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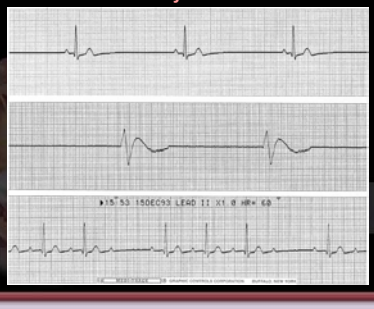
Pulseless Electrical Activity



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Pulseless Electrical Activity

- PEA
  - An organized rhythm on the monitor, other than VT, that does not produce a palpable pulse

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Types of PEA

- Normotensive PEA
  - Baseline cardiac contractions and shortening of myocardial fibers in the absence of detectable pulses
- Pseudo-PEA
  - Myocardial contractions are present but too weak to produce a detectable pulse
  - Presence of a pulse is measurable by invasive monitoring or echocardiography
- True PEA
  - Myocardial contractions are absent

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Categories of PEA Rhythms

- Electromechanical dissociation (EMD) rhythms
- Pseudo-EMD rhythms
- Idioventricular or ventricular escape rhythms
- Bradyasystolic rhythms

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EMD Rhythms

- Organized electrical activity with no clinically detectable pulse
- Narrow-QRS complex that may be fast or slow

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Pseudo-EMD Rhythms

- Organized electrical activity with no clinically detectable pulse however, pulse detectable by Doppler
- Narrow-QRS complex that may be fast or slow

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Idioventricular or Ventricular Escape Rhythms

- Organized electrical activity with no clinically detectable pulse
- Slow, wide QRS complex

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Bradyasystolic Rhythms

- Bradyasystole
  - A cardiac rhythm that has a ventricular rate below 60 beats per minute in adults, periods of absent heart rhythm (asystole), or both
- Bradyasystolic states
  - Clinical situations during which bradyasystole is the dominant heart rhythm
- Organized electrical activity with no clinically detectable pulse
- Profound bradycardia with a wide QRS, often with prolonged periods of asystole

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Causes of PEA

- Possible causes of PEA: *PATCH-4-MD*
- Pulmonary embolism
- Acidosis
- Tension pneumothorax
- Cardiac tamponade
- Hypovolemia
- Hypoxia
- Heat/cold (hypo-/hyperthermia)
- Hypo-/hyperkalemia (and other electrolytes)
- Myocardial infarction
- Drug overdose/accidents

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Causes of PEA

Cause	Typical ECG Findings	History, Physical Findings	Management
Mechanical Causes			
Tension pneumothorax	Narrow QRS complex, slow rate (due to hypoxia)	History (trauma, asthma, ventilator, COPD), unequal breath sounds, no pulse with CPR, neck vein distention, tracheal deviation, difficult to ventilate patient, hyperresonance to percussion on affected side	Needle decompression – second intercostal space, midclavicular line
Cardiac tamponade	Narrow QRS complex, rapid rate (impending tamponade) – deteriorating to sudden bradycardia as terminal event	History (trauma, renal failure, thoracic malignancy), no pulse with CPR, neck vein distention	Pericardiocentesis

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Causes of PEA

Cause	Typical ECG Findings	History, Physical Findings	Management
Decreased Preload			
Hypovolemia	Narrow QRS complex, rapid rate	History, flat neck veins	Volume replacement, find source (e.g., bleeding) and manage
Sepsis		History	Volume replacement, antibiotics
Massive pulmonary embolism	Narrow QRS complex, rapid rate	History, no pulse with CPR, neck vein distention, deep vein thrombosis in lower extremities	Pulmonary arteriogram, surgical embolectomy, fibrinolytics

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Cause	Typical ECG Findings	History, Physical Findings	Management
Myocardial Dysfunction			
Massive myocardial infarction	Q waves, ST segment changes, T wave inversion	History, ECG, enzyme levels	EmergencyPTCA if unavailable, fibrinolytics
Drug overdose			
Calcium channel blocker	Slow rate, prolonged PR interval, possible AV block	History of ingestion, empty bottles at the scene, pupils, neurological exam	Calcium IV, pacing
Beta-blocker	Slow rate, prolonged PR interval, possible AV block		Glucagon IV, pacing
Cyclic antidepressants	Rapid rate, prolonged QT interval, widening of QRS, ST segment changes		Sodium bicarbonate IV
Digoxin	Slow rate, prolonged PR interval, shortened QT interval, T wave inversion or flattening		Fab antibodies

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Cause	Typical ECG Findings	History, Physical Findings	Management
Electrolytes			
Hypokalemia	ST segment depression, T waves flatten, prominent U waves, QRS widens (uncommon in adults)	Prolonged diuretic therapy; administration of K+ deficient parenteral fluids; severe GI fluid losses from gastric suctioning or lavage; prolonged vomiting or diarrhea, or laxative abuse without K+ replacement	Rapid, controlled potassium infusion
Hyperkalemia	Rapid rate; tall, narrow, peaked (tented) T waves; QRS widens; flattened or absent P waves; ST segment elevation	History of acute or chronic renal failure; diabetes; dialysis fistulas; medications; severe cell damage such as from burns, trauma, crush injuries	Calcium chloride IV push (immediate); then combination of insulin, glucose, sodium bicarbonate; then sodium polystyrene sulfonate/sorbitol; dialysis (long-term)

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Causes of PEA

Cause	Typical ECG Findings	History, Physical Findings	Management
Hypothermia			
Hypothermia	Initial tachycardia, then progressive bradycardia; J or Osborne waves	History of cold exposure, core body temperature	Rewarming guided by core temperature
Pulmonary Causes			
Severe respiratory insufficiency / arrest resulting in hypoxia	Slow rate due to hypoxia	Cyanosis, blood gas results, airway obstruction	Ventilation

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Causes of PEA

Cause	Typical ECG Findings	History, Physical Findings	Management
Post-Defibrillation PEA			
After reversal of prolonged VF with electrical countershock			No specific intervention

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PEA Management

- Primary ABCD Survey
- Secondary ABCD Survey
  - Assess blood flow with Doppler
    - If blood flow detected with Doppler, treat using hypotension/shock algorithm

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PEA Management

- Differential diagnosis
  - Search for and treat reversible causes (PATCH-4-MD)
  - Fast narrow-QRS
    - Consider hypovolemia, tamponade, pulmonary embolism, tension pneumothorax
  - Slow wide-QRS
    - Consider cyclic antidepressant overdose, calcium channel blocker, beta-blocker, or digitalis toxicity

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PEA Management

- Medications
  - Epinephrine
    - 1 mg (1:10,000 solution) IV every 3 to 5 minutes
    - ET dose 2 to 2.5 mg diluted in 10 mL NS or distilled water
  - If the rate is slow:
    - Atropine (Class IIb)
      - 1 mg IV every 3 to 5 minutes to max 0.04 mg/kg
      - ET dose 2 to 3 mg diluted in 10 mL NS or distilled water
  - Consider sodium bicarbonate
  - Consider termination of efforts