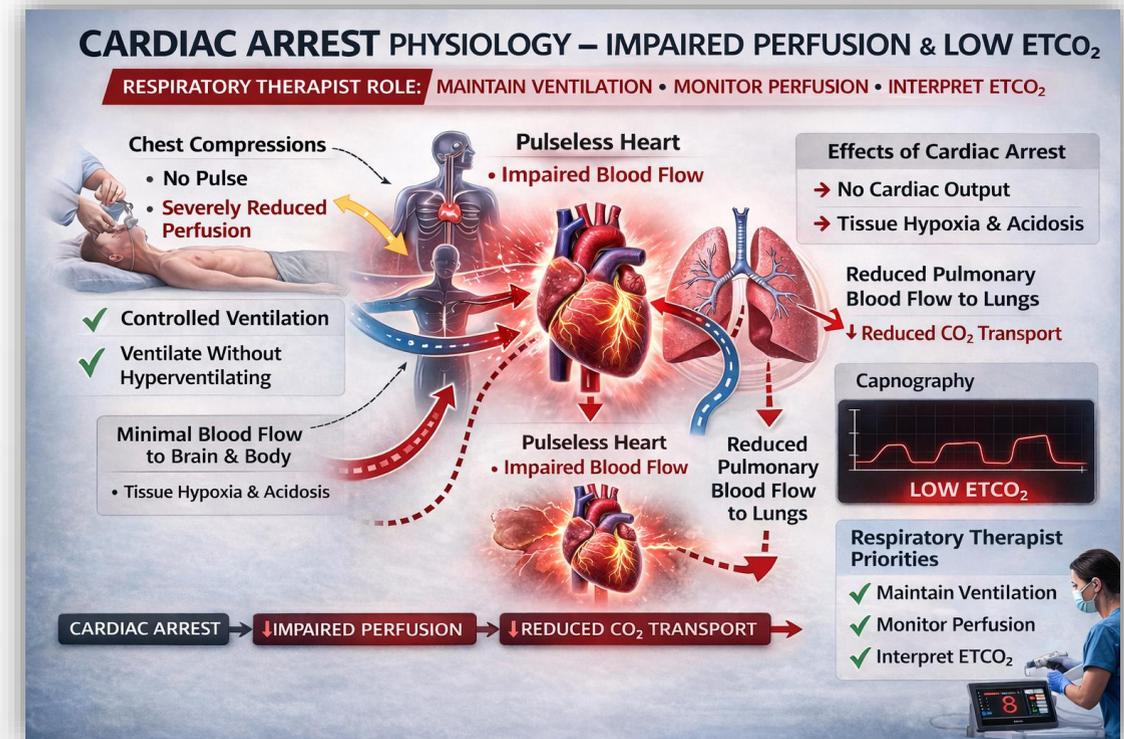


Part 4 - RT-ACLS

ACLS Medications

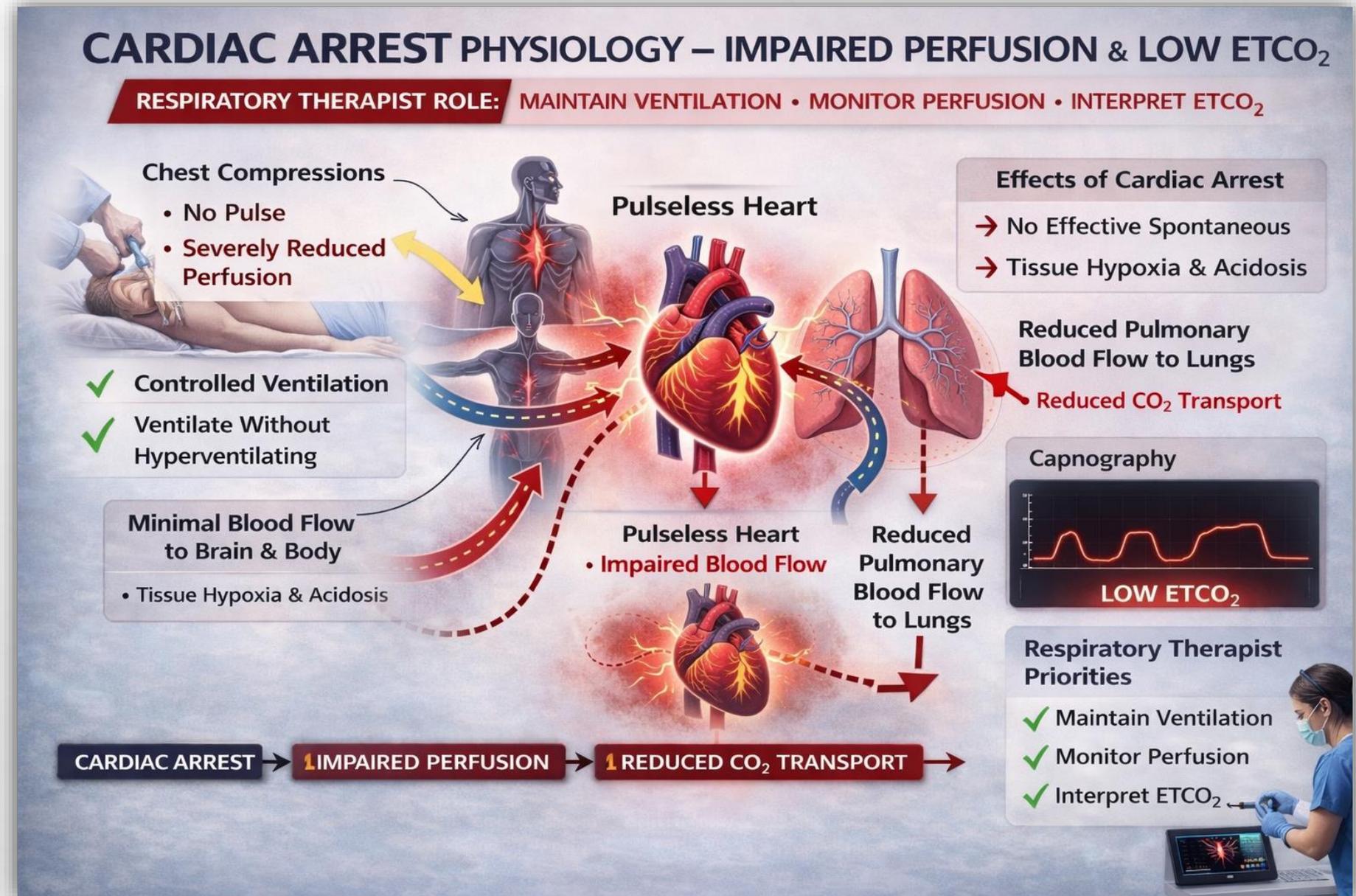
Physiologic Interpretation for the Respiratory Therapist

- Understanding medication effects through ventilation and perfusion
- Focus on physiologic response, not medication administration
- Emphasis on capnography and circulation monitoring
- Respiratory therapist as physiologic observer



Respiratory Therapist Scope During ACLS

- Maintain airway patency
- Provide effective ventilation
- Deliver oxygen to alveoli
- Remove carbon dioxide



Learning Objectives

- Physiologic purpose of ACLS medications
- Relationship between circulation and ventilation
- Capnography as indicator of perfusion
- Physiologic indicators of improving circulation
- Role of ETCO₂ in resuscitation monitoring

Learning Objectives

A graphic with a blue background and glowing hexagonal patterns. It features medical icons: a stethoscope, an open book, a laptop with a waveform, a clipboard with a pen, and a ventilator. On the right, there are four objective boxes, each with a green checkmark icon. At the bottom right, there is a circular inset image of three healthcare professionals in blue scrubs.

- ✓ Identify ETCO₂'s Role During ACLS
 - Identify ETCO₂'s Time
- ✓ Perform Proper Ventilation Technique
 - Perform Proper Ventilation Technique
- ✓ Interpret Capnography Waveforms
 - Interpret Capnography
- ✓ Coordinate with the Resuscitation Team



Physiology of Cardiac Arrest

- Loss of effective cardiac output
- Oxygen delivery to tissues stops
- Carbon dioxide transport stops
- Cellular hypoxia develops rapidly
- Ventilation alone cannot restore perfusion

H's and T's – Causes of Cardiac Arrest

- ✓ **H**ypovolemia
- ✓ **H**ypoxia
- ✓ **H**ydrogen Ions (Acidosis)
- ✓ **H**yperkalemia / **H**ypokalemia
- ✓ **H**ypothermia
- ✓ **H**ypoglycemia
- ✓ **T**oxins / Tablets
- ✓ **T**amponade
- ✓ **T**ension Pneumothorax
- ✓ **T**hrombosis (Myocardial / Pulmonary)
- ✓ **T**rauma



Purpose of ACLS Medications

- Improve coronary perfusion pressure
- Stabilize cardiac electrical activity
- Improve cardiac contractility
- Correct metabolic disturbances



ACLS Medication Recommendations

Part 2: Specific Arrhythmias Management



Stable Wide Complex Tachycardia

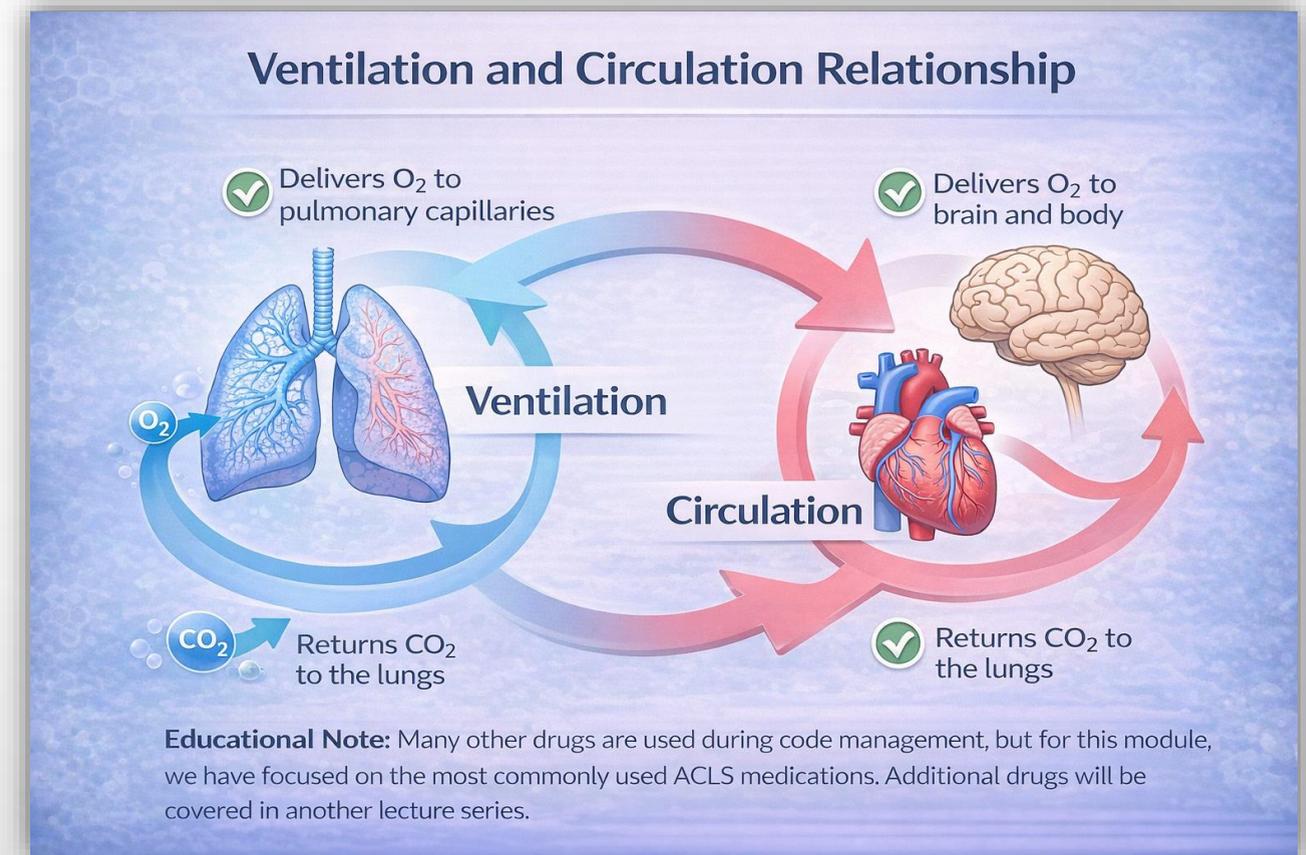
- ✓ Adenosine
- ✓ Amiodarone
- ⚠ **AVOID: Verapamil**

Polymorphic Ventricular Tachycardia ✓ Magnesium	<ul style="list-style-type: none">• With prolonged QT (Torsades de Pointes)<ul style="list-style-type: none">• Magnesium• Lidocaine or amiodarone
Regular Narrow Complex Tachycardia ✓ Vagal maneuvers	<ul style="list-style-type: none">• Vagal maneuvers• Adenosine• Diltiazem or verapamil
Atrial Fibrillation or Flutter with RVR ✓ Beta-blocker or diltiazem	<ul style="list-style-type: none">• Beta-blocker or diltiazem• Amiodarone
Symptomatic Bradycardia ✓ Treat reversible causes	<ul style="list-style-type: none">• Treat reversible causes• Atropine• Epinephrine or transcutaneous pacing

Educational Note: Many other drugs are used during code management, but for this module, we have focused on the most commonly used ACLS medications. Additional drugs will be covered in another lecture series.

Ventilation and Circulation Relationship

- Ventilation delivers oxygen to lungs
- Circulation delivers oxygen to tissues
- Circulation returns CO₂ to lungs



Epinephrine

Physiologic Mechanism

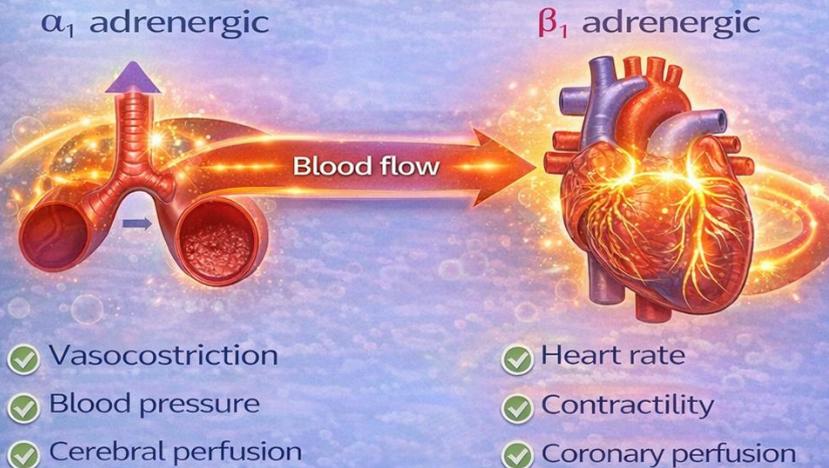
- Alpha-adrenergic vasoconstriction
- Increased systemic vascular resistance
- Increased coronary perfusion pressure

How Epinephrine Works

Mechanism of Action

- α_1 receptors \rightarrow vasoconstriction
- β_1 receptors \rightarrow \uparrow heart rate & contractility

✔ Improves coronary & cerebral perfusion



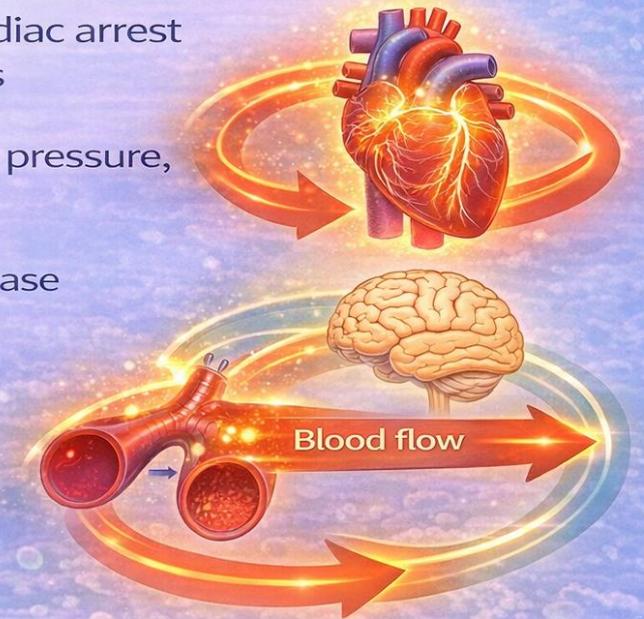
Points to Remember: Epinephrine

Physiologic Effects

- Improves coronary perfusion
- Improves systemic perfusion
- Improves oxygen delivery

Points to Remember: Epinephrine

- ✓ First-line medication in cardiac arrest according to AHA guidelines
- ✓ Restores coronary perfusion pressure, raising chances of ROSC
- ✓ Vasoconstrictive effects increase blood pressure to the brain
- ✓ Raise ETCO₂ indicates improved circulation



Amiodarone

Physiologic Mechanism

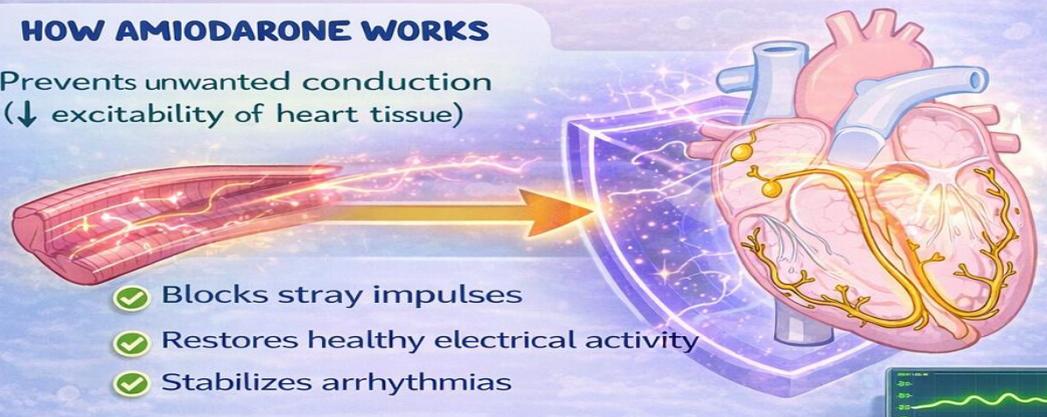
- Stabilizes cardiac electrical conduction
- Restores organized cardiac rhythm

Amiodarone: Class III Antiarrhythmic

Treats/Prevents Arrhythmias & Cardiac Arrest

HOW AMIODARONE WORKS

Prevents unwanted conduction
(↓ excitability of heart tissue)



- ✓ Blocks stray impulses
- ✓ Restores healthy electrical activity
- ✓ Stabilizes arrhythmias



Side Effects of Amiodarone

COMMON	RARE
<ul style="list-style-type: none">✓ NAUSEA✓ VOMITING✓ WEIGHT LOSS✓ BLUISH-GREY SKIN DISCOLORATION✓ HYPO- or HYPER-THYROIDISM✓ LIVER DISEASE✓ HYPERSENSITIVITY 	<ul style="list-style-type: none">✓ OPTIC NEUROPATHY → LEADS to BLURRED VISION✓ MEMORY LOSS✓ CONFUSION✓ PERIPHERAL NEUROPATHY 
with LONG-TERM USE	
<ul style="list-style-type: none">✓ NAUSEA✓ VOMITING✓ WEIGHT LOSS✓ BLUISH-GREY SKIN DISCOLORATION✓ LIVER DISEASE 	<ul style="list-style-type: none">✓ OPTIC NEUROPATHY → LEADS to BLURRED VISION✓ MEMORY LOSS✓ CONFUSION✓ PERIPHERAL NEUROPATHY 



Points to Remember: Amiodarone

- Stabilizes cardiac rhythm
- Improves cardiac output
- Improves perfusion
- Improves ETCO₂

Points to Remember: Amiodarone

- ✓ Stabilizes cardiac electrical activity during life-threatening ventricular arrhythmias
- ✓ Helps terminate ventricular fibrillation and ventricular tachycardia when electrical instability persists
- ✓ Improves the likelihood of restoring coordinated cardiac contraction
- ✓ Supports restoration of effective circulation by allowing the heart to resume organized electrical function
- ✓ Improvement in perfusion may be reflected by a gradual rise in ETCO₂
- ✓ Does not directly increase perfusion pressure, but restores the electrical conditions necessary for circulation
- ✓ Used when defibrillation and initial resuscitation efforts have not restored a stable rhythm
- ✓ Used when **defibrillation** and initial resuscitation efforts have not restored a stable rhythm



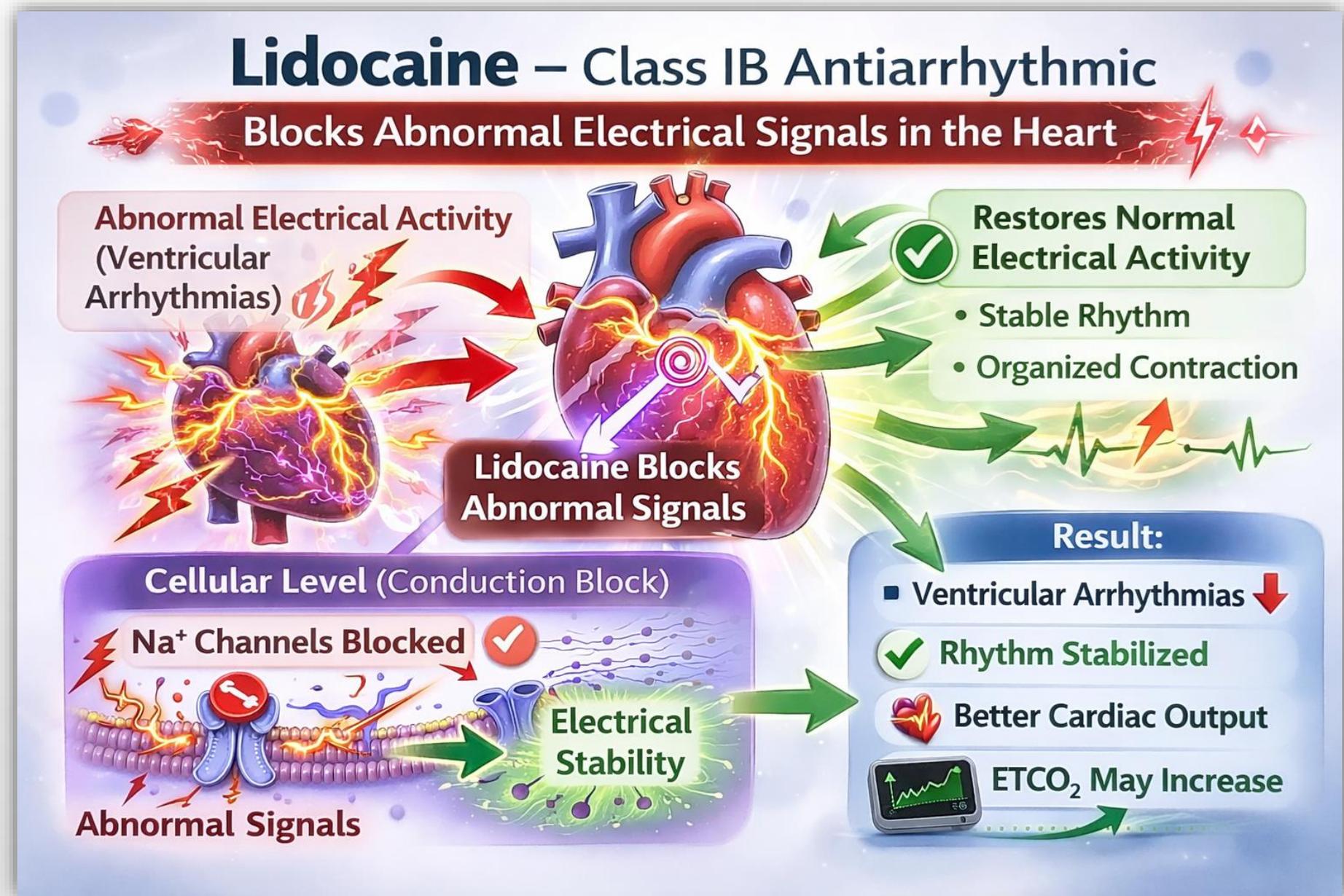
Lidocaine – Class IB Antiarrhythmic

Blocks Abnormal Electrical Signals in the Heart

Lidocaine

Physiologic Mechanism

- Suppresses ventricular arrhythmias
- Stabilizes myocardial electrical activity



Points to Remember: Lidocaine

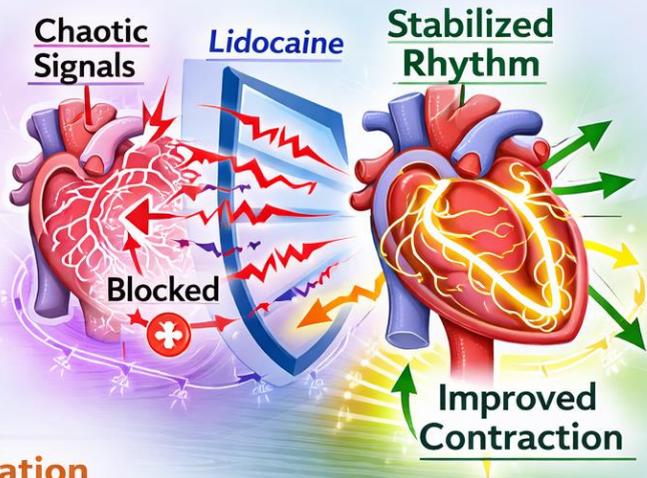
- Stabilizes myocardial electrical activity
- Improves cardiac output
- Improves perfusion
- Improves ETCO₂

Points to Remember: Lidocaine

Class IB Antiarrhythmic

Stabilizes Cardiac Electrical Activity by **Blocking Abnormal Impulses**

- Prevents rapid, abnormal electrical signals in ventricular tissue
- Helps terminate ventricular fibrillation (VF) and ventricular tachycardia (VT)
- Restores organized electrical activity → improves **coordinated contraction**
- Supports restoration of **effective circulation** when arrhythmias cause cardiac arrest



Improved Perfusion → Gradual ↑ ETCO₂

Does NOT directly ↑ Perfusion Pressure

- Restores **Electrical Stability** Needed for Circulation

Used when **VF/VT** persists despite **Defibrillation & CPR**



Atropine

Physiologic Mechanism

- Blocks parasympathetic influence
- Increases heart rate

Atropine: Anticholinergic Drug

Blocks Parasympathetic Effects

How Atropine Works

- ✓ Blocks acetylcholine at muscarinic receptors (M1-M5)
- ✓ Opposes vagus nerve effects
- ✓ Interrupts parasympathetic (rest & digest) responses

ATROPINE Presynaptic Neuron

Side Effects of Atropine

COMMON	SERIOUS
<ul style="list-style-type: none">✓ Increased heart rate✓ Dry mouth✓ Blurred vision✓ Urinary retention✓ Constipation	<ul style="list-style-type: none">✓ Palpitations (irregular heartbeats)✓ Confusion / Hallucinations✓ Acute glaucoma

ATROPINE → **Nicotinic Receptor**

SERIOUS

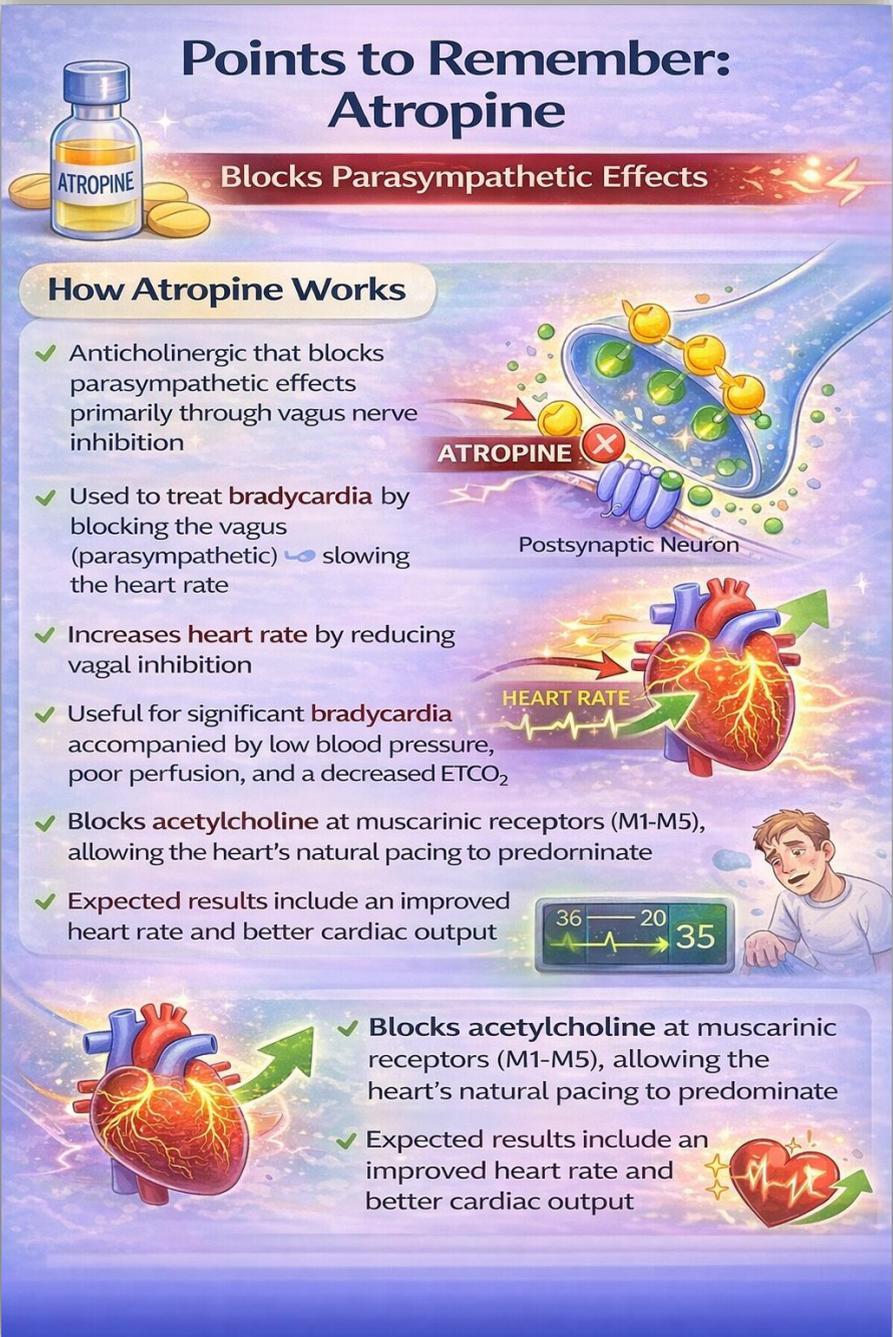
- ✓ Palpitations (irregular heartbeats)
- ✓ Confusion / Hallucinations
- ✓ Acute glaucoma

* Caution needed in elderly & those with glaucoma



Points to Remember: Atropine

- Increases heart rate
- Improves cardiac output
- Improves perfusion
- Improves ETCO₂



Points to Remember: Atropine

Blocks Parasympathetic Effects

How Atropine Works

- ✓ Anticholinergic that blocks parasympathetic effects primarily through vagus nerve inhibition
- ✓ Used to treat bradycardia by blocking the vagus (parasympathetic) → slowing the heart rate
- ✓ Increases heart rate by reducing vagal inhibition
- ✓ Useful for significant bradycardia accompanied by low blood pressure, poor perfusion, and a decreased ETCO₂
- ✓ Blocks acetylcholine at muscarinic receptors (M1-M5), allowing the heart's natural pacing to predominate
- ✓ Expected results include an improved heart rate and better cardiac output

ATROPINE

Postsynaptic Neuron

HEART RATE

36 — 20 → 35

Blocks acetylcholine at muscarinic receptors (M1-M5), allowing the heart's natural pacing to predominate

Expected results include an improved heart rate and better cardiac output



Magnesium

Physiologic Mechanism

- Stabilizes myocardial conduction
- Treats torsades de pointes

Magnesium – for Cardiac Arrest

Key Points for Use in Emergencies

- ✓ **Treats Refractory V-Fib/V-Tach**
 - ✓ Helps restore normal rhythm in cases resistant to defibrillation
- ✓ **Used in Torsades de Pointes**
 - ✓ First-line treatment for this specific type of polymorphic ventricular tachycardia
- ✓ **Helps restore normal rhythm in cases resistant to defibrillation**
- ✓ **First-line treatment for this specific type of polymorphic ventricular tachycardia**
- ✓ **Corrects Low Magnesium Levels**
 - ✓ Restores magnesium levels as a deficiency can contribute to arrhythmias
- ✓ **Safe and Effective for Emergencies**
 - ✓ Given intravenously in emergency settings for rapid action
- ✓ **Magnesium Sulfate Tabs**
 - ✓ Restores magnesium levels as a deficiency can contribute to arrhythmias

VALID USES OF MAGNESIUM SULFATE IN CARDIAC EMERGENCIES

- ✓ Ventricular Fibrillation
- ✓ Ventricular Tachycardia
- ✓ Torsades de Pointes

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Points to Remember: Magnesium

- Stabilizes rhythm
- Improves perfusion
- Improves ETCO₂

Magnesium During a Code Blue

Points to Remember in Cardiac Arrest

The infographic features a central illustration of a drip chamber labeled 'MAGNESIUM' with a blue liquid inside. Arrows radiate from this central point to six surrounding boxes, each containing specific clinical information and illustrations of medical equipment and personnel.

- Administer Magnesium Sulfate (MgSO₄)**
 - Typically 1-2 grams IV over 5-10 minutes
- Commonly given for Torsades de Pointes**
 - Helps stabilize the heart muscle and restore normal rhythm
- Monitor ECG & Vital Signs**
 - Check to see if rhythm converts to normal
- Watch for Hypotension & Respiratory Depression**
 - Monitor BP and respiratory rate closely
- Have Calcium Gluconate Ready!**
 - On hand to counteract magnesium toxicity if needed
- Continue Standard ACLS Protocol**
 - Give magnesium sulfate in addition to CPR, defibrillation, epinephrine, etc.

Give magnesium according to evidence-based guidelines and in appropriate cases.

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Sodium Bicarbonate

Physiologic Mechanism

- Corrects metabolic acidosis
- Improves myocardial function

Sodium Bicarbonate for Use in a Code

Key Points in Emergency Resuscitation

- 1. Assess Blood Gases (ABGs)**
 - ✓ Confirm severe metabolic acidosis with ABGs before using sodium bicarb (pH < 7.1)
- 2. 1 mEq/kg IV Push**
 - ✓ Typical dose of 8.4% sodium bicarbonate
- 3. Treat Severe Acidosis**
 - ✓ Used when metabolic acidosis is confirmed with pH < 7.1 or pCO₂ is significantly elevated
- 4. Watch for Key Effects**
 - ✓ Increases blood pH
 - ✓ Temporary drop in potassium (K⁺)
 - ✓ Monitor ECG for narrowing of QRS complex
- 5. Have Calcium Gluconate Ready**
 - ✓ Counteracts hyperkalemia (risk increases when acidotic)
 - ✓ Prevents complications from lowered calcium
- 6. Continue Standard ACLS Care**
 - ✓ Use along with CPR, defibrillation, epinephrine
 - ✓ Follow latest ACLS guidelines

Administer sodium bicarbonate based on evidence and in appropriate cases.

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Points to Remember: Sodium Bicarbonate

- Corrects acidosis
- Improves cardiac function
- Improves perfusion
- Improves ETCO_2

Sodium Bicarbonate

During a Code Blue

Points to Remember in Cardiac Arrest

- 1. Assess Blood Gases First**
 - ✓ Check ABGs to confirm severe metabolic acidosis ($\text{pH} < 7.1$)
- 2. Typical Dosing in Arrest**
 - ✓ 1 mEq/kg IV push of 8.4% sodium bicarbonate (50 mL = 50 mEq)
- 3. Main Use: Severe Acidosis**
 - ✓ Treats severe metabolic acidosis when $\text{pH} < 7.1$
- 4. Monitor ECG Response**
 - ✓ Check for narrowing QRS complex and return of near-normal rhythm
- 5. Watch for Side Effects**
 - ✓ Risk of alkalosis, hypernatremia, hypokalemia
- 6. Continue Standard ACLS Protocol**
 - ✓ Use along with CPR, defibrillation, other meds like epinephrine

Give sodium bicarb according to evidence based guidelines and in appropriate cases.

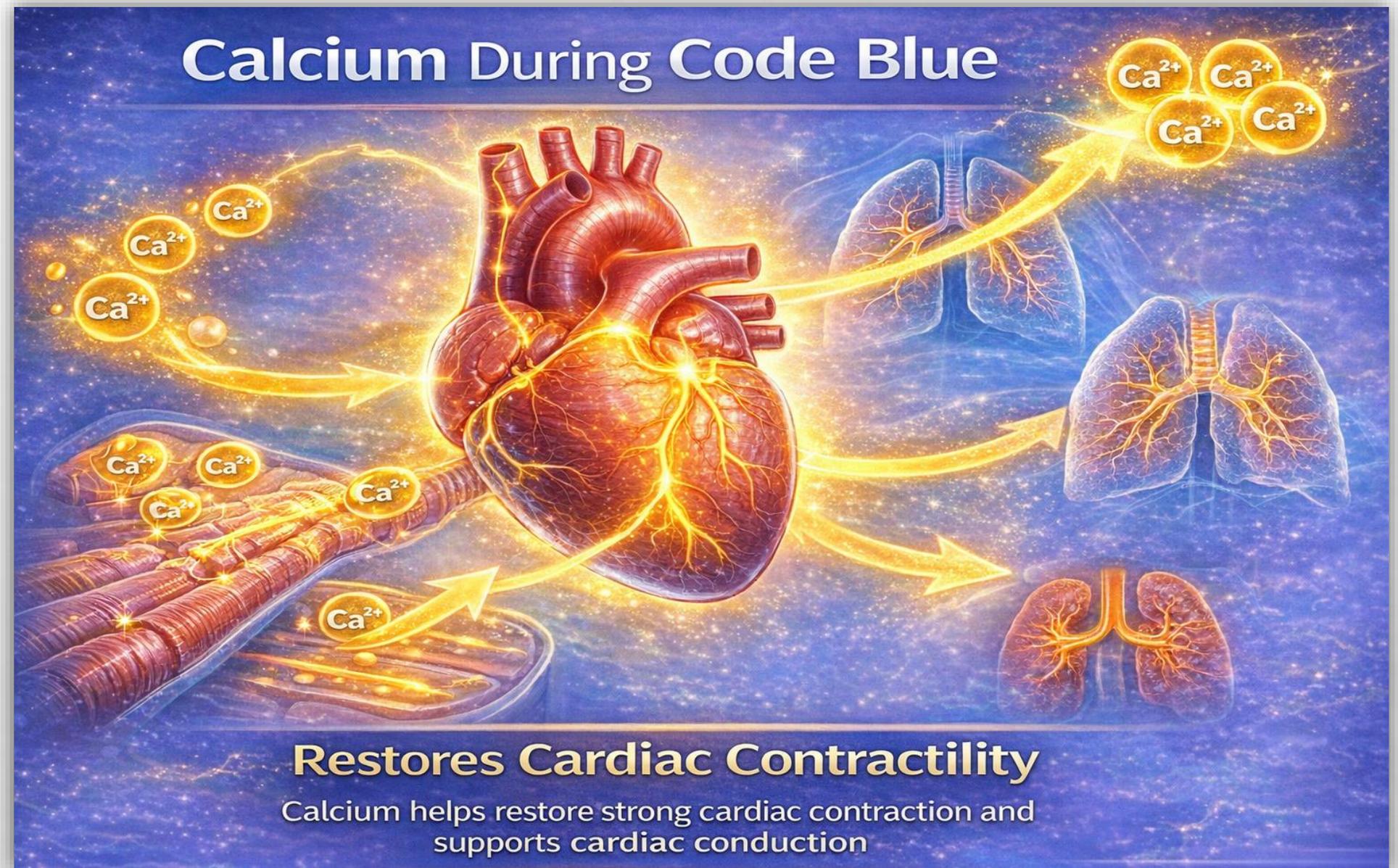
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Calcium

Physiologic Mechanism

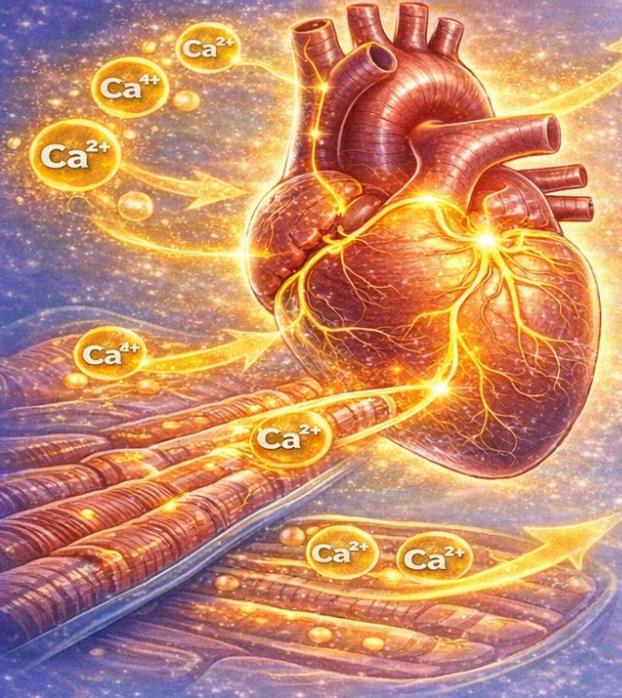
- Improves myocardial contractility



Points to Remember: Calcium

- Improves contractility
- Improves cardiac output
- Improves perfusion
- Improves ETCO₂

Points to Remember: Calcium



- 1 Supports cardiac muscle contraction by restoring myocardial contractility
- 2 Helps stabilize cardiac cell membranes during electrolyte-related cardiac instability
- 3 Improves the heart's ability to generate effective mechanical contraction
- 4 Supports restoration of circulation when contractility is impaired
- 5 May improve perfusion when cardiac weakness is related to metabolic or electrolyte imbalance
- 6 Acts at the cellular level to improve cardiac muscle responsiveness
- 7 Helps restore the physiologic conditions necessary for effective cardiac output



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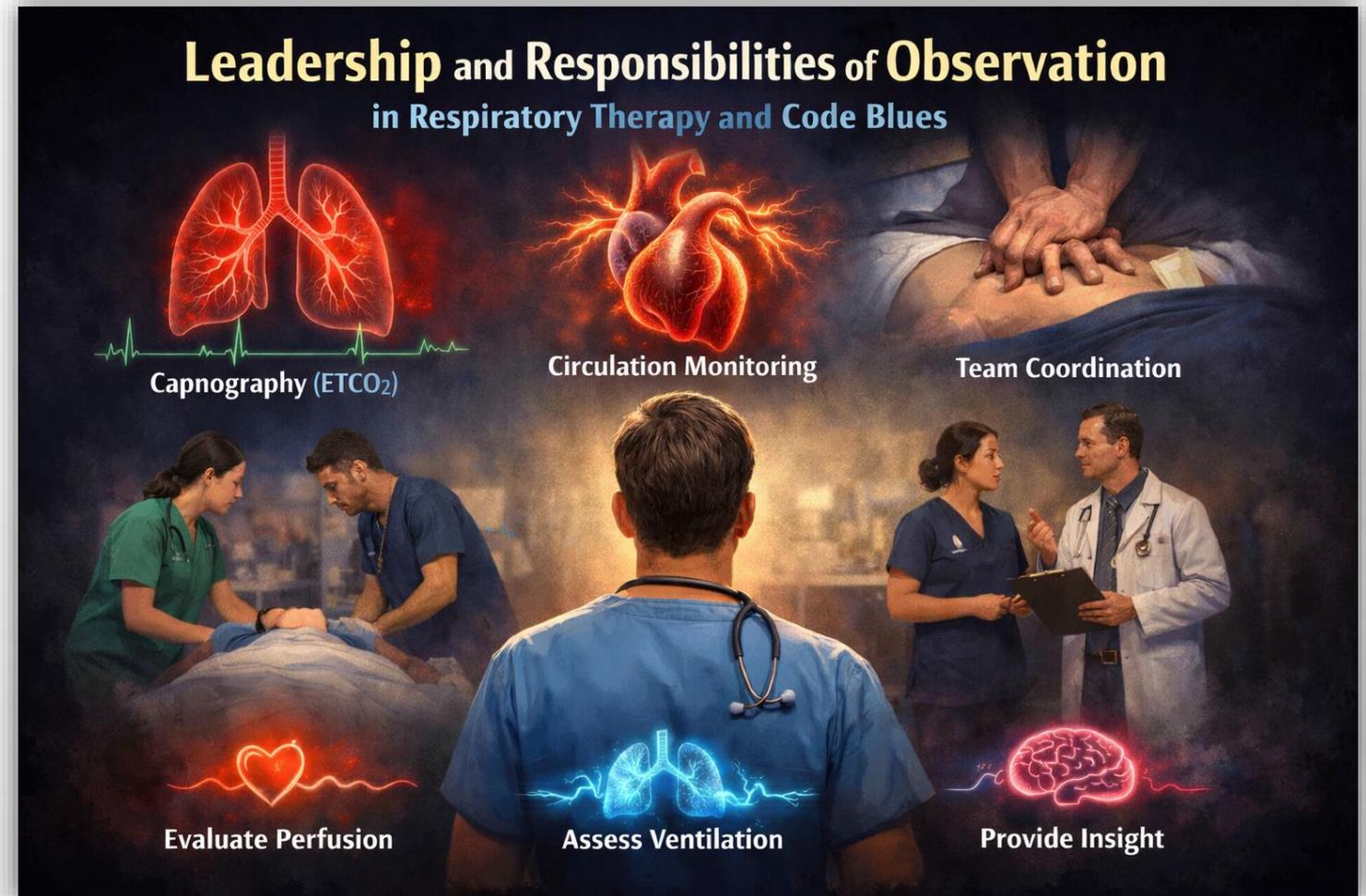


Team Coordination During ACLS

- Physician directs care
- Nurse administers medications
- Respiratory therapist manages ventilation

Respiratory therapist provides physiologic monitoring

- ETCO₂ reflects perfusion
- Early indicator of ROSC

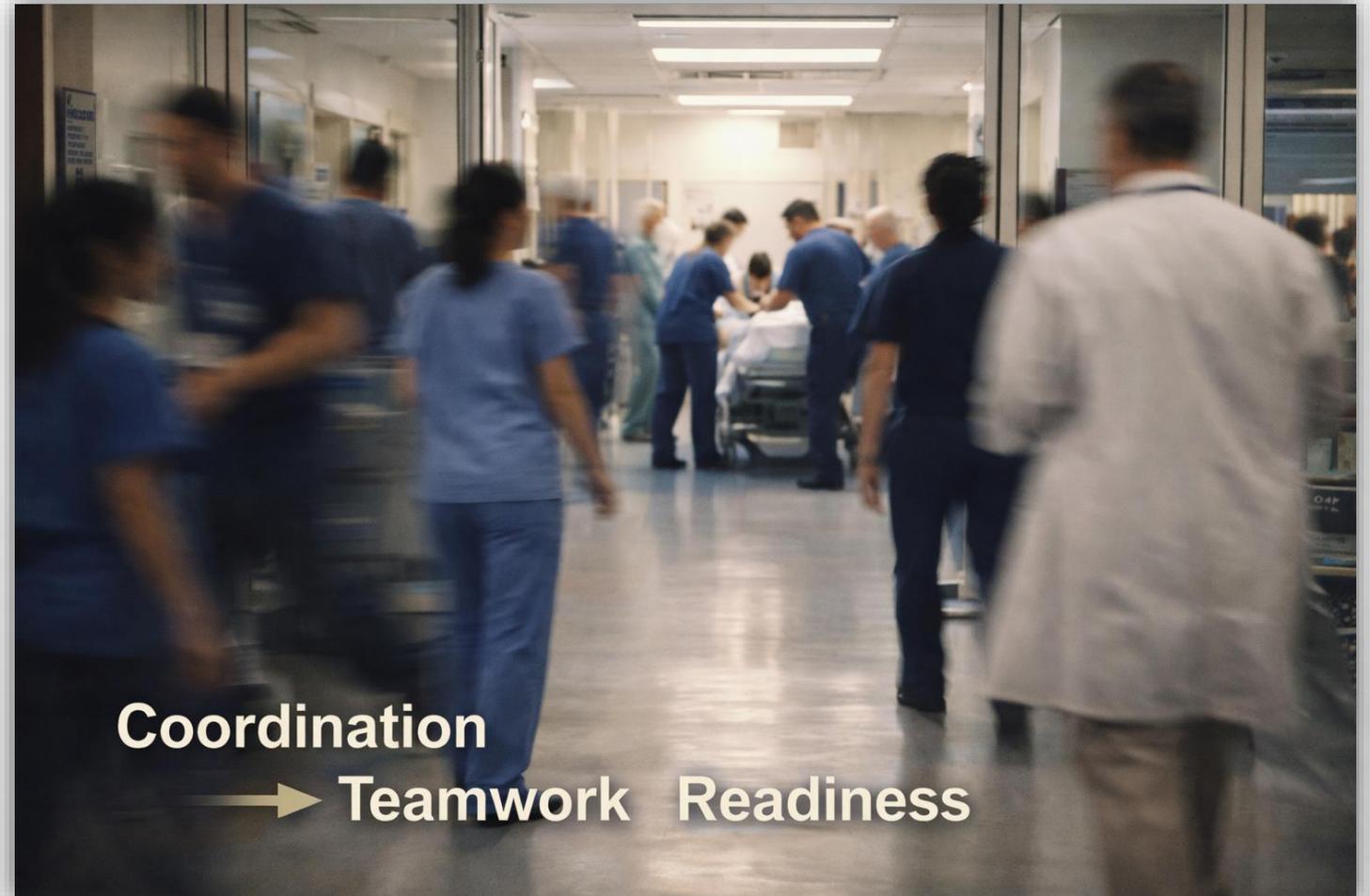


ACLS medications restore Perfusion

- Ventilation effectiveness
- Oxygen delivery
- ETCO₂ monitoring



The Language of Perfusion: A Respiratory Therapist's Case Study in ACLS Pharmacology



Course Wrap-Up

- Respiratory therapist is essential physiologic observer
- Capnography provides real-time perfusion feedback
- Physiologic awareness improves resuscitation success





RT-ACLS Module References

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1. AHA 2020 ACLS Guidelines	11. Callaway CW et al. 2020 Circulation
2. Neumar RW et al. 2019 Circulation	12. Link MS et al. 2015 Circulation
3. Nolan JP et al. 2020 Resuscitation	13. MacKinnon NJ et al. 2011 Crit Care Med
4. Pantazopoulos IN et al. 2018 Critical Care	14. Advanced Capnography Guidelines
5. Kalenda Z. 1987 Resuscitation	15. Current Trends in ACLS Pharmacology
6. Arnold J et al. 2021 Respir Care	
7. Lee DH et al. 2016 Am J Emerg Med	
8. Capnography in Resuscitation: Review Article	
9. ACLS Capnography Protocols & Studies	
10. Institutional ACLS Medication Policies	

DATE: 04/24/24 Dr. Respiratus
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