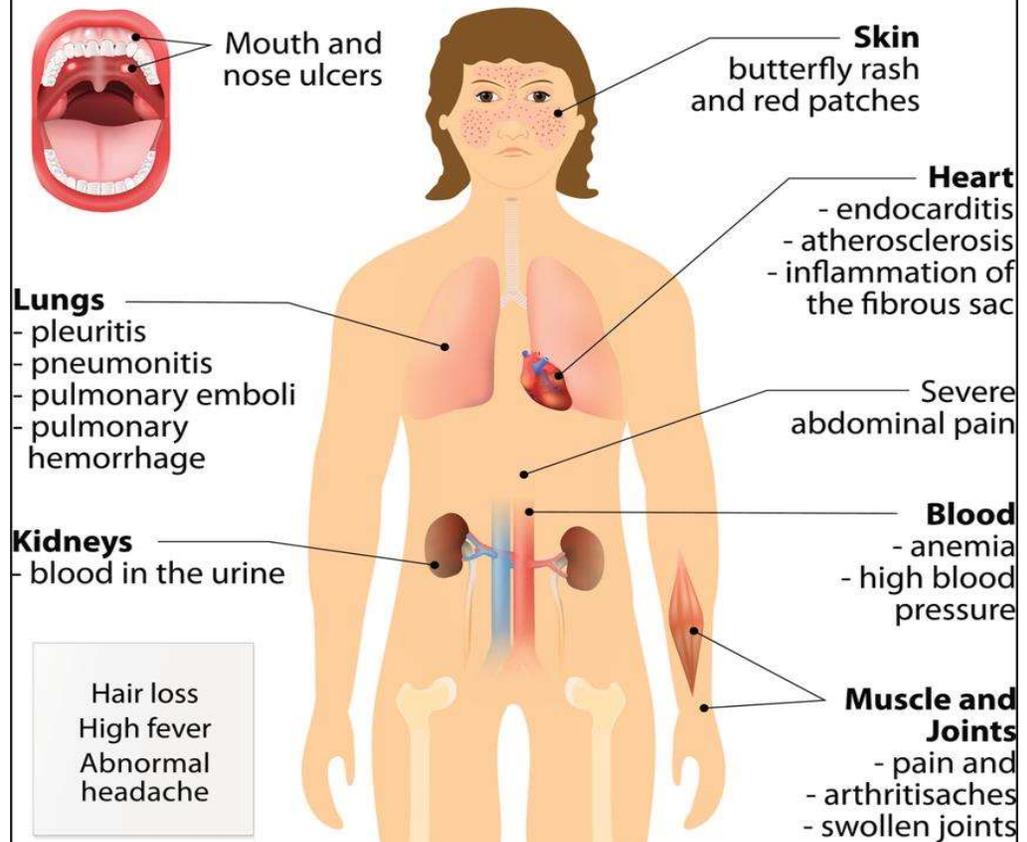
Joint pain

# Lupus

## Classic Presentation Triad

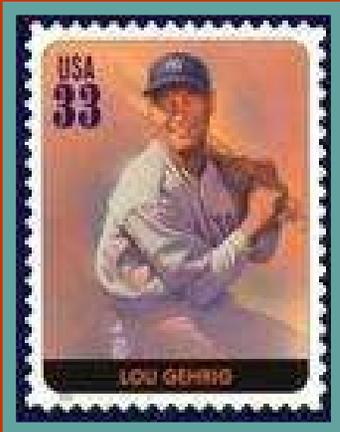
Fever  
Joint Pain  
Rash

## Systemic lupus erythematosus



# ALS

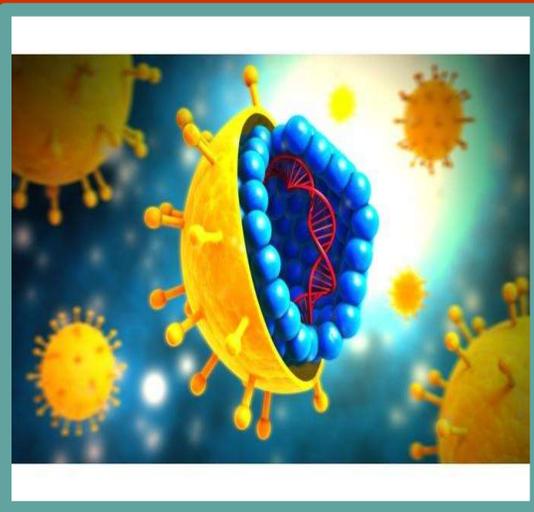
## Amyotrophic Lateral Sclerosis



***Progressive atrophy of muscle fibers/demyelination of nerve cells in spinal cord & brain***

- **Most common degenerative disease of motor neuron system**
- **Incurable & fatal (median survival 3 years)**
- **Clinical Presentation**
  - **Respiratory failure – most common cause of death**
- **Therapies**
- **Management**

# Guillain Barre Syndrome



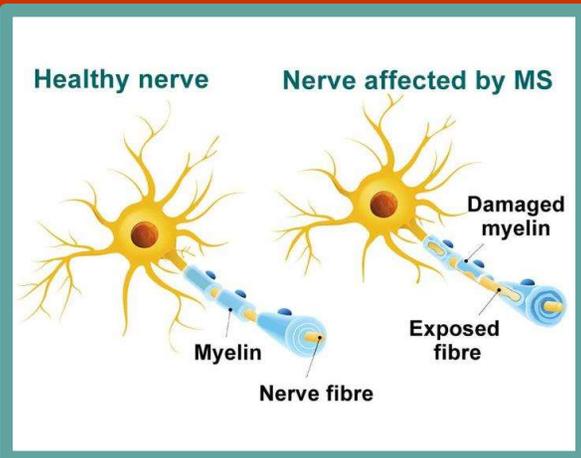
## *Acute Inflammatory Polyneuropathy*

- **Signs & Symptoms:**
  - **Progressive Ascending Systemic Weakness**
  - **Acute onset: Rapid progression- hours to 3 weeks**
  - **Symptoms usually start to subside about 2 weeks after maximal weakness**
  - **Most recovery within 1<sup>st</sup> 6 months**
- *Avoid unnecessary movement & PROM early during onset & progression because movement exacerbates pain associated with demyelination*
- **Diagnostic Findings: EMG, LP**
- **Goals of Care: Normal neuro function, pain relief**
- **Potential Complications:**
  - **Respiratory failure**
  - **Autonomic dysfunction**

# Multiple Sclerosis

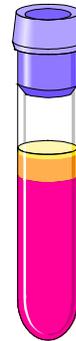
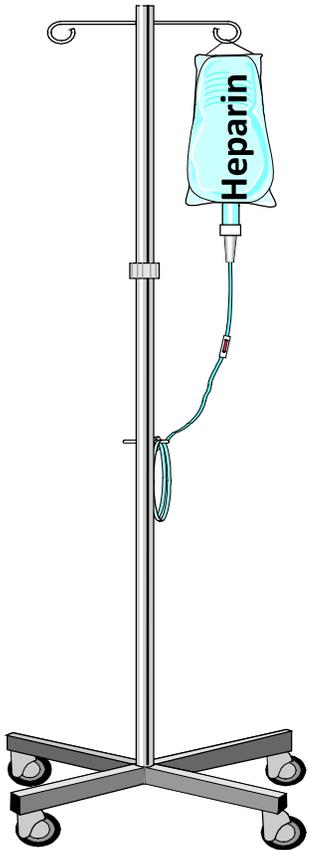
***Symptomatic episodes that occur months or years apart & affect different anatomic locations***

- **Etiology**
- **Classifications**
- **Clinical Presentation**
- **Therapies**
- **Management**

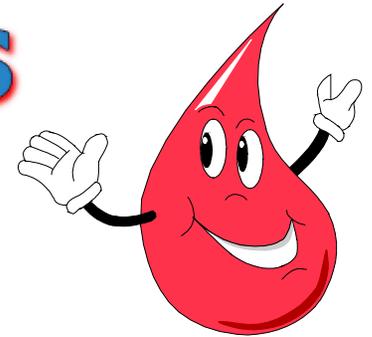


PCCN Only

# Drug-Induced Coagulopathies



- White Blood Cells  
6-9000/mm<sup>3</sup>
- Platelets  
200-400,000/mm<sup>3</sup>
- Red Blood Cells  
4-5 Million/mm<sup>3</sup>



# 10 ways to be prepared to treat patients on direct oral anticoagulants (DOACs)



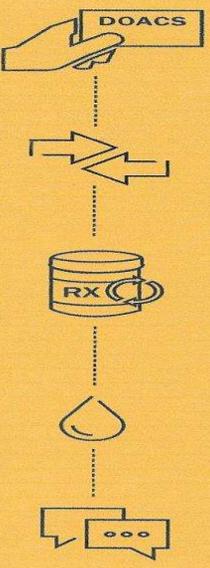
Anticoagulants are the No. 2 top medications involved in error incidents causing death or serious harm.





Risks for patients on DOACs can be avoided with appropriate and timely treatment.

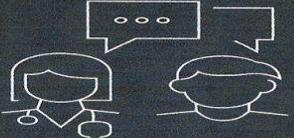
- 1 **Learn the names of DOACs.**
- 2 You **CANNOT** stop bleeding in patients on DOACs the same way you can for patients on warfarin (Coumadin®) and heparin.
- 3 **Reversal agents** for DOACs are not as well-known as those for warfarin and heparin — and they may not be available in all care settings.
- 4 Some DOACs have **NO** FDA-approved reversal agent at this time, so patients on these DOACs need to be assessed according to guidelines on the management of DOACs.
- 5 **Avoid therapeutic duplication.** Because not all providers are familiar with all DOACs, they may accidentally prescribe a second anticoagulant. Also, patients may not recognize these drugs as anticoagulants and may not be able to identify them when questioned.
- 6 **Assess bleeding risk** before surgery and outpatient procedures.
- 7 **Communicate the specifics** of a patient's DOAC at **transitions of care.**
- 8 **Follow evidence-based practice guidelines** for baseline and ongoing laboratory tests to ensure that patients on a DOAC are monitored and dosed appropriately.
- 9 **Include the DOAC's indications for use** on the patient's prescription, in the instructions for the patient, and in the electronic medical record (EMR).





**DOACs include:**

- Apixaban (Eliquis®)
- Betrixaban (Bevyxxa®)
- Dabigatran (Pradaxa®)
- Edoxaban (Savaysa®)
- Rivaroxaban (Xarelto®)



10 **Educate patients and families** about DOACs. Patients may not fully understand the risks of the specific DOAC prescribed for them. Patients on DOACs should know:

- Their medication dose and schedule.
- Importance of follow-up appointments and laboratory testing, if needed.
- Potential drug-drug, drug-herb/supplement and drug-food interactions.
- Potential for adverse drug reactions and how adverse reactions present.
- When to contact the doctor or visit the emergency department.

# **Anticoagulants**

## **Prevent Venous Thrombosis**

- **Vitamin K Antagonist**
- **Direct Thrombin Inhibitors**
- **Indirect Thrombin Inhibitors**



**PCCN Only**

# **Antiplatelets**

## **Prevent Arterial Thrombosis**

- **Aspirin**
- **Nonsteroidal Anti-inflammatory Drugs (NSAIDs)**
- **Adenosine Diphosphate (ADP) Receptor Antagonists,  
P2Y12 Inhibitors**



**PCCN Only**



**Immune**

**Deficiencies**

# Immunosuppression Etiology

- **Primary Neutropenia**
- **Immunosuppressive Agents (chemo, anti-rejection)**
- **Radiation Therapy**
- **Autoimmune Disorders**
- **Viral Infections (HIV/AIDS)**
- **Genetic Disorders**
- **Diseases/Disorders (DM, ETOH abuse)**
- **Chronically Critically Ill and Septic**

# **Immunology/Oncology**

## **Goals of Therapy**

- **Safety**
  - **Prevention of opportunistic infection**
  - **Monitoring & treatment**
  - **General support**
- 

# Oncology Complications

- **Bone Marrow Suppression**
- **Tumor Lysis Syndrome**
- **Engraftment Syndrome**
- **Leukostasis**
- **Cardiac Tamponade/Pleural Effusion**
- **Hypercalcemia**
- **SIADH**
- **Carotid Artery Rupture**
- **Hepatic Veno-Occlusive Dis**
- **Superior Vena Cava Syndrome**

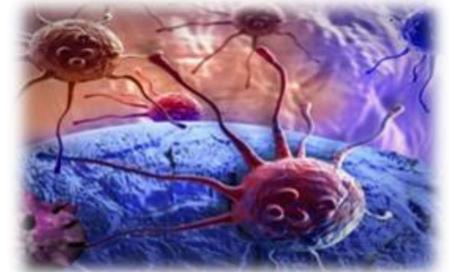


**CCRN Only**

# Oncology Complications

## Tumor Lysis Syndrome (TLS)

- Acute life-threatening metabolic imbalance
- 2<sup>o</sup> to rapid cancer cell death
- Tumor/cancer cells lyse
  - Hyperkalemia
  - Hyperphosphatemia (>4.5 mg/dl)
  - Hypocalcemia
  - Acidosis
  - Hyperuricemia (>7.5mg/dl)
  - Dehydration/inadequate hydration



**CCRN Only**

# Oncology Complications

## Tumor Lysis Syndrome

CCRN Only

- **Management**
- **Prevention!!!**
- **Pre-treat with fluids**
- **Adequate hydration: Ensure 2-3L/day**
- **Phosphate binding agents and Allopurinol 48 h prior**
- **Monitor metabolic/electrolyte abnormalities**



4. Which of the following is true regarding a bleeding patient on DOACs (direct oral anticoagulants)?
- A. Sodium bicarb is the best reversal agent & there are many drug-to-drug & drug-to-food interactions
  - B. PTT is the best monitoring test & DOACs have a very long half life
  - C. Edoxaban is dialyzable & is safe to take with aspirin
  - D. Pradaxa is dialyzable, Eliquis & Xarelto have the same reversal agent
- 

# Heme/Immunology Blueprint

Coagulopathies

Anemia

Immune  
Deficiencies

Transfusion  
Reactions  
CCRN ONLY

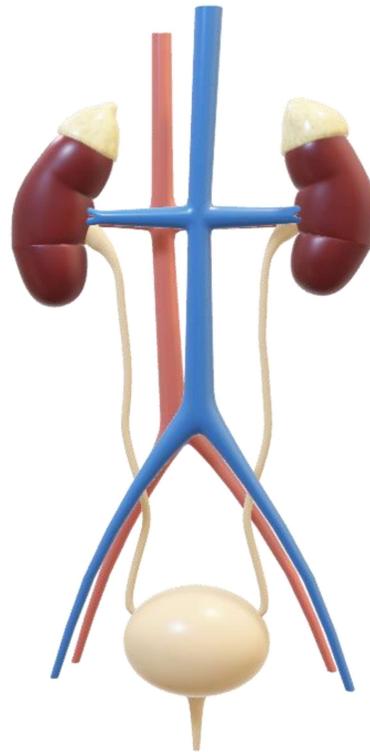
Thrombocytopenia  
CCRN ONLY

Oncology  
Complications  
CCRN ONLY

# Renal

**PCCN 4%**

**CCRN 20%**  
(Gen Med: GI, Renal,  
Heme, Endocrine &  
Skin)



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# Renal Blueprint

- Acute Kidney Injury
  - Chronic Kidney Disease
  - Electrolyte Imbalances
- 
- **PCCN ONLY:**
  - End-Stage Renal Disease
- 
- **CCRN ONLY:**
  - Infections (Kidney, Urosepsis)
  - Acute Genitourinary Trauma

# Testable Nursing Actions

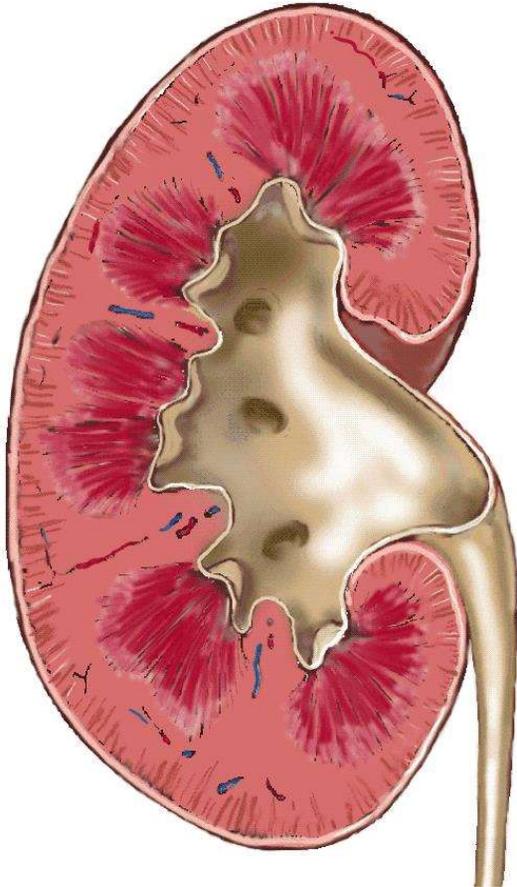
- **PCCN:**

- Identify meds that can be removed during dialysis/cause nephrotoxicity
- Manage pre-& post-hemodialysis/peritoneal dialysis

- **CCRN:**

- Manage patients:
  - Requiring renal procedures (biopsy, etc.)
  - Requiring renal therapeutic intervention

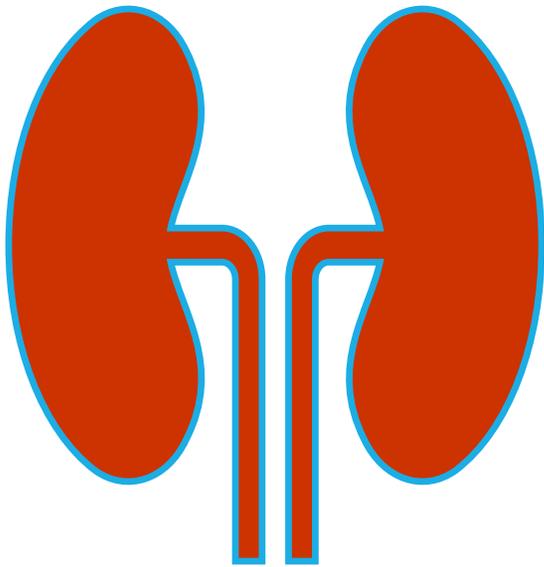
# Physiology



## **FUNCTION**

- 1. Excretion of Metabolic Wastes**
- 2. Urine Formation**
- 3. Acid-Base Balance Regulation**
- 4. Electrolyte Regulation**
- 5. Fluid Regulation**
- 6. Blood Pressure Regulation**
- 7. Erythropoietin Secretion/Anemia Regulation**

# Chronic Kidney Disease (CKD)



Permanent & Irreversible Condition

Stages:

- Diminished Renal Reserve
- Renal Insufficiency
- End Stage Renal Disease

**ESRF or ESRD or CRD or CRF**

# System

# Alterations

Neuro	Pulm	Cardiac	GI	Heme
Lethargy  Daytime Drowsiness	SOB  Tachypnea	Elevated HR	Nausea  Vomiting  Anorexia	Anemia
Flat Affect	Kussmaul's breathing	HTN	Ulcers	Bleeding
Weakness in Extremities	Uremic Halitosis	CHF	Diarrhea	Bruising
Encephalopathy	Pulmonary edema	Electrolyte disturbances	Constipation	Iron & Folic Acid Deficiency

1. The acid base imbalance typically present with acute kidney disease?

A. Respiratory acidosis

B. Respiratory alkalosis

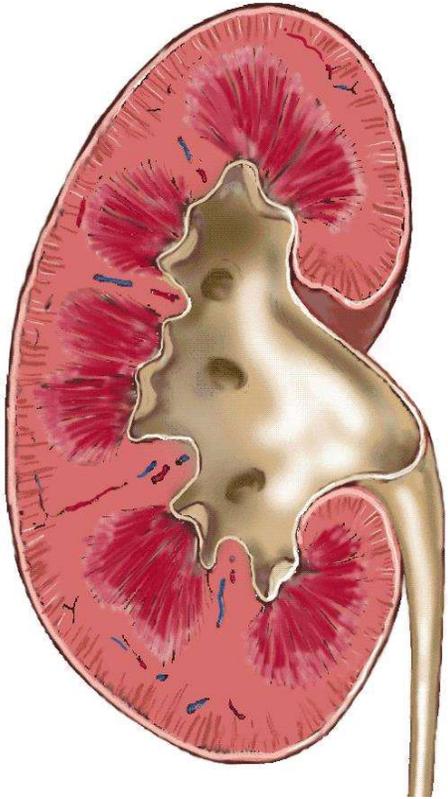
C. Metabolic acidosis

D. Metabolic alkalosis

2. Three days post blunt abdominal trauma with hemorrhagic shock from spleen rupture, a patient develops azotemia, oliguria & electrolyte imbalance. The most probable cause of the acute kidney injury is:

- A. Pre-renal
- B. Intrarenal
- C. Post-renal
- D. Blunt trauma to the flank

# Acute Kidney Injury



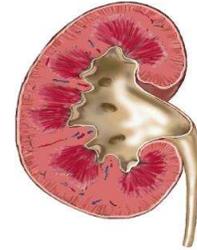
- Sudden deterioration



**Glomerular Filtration Rate**

- Interstitial inflammatory changes
- Tubular lumen obstruction
- Oliguric < 400 ml/day
- Non-Oliguric

# Common Etiologies



## Pre-Renal

Perfusion Problem

## Post-Renal

Problem after the kidneys

## Renal (ATN)

Kidney Tissue Problem

**Glomerular  
Dysfunction  
Ischemia  
Bladder  
Hypertension  
Trauma**

# Pre-Renal vs. Renal Causes

Assessment	Pre-Renal	Renal
Urinary Na	<20 mEq/L	> 20 mEq/L
Specific Gravity (urine)	> 1.010-1.030 (concentrated)	Normal
BUN : Creatinine (serum)	> 20:1	10-20:1 Normal
Response to volume or diuretics	Positive response	No response

# **Rhabdo (striated)** **myo (muscle) lysis (breakdown)**

## **Assessment/Diagnosis**

- **BUN : Cr**
- **Serum CK-MM**
- **Myoglobinuria**
- **Metabolic Acidosis**
- **Tea/Rust Colored Urine**

## **Treatment**

- **Eliminate Cause**
- **Support Renal Clearance/Function**
- **UO > 150ml/hr**
- **Intravascular Vol Expansion (NS)**
- **Alkalinization of Urine**
  - **Goal pH >6.5**
- **Mannitol & Lasix**
- **Prevent Further Damage**

3. Five days post injury/surgery it is determined that dialysis will be necessary for a patient. The decision to choose CRRT instead of hemodialysis will be based on which set of assessment data?

A. Electrolyte imbalance, high CVP and MAP above 70

B. K of 6.8, low CVP and BUN: Creatinine 38:4

C. ARDS, electrolyte imbalance and hemodynamically stable

D. Volume overload, hemodynamic instability and azotemia

4. A chronic dialysis pt has missed 3 dialysis treatments. Admission labs are  $\text{Ca}^{++}$  7.1mg/dL, &  $\text{K}^+$  6.5mg/dL. Monitor shows tall T waves & occasional PVCs. While preparing for dialysis the nurse would also anticipate:

A. Administering oral aluminum hydroxide and hanging a Lidocaine infusion at 2mg/min

B. Connect the pt to the external pacemaker and administer 10U regular insulin IVP

C. Prepare for arterial line and central line insertion

D. Administering 1 amp sodium bicarbonate and get a 12 lead ECG

5. A patient who was struck by lightning 24 hrs ago, now has cranberry/rust colored urine. Expected treatments would include:

A. Continuous Renal Replacement Therapy (CRRT)

B. PRBC and FFP

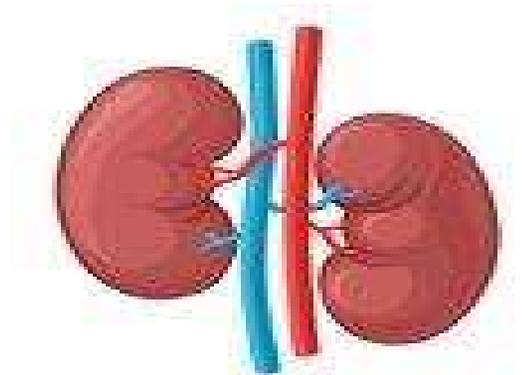
C. High volume fluid administration and 25gm Mannitol

D. Dopamine infusion at 4mcg/kg/min and 40 mg Furosemide

# Acute Kidney Injury

## Phases

- **Onset**
- **Oliguric**
- **Diuretic**
- **Recovery**



# Classifications of AKI

## RIFLE : Acute Kidney Injury Network (AKIN)

- **Risk: Stage I**
  - Urinary output decrease of  $<0.5\text{ml/kg/hr}$  for 6 hr
  - Or Creatinine increase X 1.5
- **Injury: Stage II**
  - Urinary output decrease of  $<0.5\text{ml/kg/hr}$  for 12 hr
  - Or Creatinine increase X 2.0
- **Failure: Stage III**
  - Urinary output decrease of  $<0.3\text{ml/kg/hr}$  for 24 hr or anuria X 12 hr
  - Or Creatinine increase X 3.0
- **Loss: Complete loss of function for at least four weeks**
- **ESRD: End stage renal disease**

# **Treatment Options/Alternatives**

- **Drug Therapy**
  - **Diet Therapy**
  - **Renal Replacement Therapy (RRT)**
    - **Hemodialysis**
    - **Peritoneal Dialysis**
    - **Continuous Renal Replacement Therapy**
  - **Renal Transplant**
- 

# GU Trauma

CCRN only

# GU Trauma

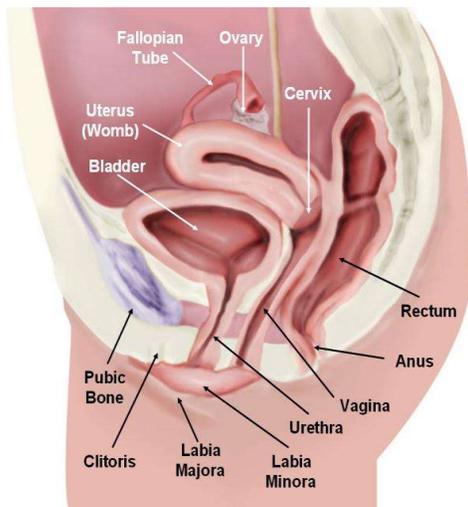


- **Blunt: > 75%**
- **Penetrating: < 25%**
- **Always Assess:**
- **For Renal Trauma with Any Trauma to General Flank Area**

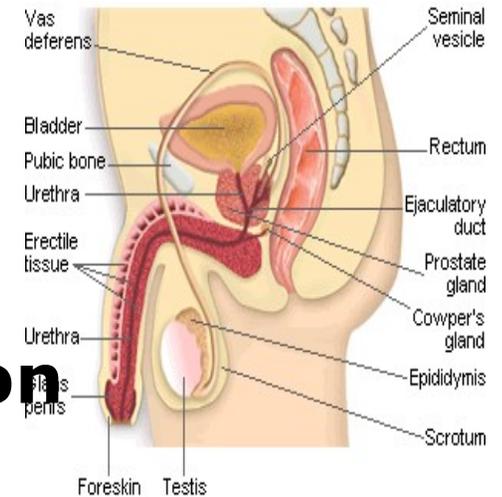
**OR**

- **Evidence of Trauma to Other Organs in Region of Kidneys and Lower Rib Fractures**

# GU Trauma



- **Types of Injuries**
  - **Renal Tissue Contusion**
  - **Kidney Laceration**
  - **Kidney Fracture**
  - **Renal Vascular Injury**
  - **Rhabdomyolysis**
- **Clinical Presentation**
- **Treatment Options**

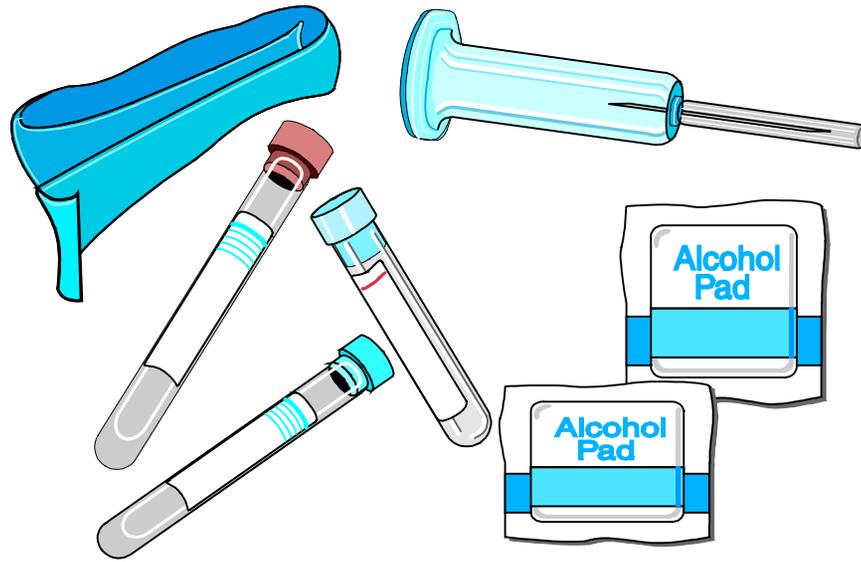


# Renal System Infections

- **UTI**
- **Bladder Infection**
  - Pain on urination
  - Cloudy urine
- **Kidney Infection**
  - Flank pain
  - Fever
  - Low back pain

**Causes**  
**S&S**  
**Treatment**





# Electrolytes

6. Which electrolyte imbalance is common in AKI?

A. Hyponatremia

B. Hypokalemia

C. Hypophosphatemia

D. Hypouricemia

# Sodium

(135-145 mEq/L)

Osmotically active cation (positive charge)

Essential in extracellular fluid

Close relationship between water and sodium

Responsible for extracellular fluid volume

Regulates cellular membrane potential

Kidneys regulate

Most frequent electrolyte disorder: Hyponatremia

# Hyponatremia ( $< 135$ mEq/L)

**Fluid excess**  
**Sodium deficit**



**Neurological:** Headache, confusion, fatigue, seizures



**Pulmonary:** Respiratory distress



**Cardiac:** Orthostatic hypotension, decreased CVP



**Gastrointestinal:** Anorexia, N & V, abdominal cramps

# Hyponatremia Management

**Na < 135 mEq/L**



**Oral or IV replacement**

**0.9% NaCl or lactated Ringer's  
IV solution**

**Hypertonic saline- emergency  
situations**



**Rapid correction can cause:**

**Cerebral edema or osmotic demyelination  
syndrome (ODS)**

**Central pontine myelinolysis (CPM)**

# Hypernatremia ( $> 145$ mEq/L)

Fluid deficit

Sodium excess



**Neurological:** Irritability, restlessness, confusion, lethargy, seizures



**Pulmonary:** Dyspnea, tachypnea



**Cardiac:** Tachycardia, dry mucous membranes, orthostatic hypotension



**Gastrointestinal:** Anorexia, N & V, abdominal cramps

# Hypernatremia Management

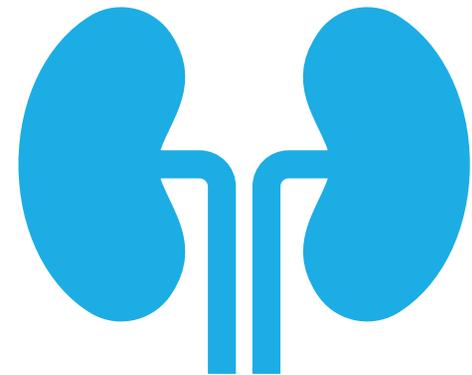
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- **Sodium > 145 mEq/L**
  - Replace volume and treat underlying cause

**Free water deficit (L)-  $(0.6 \times \text{kg}) \times \frac{\text{Na}-140}{140}$**

## Example

- **70 kg patient, Na= 160 mEq/L**
- **$(0.6 \times 70) \times \frac{160-140}{140} = 42 \times 0.14 = 5.88$  L free water deficit**



# Potassium

(3.5-5.5 mEq/L)

Major intracellular cation

Maintains cellular osmolarity

Affected by pH

Cardiac contractility and nerve impulses

# Hypokalemia ( $< 3.5$ mEq/L)

Decreased intake

Increased loss

Shift of  $K^+$  into cells



**Neurological:** Decreased reflexes, lethargy, confusion, depression



**Pulmonary:** Respiratory arrest, weak muscles



**Cardiac:** Tachycardia, orthostatic hypotension



**Gastrointestinal:** Decreased motility, constipation, N & V, abdominal cramps, paralytic ileus

# Hypokalemia Management

$K < 3.5 \text{ mEq/L}$

- Oral replacement
- IV replacement
- **Magnesium**
  - More than 50% of hypokalemia cases have concomitant magnesium deficiency

# Hyperkalemia

(> 5.5 mEq/L)

Excess intake

Decreased loss

Shift of K<sup>+</sup> OUT of cells



**Neurological:** Hyporeflexia, numbness, paresthesias



**Cardiac:** Conduction disturbances, Tall T waves, wide QRS, prolonged PR, ST depression, V Fib/Asystole



**Pulmonary:** Respiratory arrest, weak muscles



**Gastrointestinal:** N & V, diarrhea



**Musculoskeletal: Early-** Cramping, irritability  
**Late-** Weakness  
Flaccid paralysis (mimics Guillain-Barre)

# Hyperkalemia Management

1

## Protect Cardiac Function

Administer CaCl or Ca Gluconate slow IVP

---

2

## Shift Potassium into cells

IV Insulin with IV Dextrose

Sodium Bicarbonate

Albuterol- nebulizer treatment

3

## Remove Potassium

Loop diuretics, +/- thiazide diuretics

Sodium polystyrene sulfonate (Kayexalate)

Sorbitol

Patiromer (Veltassa)

Hemodialysis

# Renal Blueprint

Acute Kidney  
Injury

Chronic Kidney  
Disease

Electrolyte  
Imbalances

End Stage Renal  
Disease  
PCCN ONLY

Acute GU Trauma  
CCRN ONLY

Infections  
(Kidney, Urosepsis)  
CCRN ONLY

# Combo Day 2 Schedule

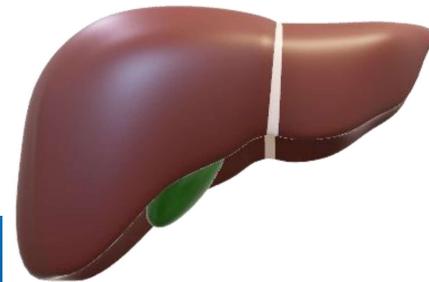
<b>0800-0920</b>	<b>Renal, GI</b>
<b>0920-0930</b>	<b>Break</b>
<b>0930-1035</b>	<b>Behavioral, Professional Caring &amp; Ethical Practices</b>
<b>1035-1045</b>	<b>Break</b>
<b>1045-1200</b>	<b>Respiratory</b>
<b>1200-1230</b>	<b>Lunch</b>
<b>1230-1345</b>	<b>Respiratory Continued</b>
<b>1345-1355</b>	<b>Break</b>
<b>1355-1455</b>	<b>Neurological</b>
<b>1455-1500</b>	<b>Break</b>
<b>1500-1600</b>	<b>Neurological, Musculoskeletal, Skin</b>

# Gastrointestinal

**PCCN 7%**

**CCRN 20%**

**(Gen Med: GI, Renal,  
Heme, Endocrine & Skin)**



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# GI Blueprint

- **GI Surgeries (including Bariatric)**
  - **Hepatic Disorders**
  - **Ischemic Bowel**
  - **Malnutrition**
  - **Pancreatitis**
- 
- **PCCN ONLY:**
  - **GI Motility Disorders (Obstruction, Ileus, DM Gastroparesis)**
  - **GI Bleed: Upper & Lower**
  - **GI Infections (C. Difficile)**
- 
- **CCRN ONLY:**
  - **Abdominal Compartment Syndrome**
  - **Acute Abdominal Trauma/GI Hemorrhage**
  - **Bowel infarction, obstruction, perforation**

# Testable Nursing Actions

## CCRN:

- **Manage patients:**
  - **Abdominal pressure monitoring, GI drains, nutrition**
  - **Address barriers to nutrition/fluids**
  - **Monitor patients for procedures (EGD, PEG, etc.)**

## PCCN:

- **Manage patients:**
  - **Requiring tubes & drains, fecal containment devices**
  - **Pre- & post-procedure (EGD, colonoscopy, bariatric surgery etc.)**
  - **Enteral & parenteral nutrition**

# GI Assessment

- **Inspection**
- **Auscultation**
- **Palpation**
- **Percussion**



1. Which of the following GI disorders is likely to present with this assessment Data: HR 117, RR 31, BP 172/94, Temp 37.9C (100.2F), Elevated PT & aPTT, Low Albumin, Low HCT, & High AST & ALT?
    - A. Liver failure
    - B. Pancreatitis
    - C. Upper GI Bleed
    - D. Ruptured spleen
- 

2. Which of the following lab results would be consistent with a diagnosis of pancreatitis?

- A. Elevated serum amylase, decreased serum lipase, and hypercalcemia
  - B. Elevated white blood cell count, hypoglycemia, and hypocalcemia
  - C. Decreased serum amylase and lipase, hyperglycemia, and hypercalcemia
  - D. Elevated serum amylase, hyperglycemia, and hypocalcemia
- 

# Nutrition Pathology Causes

Malabsorption	Malnutrition
Inability of small intestine to obtain appropriate dietary nutrients	Inadequate intake
Crohn's disease	Excess/imbalance or deficiency of calories & nutrition
Pancreatitis	Eating disorders, poverty, famine
Celiac disease	Reduced appetite due to illness
Cystic fibrosis	Excess loss (diarrhea, vomiting)
Biliary atresia	
Parasites	

# Enteral Feeding Tubes

## Nasogastric/orogastric

- Easy placement
- Low-risk
- Able to use for decompression/suction as well as feeding

## Post-pyloric

- Placement requires specialized training and/or equipment
- Lower risk of aspiration
- Better able to meet nutritional goals

## Percutaneous Endoscopic Gastrostomy

- Long-term feeding solution
- Less overall complications

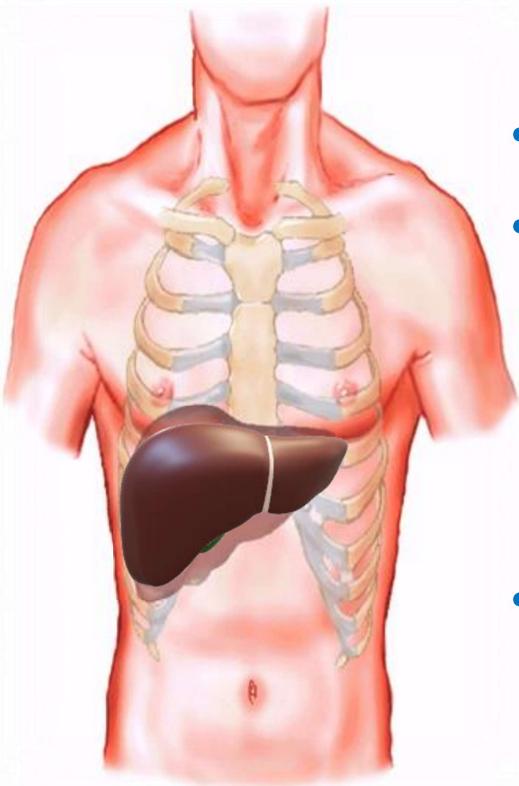
# Parenteral Nutrition

## Nursing Considerations

- In line filter needed
- Monitor for:
  - Hyperglycemia
  - Hypertriglyceridemia
  - Electrolyte imbalances
- CLABSI prevention

# Liver Functions

## Metabolic Factory & Waste Disposal Plant



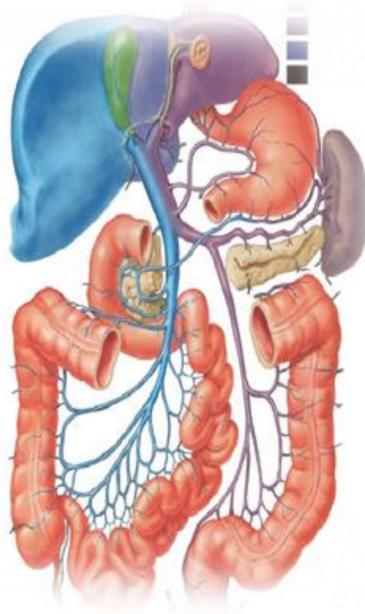
- **Detoxification**
- **Metabolism:**
  - Carbohydrates
  - Fats
  - Protein
  - Bilirubin
- **Vitamin & Mineral Storage**
- **Production of:**
  - Bile Salts
  - Clotting Factors
- **Blood Reservoir**
- **Immune response**



# Liver Function Assessment

- **Protein**
- **Prealbumin**
- **Albumin**
- **Bilirubin**
- **Ammonia**
- **BUN/Cr**
- **Glucose**
- **Coagulation studies**
- **Hepatic Enzymes**
  - **Gamma-glutamyl transpeptidase (GGT)**
  - **Alkaline Phosphatase (ALP)**
  - **Alanine Transaminase (ALT)**
  - **Aspartate Transaminase (AST)**

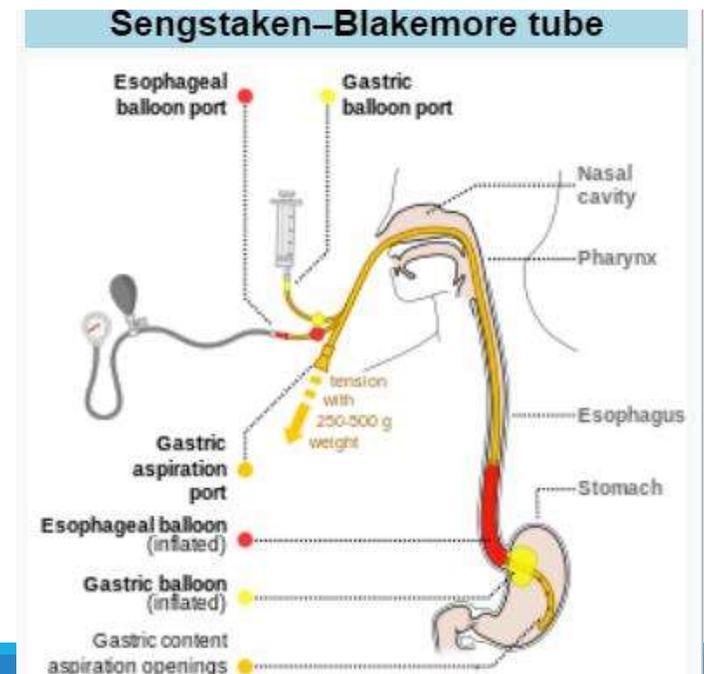
# Liver Dysfunction



- **Hepatic Encephalopathy**
- **Malnutrition**
- **Coagulopathy**
- **Portal Hypertension**
- **Hepatorenal Syndrome**
- **Ascites**
- **Infection**

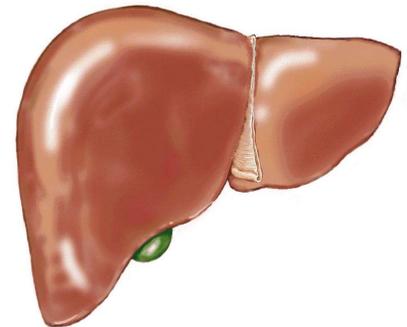
# Esophageal Varices

- Engorged dilated sub-mucosal veins in mid-distal esophagus
- Caused by portal hypertension
- Treatment:
  - Protect airway
  - Support hemodynamics
  - Correct coagulopathies
  - Variceal band ligation
  - TIPSS- Trans Juglar Intrahepatic Portosystemic Shunt
  - Beta Blockers
  - Balloon devices: Blakemore, Minnesota tubes



# Liver Pathologies

- **Nonalcoholic Fatty Liver Disease (NAFLD)**
- **Nonalcoholic Steatohepatitis (NASH)**
- **Cirrhosis**
- **Hepatitis**
- **Cancer**



# Pancreatic Function

## Endocrine Functions

**Synthesis & Release of Hormones:**

**Glycogen**

**Insulin**

**Gastrin**

## Exocrine Functions

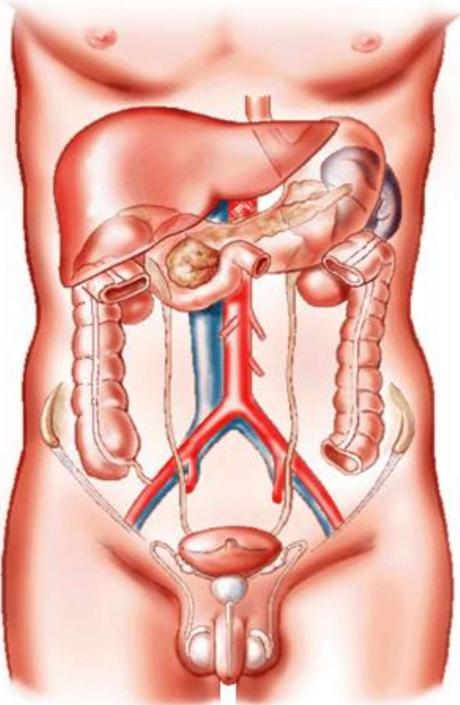
**Pancreatic Enzymes Break Down**

**Protein**

**Starch**

**Fat**

**Bicarbonate** increases pH



# **Acute Pancreatitis**

## **Pathophysiology**

### **Two Main Forms/Types:**

- **Acute Edematous**  
**Tissue Damage**  
**Fat Necrosis**
- **Hemorrhagic/Necrotizing**
- **Vascular Damage & Hemorrhage**
- **Increased Capillary Permeability**
  - **Widespread dysfunction**
  - **Systemic Inflammation**

# Acute Pancreatitis

## Clinical Presentation

Abdominal pain/distention

Low grade fever

N & V

Jaundice

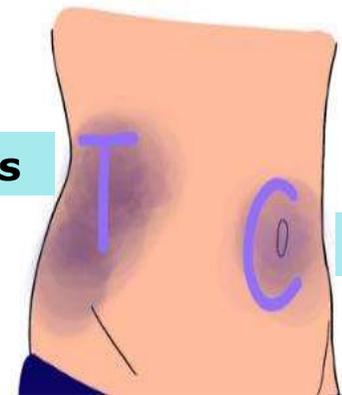
↑ Serum amylase or lipase

Hypoactive bowel sounds

? Ascites

Hypovolemic shock

Turner's



Cullen's

### Necrotizing Pancreatitis

**Cullen's Sign:**

Bluish Discoloration Umbilical

**Grey Turner's Sign:**

Bluish Discoloration Flank

# Acute Pancreatitis

## Lab Assessment

**\*\*Hypocalcemia\*\***

**\*\*Elevated Lipase\*\***

**\*\*Elevated Amylase\*\***

**\*\*Increased BUN & Cr\*\***

**Increased H & H**

**Decreased H & H**

**Elevated Liver Function  
Tests**

**Elevated WBC**

**Hypokalemia**

**Hypomagnesemia**

**Hyperglycemia**

**High Triglycerides**

**Hyperbilirubinemia**

**Low Albumin**

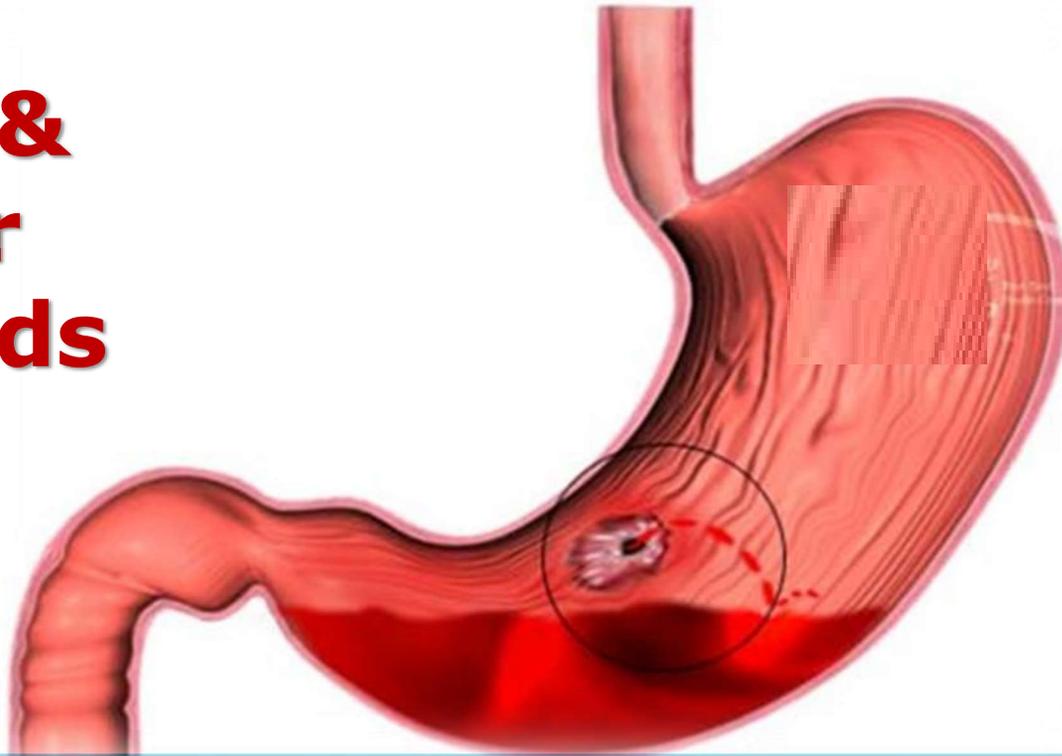
# **Acute Pancreatitis**

## **Treatment Options**

- **Fluid Resuscitation (moderately aggressive)**
- **Antibiotics**
- **Pain Management**
- **Monitor & Replace Electrolytes**
- **Treat Multisystem**
- **Nutritional Support- early oral feeding (24-48h)**
- **Surgery:**
  - **If caused by gallstones= cholecystectomy**

# GI Bleeding

**Upper &  
Lower  
GI Bleeds**



# GI Bleeds

Lower GI Bleed	Upper GI Bleed
<b>Diverticulitis</b>	<b>Peptic ulcer disease</b> ( <i>H. pylori</i> infection)
<b>Angiodysplasia</b>	<b>Esophagitis or gastritis</b>
<b>Other:</b> <ul style="list-style-type: none"><li>• Cancer</li><li>• Hemorrhoids</li><li>• Bowel infarction</li><li>• Inflammatory bowel diseases (Ulcerative colitis, Crohn's disease)</li></ul>	<b>Esophageal or gastric varices</b>
	<b>Mallory-Weiss Syndrome</b>

# Acute Upper GI Bleeding

## Clinical Presentation/Testing

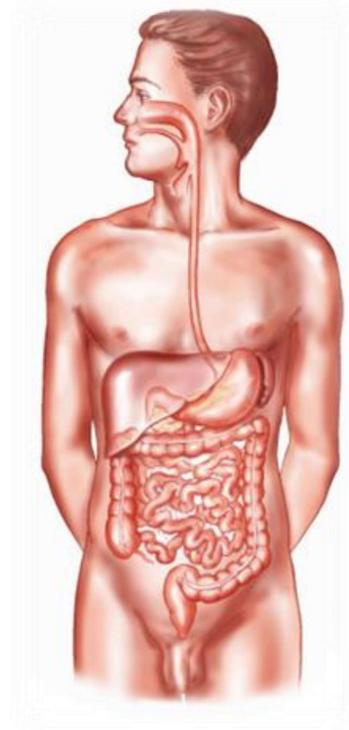
- Hematemesis
  - Melena
  - Hematochezia
  - Epigastric pain
  - H & H
  - Coagulation and platelets
  - Elevated BUN
  - Liver function tests
  - Endoscopy
  - Angiography
- 
- A solid blue horizontal bar spanning the width of the slide, located at the bottom.

# Upper GI Bleed Management

Pharmacological	Upper GI Bleed
<b>Proton pump inhibitors (PPI)</b>	<b>Endoscopic interventions</b> <ul style="list-style-type: none"><li>• Endoscopic epinephrine injection</li><li>• Electrocoagulation</li><li>• Clipping/band ligation</li></ul>
<b>Blood products</b>	<b>Surgery:</b> <ul style="list-style-type: none"><li>• Vagotomy</li><li>• Oversew of the tear or ulcer</li><li>• Total or subtotal gastric resection</li></ul>
<b>Antibiotics if suspect variceal bleeding</b>	<b>Transcatheter arterial embolization</b>
<b>Octreotide/somatostatin to reduce portal pressure by</b>	

# Disorders of the Bowel

- **Ischemia / Infarction**
- **Obstruction**
- **Perforation / Peritonitis**



3. Which of the following assessment findings is indicative of a large bowel vs. small bowel obstruction?

A. High Pitched Bowel Sounds, Nausea & Vomiting, Acute Pain

B. Ascites, Rebound Tenderness, Jaundice

C. Low Grade Fever, Steatorrhea, No Bowel Sounds

D. Lower Abdominal Pain, Distention, No Vomiting

# Bowel Obstruction Causes

## External to the bowel

- Adhesions

## Internal to the bowel

- Tumors
- Emboli
- Hernias
- Fecal Impaction
- Infections
- Inflammatory Bowel Disease

# Bowel Obstruction

## Small Intestine

- Sudden Onset Acute Pain
- N & V
- Wave-Like Hyperactive  
High Pitched BS
- Some Gas or Feces
- Distention (mild)

## Large Intestine

- Slow Onset Pain in  
Lower Abd
- No N & V
- No Stool
- Low Pitched BS
- Large Amount of  
Distention

# Obstruction Diagnosis & Treatment Options

- **Diagnose:**
  - **History**
  - **X-Ray/CT**
  - **Upper or Lower Barium**
  - **Scope (Colon, Sigmoid, Endo)**
- **Pain Management**
- **IV Fluids**
- **Decompression: NG, Rectal or Intestinal Tube**
- **Antibiotics**
- **NPO & Time (Rest the Bowel)**
- **Surgery: Exp Lap or Laparoscopy**

# Disorders of the Bowel

- **Infarction**

- **Treatment Options**

- **Angiography to Identify/Confirm Occlusion**

- **Surgery: Remove Occlusion & Dead Bowel**

# Disorders of the Bowel

## Perforation/Peritonitis

- **Etiology**
- **Gastric/Intestinal Contents Leak into Peritoneal Cavity**
- **Ulcer Perforation**
- **Diverticular Rupture**
- **Trauma**
- **Bowel Infarction**

# Disorders of the Bowel

## **Perforation/Peritonitis** **Clinical Presentation**

- **Infection/Sepsis (all the S&S)**
  - **Sudden Onset of Severe Pain**
  - **Rigid Abdomen with Rebound Tenderness**
  - **Hypoactive Bowel Sounds → No Bowel Sounds**
- 

# **Disorders of the Bowel**

## **Perforation/Peritonitis**

### **Treatment Options**

- **Surgery-Repair Cause & Clean Up**
  - **Antibiotics**
  - **Fluids**
  - **Treat Sepsis**
  - **Treat MODS**
- 

4. After ambulation, the post-op Gastric Bypass pt C/O abdominal pain, & is tachycardic, tachypneic, diaphoretic, & febrile. Assessment reveals: clean, dry, closed abdominal staples & large firm tender abdomen. The most likely diagnosis for these acute changes are:

A. Pulmonary Emboli

B. Routine post-operative pain

C. Anastomosis Leak & Possible Peritonitis

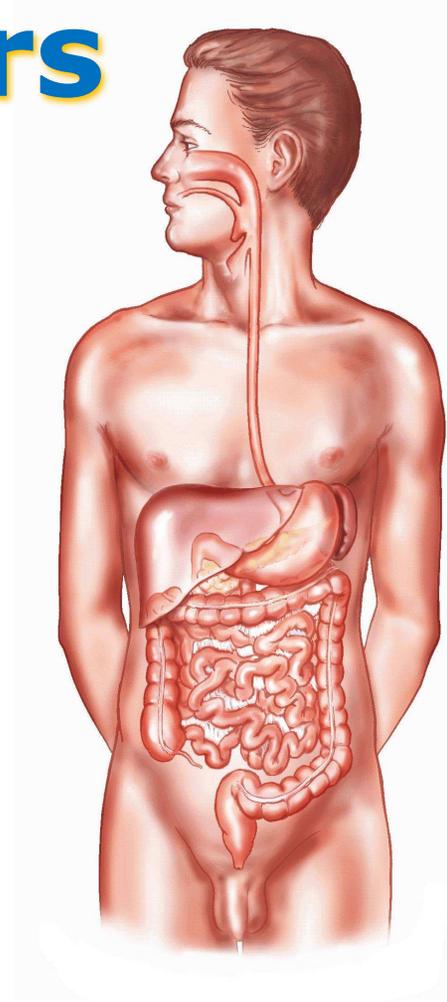
D. Acute Gall Stone Development

# GI Motility Disorders

- **Ileus**

**PCCN only**

- **DM Gastroparesis**

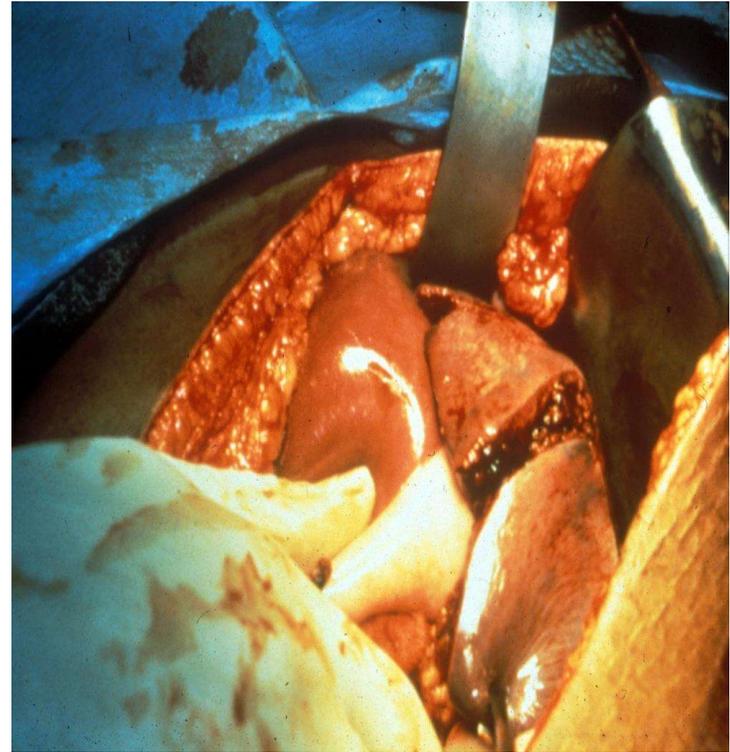


5. The RN is educating a pt. newly diagnosed with diabetic gastroparesis. Which lifestyle modifications will be most appropriate & helpful?

- A. Eat fewer and larger meals each day
  - B. Eat a diet high in insoluble fiber
  - C. Ensure blood glucose levels are well controlled
  - D. Drink carbonated beverages routinely
- 

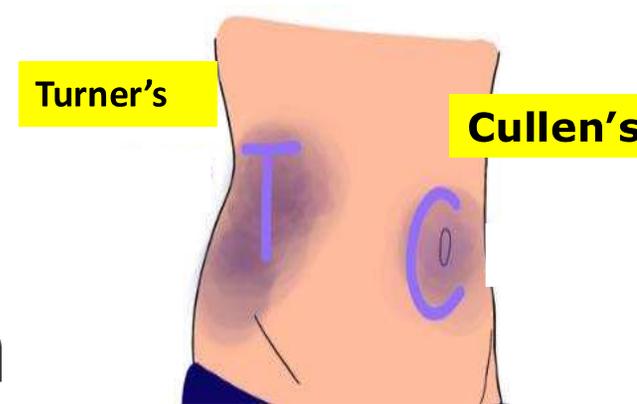
# Acute Abdominal Trauma

CCRN ONLY

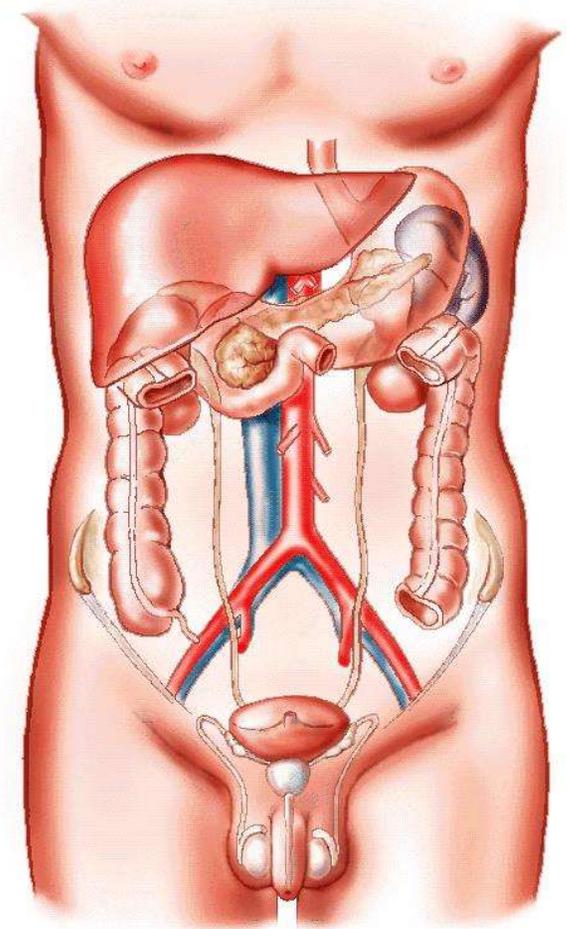
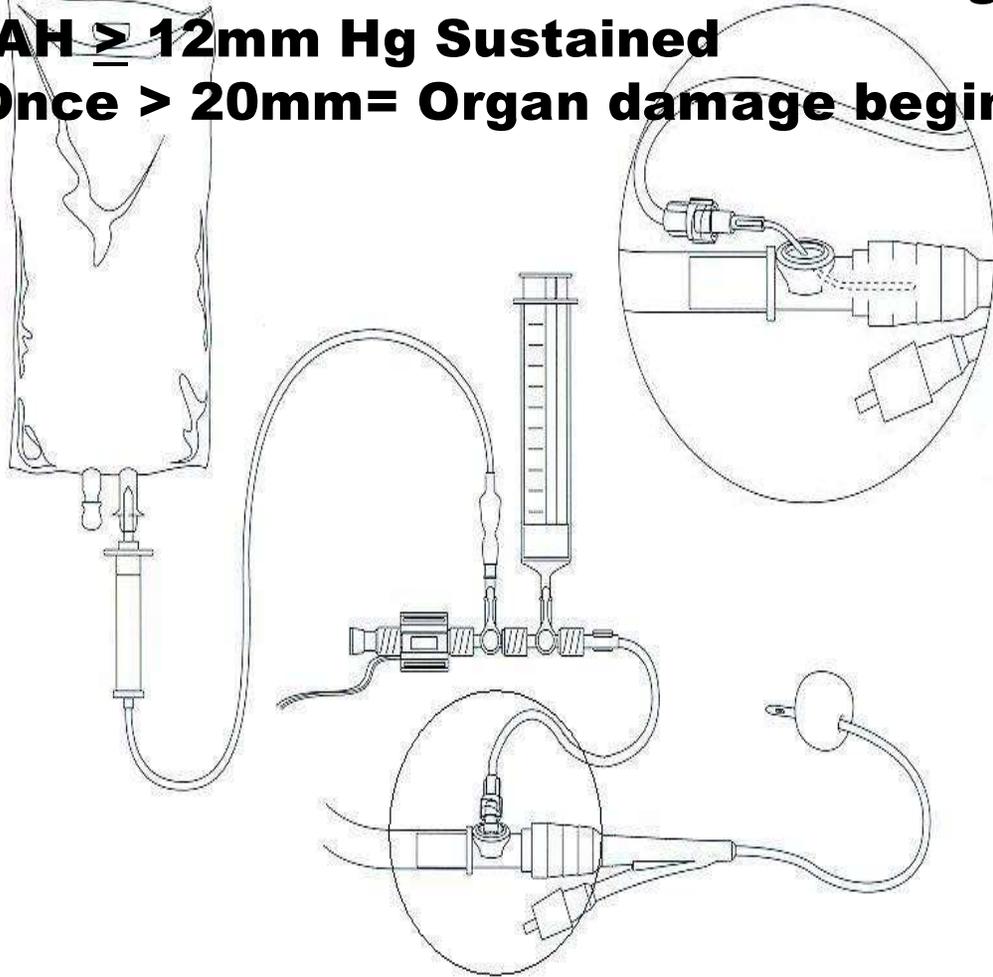


# Assessment

- **Cullen's Sign: Umbilical**
- **Grey Turner's Sign: Flank**
- **Kehr's Sign: Shoulder Pain**
- **Abdominal Compartment Syndrome (ACS)**



**Normal Bladder Pressure 0-5 mmHg**  
**IAH  $\geq$  12mm Hg Sustained**  
**Once  $>$  20mm = Organ damage begins**



**MAP-IAP (Intra-abdominal Pressure)**  
**Normal  $>$  60mmHG**

# **GI Trauma Treatment**

- **Fluid Resuscitation**
- **Diagnosis Problem**
- **Plug Holes &/or Repair Lacerations**
- **Support Damaged Organ(s)**
- **Remove Damaged Tissue/Organ(s)**

# Treatment

- **Post Treatment Major Concerns**
  - **Infection/Sepsis**
  - **Hemodynamic Status**
  - **Organ Function**
  - **ARDS, AKI, MODS**

6. A patient admitted with hemorrhagic shock was intubated & given blood products & crystalloids. For the past 12 h, intra-abdominal pressures have been 5-6 mmHG. Now, the pt is agitated, coughing, & pressure has increased to 20mmHG. What action to take 1st?

A. Call the provider stat and report the intra-abdominal pressure reading

B. Elevate the HOB to 45 degrees and after re-zeroing the transducer, re-measure the pressure again

C. Increase the patient's sedation, re-zero the transducer, and measure the pressure again

D. Monitor the pt's vital signs and measure the intra-abdominal pressure again in 1 hour

# GI Blueprint

GI Surgeries  
(Including Bariatric)

Pancreatitis

Ischemic Bowel

Malnutrition

Hepatic Disorders

GI Motility Disorders  
GI Bleed  
CCRN ONLY

Abd Trauma  
Abd Compartment  
Syndrome  
CCRN ONLY

Bowel  
Infarction/Obstruction  
CCRN ONLY

Behavioral /  
Psychosocial  
PCCN 3%

CCRN 14%

(Neuro, Behavioral,  
Musculoskeletal)



# **Behavioral/Psychosocial Blueprint**

- Anxiety
  - Depression
  - Disruptive behaviors- Aggression, Violence
  - Substance Use Disorder:
    - Alcohol, Drug abuse/seeking behavior, withdrawal
  
  - CCRN ONLY:**
  - Abuse & Neglect
  - Suicidal Ideation &/or behaviors
  - Risk Taking Behaviors
  - PTSD
- 

# PCCN Nursing Actions

- **Screen patients using:**
    - **Delirium assessment tool (CAM)**
    - **Withdrawal assessment tool (CIWA, COWS)**
  
  - **Manage patients:**
    - **Suicidal ideation**
- 

# CCRN Nursing Actions

- **Respond to behavioral emergencies**
  - **Manage assessment tools (delirium, cognitive, ETOH impairment)**
  - **Manage patients:**
    - **Requiring therapeutic interventions**
    - **Medication management for agitation**
    - **Physical restraints**
- 



# Psychosocial Assessment

Acute Care Hospitalization is a  
*"Potential Crisis"*

- **Pre-Existing Mental Health Diagnosis**
- **Undiagnosed Mental Health Problems**
- **Pre-hospitalization coping skills**
  - **Functional**
  - OR
  - **Dysfunctional**

# Assessment Tools

Condition	Tool
<b>Delirium</b>	<u>Confusion Assessment Method (CAM)</u> (Acute onset and fluctuating course, Inattention, Altered LOC, Disorganized thinking) <u>4AT</u> (Alertness, Abbreviated mental test, Attention, Acute change) <u>ICDSC</u> (Altered LOC, Inattention, Disorientation, Hallucination/delusion, Agitation, Inappropriate speech, Sleep-wake disturbances, Symptom Fluctuation)
<b>Alcohol Withdrawal Syndrome</b>	Clinical Institute Withdrawal Assessment for Alcohol (CIWA) Minnesota Detoxification Scale (MINDS)
<b>Dementia</b>	Mini-Mental State Examination (MMSE) Montreal Cognitive Assessment (MoCA)

1. An elderly patient, admitted 5 days ago, is experiencing intermittent periods of confusion and is more withdrawn. The most appropriate initial nursing action would be to:
    - A. Move the patient to a private room and limit visitors.
    - B. Place the patient on the unit sleep protocol and review the med list.
    - C. Keep the lights on in the room and discuss the need for restraints
    - D. Turn the TV to the patient's favorite channel and discuss need for an antidepressant.
- 

2. A hallucinating patient with a history of schizophrenia is admitted with DKA. A priority nursing action of the admission nurse would be to:

A. Review all pre-admission medications

B. Contact the patient's counselor

C. Hold all psych medications until blood glucose is normal

D. Place wrist restraints on the patient

3. A 3d post-op pt is agitated, tachycardic, diaphoretic, & has dilated pupils. They deny pain & are describing a feeling of “bugs crawling on them.” Despite freq reorientation, they try to climb OOB. What is the best strategy to minimize these symptoms?

A. Lorazepam (Ativan)

B. Place soft restraints on the patient

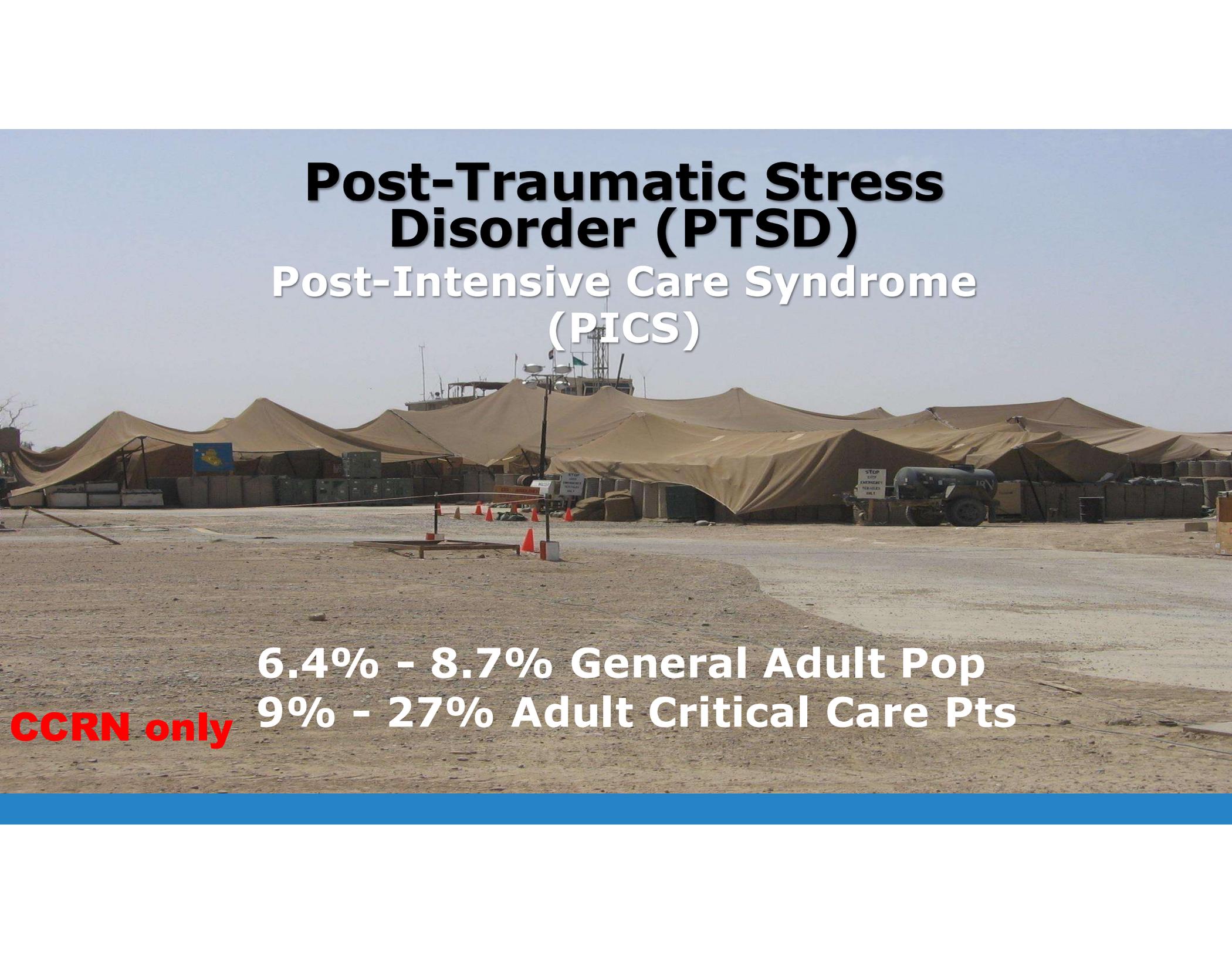
C. Methadone

D. Ask a family member to remain with the patient

# Depression



An Abnormal Emotional State  
Characterized by **Exaggerated Feelings** of  
Sadness, Melancholy, Dejection,  
Worthlessness, Emptiness &  
Hopelessness That are  
**Inappropriate & Out of Proportion to  
Reality**



# Post-Traumatic Stress Disorder (PTSD)

## Post-Intensive Care Syndrome (PICS)

6.4% - 8.7% General Adult Pop

9% - 27% Adult Critical Care Pts

**CCRN only**

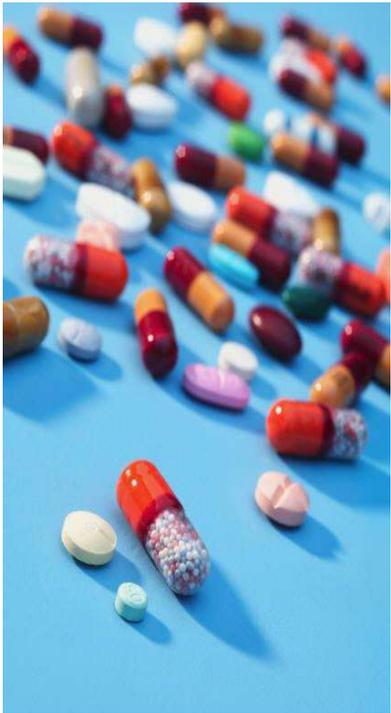
# Post-Traumatic Stress Disorder (PTSD)

- **Clinical Presentation (last > 6mo after event)**
  - Sympathetic Stimulation
- **Assessment**
  - PTSD Screening Tool
  - Agitation, Sedation and Confusion Assessment
- **Treatment Options**
  - Prevention!
  - Early Identification of Risk Factors
  - ICU Diary
  - Discharge Follow-Up/Peer support

4. A patient is admitted after experiencing a major MVC & sustaining a femur & rib fractures. The pt now states that they “fear for their life & does not want to drive again.” What would be the best goal related to this fear by discharge? The patient will:

- A. Be free from flashbacks
  - B. Not require sedatives to sleep at night
  - C. Exhibit a full range of emotions before discharge
  - D. Not discuss the traumatic event with family members
- 

# Substance Use Disorder



# Alcohol Withdrawal

- May affect 1 in 5 adults admitted
  - Assess with CIWA
- Autonomic hyperactivity symptoms
  - Tachycardia/Tachypnea
  - Anxiety/agitation
  - Insomnia
  - Disorganized thought processes
  - Visual &/or Auditory hallucinations or illusions
  - Tactile hallucinations
- Delirium Tremens may occur 72-96 h after last drink (**Medical Emergency**)
  - Potential for seizures

# **Alcohol Withdrawal Treatment Options**

- **Anticipate/Prevent**
  - **Decrease Stimulation**
  - **Safety Measures**
  - **Short, Direct Conversations**
  - **VS Monitoring**
  - **Protocol Driven**
- 

# Aggression

- **Warning signs**
- **De-escalation Management**
  - **Calm/decrease stimulation**
  - **Identify trigger(s)**
- **Violence**
  - **Safety Measures**

# **Suicidal Behavior Treatment Options**

- **ICU → Physical Needs**
  - **Counseling / Psychotherapy**
  - **Elderly, Chronically Terminally Ill**
  - **Not Always Obvious**
-

5. The spouse of a patient recently admitted because of a single vehicle crash tells the nurse "I'm afraid they were trying to kill themselves." A priority for the nurse would be to:

A. Identify if the patient has a history of depression

B. Ask the patient directly about suicidal intent with the wife in the room

C. Obtain an order for a psychiatric consult

D. Ensure the suicide assessment is completed in the electronic health record



6. The spouse of a patient, who has been determined to be brain dead insists on continuing all life-sustaining treatments. The RN is upset & believes the pt is suffering & that the spouse is ignoring the care team's advice. What should the RN do first?

A. Discuss possible solutions with a charge nurse or supervisor

B. Confront the spouse about the concerns

C. Request a new patient assignment

D. Engage the ethics team and hospital legal team



# Behavioral/Psychosocial Blueprint

Depression

Disruptive  
Behaviors

Anxiety

Substance Use  
Disorder

PTSD  
CCRN ONLY

Abuse &  
Neglect  
CCRN ONLY

Suicidal  
Ideation  
CCRN ONLY

Risk Taking  
Behaviors  
CCRN ONLY

# Professional Caring & Ethical Practice

20%



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# **Professional Caring & Ethical Practice Blueprint**

- **Advocacy/Moral Agency**
  - **Caring Practices**
  - **Collaboration**
  - **Systems Thinking**
  - **Response to Diversity**
  - **Clinical Inquiry**
  - **Facilitation of Learning**
- 

# **AACN Synergy Model**

**The Needs or Characteristics  
of  
Patients and Families  
Influence and Drive  
The Characteristics or Competencies  
of  
Nurses**



# AACN Synergy Model

## 8 Patient Characteristics

1. Resiliency
2. Vulnerability
3. Stability
4. Complexity
5. Resource availability
6. Participation in care
7. Participation in decision making
8. Predictability

## 8 Nurse Characteristics

1. Clinical judgment (80%)
2. Caring Practices
3. Advocacy & Moral agency
4. Clinical inquiry, Innovator/Evaluator
5. Collaboration
6. Systems thinking
7. Response to Diversity
8. Facilitation of learning

# AACN Synergy Model

## 1. Caring Practices

- Safe & supportive environment
- Identify what are the priorities of the patient/family
- Develop trust with family
- Assess coping strategies

## 3. Clinical Inquiry

- Utilizing Evidence Based Practice (EBP) to evolve in care
- Don't say "This is how we've always done it"!

## 2. Advocacy & Moral Agency

- Respecting beliefs, values & rights
- Assist with informed decision making
- Patient Advocate
- Privacy concerns

# AACN Synergy Model

## 4. Collaboration

- Appropriate referrals
- Involve multidisciplinary team members in care
- Set appropriate & realistic expectations/goals with patient & family

## 5. Systems Thinking

- Prioritize patient safety
- “Swiss cheese Model”-
- Assess for system issues
- Identify patient appropriately
- “Just culture” concept

## 6. Response to Diversity

- Cultural sensitivity
- Avoid stereotypes

## 7. Facilitation of Learning

- **Discharge education starts on admission**
- Identify barriers to learning
- Utilize Teach Back
- Provide appropriate education based on needs

1. Which of the following actions by a nurse might decrease a patient's self-esteem? (Caring Practices)
    - A. Discussing the negative consequences of the patient's condition
    - B. Requiring the patient to participate in all treatments
    - C. Providing opportunities to discuss issues important to the patient.
    - D. Indicating his or her acceptance of the patient's condition
- 

2. A 22-year-old patient with end-stage liver failure secondary to Hep C has been declared brain dead. The parents decide to discontinue feedings & donate their child's organs. In response to the parents' request, the most appropriate action by the RN would be to:

A. Contact the Organ Procurement Agency

B. Convene a multidisciplinary care conference

C. Tell the parents that their daughter's condition precludes organ donation

D. Discontinue feedings per the parents' request

3. A patient is confused about time & place, despite frequent reorientation. For the patient's safety, the Nurse would initially:

A. Put a vest restraint on the patient

B. Ask a family member to stay with the patient

C. Administer a mild sedative

D. Increase the frequency of observation of the patient

4. A patient has been waiting for 2 mos for a heart transplant. A family member angrily tells the nurse, "This is hopeless!" The nurse's actions should be based on the knowledge that: (Caring Practices)

A. Expressions of frustration are normal and usually require no nursing intervention

B. Since expressions of hopelessness may be harmful to the patient, the family member should be encouraged to keep those statements out of the patient care area

C. The integrity of the family system is crucial in the transplant process

D. Encouraging discussion of negative emotions can impede their resolution

5. A patient is admitted in DKA. Since admit, the glucose levels have been in the range of 400 – 500 mg/dl, & Regular Insulin has been administered on a sliding scale. Given these findings, the most appropriate initial nursing intervention is to:

- A. Consult with the MD about changing the regular insulin via a continuous drip
  - B. Arrange for a nutrition consult
  - C. Consult with the physician about increasing the maximum dosage of insulin on the sliding scale
  - D. Request for an evaluation by a Diabetic Educator
- 

6. When teaching a family member to perform an aspect of patient care, the nurse understands that family members:

A. Are unaffected by the timing of teaching

B. Learn best if they perceive a need to learn

C. Learn best if shown a complex procedure all at once

D. Learn unrelated tasks first

7. When caring for a 15-year-old patient, the nurse would:

A. Address worries about the future

B. Use games as a teaching strategy

C. Encourage the patient to talk about life experiences

D. Allow the patient's peers to visit

8. A patient with receptive aphasia and dementia meets criterion to be enrolled into a clinical trial. How should the nurse proceed to ensure that informed consent is ethically obtained?

A. Involve the patient's legal guardian in the consent process

B. Ensure that the investigator is aware of the patient's condition

C. Inform the IRB of the potential risk to the patient

D. Obtain a copy of the consent form to place in the patient's chart

9. Six members of a trauma patient's family arrive at the ICU asking questions about their loved one's condition. The nurse's most appropriate response would be to:

A. Ensure that the chaplain is available

B. Include the family in patient care

C. Offer the family a tour of the ICU

D. Identify a family spokesperson

10. Three hours after cardiac surgery, a patient who is a Jehovah's Witness & did not consent to blood transfusions in the pre-op consent paperwork, has a Hgb of 5 & accumulated chest tube drainage of 1800 ml. The most appropriate action would be to:

- A. Request the spouse sign the consent for blood administration
- B. Administer donated directed PRBCs from a family member
- C. Petition a judge for a court order to transfuse whole blood
- D. Infuse normal saline and vasopressors to maintain blood pressure

11. A patient who does not speak or understand English has just undergone an aortic valve replacement. The RN notices they are increasingly restless & splinting their chest with both hands. An effective means of communication with this patient would be:

A. Using a letter board

B. Contacting the patient's family

C. Use an approved & validated interpreter service

D. Using "yes" or "no" questions

12. The daughter of a mechanically ventilated patient is to be taught how to suction. When developing a teaching plan, the nurse must first:

- A. Obtain written information about the procedure
  - B. Determine a schedule for demonstrating the technique
  - C. Assess the knowledge and skills the daughter needs to learn
  - D. Encourage the daughter to observe the procedure on other patients
- 

13. When providing culturally sensitive care, the nurse understands that:

- A. All members of a specific culture hold the same beliefs
  - B. It is always important to place every patient on the same standards of care
  - C. Individual needs are not relevant when best practices are being used
  - D. It is essential that the patient's goals are an important part of care planning
- 

14. Transport staff returned a patient after a study requiring sedation. Minutes later a crash was heard, and the patient was found on the floor near the bathroom. This event was the patient's fifth unwitnessed fall in a month. It would be most effective for the staff to:

- A. Request that transport staff receive retraining about fall precautions, including bed alarms
- B. Review the bed alarm policy for all patients after procedures
- C. Recommend a focused review of unit falls and actionable interventions
- D. Complete a hospital safety report addressing staffing challenges

15. A patient recalls a near-death experience (NDE) that occurring during resuscitation and wishes to tell the nurse about it. What is the optimal response by the nurse?

- A. Make time to listen actively while the patient tells the story
  - B. Let the patient know that NDE's are often hallucinations
  - C. Compare the patient's story to the actual resuscitation events
  - D. Encourage the patient to describe the NDE to his family
- 

# Professional Caring & Ethical Practice Blueprint

Advocacy &  
Moral Agency

Caring  
Practices

Collaboration

Systems  
Thinking

Response to  
Diversity

Clinical  
Inquiry

Facilitation of  
Learning



# Respiratory



**PCCN 14%**

**CCRN 15%**



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# Respiratory Blueprint

- Pulmonary Emboli
- ARDS
- Asthma
- COPD
- Pleural Space Complications
- Pulmonary Fibrosis
- Pulmonary Hypertension
- Thoracic Surgery

- **PCCN ONLY:**
- Connective Tissue Disorders (Sarcoidosis)
- Respiratory Infections
- Respiratory Depression
- Ventilators (Chronic, Home, Stable)
- Sleep Apnea- Obstructive & Central

- **CCRN ONLY:**
- Ventilators & Failure to Wean
- Status Asthmaticus
- Thoracic Trauma
- TRALI

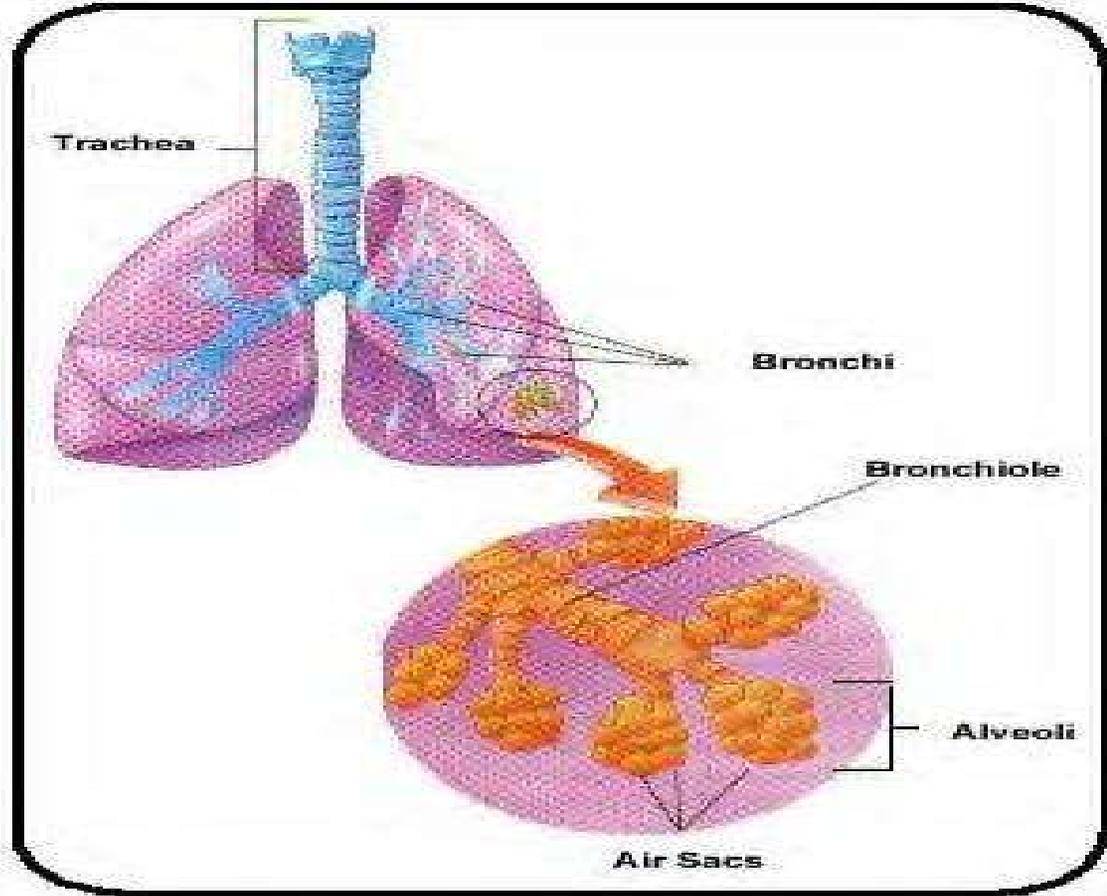
# CCRN Testable Nursing Actions

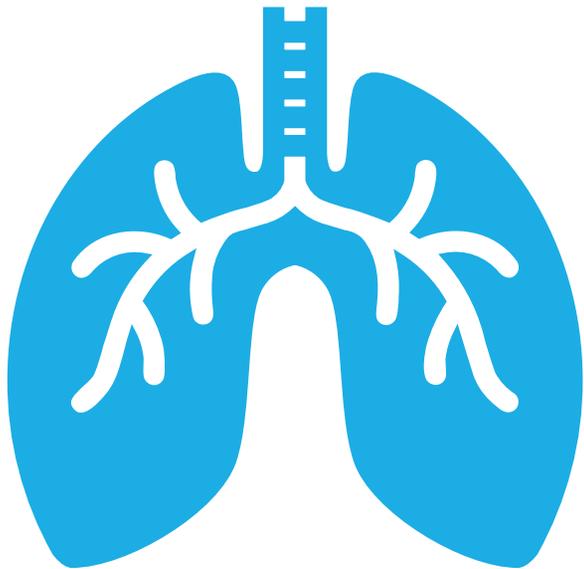
- **Blood Gas Interpretation**
- **Manage patients requiring:**
  - **Mechanical Ventilation**
  - **Noninvasive + pressure ventilation**
  - **Oxygen therapy**
  - **Prevention of ventilator complications**
  - **Prone positioning**
  - **Therapeutic gases**
  - **Thoracentesis**
  - **Tracheostomy**

# **PCCN Testable Nursing Actions**

- **Interpret Blood Gases (ABG, VBG)**
- **Maintain airway/respiratory compromise**
- **Manage patients in prone position**
- **Manage mechanical ventilation**
- **(stable, home, chronic)**
- **Non-invasive O<sub>2</sub> or ventilation delivery systems**
- **Respiratory monitoring devices: SpO<sub>2</sub> & capnography**
- **Tracheostomy tubes**
- **Chest tubes (including pleural drains)**
- **Manage pulmonary artery hypertension (PAH)**
- **Pre-& post:**
  - **Bronchoscopy**
  - **Chest tube insertion**
  - **Respiratory complications**

# Anatomy Review





# Definitions

## Ventilation

- Moving Air Into & Out of The Lungs

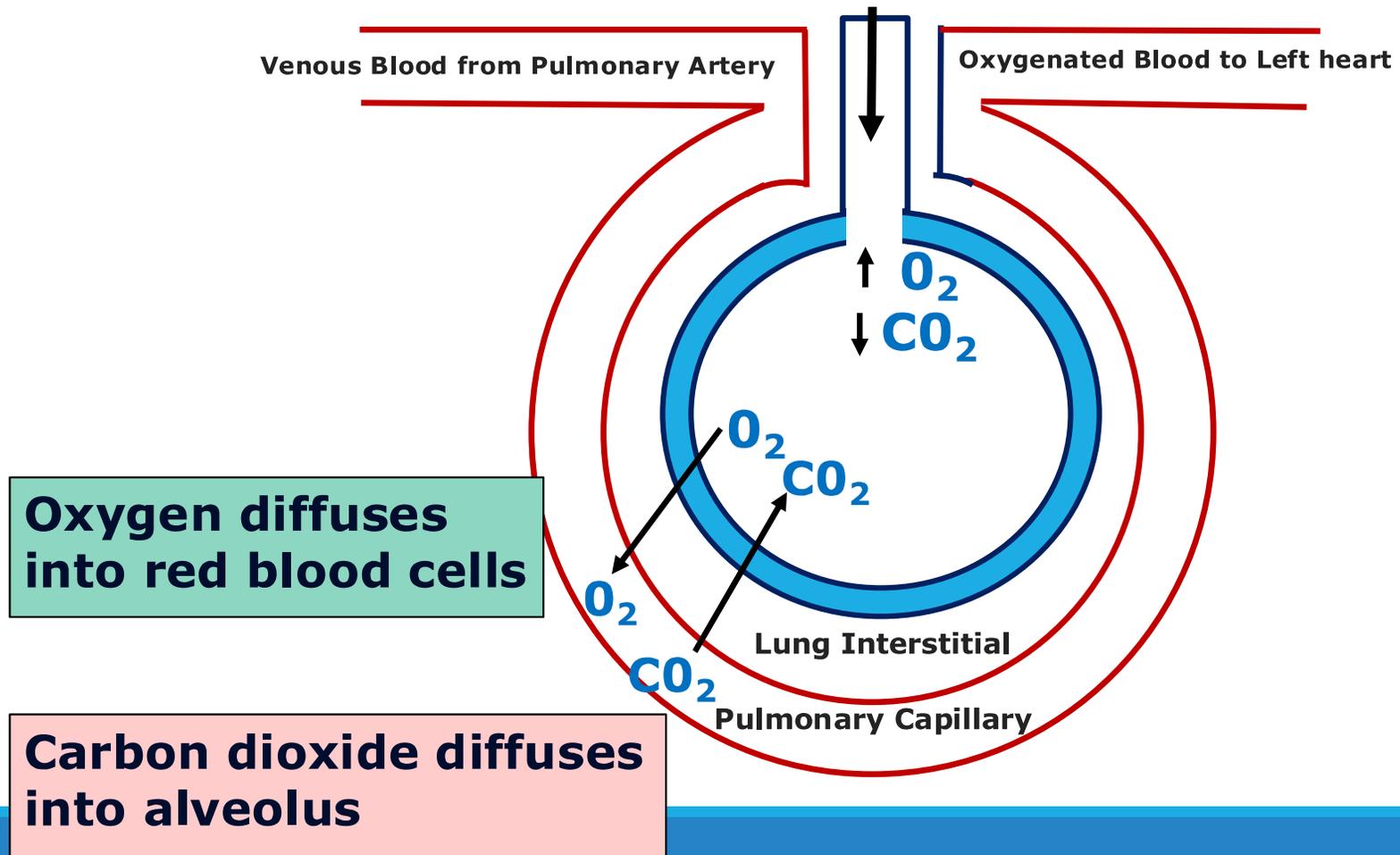
## Diffusion

- Movement of Gas From Higher Concentration to Lower Concentration

## Perfusion

- Transporting Gases to the Body via Circulatory System

# Pulmonary Physiology



# Definitions



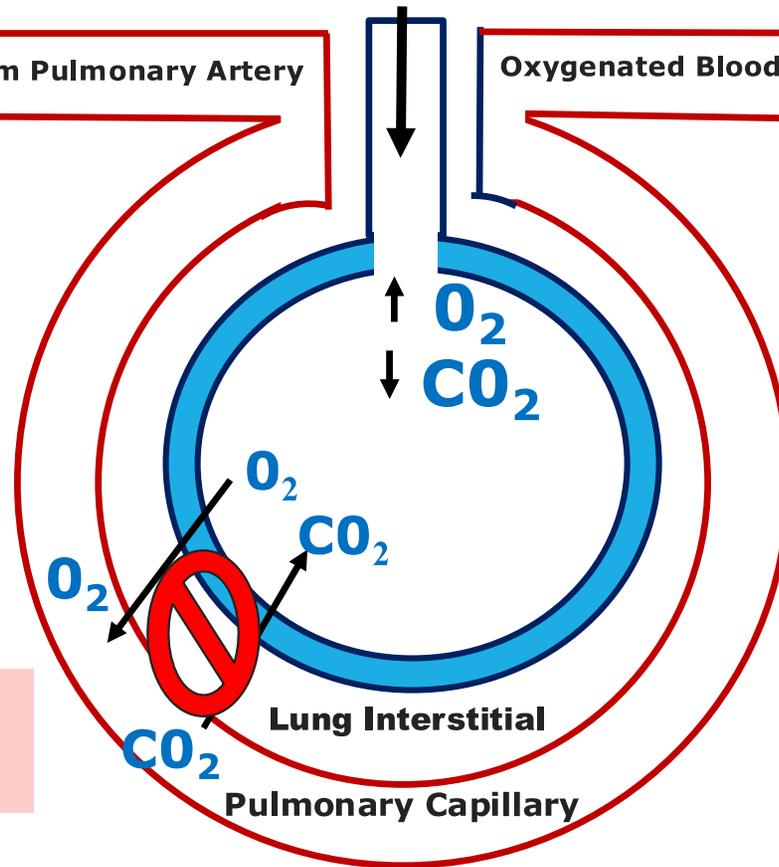
Venous Blood from Pulmonary Artery

Oxygenated Blood to Left heart

**Dead Space  
Ventilation:**

**Alveoli Ventilation  
without adequate  
Perfusion**

**Pulmonary  
Emboli**

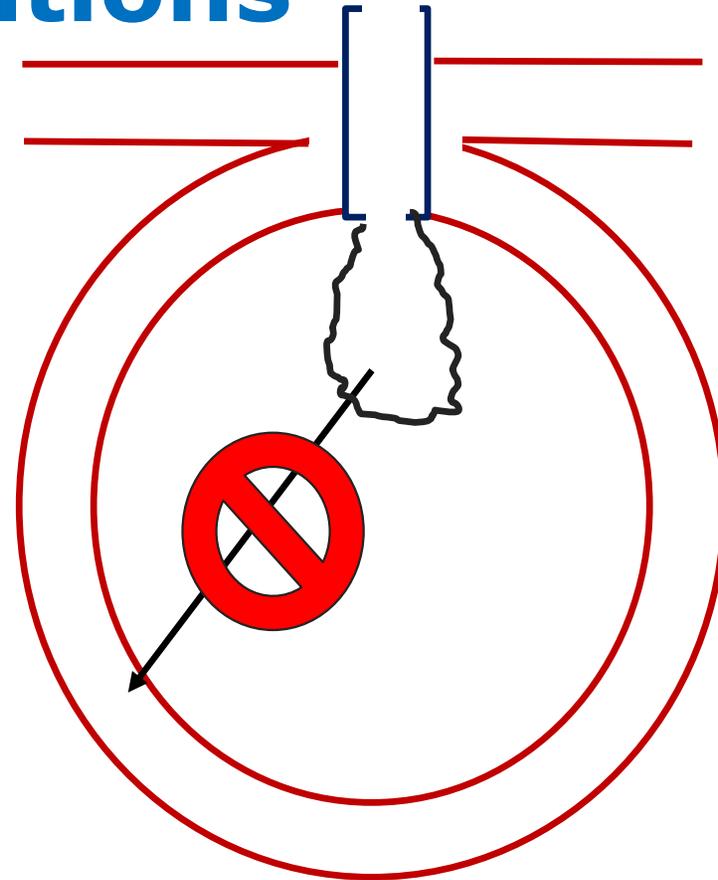


# Definitions

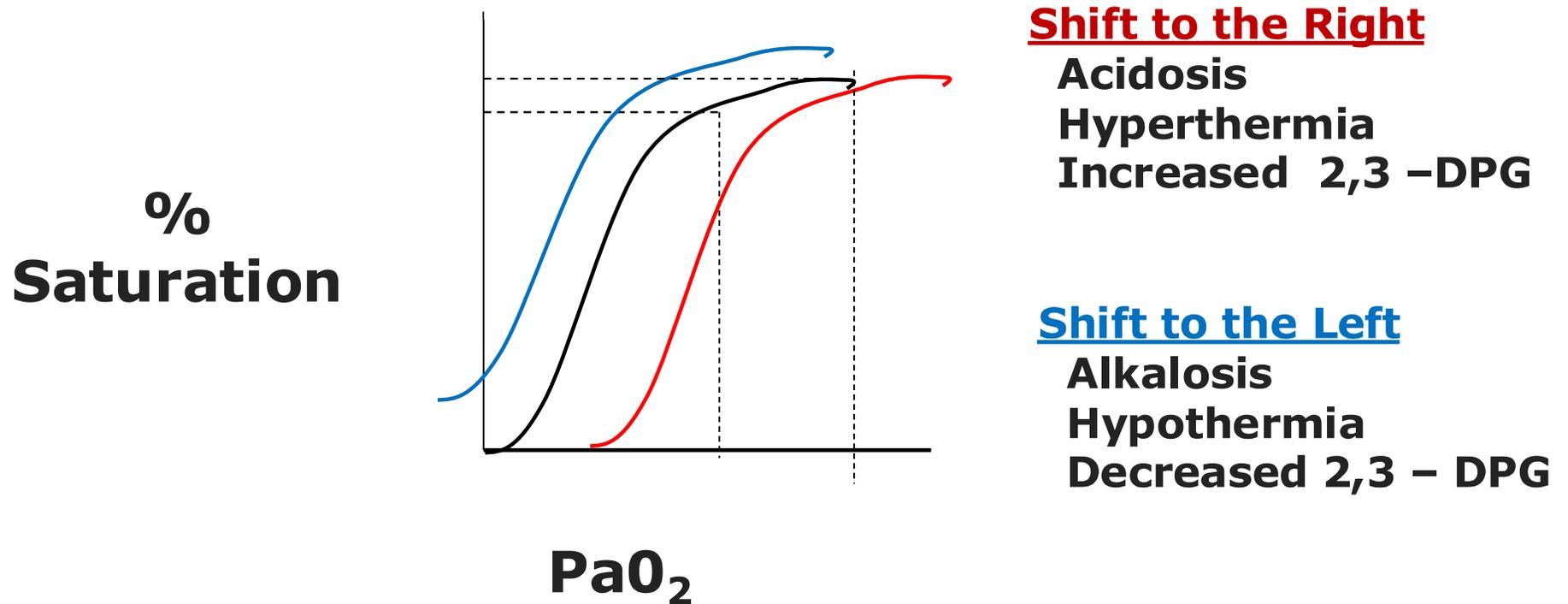
**Intrapulmonary Shunting:**

**Perfusion  
with inadequate or absent  
Ventilation**

**Atelectasis**



# Oxyhemoglobin Dissociation Curve



# ABG

<b>PaO<sub>2</sub></b>	<b>80-100</b>
<b>pH</b>	<b>7.35-7.45</b>
<b>PaCO<sub>2</sub></b>	<b>35-45</b>
<b>HCO<sub>3</sub></b>	<b>22-26</b>
<b>SaO<sub>2</sub></b>	<b>95-100</b>

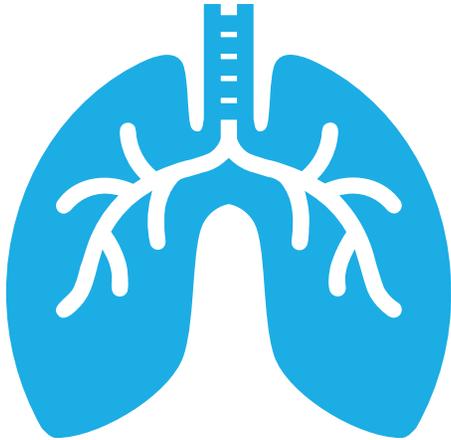
# VBG

<b><math>PO_2</math></b>	<b>30-40</b>
<b>pH</b>	<b>7.31-7.41</b>
<b><math>VpCO_2</math></b>	<b>41-51</b>
<b><math>HCO_3</math></b>	<b>23-29</b>
<b><math>SpO_2</math></b>	<b>75%</b>

**Assessment  
of  
Gas  
Exchange**

- **Indications of Oxygenation Status?**
- **Indications of Ventilation Status?**
- **Indications of Acid-Base State?**

# Respiratory Regulation



**Ventilation & Diffusion → PaCO<sub>2</sub>**

**Blowing Off PaCO<sub>2</sub>**

**Retaining PaCO<sub>2</sub>**

**Changes in A/B Balance Can  
Occur Very Quickly**

# RESPIRATORY ACIDOSIS



**pH < 7.35**



**PaCO<sub>2</sub> > 45 mmHg**



**Respiratory  
Depression**

**Decreased  
Ventilation**

# RESPIRATORY ALKALOSIS



**pH > 7.45**

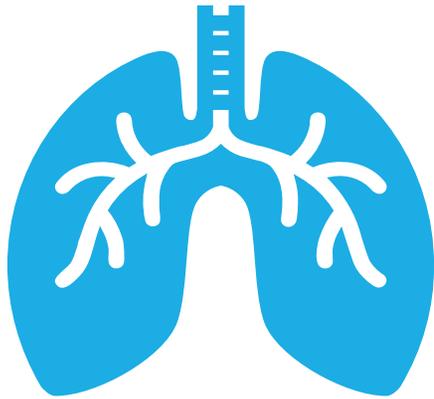
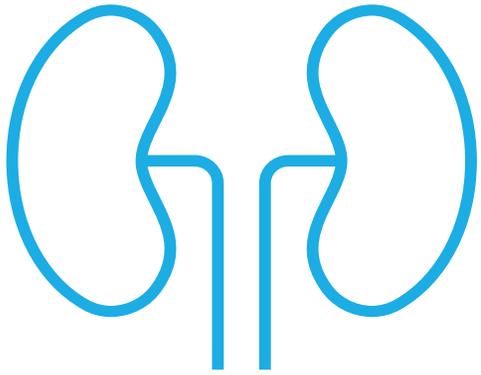


**PaCO<sub>2</sub> < 35 mmHg**



**Hyperventilation**

**Increased  
Ventilation**



# Metabolic Regulation

**Normal  $\text{HCO}_3^-$  22-26 mEq/L**

**Base Excess -2 - + 2**

**Kidneys Function as Buffer**

**Retain or Excrete**

**Acid (H) or Base (Bicarbonate)**

**Does NOT Happen Quickly**

# METABOLIC ACIDOSIS



**pH < 7.35**



**HCO<sub>3</sub> < 22 mEq/L**

**BE < -2**



**Increase in Acid**  
**Decrease in Base**

**Anion Gap > 12**

**Anion Gap = Na - (Cl + HCO<sub>3</sub>)**

# METABOLIC ACIDOSIS

**M**ethanol

**U**remia

**D**KA

**P**ropylene glycol

**I**soniazid

**L**actic acidosis

**E**thylene glycol

**S**alicylates

# METABOLIC ALKALOSIS



**pH > 7.45**



**HC03 > 26 mEq/L**

**BE > +2**



**Increase in Base  
Decrease in Acid**

# Determination of Compensation

Disorder	pH	Primary	
Respiratory Acidosis	↓	↑ Pa CO <sub>2</sub>	
Respiratory Alkalosis	↑	↓ PaCO <sub>2</sub>	
Metabolic Acidosis	↓	↓ HCO <sub>3</sub>	
Metabolic Alkalosis	↑	↑ HCO <sub>3</sub>	

# Rapid Sequence Intubation (RSI)

---

- Rapid unconsciousness (induction) and neuromuscular blockade (paralysis)
- **Goal:** To intubate without use of bag-valve-mask ventilation
- Indications
- Contraindications

## Indications

- Inability to maintain airway patency
- Inability to protect the airway against aspiration
- Failure to ventilate
- Failure to oxygenate
- Anticipation of a deteriorating course that will eventually lead to respiratory failure

# PEtCO<sub>2</sub>: Capnography

## PaCO<sub>2</sub> 35-45 mmHg

### Measure of **Ventilation**

- Hypoventilation = Increased CO<sub>2</sub>
- Hyperventilation = Decreased CO<sub>2</sub>

### Measure of **Perfusion**

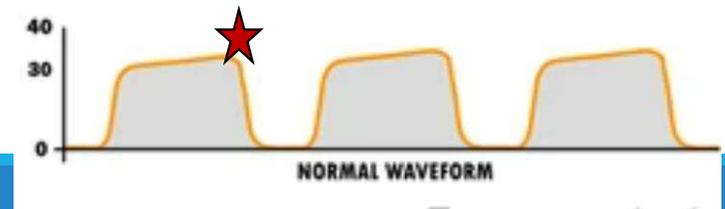
- ↓ in low CO states
- Resuscitation goal >10mm HG

### **VQ mismatch:**

- **High** PaCO<sub>2</sub> & **low** PEtCO<sub>2</sub>

Calculate gradient:  
PaCO<sub>2</sub> - PEtCO<sub>2</sub>

Normal:  
Approx. <5 mmHG  
difference

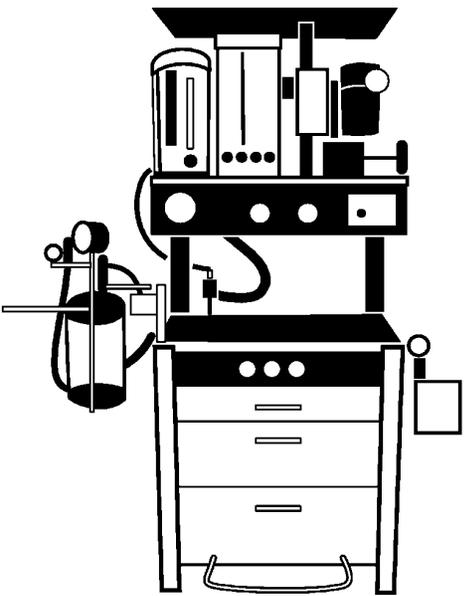


# Ventilator Management

New To PCCN Test Plan:  
Stable, Home, Chronic  
Ventilators

## MODES ARE CLASSIFIED BY INSPIRATORY TRIGGER

- **Volume Cycled (A/C, CMV, SIMV)**
  - Volume is set & pressure is variable
- **Pressure Cycled (Pressure Control PC)**
  - Pressure is set and volume is variable
- **Pressure Support**



# Mechanical Ventilation

## Volume & Pressure Combined Modes

- **Airway Pressure Release Volume (APRV)**
- **Bi-level/Bi-phasic Positive Airway Pressure (BiPAP)**
- **Pressure Regulated Volume Controlled (PRVC)**

- Allows for spontaneous breathing
- Helps improve ventilation/meet clinical goals
- Does not require sedation or muscle relaxants
- Less barotrauma and auto-PEEP
- Has not proven to be superior to earlier modes

# Therapeutic Gases

---

- **Oxygen**
- **Inhaled Nitrous oxide (iNO)**
- **Carbon dioxide therapy (CO<sub>2</sub>)**
- **Helium-oxygen therapy (Heliox)**

**CCRN Only**

# Ventilator-Associated Events

---

- **Patient response complications**
  - **Hemodynamic compromise**
  - **Barotrauma and volutrauma**
  - **Ventilator-associated pneumonia**
  - **Positive fluid balance and hyponatremia**
  - **Upper GI hemorrhage**
  
- **Ventilator malfunction**

- **VAP:** Ventilator-associated pneumonia
- **VAC:** Ventilator-associated complication
- **VAE:** Ventilator-associated event

# Weaning

---

- **Spontaneous breathing trials (SBT)**
- **Sedation Vacation—“Wake up and breathe”**
- **Nutrition**
- **Protocol-driven: Society of Critical Care Medicine *ICU Liberation Bundle (A-F)***

## **ICU Liberation Bundle (ABCDEF bundle)**

- **A:** Assess, Prevent, and Manage Pain
- **B:** Both Spontaneous Awakening Trials (SATs) and Spontaneous Breathing Trials (SBTs)
- **C:** Choice of Analgesia and Sedation
- **D:** Delirium: Assess, Prevent, and Manage
- **E:** Early Mobility and Exercise
- **F:** Family Engagement and Empowerment

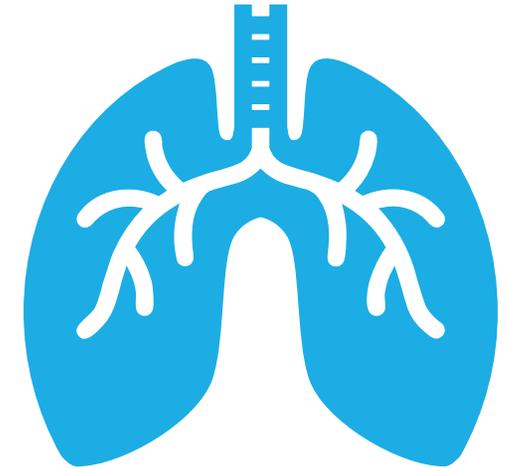
# Noninvasive Ventilation (NIV)

Fewer intubations

Continuous Positive Airway Pressure (CPAP)

Bilevel Positive Airway Pressure (BiPAP)

High-flow nasal cannula



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1. Which of the following clinical situations correlates with ABG results of pH 7.22, PaCO<sub>2</sub> 65 mm Hg, HCO<sub>3</sub> 23 mEq/L, PaO<sub>2</sub> 56 mm Hg?
    - A. Acute tracheal obstruction
    - B. Anxiety-induced hyperventilation
    - C. Chronic Obstructive Pulmonary Disease
    - D. Diarrhea for 36 hrs in a debilitated patient
- 

2. An intubated post op pt is beginning to wake up. Vent settings are AC rate-14, TV 450, FiO2 60%, 5cm PEEP. Pt's current RR is 36. ABG: pH 7.52, PaCO2 28, HCO3 24, PaO2 150. What changes/treatment, if any, should the nurse anticipate?

A. No changes to the vent settings, admin an anti-anxiety agent

B. Decrease the TV and increase the PEEP

C. Change the mode from AC to PS and decrease the FiO2

D. Decrease the FiO2 and consider pain or anti-anxiety medication

3. Which nursing care actions will have the greatest potential for decreasing VAE in the ICU?

A. HOB @ 15 degrees and DVT prophylaxis

B. HOB > 30 degrees and frequent oral care

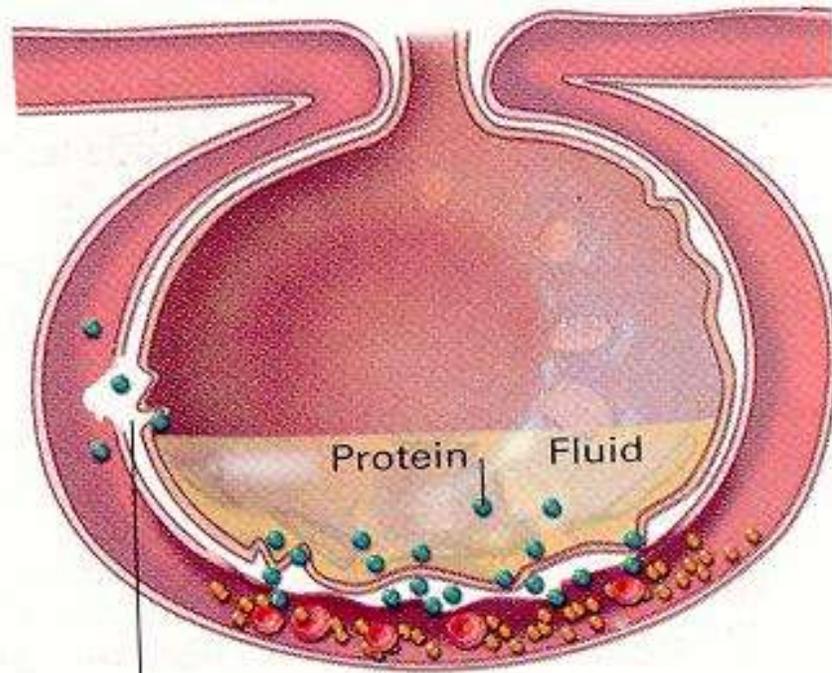
C. Turning every 2 hours with ETT suction

D. ETT position change every day and stress ulcer prophylaxis

# Restrictive Lung Disorders

Restrictive  
Expiratory  
Lung  
Volumes

ARDS  
Infections  
Occupational LD  
Sarcoidosis  
Atelectasis



Damaged alveolar epithelium  
and capillary endothelium

# ARDS

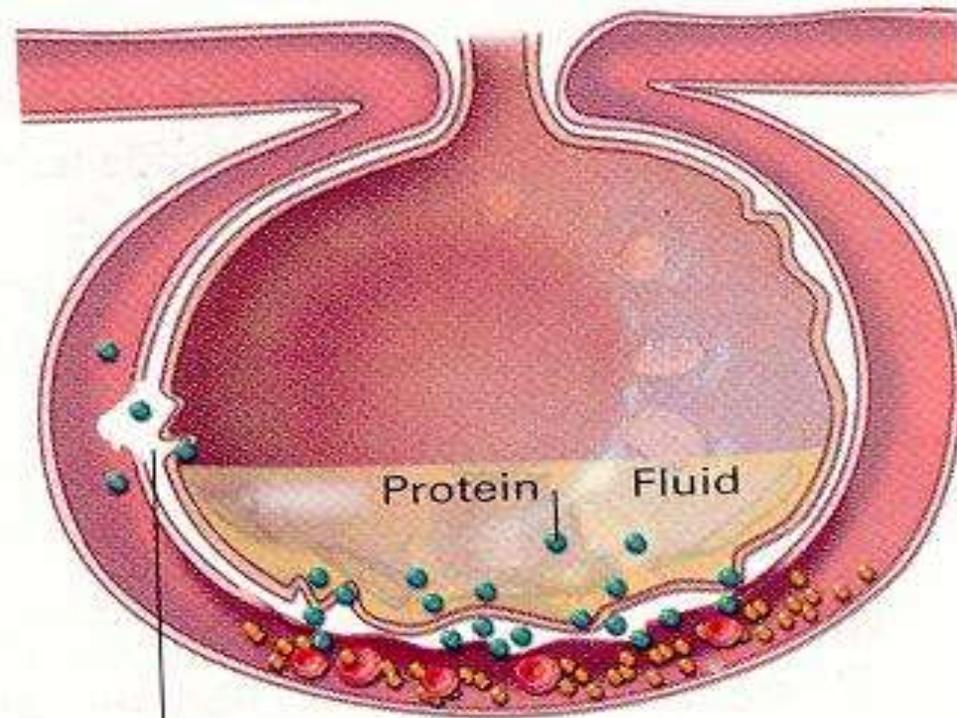
# Causes of ARDS

## Direct Injury

**Trauma\***  
**Smoke or toxic  
chemical inhalation\***  
**Gastric aspiration\***  
**Anesthesia**  
**Pulmonary, fat or  
amniotic embolism**  
**High-altitude  
sickness**  
**Near drowning**

## Indirect Injury

**Sepsis\*\***  
**Hypoperfusion states**  
**SIRS**  
**Massive blood  
transfusions (TRALI)**  
**IV fluid overload**  
**Pancreatitis**  
**DIC**  
**Severe anemia**



Damaged alveolar epithelium and capillary endothelium

# ARDS

<b>Timing</b>	<b>Within 1 week of known clinical insult or new or worsening resp symptoms</b>
<b>Chest Imaging</b>	<b>Bilateral opacities – not fully explained by effusion, lobar/lung collapse, or nodules</b>
<b>Origin of Edema</b>	<b>Resp failure not fully explained by cardiac failure or fluid overload.</b>
<b>Stages:</b>	
<b>Exudative</b>	<b>0-4 days</b>
<b>Proliferative</b>	<b>3-10 days</b>
<b>Fibrotic</b>	<b>7-14 days</b>
<b>Treatment Options</b>	<b>Treat underlying cause Mechanical Ventilation Prevent Infection Pharmacology</b>

# ARDS Definition

---

- Acute onset
- PaO<sub>2</sub>/FiO<sub>2</sub> ratio <200 mmHg
- Bilateral infiltrates
- No evidence of LV failure (PAOP <18 mmHg)

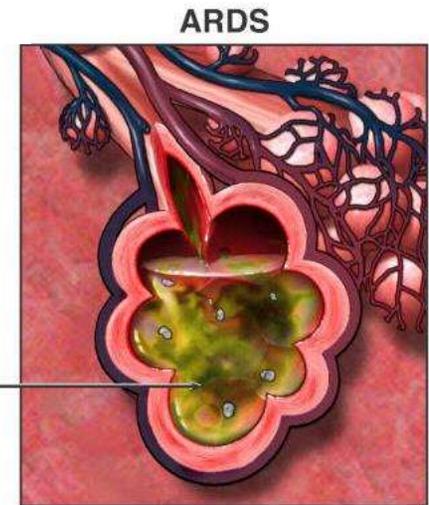
$$\frac{\text{PaO}_2 \ 100}{\text{FiO}_2 \ .21} = 476$$

Example:

Patient has a PaO<sub>2</sub> of 90 mmHG and receiving 40% oxygen (FiO<sub>2</sub> = 0.40),

Then their PF ratio would be 90/0.40= 225 PF Ratio

Fluid releasing from capillaries filling the alveolar space and preventing gas exchange



# ARDS Criteria: New Global Definition of ARDS (2023)

## Diagnostic Criteria That Apply to All ARDS Categories

Inclusion of HFNC to capture patients with more indolent courses

Ultrasound can be used to identify loss of lung aeration

<b>OXYGENATION</b>	Sp <sub>02</sub> :F <sub>I02</sub> can be used for diagnosis and assessment of severity if Sp <sub>02</sub> is ≤97%		
<b>Nonintubated ARDS</b>	New category created for HFNO at ≥30 L/min who otherwise meet ARDS criteria		
<b>Intubated ARDS</b>	Mild: 200 < Pa <sub>02</sub> :F <sub>I02</sub> ≤ 300 mm Hg or 235 < Sp <sub>02</sub> :F <sub>I02</sub> ≤ 315 (if Sp <sub>02</sub> ≤ 97%)	Moderate: 100 < Pa <sub>02</sub> :F <sub>I02</sub> ≤ 200 mm Hg or 148 < Sp <sub>02</sub> :F <sub>I02</sub> ≤ 235 (if Sp <sub>02</sub> ≤ 97%)	Severe: Pa <sub>02</sub> :F <sub>I02</sub> ≤ 100 mm Hg or Sp <sub>02</sub> :F <sub>I02</sub> ≤ 148 (if Sp <sub>02</sub> ≤ 97%)
<b>Modified Definition for Resource-Limited Settings</b>	Sp <sub>02</sub> :F <sub>I02</sub> ≤ 315 (if Sp <sub>02</sub> ≤ 97%) <sup>†</sup> . Neither positive end-expiratory pressure nor a minimum flow rate of oxygen is required for diagnosis in resource-limited settings.		

# ARDS Treatment

---

**Goal:** Utilize supportive strategies to limit further lung injuries

Treat underlying cause

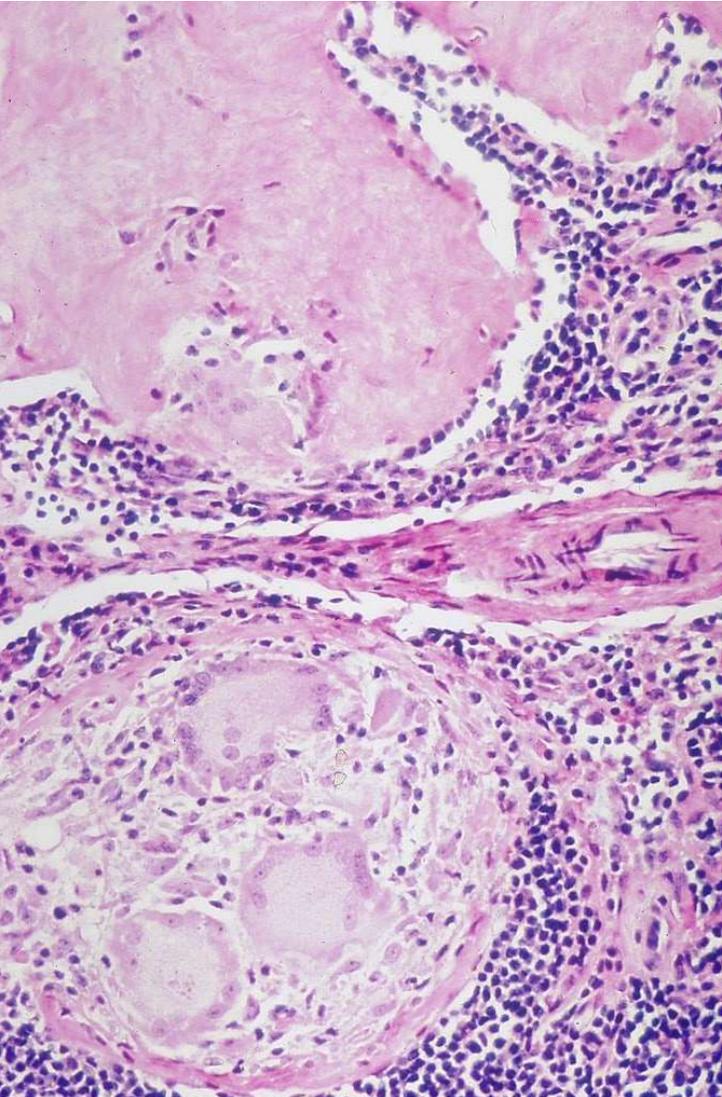
Prevent infection

Pharmacology

Prone positioning

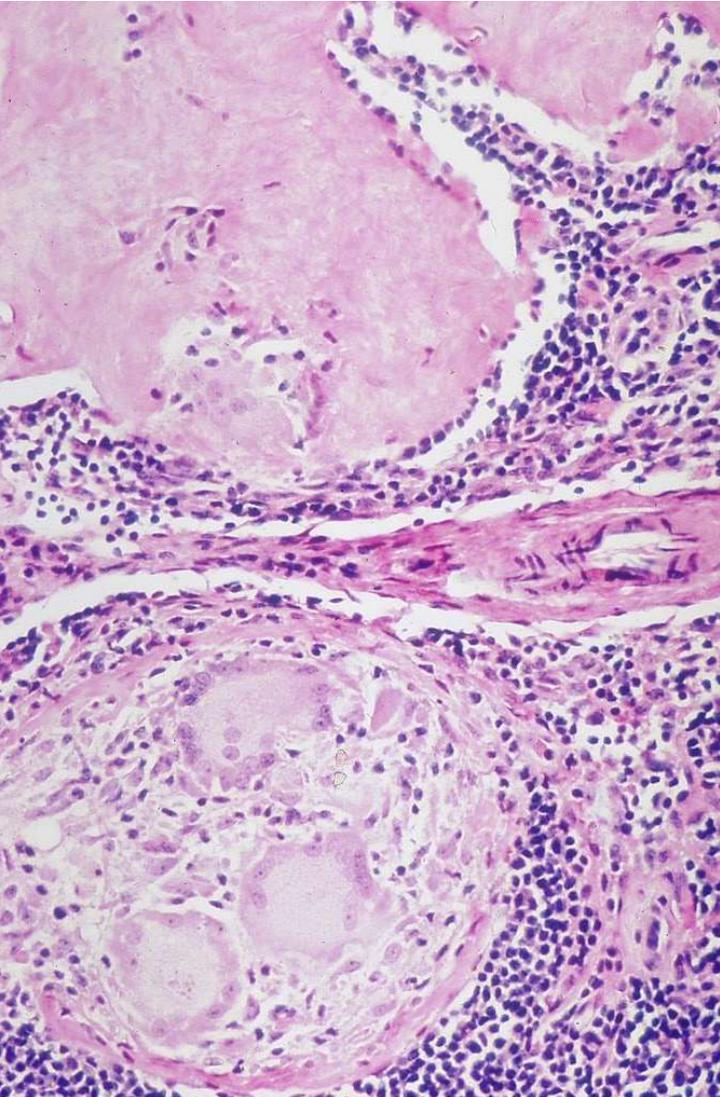
## Potential Complications Associated with Prone Positioning:

- Pressure injuries
- Airway safety
- Ocular safety
- Nerve injury
- Enteral feeding



# Sarcoidosis: Connective Tissue Disorder

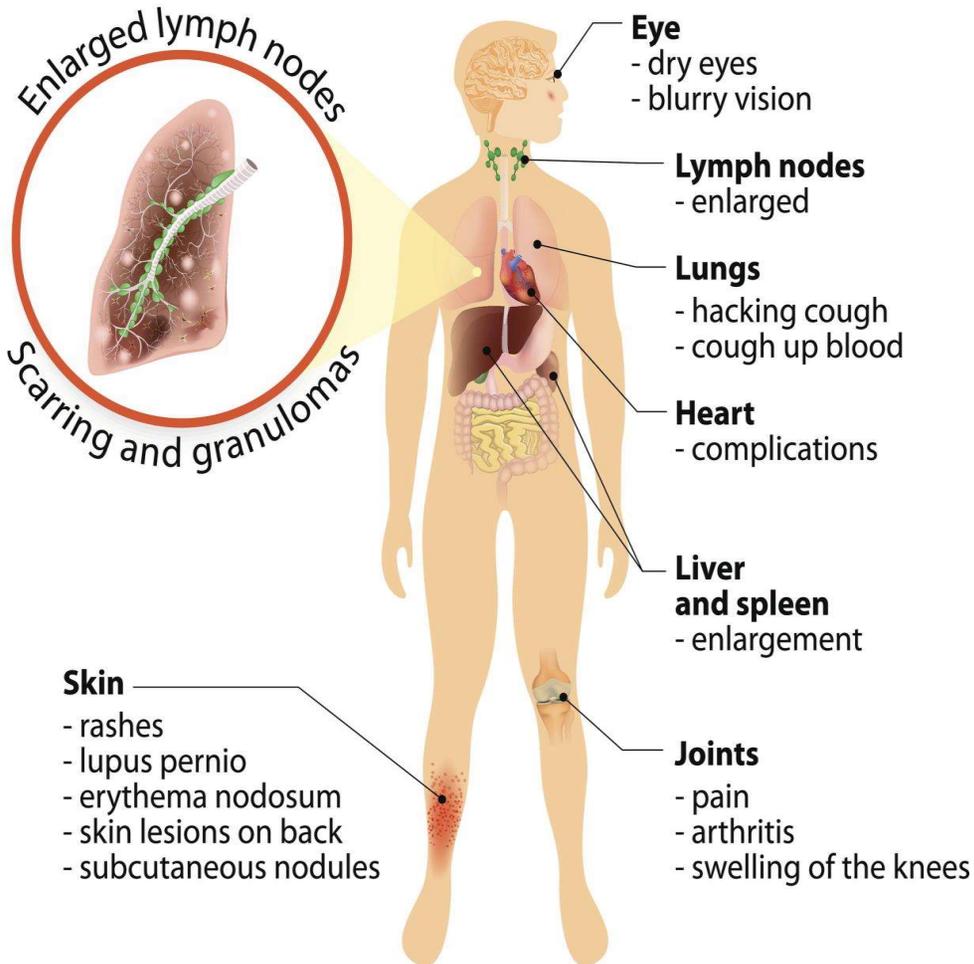
- **MULTISYSTEM DISEASE:  
UNKNOWN ETIOLOGY**
  - Sarcoid granulomas
  - Necrosis
  - Pulmonary infiltrates
  - Lymphadenopathy
  - Advanced- “honeycombing”  
appearance
  - Vasculitis



# Sarcoidosis: Connective Tissue Disorder

- **Risk Factors:**
  - **Genetics**
  - **Viral infections**
  - **Environmental**

# Sarcoidosis



## Sarcoidosis: Connective Tissue Disorder

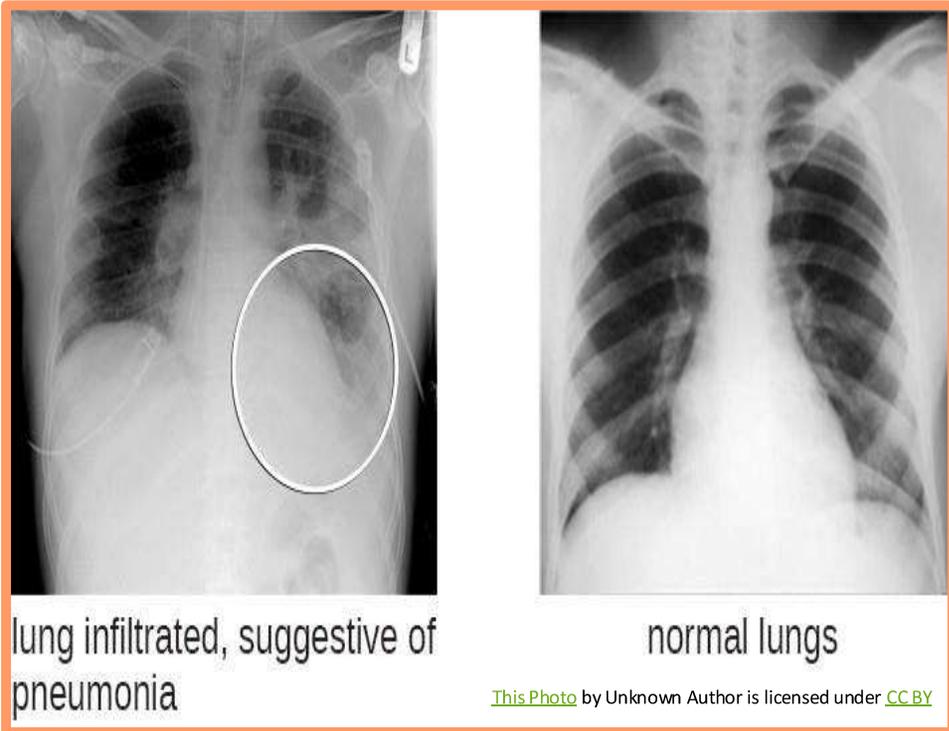
- **Presentation**
- **Management**
- **Nursing Considerations**

# Pneumonia

## Inflammatory Process of the Lung Parenchyma

Caused by Infection that Leads to Alveolar Consolidation

- Treatment Options
  - Antibiotics
  - Oxygen
  - Mechanical Ventilation
  - Positioning
  - Fluids & Humidification
  - Pulmonary Hygiene
  - Manage Fever & Pain
  - Prevention



4. A patient with COPD is being admitted with pneumonia. Review the admission assessment and then contact the MD with the ABG results. What do you anticipate the order or response to be?

A. Call anesthesia to intubate the patient and begin mechanical ventilation

B. Administer the antibiotic for the pneumonia ASAP

C. Increase the patient's O<sub>2</sub> to 4L

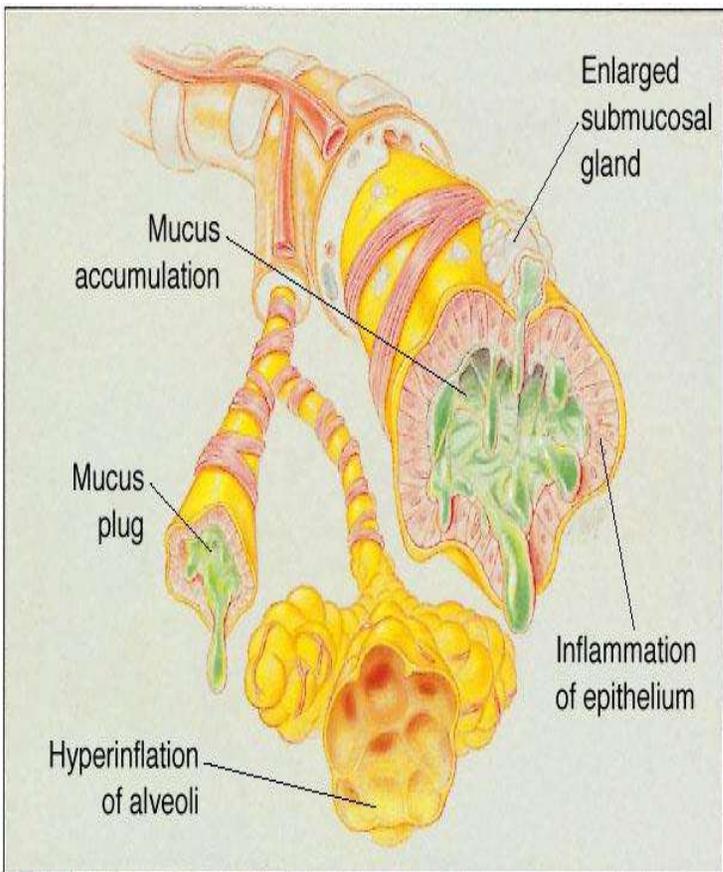
D. Continue to monitor the patient for any respiratory distress

Admission assessment:  
Unlabored RR of 28  
Denies SOB or chest  
HR 112 A-fib  
BP 188/92  
T 37.9° (100.2°)  
Coarse breath sounds  
diminished in bases  
1L O<sub>2</sub> via NC.  
ABG:  
pH 7.28  
PaCO<sub>2</sub> 55  
HCO<sub>3</sub> 35  
PaO<sub>2</sub> 71

5. The major effect of acute respiratory distress syndrome (ARDS) on the lung tissue is:

- A. Decreased capillary permeability
- B. Increased functional residual capacity
- C. Decreased compliance
- D. Increased alveolar surface tension

# Obstructive Lung Disorders



**COPD**  
**Emphysema**  
**Bronchitis**  
**Asthma**  
**Sleep Apnea**  
**(Obstructive & Central)**

# COPD

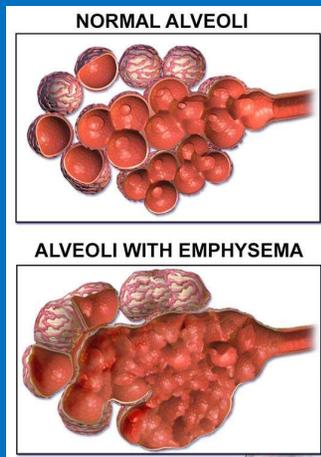
## Bronchitis:

Inflammatory  
Response to an  
Irritant

- **Vasodilation, Congestion**
- **Mucosal edema & bronchospasm**
- **Small & large airways, NOT Alveoli**
- **Chronic cough/sputum production daily**
- **Chronic:  
 $\geq 3$  months for  $\geq 2$  years**

# COPD

## Emphysema

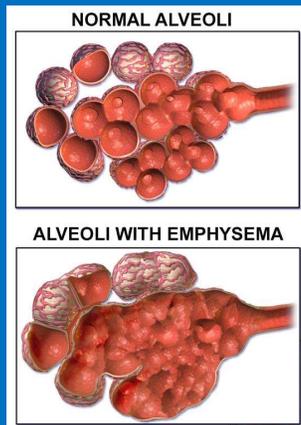


- Irritation/Inflammation of Bronchioles
- ↑
- Mucus Production
  - Obstruction
  - Tissue Injury
- ↓
- Surfactant
  - Bronchiolar collapse



# COPD

## Emphysema



- **Obstruction → Air Trapping**
- **Alveoli Distention**
- **Enlargement of Air Sacs**
- **Loss of Elastic Recoil**
- **Multiple Alveoli Fuse into One Large One**
- **Decreased Surface Area**

# COPD

## Clinical Presentation

- **Dyspnea on Exertion**  **Dyspnea at Rest**
- **Productive Cough**
- **Tachypnea with Small Tidal Vol**
- **Drop in FEV1 in 1 second**
-  **AP Diameter**
-  **Breath Sounds in Bases**

# COPD

## Clinical Presentation

- **Malnutrition/Muscle Wasting  
(including diaphragm)**
- **Chest X-Ray**
  - **Flattened Diaphragm**
  - **Decreased Vascular Markings**
  - **Bullae**
- **Right Heart Failure**
- **Multisystem Dysfunction**
  - **Chronic Hypoxemia**
  - **Chronic Hypercapnia**

# COPD

## Treatment Options

- **Treat Primary Cause of Admission**
- **O<sub>2</sub> administration **With Caution****
- **Hydration & Humidification**
- **Secretion Removal**
- **Medications**
- **Nutrition**
  - **High-calorie**
  - **Low-carbohydrate**

# COPD

## ABG Clinical Presentation

pH 7.35-7.45

PaCO<sub>2</sub> 35 – 45

HCO<sub>3</sub> 22-26

PaO<sub>2</sub> 80 – 100

# **Asthma**

**Caused by:  
Intrinsic  
or  
Extrinsic  
Factors**

- **Hyperactive airway**
- **Widespread narrowing**
- **Mucosal edema**
- **Smooth muscle contraction**
- **Excessive mucus**
- **Decreased secretion clearance**

# Status Asthmaticus

## Medical Emergency

- **Hyperactive airway**
- **Widespread narrowing**
- **Bronchospasm**
- **Excessive mucus**
- **Air Trapping**
  - **Hyperinflation**
  - **Increased intrathoracic pressures**
  - **Decreased venous return**
  - **Increased RV afterload**

**CCRN only**

# Obstructive

## Sleep

## Apnea

*Snoring*

*Sleepiness*

*Significant-other  
report of apneic  
episodes*

Repeated episodes of apnea

Secondary to upper airway  
obstruction

### Presentation:

Snoring

Lack of Sleep

Potential for Trauma

Night Sweats

GERD

### Complications:

HTN, Cor Pulmonale,  
Stroke, MI

### Etiology:

Obesity >50% of pts

Neck > 17 in

Nasal obstruction

Male > Female

Postmenopausal women

Age > 50 yrs

Smokers

HTN

### Diagnosis:

Polysomnography

Risk Factors

# Central Sleep Apnea

- Dysfunction in the brain & sleep center due to an underlying disorder
- Brief disruption between the brain and muscles that control breathing
- May be seen with:
  - Alzheimer's disease
  - Parkinson's disease
  - Drug-induced (opioids)
  - Stroke
  - High-altitude
  - Damage to medullary respiratory center
  - Treatment-Emergent

# Sleep Apnea

## Treatment Options

**Treat Underlying Disorder**

**Weight Loss**

**Avoid Alcohol/Sedatives 4-6h Before Sleep**

**Smoking Cessation**

**HOB > 30 degrees (Avoid Supine Position)**

**Oral Appliances**

**Nasal CPAP, BiPAP, ASV\*\***

**Medications \*\***

**Surgery\*\***

**\*\*Also helpful with  
Central Sleep Apnea**

6. A patient who has experienced a stroke is restless, using accessory muscles to breathe, and has slid down in the bed. The patient has sonorous respirations and a SpO<sub>2</sub> of 90%. What should be the nurse's first action?

A. Apply oxygen via nasal cannula

B. Administer a benzodiazepine

C. Reposition the patient

D. Administer a PRN opioid

# Pulmonary Arterial Hypertension (PAH)

**Chronic & Progressive Increase in Pulmonary Vascular Resistance**

**Etiology:**  
Primary or Secondary Causes

**World Health Organization (WHO) Classifications:**  
WHO Group 1/PAH- Pulmonary Vasculature is primary problem

**Complications:**

Increased right ventricular afterload → right heart failure (*Cor Pulmonale*)

Dilation of pulmonary artery

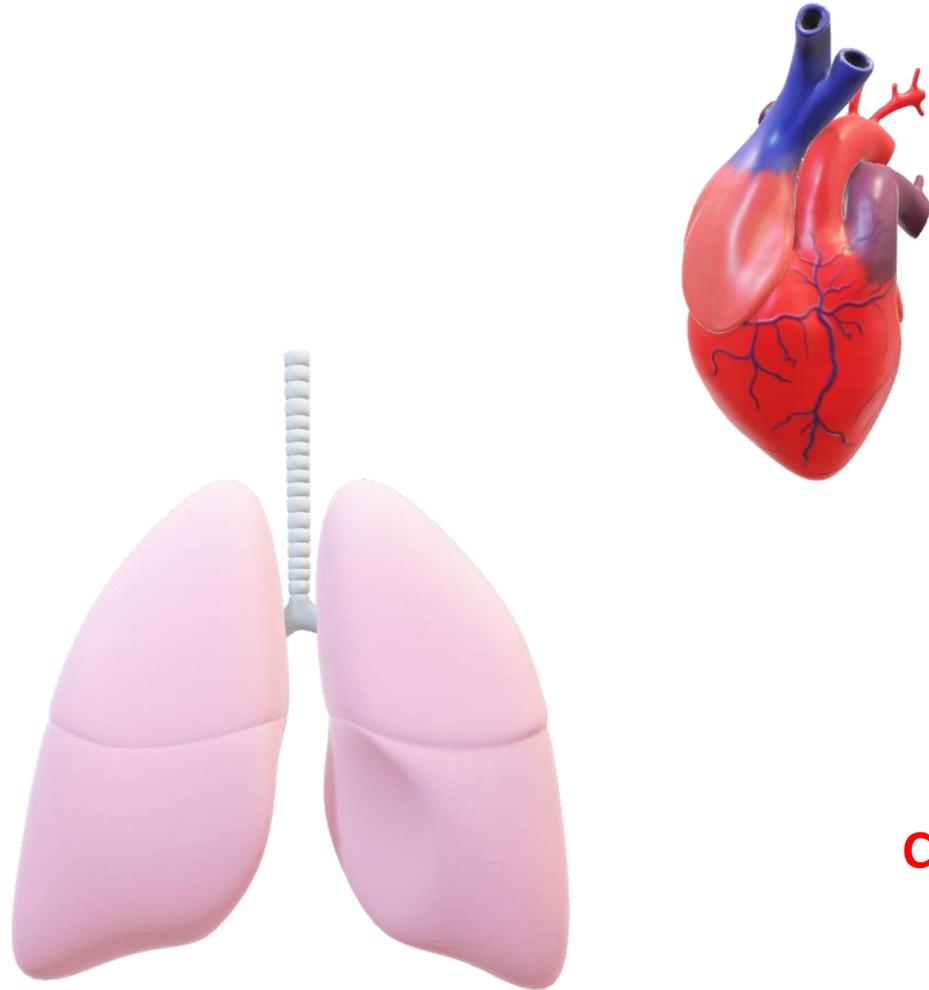
**Clinical presentation**

**Diagnosis:**  
TTE-  
Initial screening

**R Heart Cath-  
Gold Standard**

**Treatment  
Goals**

# Thoracic Trauma



**CCRN Only**

# Mechanism of Injury

## PENETRATING

- Projectiles
- High-Energy
  - Ballistic Type
- Low-Energy
  - Stabbings

## BLUNT

- MVC
- Falls
- Assaults
- Pedestrians Struck
- Recreational Sports
- Compression

# Index of Suspicion

## Chest Wall

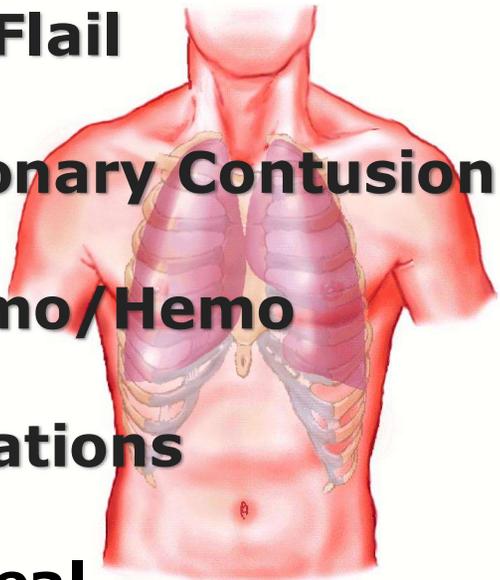
Ribs/Flail

Pulmonary Contusion

Pneumo/Hemo

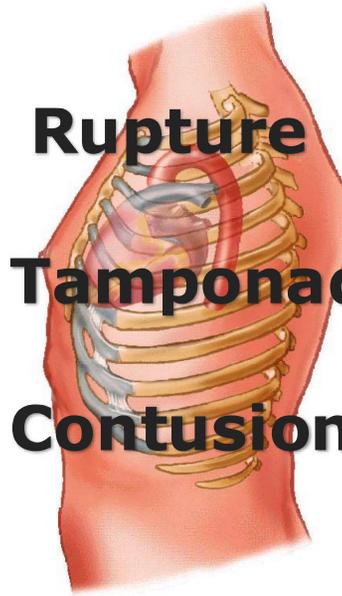
Lacerations

Tracheal  
perforation/airway trauma



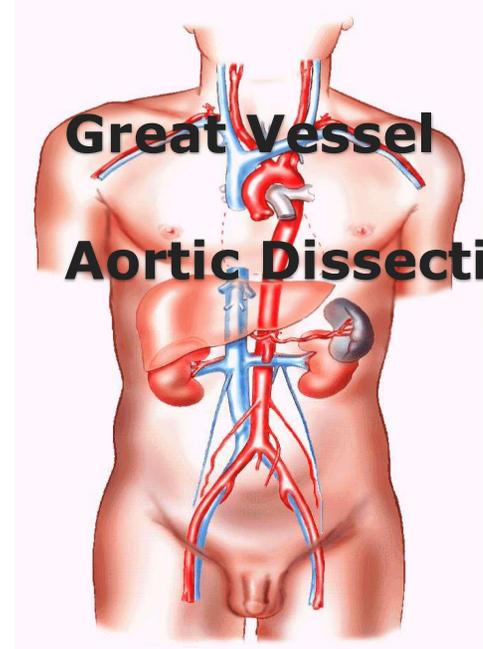
## Cardiac

Rupture  
Tamponade  
Contusion



## Vascular

Great Vessel  
Aortic Dissection



# Pulmonary Emboli



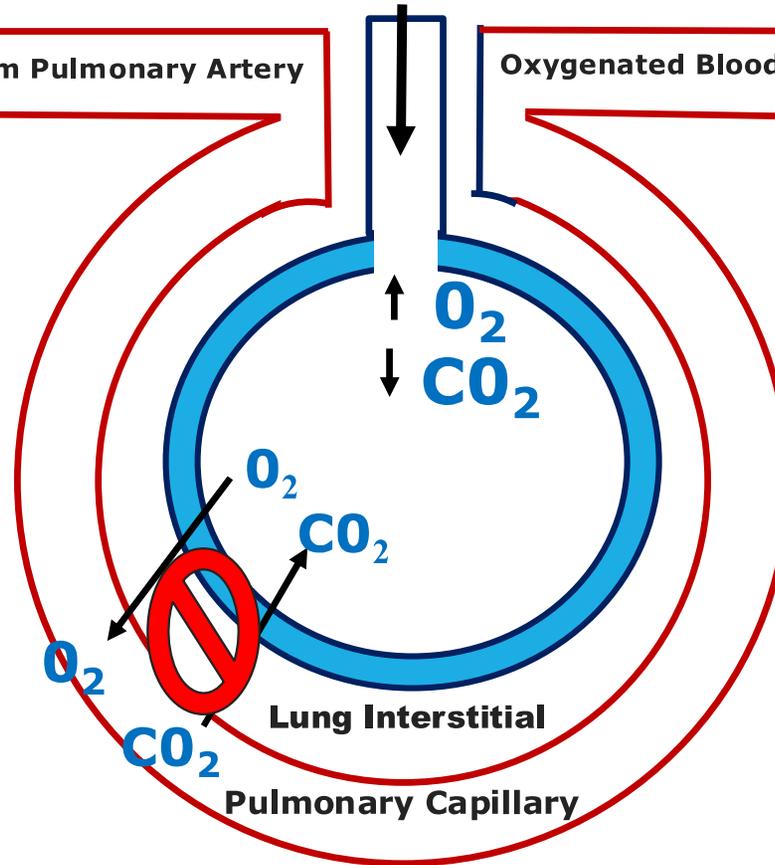
Venous Blood from Pulmonary Artery

Oxygenated Blood to Left heart

**Pulmonary  
Arterial Circulation  
Occlusion**

**Blocking flow to  
region(s) of lung**

**Dead  
Space  
Ventilation**



**Air  
Fat  
Blood  
Amniotic Fluid**

# **Pulmonary Emboli**

## **Etiology**

**Thromboemboli 90% DVT**

**Virchow's Triad**

- 1. Venous Stasis**
  - 2. Hypercoagulability**
  - 3. Vascular Wall Damage**
- 

# **Pulmonary Emboli**

## **Pathophysiology**

- **Pulmonary artery obstruction**
  - **V/Q mismatching**
  - **Non-perfused alveoli collapse**
  - **Pulmonary infarction**
  - **Increased PVR → Afterload on RV**
  - **RV Failure**
- 
- A solid blue horizontal bar spanning the width of the slide, located at the bottom.

# PE

## ABG Clinical Presentation

pH 7.35-7.45

PaCO<sub>2</sub> 35 – 45

HCO<sub>3</sub> 22-26

PaO<sub>2</sub> 80 – 100

# **Pulmonary Emboli**

## **Treatment Options**

- **ABCs**

- **Administer 100% O<sub>2</sub>**

- **Intubate if necessary**

- **Anticoagulation**

- **Consider (Risk vs. Benefit):**

- **Thrombolytics**

- **Catheter directed thrombolysis**

- **Embolectomy**

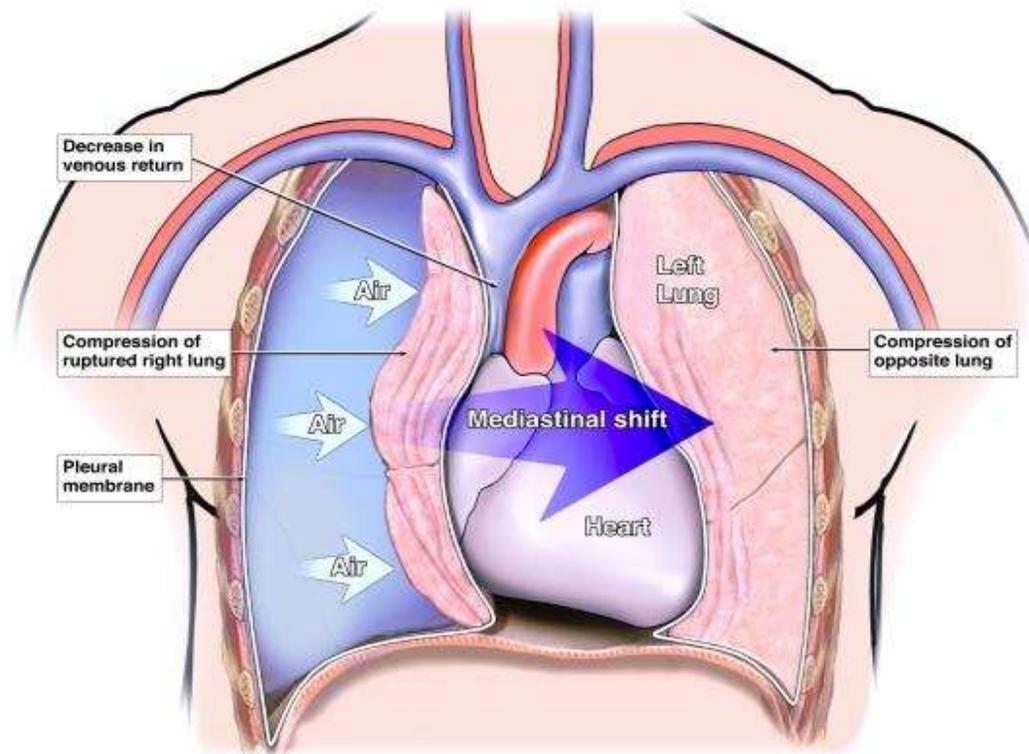
**Treat the Cause**

**Future Prevention**

- **Long-term anticoagulation**

- **IVC Filter**

# Pleural Space Abnormalities



# Pleural Space Abnormalities

---

## Pneumothorax Classifications

- Tension
- Simple
- Open-Sucking chest wound

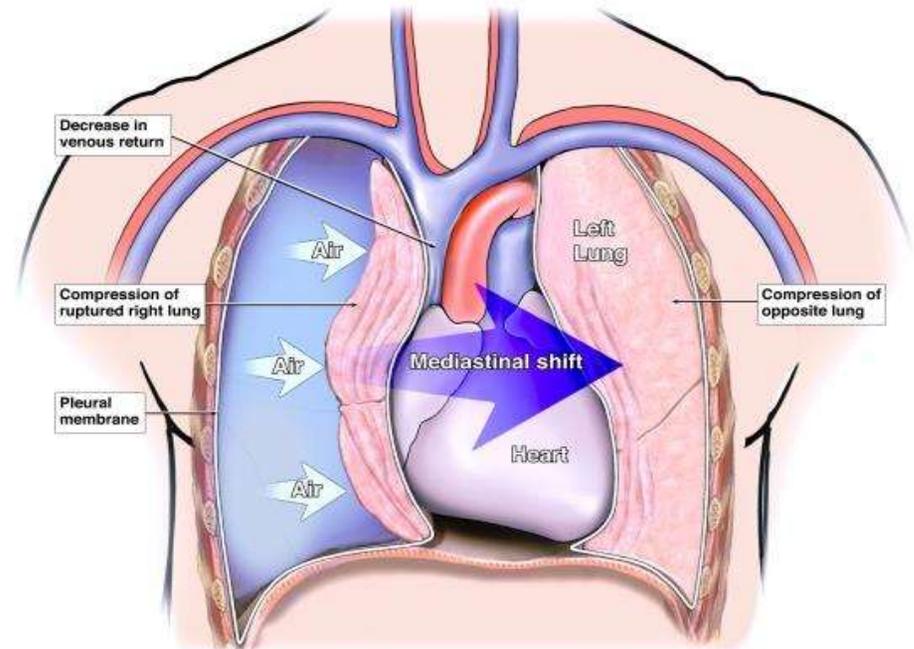
Hemothorax

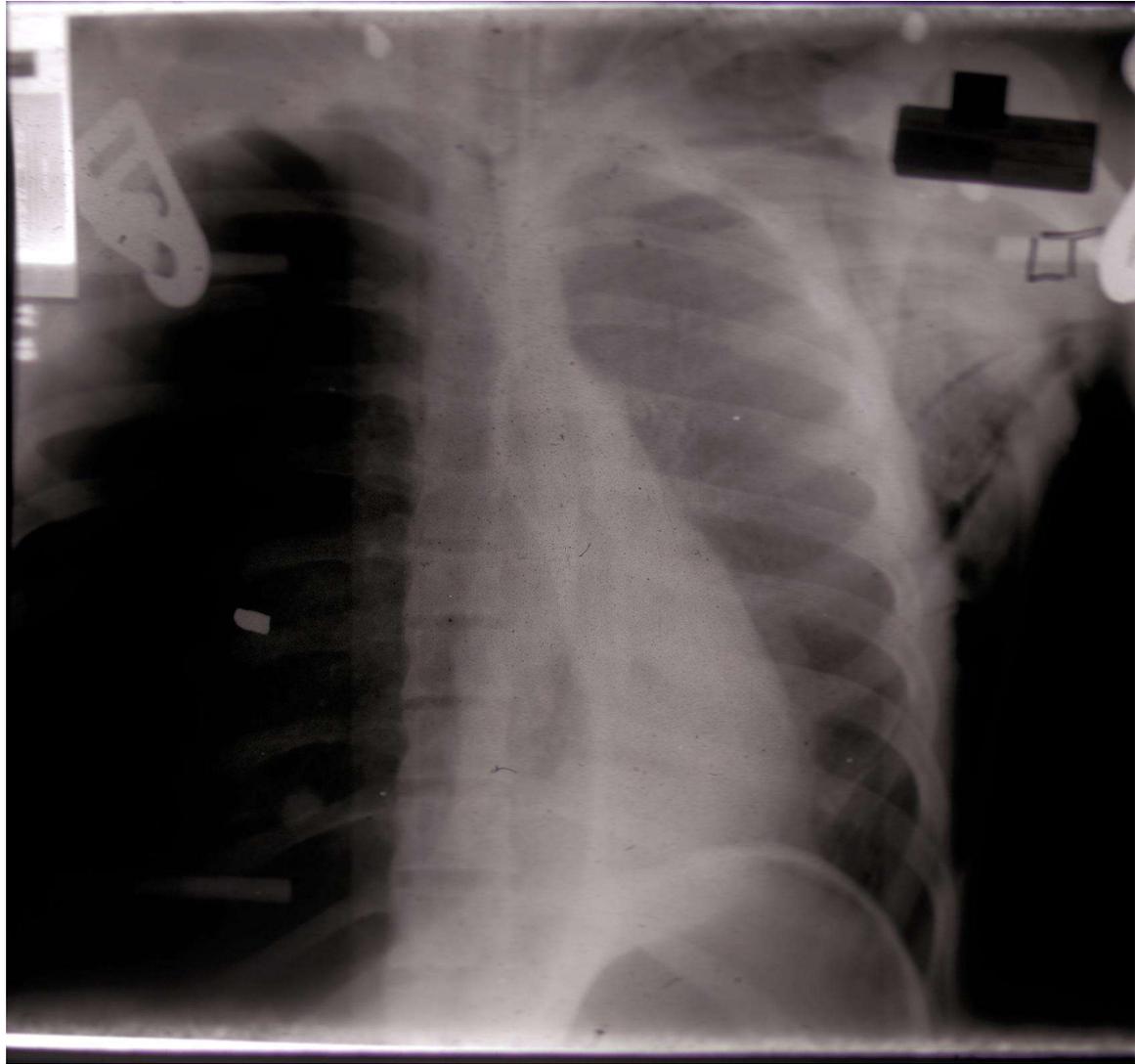
Hemopneumothorax

Pneumomediastinum

Pleural effusion

Empyema





# **Tension Pneumothorax**

## **Clinical Presentation**

- **Respiratory Distress**
  - **Hypoxia**
  - **Tachycardia**
  - **Hypotension**
  - **Decreased Breath Sounds**
  - **Tracheal Deviation/JVD**
  - **Visualized on X-Ray**
- 
- A solid blue horizontal bar spanning the width of the slide, located at the bottom.

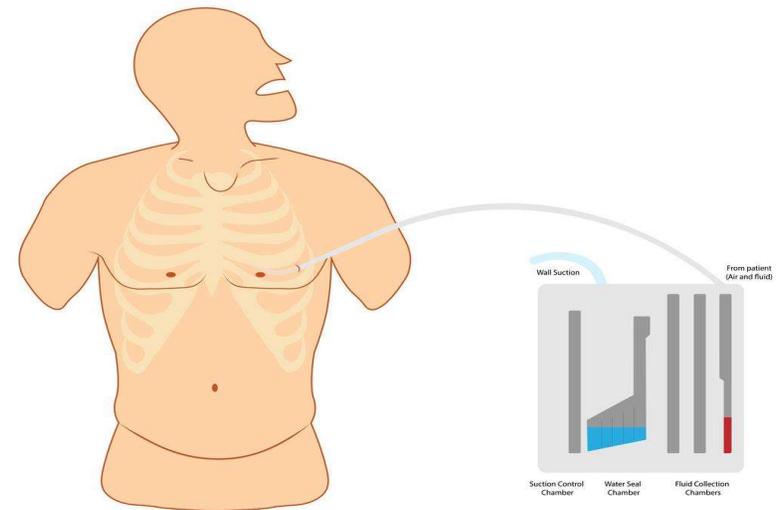
# **Tension Pneumothorax Treatment Options**

- **Emergent Needle Decompression**
  - **O<sub>2</sub> & Potentially Intubation**
  - **Chest Tube Placement**
    - **Insert High for Pneumo**
    - **Insert Low for Hemo**
- 

# Clinical Assessment

- Potential for Air Leak
- No Stripping or Milking Routinely
- Position Below Level of Chest
- No Dependent Loops
- Monitor:
  - Air Emboli
  - Dressing Site
  - Tube Patency

## Chest Tubes



# Thoracic Surgery

---

**Tracheal surgery**

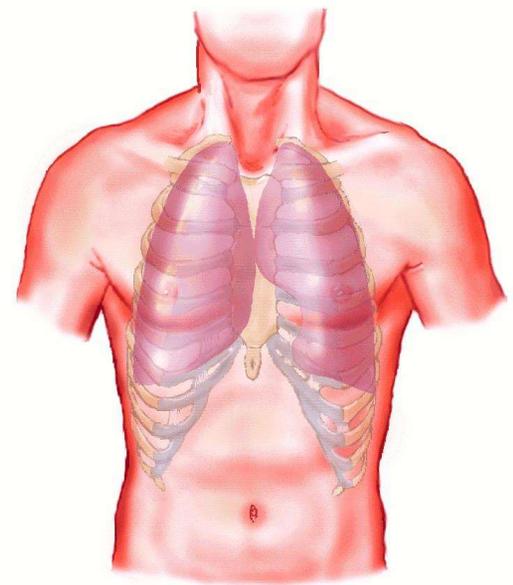
**Pneumonectomy**

**Lobectomy**

**Segmental resection (segmentectomy)**

**Wedge resection**

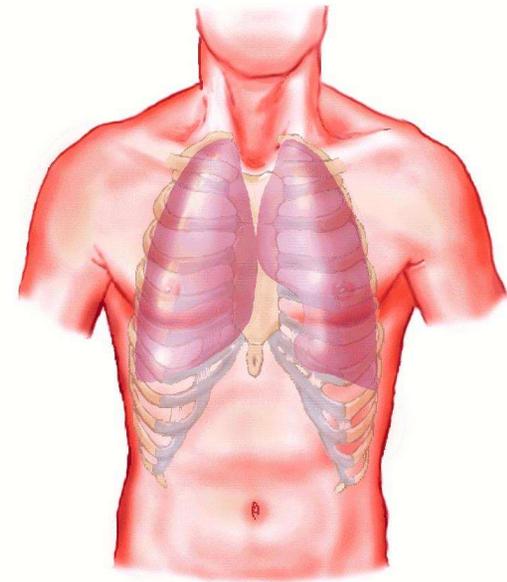
**Decortication**



# Thoracic Surgery: Nursing Care

---

- **Oxygen therapy**
- **Hemodynamic monitoring**
- **Positioning**
- **Initiating “turn, cough, deep breathe” measures**
- **Promote abdominal breathing**
- **Nutrition**
- **Chest tube**
- **Assess subcutaneous air**
- **Assess air leaks**
- **Special treatment: pneumonectomy**
- **Cannot lie on operative side**
- **Assess midline shift of trachea (tracheal deviation)**



7. Which patient is most at risk of developing secondary pulmonary hypertension?

A. A patient with a 5-year history of scleroderma

B. A patient who has peripheral vascular disease

C. A patient with history of a stroke

D. A patient with diabetes

8. A patient with a large femur fracture suddenly develops dyspnea and anxiety & also complains of chest pain on inspiration. Which is the most likely cause?

- A. Myocardial infarction
  - B. Acute respiratory failure
  - C. Pulmonary emboli
  - D. Ischemic stroke
- 

9. A pt is admitted with aspiration pneumonia. They are suddenly short of breath & RT is called to place the pt on high flow nasal cannula, but the SpO<sub>2</sub> is not improving. The team suspects the pt has ARDS. Which finding is most consistent with this diagnosis?

A. JVD

B. New onset cardiac murmur

C. Peripheral edema bilaterally

D. CXR shows fluid in the lungs

10. A patient with a spontaneous pneumothorax has a chest tube attached to water-seal drainage system. The nurse notes that the water in the water-seal chamber rises during inspiration and falls during expiration. These observations most likely indicate that:

A. Pleural pressure changes that are expected

B. A pleural air leak

C. Faulty leaking chest drainage system

D. Inappropriate suction settings

11. Which of the following procedures will be used to confirm a diagnosis of PAH?

A. Right heart catheterization

B. Transesophageal echocardiogram

C. Pulmonary function tests

D. Left heart catheterization



# Respiratory Blueprint

- Pulmonary Emboli
- ARDS
- Asthma
- COPD
- Sleep Apnea- Obstructive & Central
- Pleural Space Complications
- Pulmonary Fibrosis
- Pulmonary Hypertension
- Connective Tissue Disorders
- Thoracic Surgery

- **PCCN ONLY:**
- Connective Tissue Disorders (Sarcoidosis)
- Respiratory Infections
- Respiratory Depression
- Ventilators (Chronic, Home, Stable)

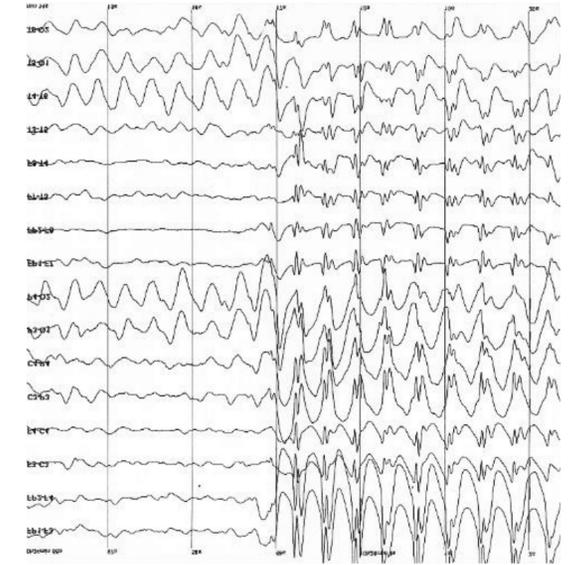
- **CCRN ONLY:**
- Ventilators & Failure to Wean
- Status Asthmaticus
- Thoracic Trauma
- TRALI

# Neuro

PCCN 7%

CCRN 14%

(Neuro, Behavioral,  
Musculoskeletal)



**B** **E** **F** **A** **S** **T**

**BALANCE**  
LOSS OF BALANCE  
HEADACHE,  
DIZZINESS

**EYES**  
SUDDEN LOSS  
OF VISION  
IN ONE OR BOTH EYES

**FACE**  
DOES THE  
PERSON'S FACE  
LOOK UNEVEN?

**ARM**  
WEAKNESS

**SPEECH**  
DIFFICULTY

**TIME**  
TO CALL  
911

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# Neuro Blueprint

- Encephalopathy
- Delirium/Dementia
- Seizures
- Space Occupying Lesions
- Stroke
- TBI
- Neuromuscular Disorders (under Heme-Autoimmune- on **PCCN blueprint**)

- **CCRN ONLY:**
- Acute Spinal Cord Injury
- Brain Death
- Hemorrhage
- Increased ICP
- Neurosurgery

# **Neuro CCRN Testable Actions**

- **Recognize/Manage patients requiring:**
    - **Neuro monitoring devices & drains**
    - **Neuroendovascular interventions (thrombectomy, etc.)**
    - **Neurosurgical procedures (pre-, intra-, post-procedure)**
    - **Spinal immobilization**
  
  - **Use of swallow eval tool to assess dysphagia**
- 

# **Neuro**

## **PCCN Testable Actions**

- **Manage neuro tubes & drains**
  - **EEG monitoring**
  - **Manage pre- & post-surgical procedures**
  - **Perform bedside screening for dysphagia**
  - **Use the NIH Stroke Scale (NIHSS)**
- 

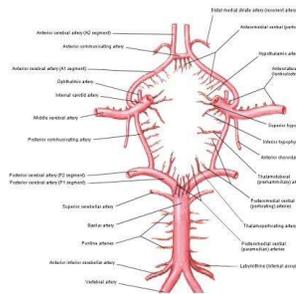


**Skull**

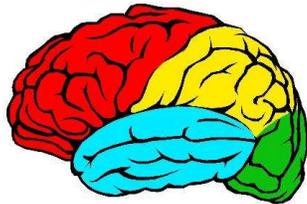
**Meninges:**

**Dura Mater, Arachnoid, Pia Mater**

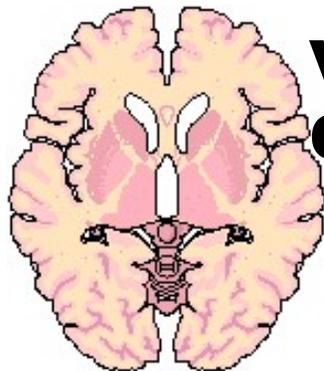
**Blood Vessels**



**Brain**



**Ventricles  
CSF**

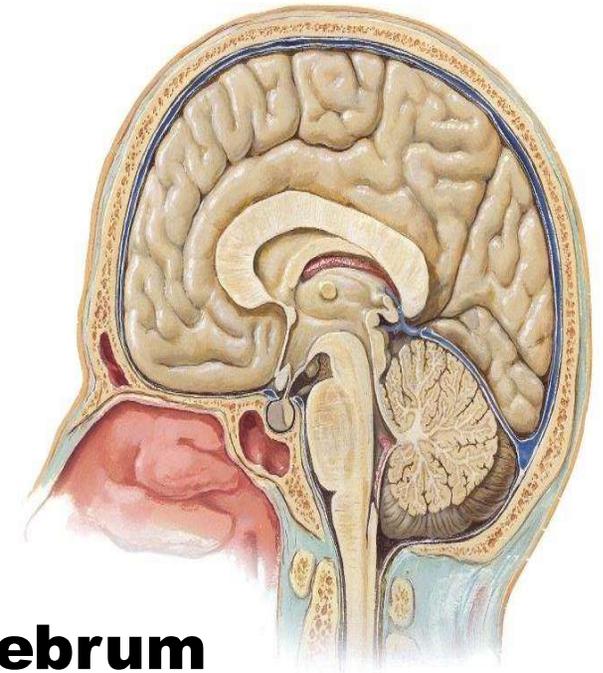


**Cranial Nerves**

**Spinal Cord**



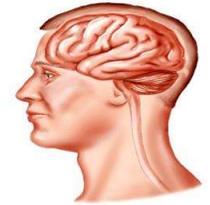
**Peripheral Nerves**



**Cerebrum  
Brain Stem  
Cerebellum**

# Neuro Assessment

- **Level of Consciousness**
- **GCS 3-15**
  - **Eye Opening 1- 4**
  - **Best Verbal 1- 5**
  - **Best Motor 1- 6**





# Neuro Assessment

- **NIH Stroke Scale**
  - **LOC**
  - **Eye deviation**
  - **Visual field loss**
  - **Motor arm and leg**
  - **Limb ataxia**
  - **Sensory**
  - **Best language**

## Altered Mental Status: Tips AEIOU

<b>T</b> Trauma, Tumor	<b>A</b> Alcohol, Abuse
<b>I</b> Infection	<b>E</b> Endocrine, Encephalopathy
<b>P</b> Poisons	<b>I</b> Insulin
<b>S</b> Shock, Sepsis, Seizures	<b>O</b> Opiates
	<b>U</b> Uremia

# Brain Death Determination

## Uniformed Determination of Death Act (1980)

Circulatory and respiratory functions irreversibly stop

or

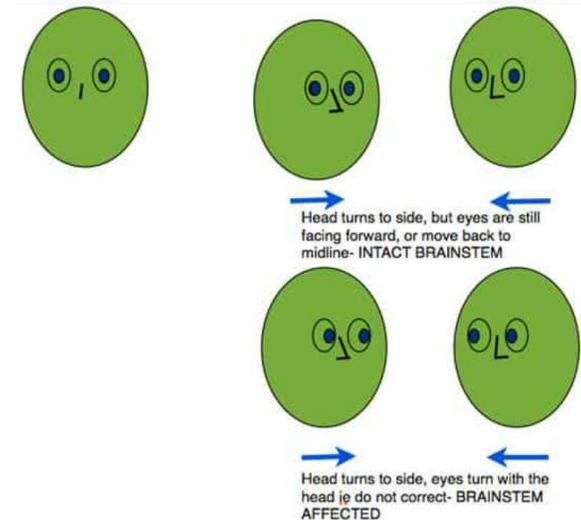
All functions of the entire brain, including the brain stem, irreversibly stop

- **Confirmation Determined By:**
  - Coma
  - Absence of brainstem reflexes
  - Apnea

### **Before diagnosis made:**

- Coma etiology (Rule out other causes- metabolic, etc.)
- Core temp > 36 degrees C
- SBP > 100mmHg (may use Vasopressors)
- Neuro exam by physician

### Oculocephalic Reflex



# Delirium

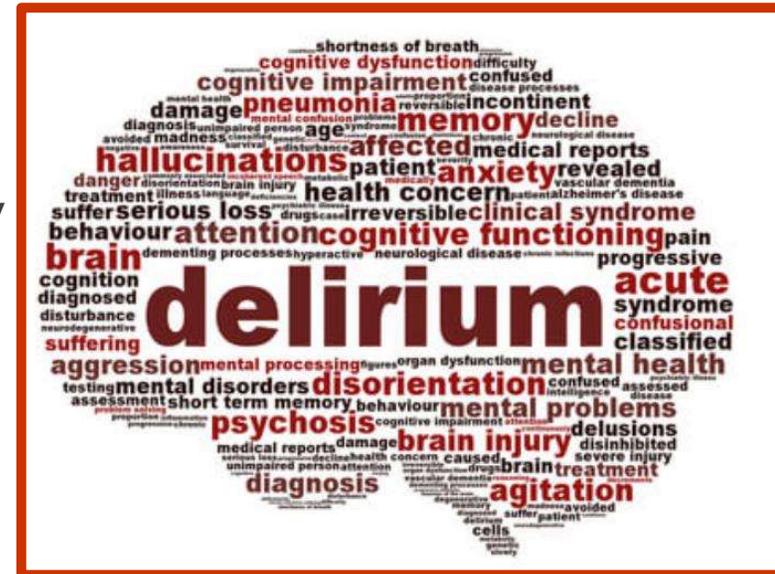
**“Rapid Onset & Fluctuating Course, the Symptoms of Delirium Include Disturbances in Consciousness & Attention & Changes in Cognition, Such as Memory Deficits or Perceptual Disturbances.”**

**APA DSM-IV**



# Delirium

- Clinical presentation
  - Disorientation & Confusion
  - Changes in psychomotor activity
  - Decreased attention span & ability to focus
- Subtypes:
  - Hyperactive type
  - Hypoactive type
  - Mixed



# Delirium

## Treatment Options

- **Prevention!**
- **Early ID of Risk Factors**
- **Accurate Assessment**
  - **Delirium Rating Scale**
  - **Confusion Assessment Method**
  - **Richmond Agitation & Sedation Scale**

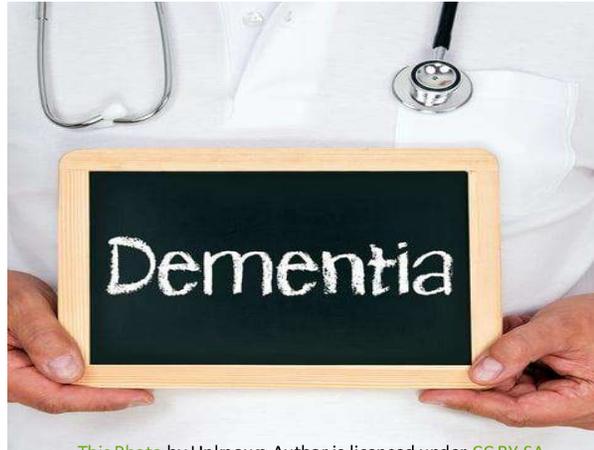
**Must Assess  
Sedation  
First**

# Delirium

## Treatment Options

- **Risk Modification**
- **Review All Medications**
- **Treat Electrolyte & Metabolic Derangements**
- **Non-Pharmacological**
- **Pharmacological**

**“Gradual onset of memory impairment and cognitive disturbances”**



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**Slow, steady decline in cognitive function**

**Organic or metabolic etiology**

**Typically, not reversible**

**Often not treatable**

1. Which of the following assessment findings is the most significant/worrisome?

A. Glasgow coma scale of 15

B. A negative Kernig's sign

C. One irregularly shaped pupil

D. A Change in level of consciousness

2. Assessment findings that would lead the nurse to believe the ICP is rising in a patient without an ICP monitoring device include:

A. Headache, dropping DBP and HR

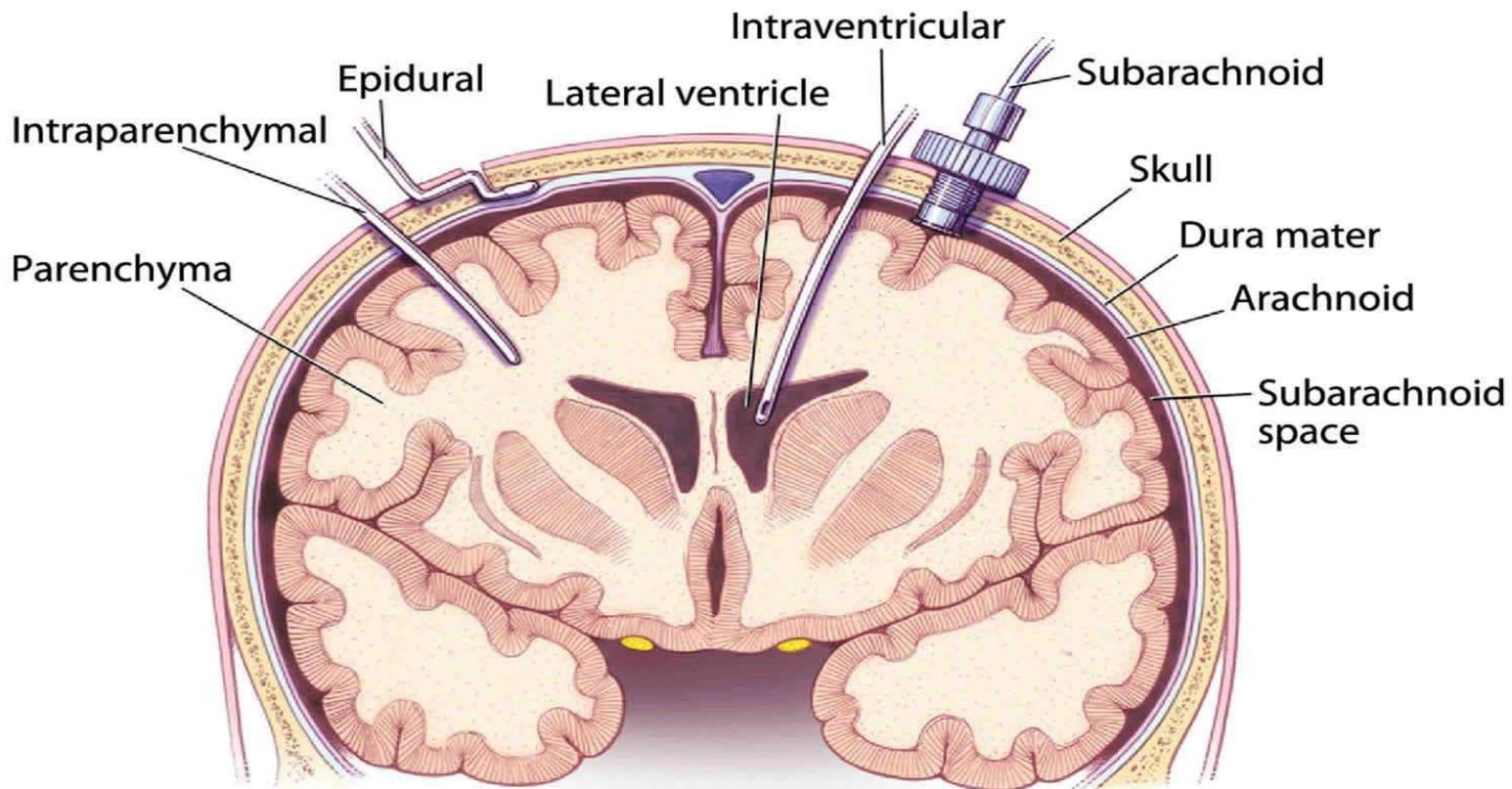
B. Change in LOC, dropping SBP, elevation in HR

C. Pupillary  $\Delta$ s, loss of motor on R and sensory on L and unusual taste in their mouth

D. Neck pain, photo-sensitivity & + Babinski reflex

3. Actions to minimize secondary injury from increased intracranial pressure in a patient with a traumatic brain injury would include:

- A. Elevate HOB, NS at 250ml/hr, hyperventilate to maintain PaCO<sub>2</sub> 45-55
- B. Maintain ICP < 20, treat elevated temp, aggressive pain and anxiety management
- C. Maintain CPP < 20, therapeutic hypothermia, hypertonic saline 3% via gtt of 50ml/hr
- D. Mannitol 25g IVP 2X daily, maintain glucose between 70-110, strict NPO/fluid restriction



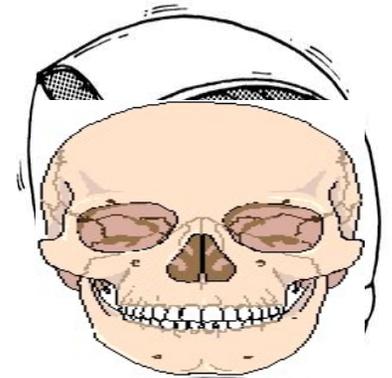
<https://healthjade.net/intracranial-pressure/>

**CCRN Only**

# ICP MONITORING

# Monroe-Kellie Hypothesis

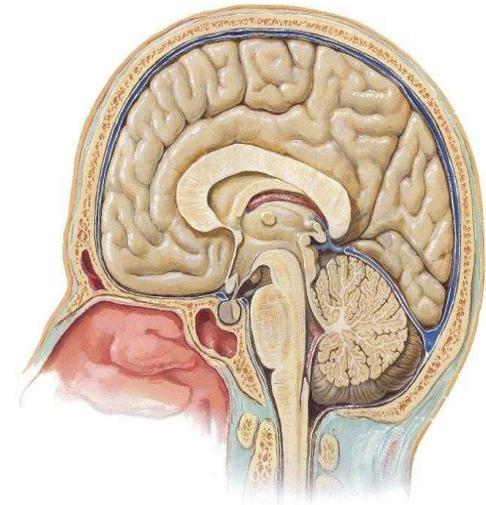
- **Skull is a “Rigid Box” Containing**
  - **Brain**
  - **Blood**
  - **CSF**
- **Pressure is Dynamic**
  - **↑ in Any Component Will Result in ↑ in Pressure**



## ICP Regulation

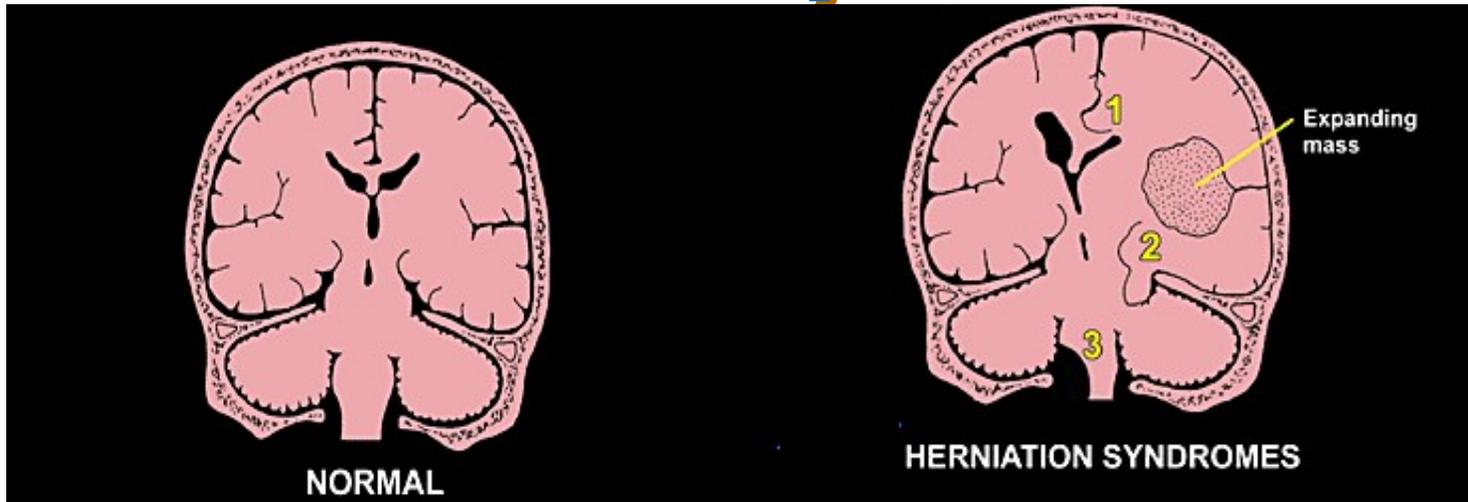
Normal =  
0-15 mmHg

- **Brain (80%)**
- **CSF (10%)**
- **Blood (10%)**



- **Acidosis or ↓ pH**  
Leads to **Cerebral Vasodilation**
- **Alkalosis or ↑ pH**  
Leads to **Cerebral Vasoconstriction**

# Herniation Syndromes



**1. Cingulate: Cingulate Gyrus Under the Falx Cerebri**

**2. Transtentorial (Uncal): Uncus of Temporal Lobe into Tentorial Notch (Downward) Pupils Dilate on Same Side**

**3. Central: Downward Displacement of Brainstem**

**Change in LOC First Then Pupils Change**

# Clinical Signs of ↑ ICP

- **Early Changes**

- **ALTERED LOC**

- **Headache**

- **Nausea and Projectile Vomiting**



# Clinical Signs of ↑ ICP

## • Late Changes

- **Focal Deficits**

- **Pupillary Changes**

- **Dilated Pupil on Side of Lesion**

- **Small Pupils (Pontine Pupils)**

	Description	Condition
	Unilateral dilated pupil	III nerve compression (90% ipsilateral to haematoma)
	Bilateral dilated pupils	Midbrain injury
	Irregular pupils	Orbital trauma
	Conjugate gaze deviation	Frontal lobe lesion
	Small / pinpoint	Pontine injury, opiate administration

# Clinical Signs of ↑ ICP

## • Late Changes

- **Vital Sign Changes (Cushing's Triad)**
  - **Widening Pulse Pressure**
  - **Bradycardia**
  - **Irregular Respirations**
- **Posturing**
  - **Flexor or Decorticate- Midbrain**
  - **Extensor or Decerebrate- Brainstem**

**Pulse Pressure  
Calculation:**

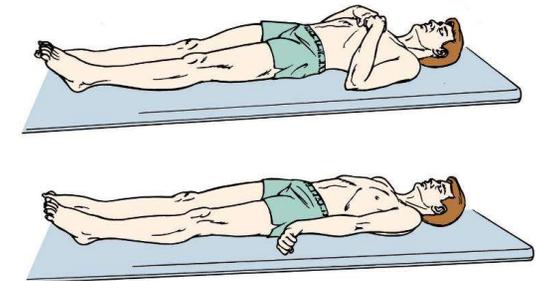
**SBP-DBP**

**Normal 40-60 mm HG**

**Ex.**

**BP 180/50**

**Pulse pressure=130**

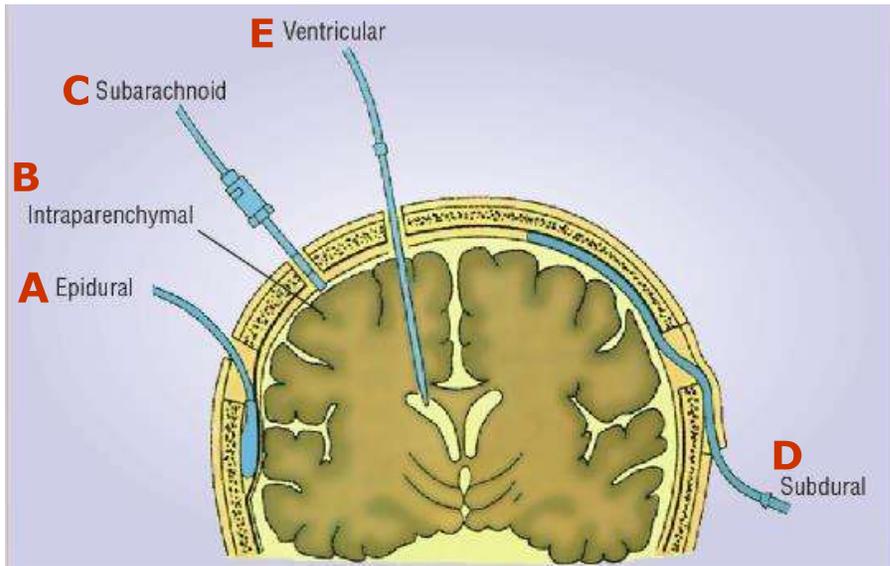


# ICP & CPP

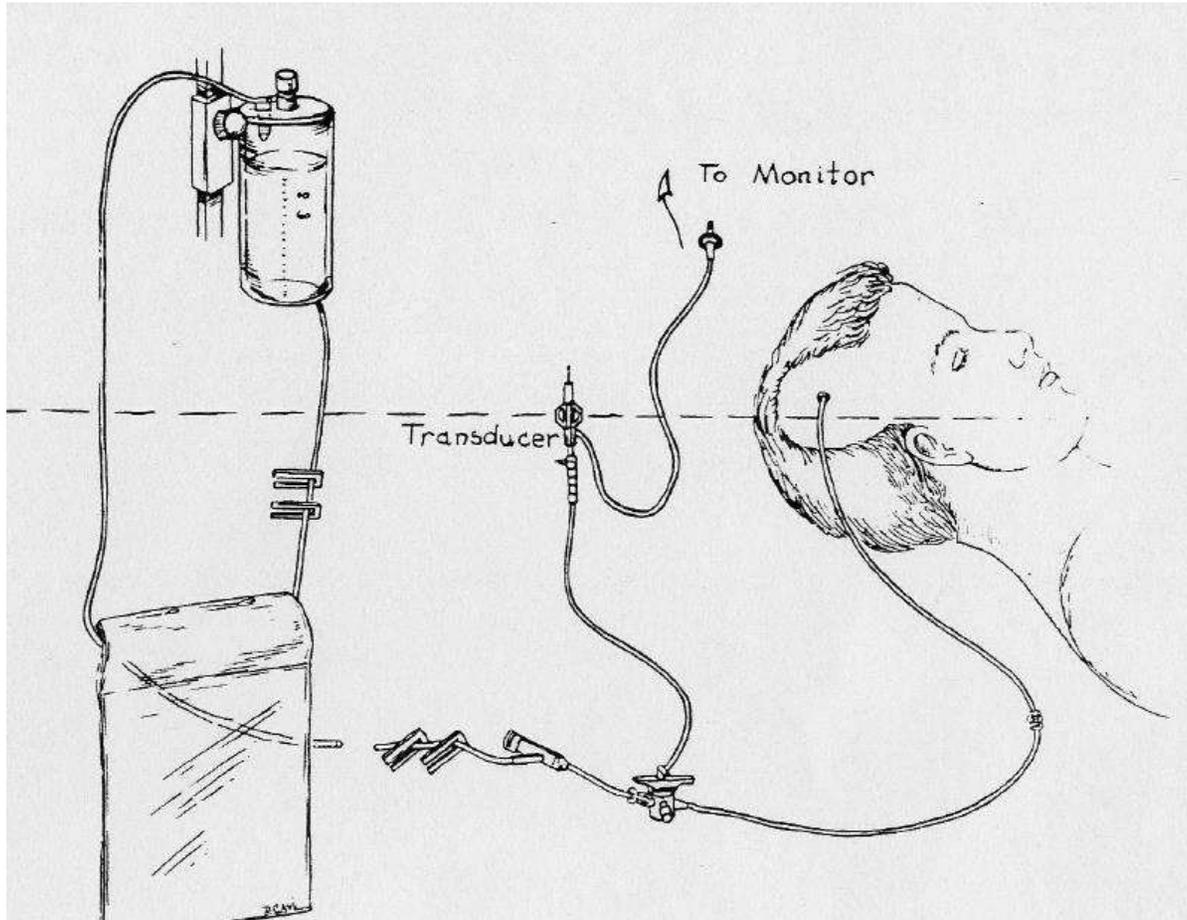
- **Cerebral Perfusion Pressure**
- **CPP = MAP - ICP**
- **Goals:**
  - **CPP > 60-70 mmHg**
  - **ICP < 20 mmHg**

# ICP Monitoring

## Types



- A. Epidural**
- B. Intraparenchymal**
- C. Subarachnoid**
- D. Subdural**
- E. Intraventricular  
(Ventriculostomy)**



**Consistent Zero Point  
(Transducer)**

**Foramen Monroe Or  
Interventricular Foramen**

**STRICT Aseptic Technique**

# **Nursing Care**

## **Increased ICP & Ventriculostomy**

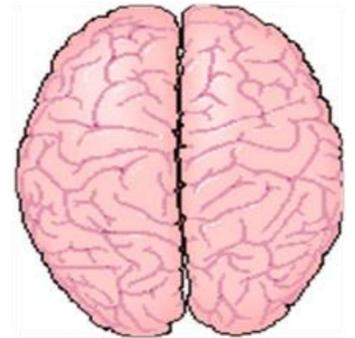
### **To Promote Venous Return:**

- **HOB 30-45 degrees**
  - **Head/Neck Midline- Avoid hyperextension/flexion/rotation**
  - **Avoid Excessive Hip Flexion**
- 
- **Minimize & Cluster Nursing Activities**
  - **Meticulous Skin Care**
  - **Decrease stimuli**
  - **Closed System When Suctioning**
- 

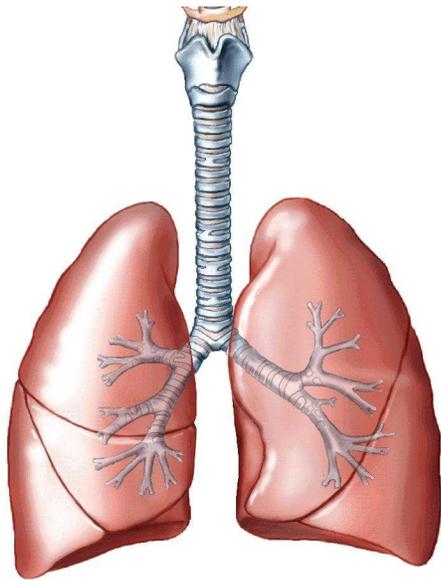
# Management of ↑ ICP

## To Promote Cerebral Perfusion

- HOB Flat
- Reduce Cerebral Tissue Demands
  - Treat Pain/Agitation
  - Treat Temp  $> 37.5^{\circ}$
  - Maintain Normoglycemia
  - Caution with Valsalva Maneuvers

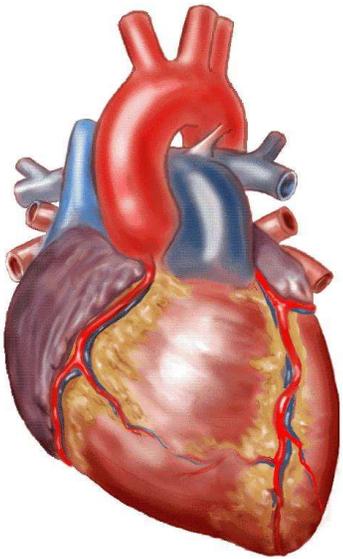


# Management of ↑ ICP

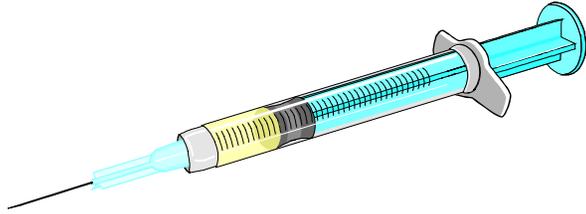


- **Prevent Hypoxemia**
- **Avoid Hypercarbia**
- **Hyperventilation – Controversial**
  - **Normal PaCO<sub>2</sub> = 35-45**
  - **Decrease to 30-35 is Common**
  - **Do Not Use > 6 – 24 hours**
- **PEEP**
  - **Increases in PEEP also Increase ICP**
  - **Use Cautiously**

# Goals of Care



- **Maintain**
  - **MAP > 80 mmHg or**
  - **CPP > 60-70 mmHg**
  - **ICP < 20mmHg**
- **Maintain Euvolemia**
  - **Crystalloids vs. Colloids**
- **Arrhythmia Management**



# Medications

- **Oxygen**
- **IVF**
- **Osmotic Therapy**
- **Hypertension**
- **Hypotension**
- **Glucocorticoid Steroids - May be used for Tumors**
- **Analgesia/Sedatives**
- **Neuromuscular Blockade (NMB)**

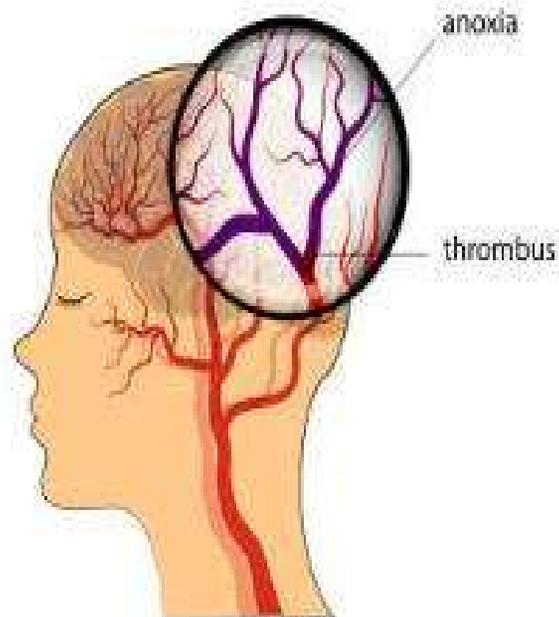


# Stroke

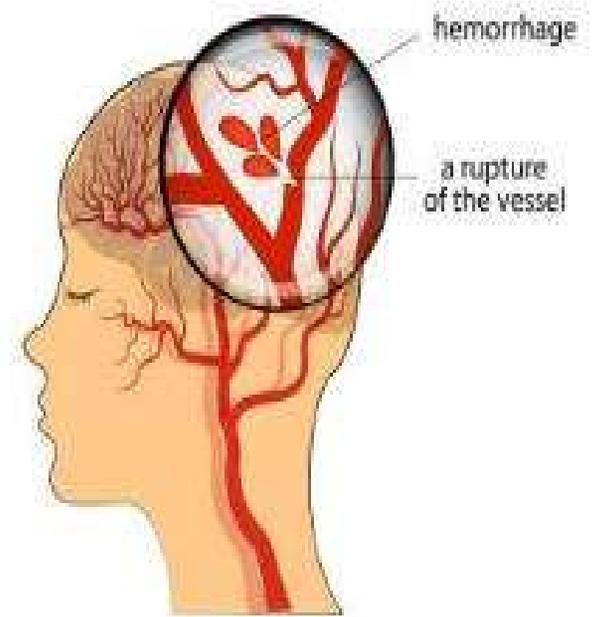


**Time is Brain**

## ISCHEMIC AND HEMORRHAGIC STROKE



ISCHEMIC STROKE



HEMORRHAGIC STROKE

**B**

**BALANCE**  
LOSS OF BALANCE  
HEADACHE,  
DIZZINESS



**E**

**EYES**  
SUDDEN LOSS  
OF VISION  
IN ONE OR BOTH EYES



**F**

**FACE**  
DOES THE  
PERSON'S FACE  
LOOK UNEVEN?



**A**

**ARM**  
WEAKNESS



**S**

**SPEECH**  
DIFFICULTY



**T**

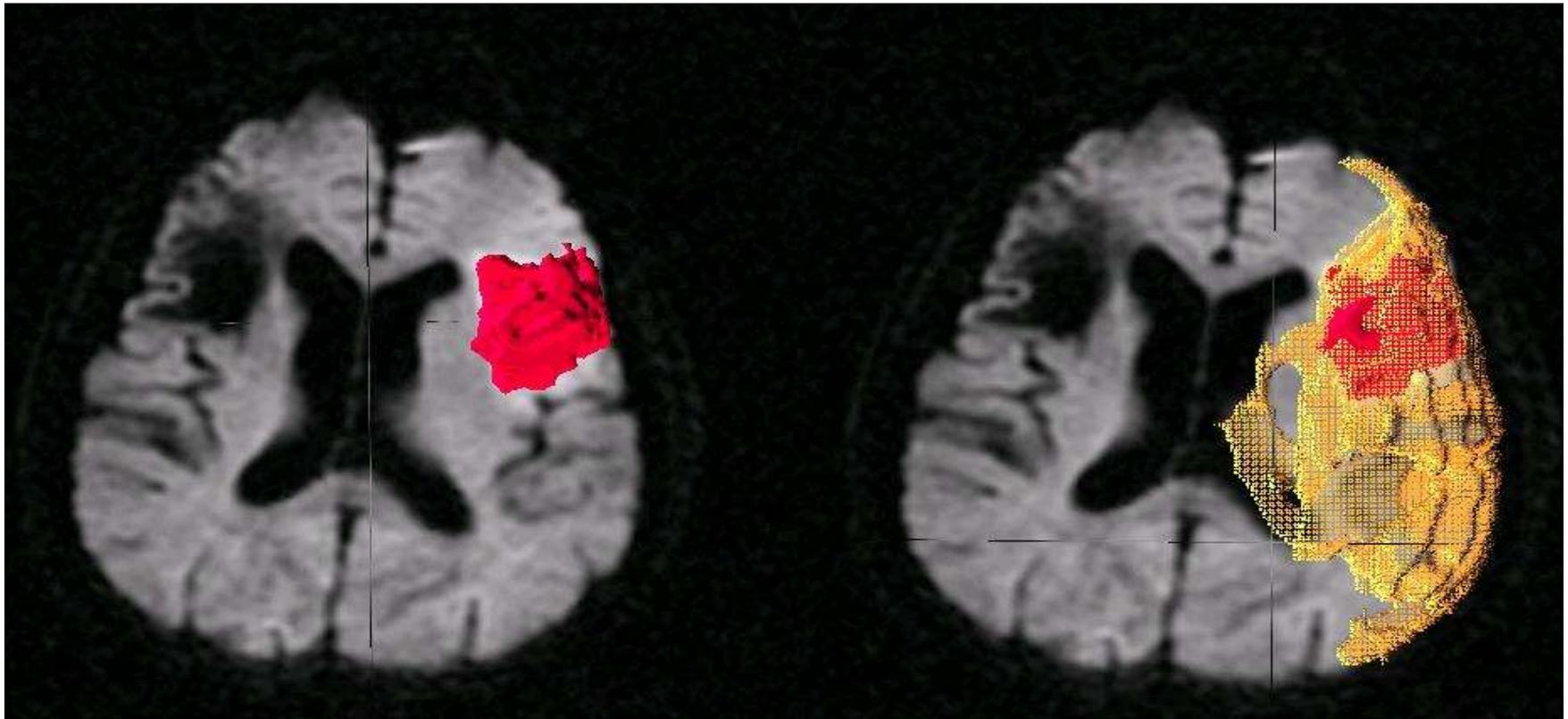
**TIME**  
TO CALL  
911



**Stroke**

**VS.**

**Penumbra**





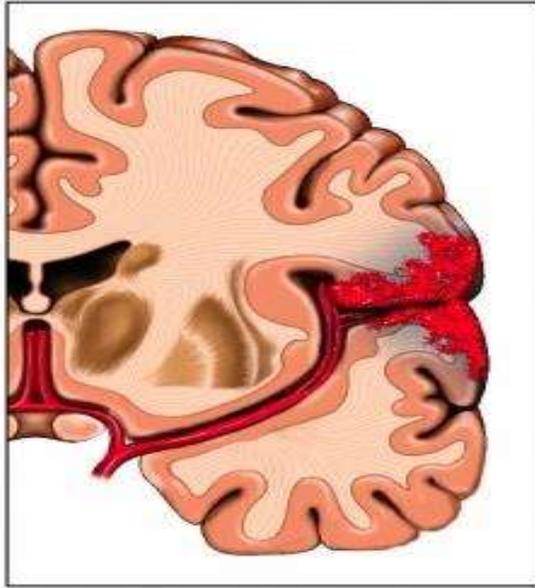




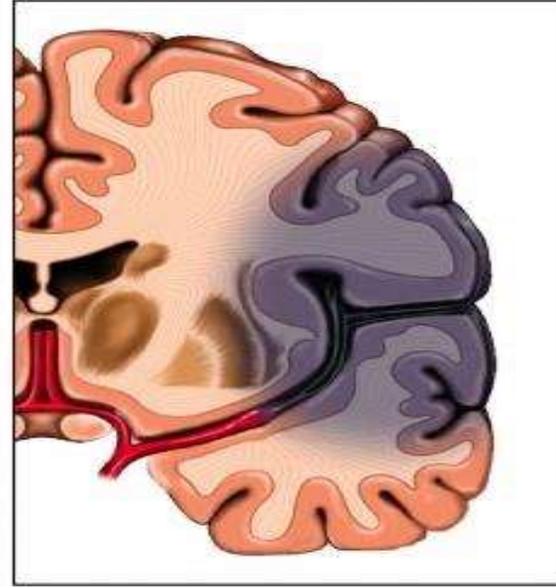
# Initial Assessment

- **Severe Unexplained Headache**
- **Difficulty:**
  - **Speaking**
  - **Understanding**
  - **Walking**
  - **Seeing**





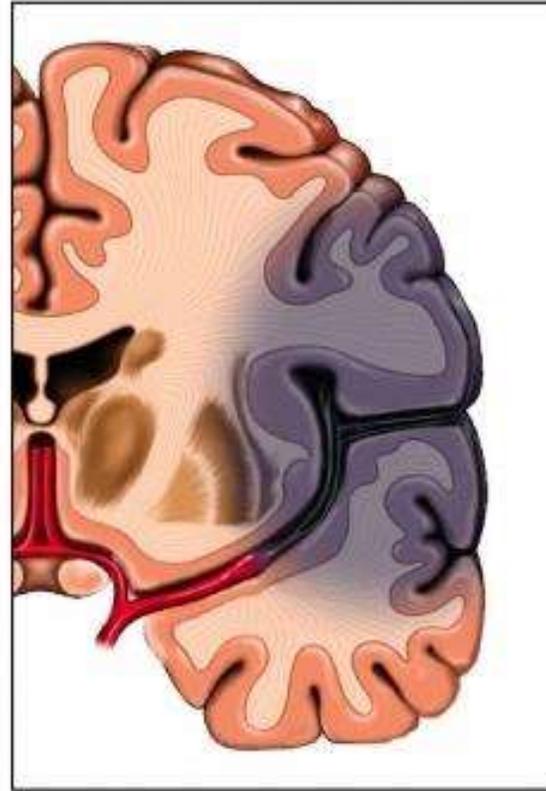
**Hemorrhagic**



**Ischemic**

# Stroke

# Ischemic Stroke



# Ischemic Stroke Initial Care

- **Hypertension**
  - **Normal Compensatory Response to Stroke**
    - **Usually Resolves in 3-4 days**
  - **Some HTN is Good**
  - **Only treat if: SBP > 220, DBP > 120\***
    - **"Permissive HTN" for first 24-48h\***
  - **If t-PA anticipated: Lower SBP  $\leq$  185, DBP  $\leq$  110\***
    - **Once t-PA given: BP  $\leq$  180/105**
- **Do Not Lower Blood Pressure > 10% per hr**

# Ischemic Stroke

## Thrombolysis

- **Activase (Alteplase or rt-PA)**
- **Only FDA Approved Drug Treatment**
- **3h window timeframe to administer, 4.5 Hr For Some Pts**
- **No ASA, Heparin x 24h**
- **TNK only FDA approved for MI**
  - **Ongoing trials**

## Thrombectomy

- **Initiated within 24 h onset in select Pts.**
- **Groin insertion site, clot retrieval**
- **Quick access to neuro team & angiography**
- **Not available in all centers**

# Ischemic Stroke

## Initial Care

### Interventions

- **Treat Hypotension**
- **Treat Hyperthermia (Keep < 37.5° C)**
- **Maintain Serum Glucose 80 - 180**
- **Monitor ABG's & Pulse Oximetry**
- **Protect Airway**

# Ischemic Stroke

## Initial Care

### Interventions

- **HOB Flat Initially,  
Then When Stable  $> 45^{\circ}$**
- **NPO  $\rightarrow$  Swallowing Study**
- **Enteral feeding recommended start  
within 48h**
- **Avoid protein catabolism & malnutrition**

4. IV tPA and Labetalol have been ordered for a patient with an acute ischemic stroke. The patient's last BP was 190/100. Which action should be first?

A. Administer the tPA IV dose since there is only 10 min in the treatment window

B. Administer the tPA IV dose and Labetalol IVP at the same time

C. Start IV Nicardipine to reduce the BP

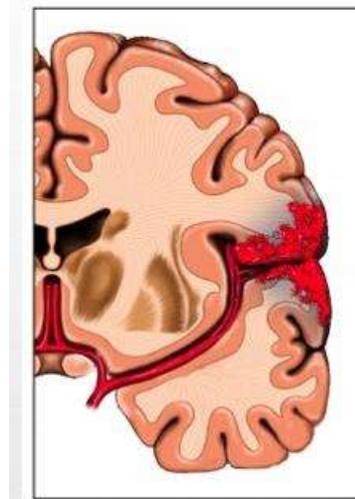
D. Administer the IV Labetalol to reduce the BP prior to administering the tPA.

# Hemorrhagic Stroke

---

## Intracerebral Hemorrhage (ICH)

- Spontaneous Bleeding into Tissue/Parenchyma
- Commonly from HTN
- Bleeding into Subarachnoid Space
- Often Due to Ruptured Aneurysm or AVM



**Hemorrhagic**

# Symptoms

## Hemorrhagic Stroke (ICH)

- **Severe HA**
- **N & V**
- **Loss of Consciousness**
- **Retinal Hemorrhage**
- **Nuchal Rigidity & Photophobia**
- **Focal Deficits**
- **Clinical Findings Similar to Ischemic Stroke**

**Hemorrhagic  
Stroke  
(ICH)**

## **Possible Complications**

- **Blood Seen on CT**
- **Hydrocephalus**
- **Diabetes Insipidus**
- **Hyponatremia May Occur:**
  - **SIADH**
  - **Cerebral Salt Wasting**

# Hemorrhagic Stroke (ICH)

## Medication & Management

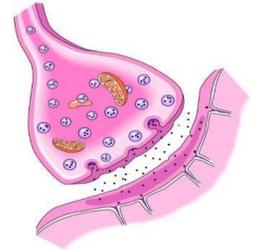
- **Call Code Stroke**
- **Strict Control of Blood Pressure**
- **Pre-Repair**  
**MAP 80-90, SBP < 140, CPP > 70**
  - **Nicardipine Hydrochloride (Cardene)**
  - **Normodyne (Labetalol)**
  - **Hydralazine (Apresoline)**
  - **Aneurysm Precautions**
  - **Pain Relief**

# Post-Surgery/Repair

## Hemorrhagic Stroke (ICH)

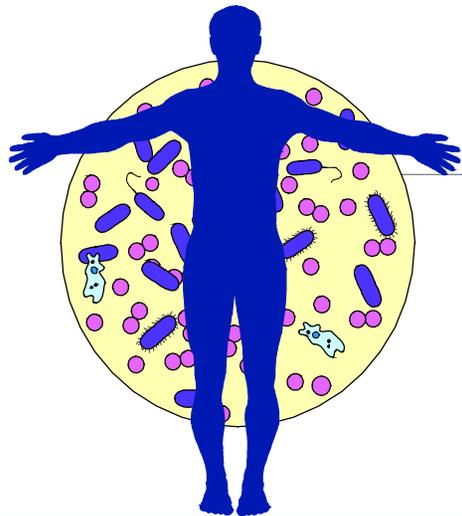
- **Vasospasm &/or Rebleeding**  
**Major Concern**
- **Hourly Neuro Checks**
- **Calcium Channel Blockers**
  - **Nimodipine**

**No Heparin, Warfarin or ASA**



# Neurologic Infections & Disorders

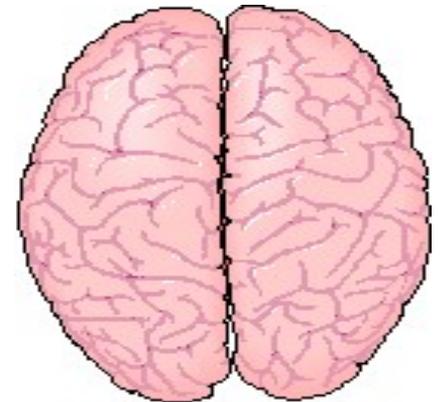
**CCRN Only**



CCRN Only

# Encephalitis

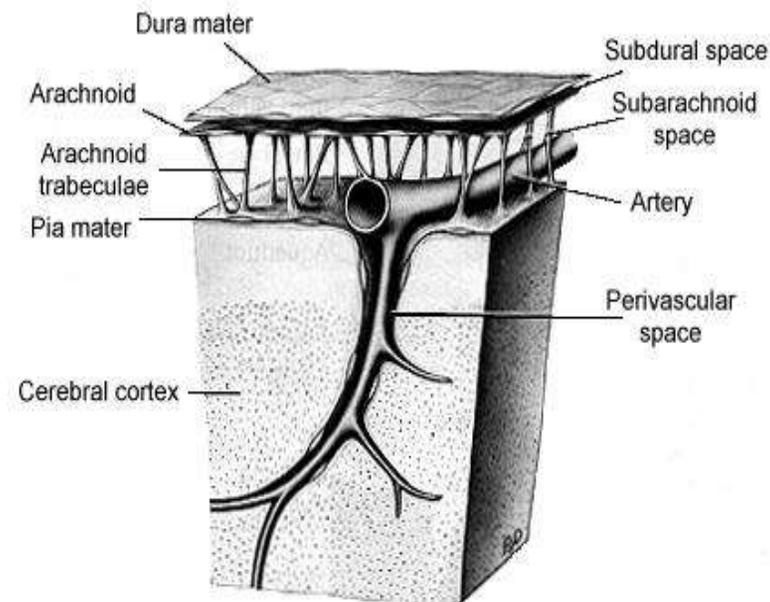
- **Inflammation of the Brain Parenchyma**
- Etiology - Usually Viral
- Clinical Presentation
  - **Personality/Behavior Changes 1<sup>st</sup>**
- **Management**
  - **ABCs**
  - **Supportive Care**
  - **Seizure, Fever & Pain Management**



# Meningitis

CCRN Only

- **Inflammation of the Meninges**
- **Etiology**
  - **Viral**
  - **Bacterial**
  - **Aseptic**
  - **Fungal**
  - **TB**



# Meningitis

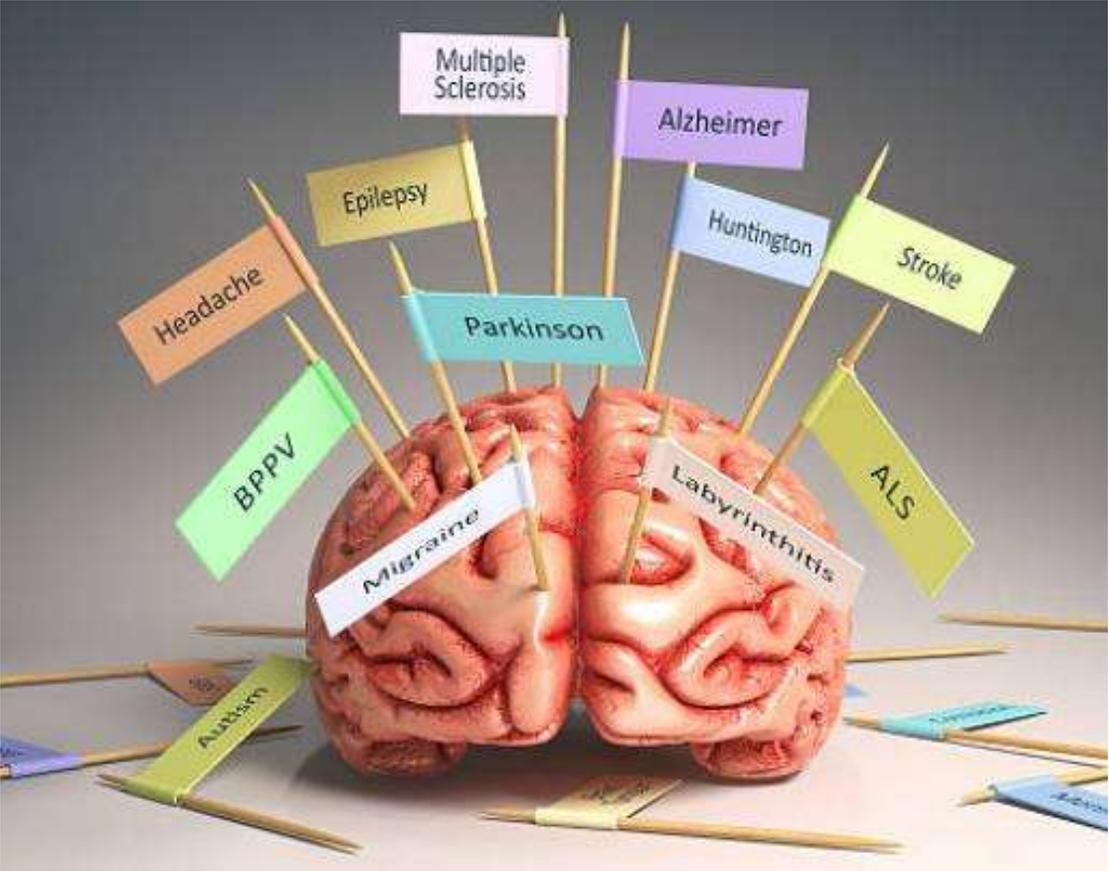
## Clinical

## Presentation

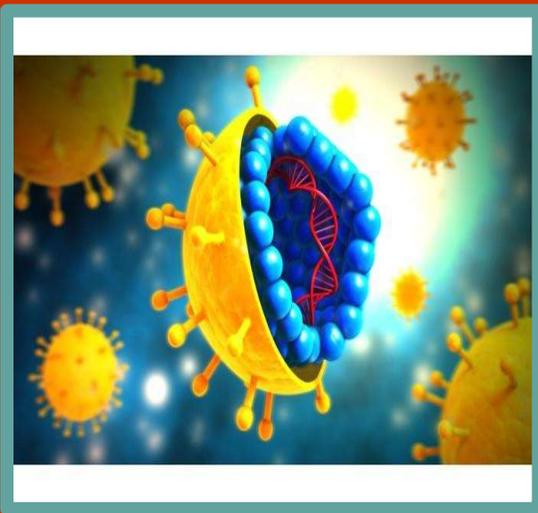
- 
- **Fever\***
  - **Altered LOC \***
  - **Nuchal Rigidity\***
  - **Kernig's Sign – Pain with Leg Lift**
  - **Brudzinski's Sign – Hip and Knee Flexion with Neck Flexion**
  - **Headache**
  - **N & V**
  - **CN Palsies**
  - **Myalgias**
  - **Photophobia**
  - **Meningococcal – Skin Rash**

# **Meningitis Management**

- **Isolation: Droplet Precautions**
    - **Bacterial Until on Antibiotics x 24 h**
  - **Antimicrobial Therapy**
- 
- **Steroid Use:**
    - **Viral**
    - **Aseptic**
    - **Certain Bacteria**
  - **Pain Management**
  - **Fever Management**
  - **Seizure Control**



# Guillain Barre Syndrome



## *Acute Inflammatory Polyneuropathy*

- **Signs & Symptoms:**
  - **Progressive Ascending Systemic Weakness**
  - **Acute onset: Rapid progression- hours to 3 weeks**
  - **Symptoms usually start to subside about 2 weeks after maximal weakness**
  - **Most recovery within 1<sup>st</sup> 6 months**
- ***Avoid unnecessary movement & PROM early during onset & progression because movement exacerbates pain associated with demyelination***
- **Diagnostic Findings: EMG, LP**
- **Goals of Care: Normal neuro function, pain relief**
- **Potential Complications:**
  - **Respiratory failure**
  - **Autonomic dysfunction**

## MOST COMMON SYMPTOMS OF MYASTHENIA GRAVIS



Muscle weakness



Eyelid droopiness



Double vision



Impaired speech



Difficulty swallowing



Changes in facial expressions



Trouble breathing

<https://myastheniagravisnews.com/myasthenia-gravis-symptoms/>

## Myasthenia Gravis

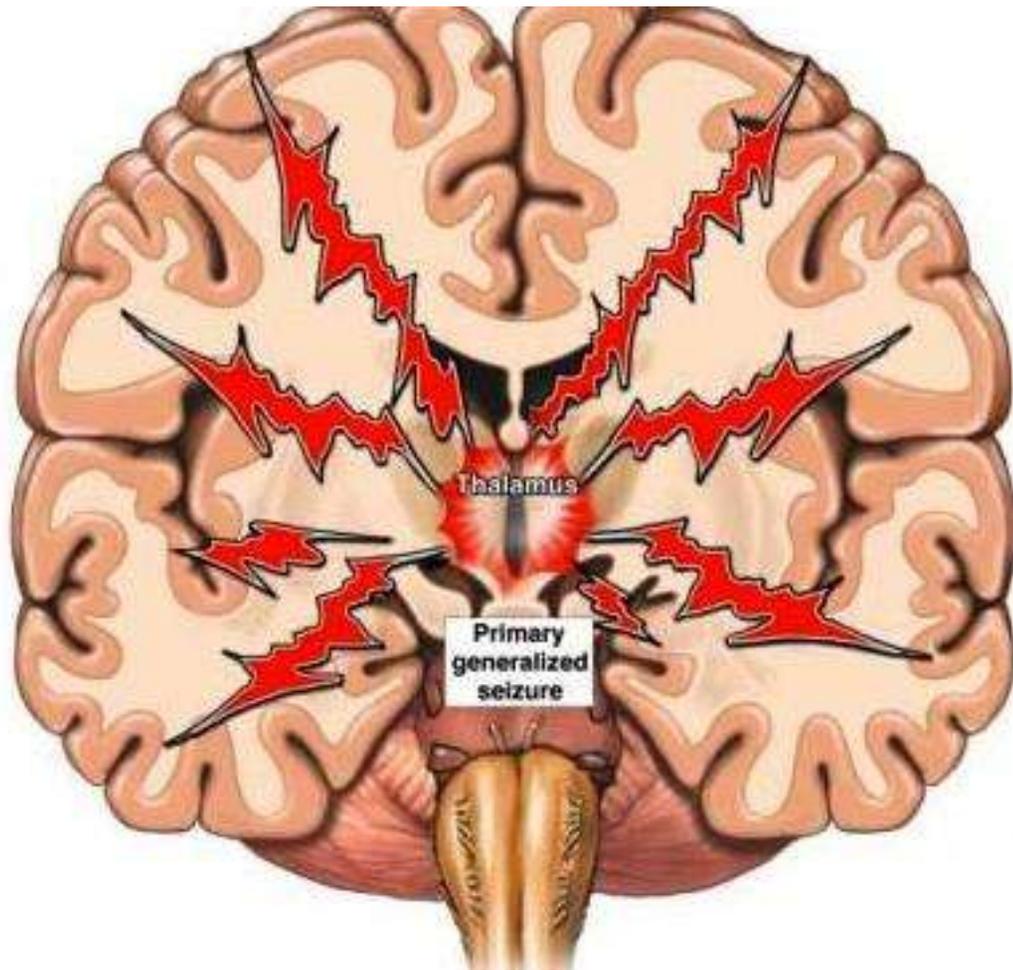
### *Antibodies Destroy Communication Between Nerves & Muscles*

- **Signs & Symptoms:**
  - Chronic weakness of voluntary muscles
  - Myasthenic Crisis
- **Diagnostic Findings:**
  - EMG \*
  - Nerve stimulation
  - Lab test for anti-MuSK antibodies
- **Treatments:**
  - Anticholinesterase meds
  - Thymectomy
  - Complement inhibition
  - Immunosuppressive meds
  - Plasmapheresis & IVIG

**CCRN Only**

5. The nurse's highest priority while monitoring a patient during a seizure should be:

- A. Making sure the patient does not injury him/herself
  - B. Closely watch the physical movements of the patient
  - C. Putting in a padded tongue blade
  - D. Monitoring the patient for a patent airway
- 



# Seizures

# Etiologies & Predisposing Factors

## • Structural Changes

- Trauma
- Infections
- Intracranial Masses

## • Cerebrovascular Disease

- Hemorrhage
- Ischemic Stroke

## • Metabolic Factors

- Fluid and Electrolyte Imbalance
- Hypoxia
- Acidosis
- Toxic Exposure
- Drug Overdose/ Withdrawal

# Seizure Classifications

## • Partial

### • Simple Partial

- One hemisphere
- No LOC

### • Complex partial

- One hemisphere
- LOC

## • Generalized

### • Absence

### • Myoclonic

### • Atonic

### • Clonic

### • Tonic

### • Tonic-clonic (Grand mal)

# **Nursing Care Interventions**

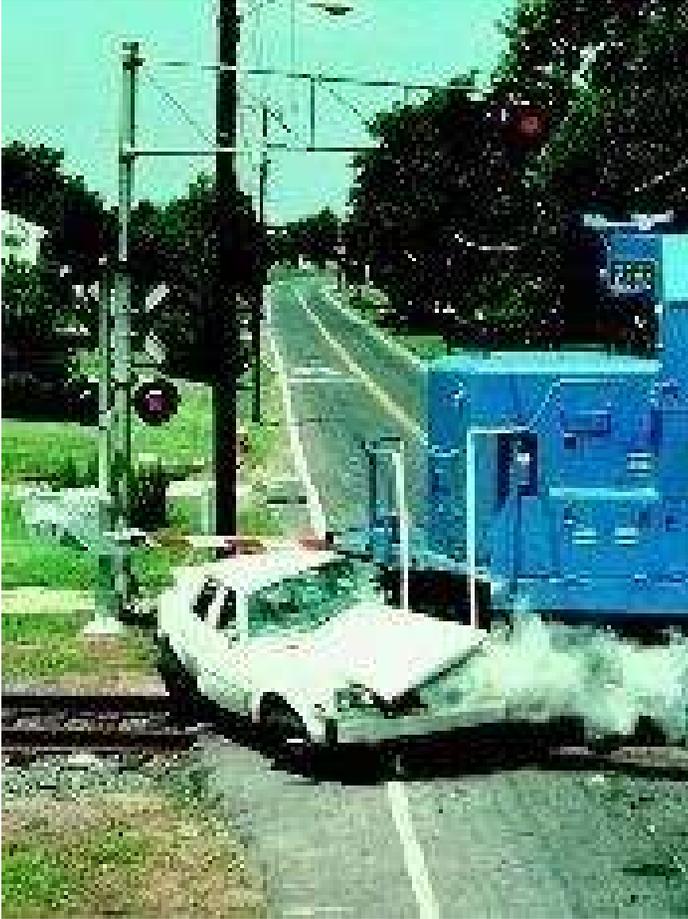
**Seizure Precautions**

**Airway**

**Safe Environment**

**Don't Restrain**

**Reassure Patient & Family**



# Traumatic Brain Injury

## Primary Head Injury

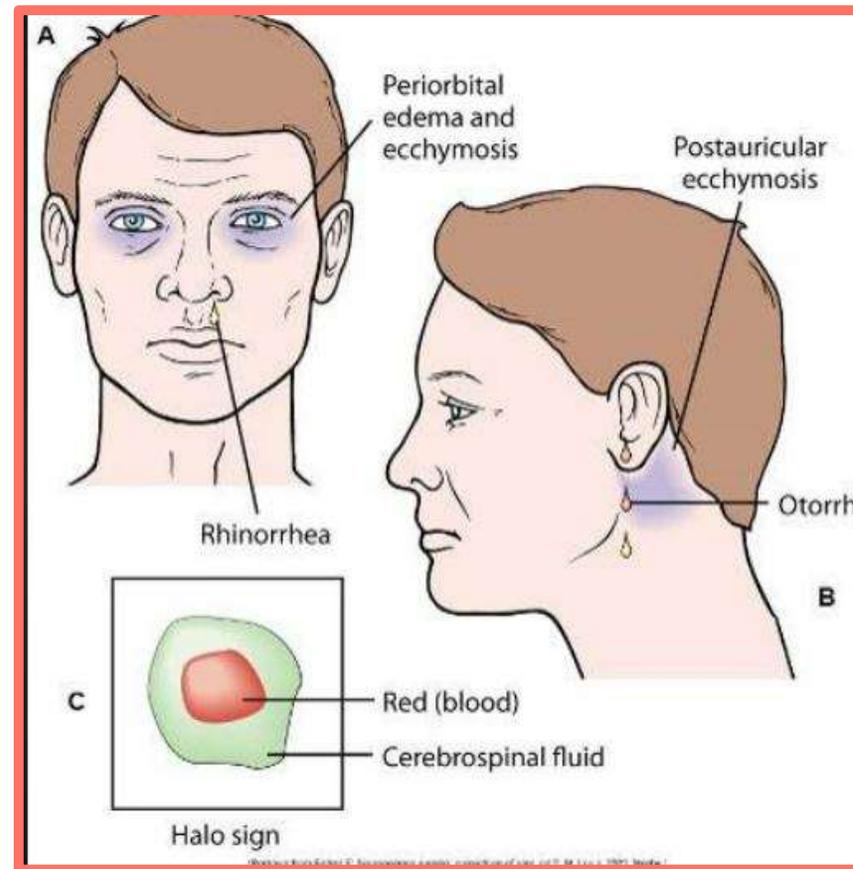
- **Traumatic Impact of the Head**
- **Common Causes:**
  - **Blunt**
  - **MVC**
  - **Falls**
  - **Sports**
- **Penetrating:**
  - **Gun Shot Wounds**
  - **Impalements**
- **Blast**

# Injuries

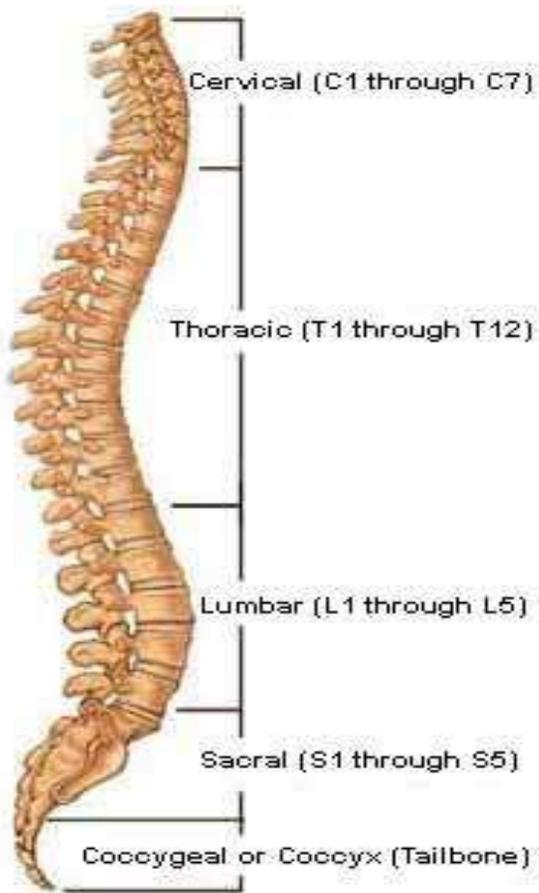
- **Tissue Damage**
  - **Bleeds**
    - **Epidural - Arterial**
    - **Subdural – Venous**
      - **Acute, Subacute, Chronic**
  - **Intracranial**
  - **Subarachnoid**
  - **Hematomas**
- 

# Injuries

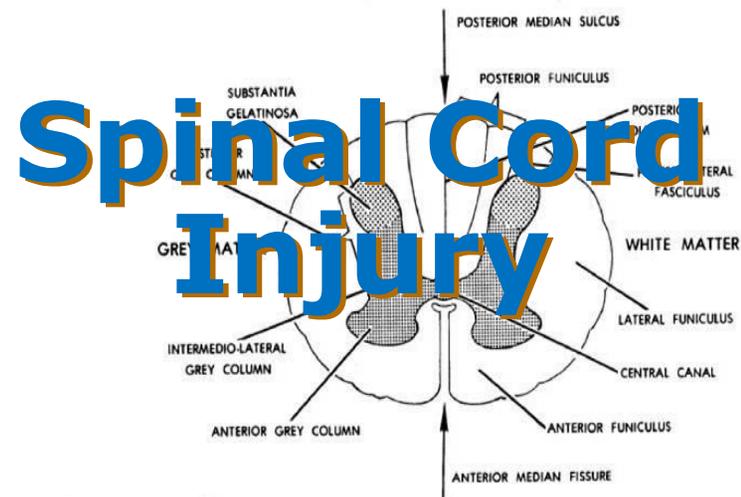
- Increased ICP
- Skull Fracture
  - Linear, Compound or Depressed
- Basilar Fracture: 5 Bones form Base
  - Anterior Fracture:
    - Raccoon's Eyes, Rhinorrhea
  - Middle Fracture:
    - Battle's Sign, Otorrhea



**Lateral (Side) View of Normal Spinal Column**



- **Concussion, Contusion**
- **Laceration**
- **Hematoma**
- **Infarction**
- **Transection**
- **Complete**
- **Incomplete**



**CCRN Only**

6. A construction worker sustained a 20-foot fall from scaffolding. There is movement and intact reflexes in the lower extremities, but none noted in the arms. This presentation is consistent with which type of incomplete spinal cord injury syndrome?

- A. Anterior Cord
- B. Central Cord
- C. Brown-Sequard
- D. Posterior Cord

# Anterior

No motor, pain or temp, has proprioception intact

# Central

Can move legs but not arms

# Posterior

No Sensory, intact motor

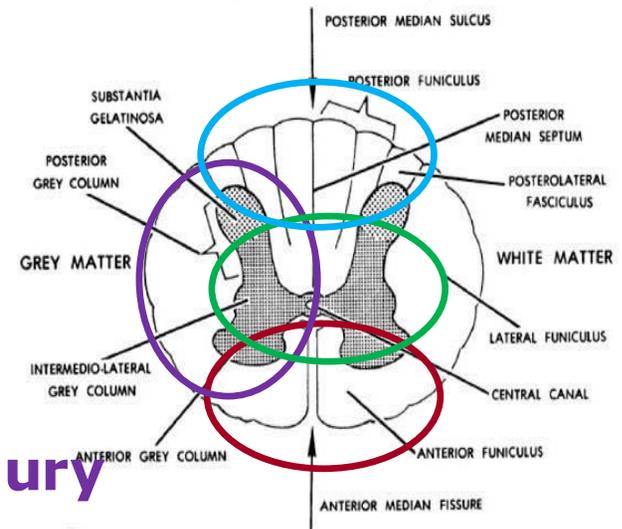
# Brown Sequard

Ipsilateral (side of injury)

loss of motor/touch on side of injury

Contralateral (opposite side)

loss of pain & temperature sensation



# Brain Tumors

## Clinical Presentation

- **Compression on Brain**
- **Infiltration of Tissue**
- **Disruption of Blood-Brain Barrier**
- **Cerebral Edema**
- **CSF Obstruction (Hydrocephalus)**

**Space  
Occupying  
Lesions**

# Clinical Presentation

---

- **Tumors are Vascular & May Bleed**
- **Elevated ICP**
- **Seizures**
- **Hormonal Abnormalities**
- **Focal Deficits**



## Brain Tumors

# Treatment

---



- **Surgery**
- **Medications**
- **Radiation**
- **Nursing Concerns**
- **Signs/Symptoms Treatment Only**

---

# Brain Tumors

# Neuro Blueprint

Encephalopathy

Delirium & Dementia

Seizures

Space- Occupying  
Lesions

Stroke

TBI  
Neuromuscular  
Disorders

Acute Spinal Cord Injury  
CCRN ONLY

Increased ICP  
Brain Death  
Neurosurgery  
CCRN ONLY

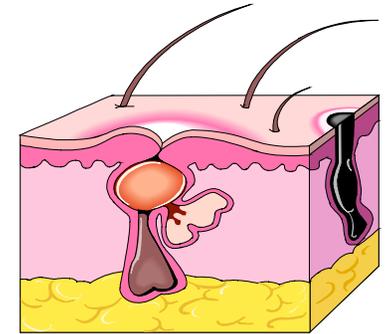
**Musculoskeletal**

**Integumentary**



**PCCN**

**Musculoskeletal 2%**



**CCRN 14%**

**Musculoskeletal**

**Combined with Neuro &  
Psychosocial**

# Blueprint

## Musculoskeletal

- Compartment Syndrome
- Functional issues (immobility/falls)
- Rhabdomyolysis (Covered in Renal module)

- **CCRN ONLY**
- Fractures
- Osteomyelitis

## Integumentary

- **PCCN (in Multisystem)**
  - Pressure injuries
  - Wounds

**CCRN**  
**(Part of Gen Med 20%)**

- Cellulitis
- IV infiltration
- Necrotizing fasciitis
- Pressure injury

# Testable Nursing Actions

## **PCCN:**

- **Initiate early mobility measures**

## **CCRN**

### **Manage patients:**

- **Requiring therapeutic interventions (wound vac, fecal management devices, IV infiltration treatment)**
  - **Progressive mobility**
  - **Compartment syndrome**
- 

1. All of the following are potential complications of immobility except:

A. DVT

B. Pulmonary Emboli

C. Compartment Syndrome

D. Pressure Ulcers

2. Which of the following interventions will not be helpful in preventing a hospital acquired pressure ulcer from occurring in a bedridden patient?

A. Proper nutrition

B. Encouraging early progressive mobility

C. Removing the extra pillows from the bed

D. Turning every 2 hours & PRN

3. A 63-year-old patient with DM had to have an infected hip replacement removed. A VAC drainage system was placed into the open wound. The nurse needs to remember to:

- A. Change the sponge every 4 hours
  - B. Maintain an unsealed dressing
  - C. Connect to suction once per shift
  - D. Monitor the drainage in the collection chamber
- 

4. An elderly diabetic patient is admitted & found to have “a week-old cat scratch” on the left lower leg that is red, tender, & has blisters that are draining a yellow fluid. The priority ordered intervention will be to:

- A. Culture the drainage and send to the lab
- B. Document the finding on the skin assessment tool
- C. Place a warm compress over the area for comfort
- D. Evaluate the white blood cell count

5. The nurse notices the patient's peripheral IV site is puffy, tight and cool to touch. She suspects which of the following?

A. Infection

B. Infiltration

C. Allergic reaction

D. Incompatible medication administration

# Blueprint

## Musculoskeletal

---

- **Compartment Syndrome**
- **Functional issues (immobility/falls)**
- **Rhabdomyolysis (Covered in Renal module)**

- **CCRN ONLY**

- **Fractures**
- **Osteomyelitis**

## Integumentary

**CCRN**  
**(Part of Gen Med 20%)**

- **PCCN (in Multisystem)**

- **Pressure injuries**
- **Wounds**

- **Cellulitis**
  - **IV infiltration**
  - **Necrotizing fasciitis**
  - **Pressure injury**
- 

# Answers

## Cardiovascular

- |       |       |
|-------|-------|
| 1. A  | 11. B |
| 2. C  | 12. B |
| 3. A  | 13. B |
| 4. A  | 14. A |
| 5. C  | 15. C |
| 6. D  | 16. C |
| 7. B  |       |
| 8. C  |       |
| 9. D  |       |
| 10. D |       |

## Endocrine Answers

- 1. C
- 2. A
- 3. D
- 4. B
- 5. C
- 6. C
- 7. B

## Heme/Immune Answers

- 1. C
- 2. C
- 3. B
- 4. D
- 5. D

## Renal Answers

- 1. C
- 2. A
- 3. D
- 4. D
- 5. C
- 6. A

## GI Answers

- 1. A
- 2. D
- 3. D
- 4. C
- 5. C
- 6. C

## Psychosocial/Behavioral

- |      |      |
|------|------|
| 1. B | 6. A |
| 2. A |      |
| 3. A |      |
| 4. B |      |
| 5. D |      |

## Professional Caring

- |       |       |
|-------|-------|
| 1. B  | 12. C |
| 2. A  | 13. D |
| 3. D  | 14. C |
| 4. C  | 15. A |
| 5. A  |       |
| 6. B  |       |
| 7. D  |       |
| 8. A  |       |
| 9. D  |       |
| 10. D |       |
| 11. C |       |

## Musculoskeletal/Integumentary

- |      |      |
|------|------|
| 1. C | 5. B |
| 2. C |      |
| 3. D |      |
| 4. A |      |

## Neurological

- 1. D
- 2. A
- 3. B
- 4. D
- 5. D
- 6. B

## Multisystem Answers

- 1. C
- 2. A
- 3. C
- 4. A
- 5. B
- 6. B
- 7. A
- 8. B
- 9. D
- 10. A
- 11. C
- 12. D

## Respiratory

- |      |       |
|------|-------|
| 1. A | 7. A  |
| 2. D | 8. C  |
| 3. B | 9. D  |
| 4. D | 10. A |
| 5. C | 11. A |
| 6. C |       |