

Case 4 Pulseless Electrical Activity

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Case Scenario

- ◆ A 55-year-old man walks into the ED complaining of severe chest and abdominal pains
- ◆ He is placed on a stretcher and begins to remove his clothes
- ◆ Just as the nurse starts to attach the monitor leads, he falls back unconscious on the stretcher

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Learning Objectives

- ◆ Be able to apply ACLS Approach (Primary and Secondary ABCD Surveys)
- ◆ Be able to stabilize the critical systems
 - Airway
 - Breathing
 - Circulation
- ◆ Be able to state 10 causes of PEA arrest

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Pulseless Electrical Activity

Primary ABCD Survey

Focus: basic CPR and defibrillation

- **C**heck responsiveness
- **A**ctivate emergency response system
- **C**all for defibrillator

- A Airway:** open the airway
B Breathing: provide positive-pressure ventilations
C Circulation: give chest compressions
D Defibrillation: assess for VF/pulseless VT, shock if indicated



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Primary ABCD Survey

- A = Airway:** open the airway
B = Breathing: provide positive-pressure ventilations
C = Circulation: give chest compressions
D = Defibrillation: Not indicated



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Pulseless Electrical Activity

Secondary ABCD Survey

Focus: more advanced assessments and treatments

- A Airway:** place airway device as soon as possible
B Breathing: confirm airway device placement by exam plus confirmation device
B Breathing: secure airway device; purpose-made tube holders preferred
B Breathing: confirm effective oxygenation and ventilation
C Circulation: establish IV access
C Circulation: identify rhythm → monitor
C Circulation: administer drugs appropriate for rhythm and condition
C Circulation: assess for occult blood flow ("pseudo-EMD")
D Differential Diagnosis: search for and treat identified reversible causes

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Secondary ABCD Survey

- A = Airway:** place airway device as soon as possible
- B = Breathing:** confirm airway device placement by physical exam
- B = Breathing:** confirm airway device placement by secondary tube confirmation
- B = Breathing:** secure airway device to prevent dislodgment
- B = Breathing:** confirm effective oxygenation and ventilation



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Secondary ABCD Survey (cont'd)

- C = Circulation:** identify rhythm
- C = Circulation:** establish IV access
- C = Circulation:** administer drugs appropriate for rhythm and condition
- C = Circulation:** assess for occult blood flow ("pseudo-EMD")
- D = Differential Diagnosis:** search for and treat identified reversible causes (Think!)

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Pulseless Electrical Activity

Review for most frequent causes

- Hypovolemia
- Hypoxia
- Hydrogen ion—acidosis
- Hyper-/hypokalemia
- Hypothermia
- "Tablets" (drug OD, accidents)
- Tamponade, cardiac
- Tension pneumothorax
- Thrombosis, coronary (ACS)
- Thrombosis, pulmonary (embolism)

Epinephrine 1 mg IV push,
repeat every 3 to 5 minutes

Atropine 1 mg IV (if PEA rate is *slow*),
repeat every 3 to 5 minutes as needed, to a total
dose of 0.04 mg/kg

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Causes: H's and T's

- ◆ Hypoxia (CNS events)
- ◆ Hypokalemia/hyperkalemia (and other electrolytes)
- ◆ Hypothermia/hyperthermia
- ◆ Hypoglycemia/hyperglycemia
- ◆ Hypovolemia (tank/anaphylaxis, gravid)

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Causes: H's and T's (cont'd)

- ◆ Trauma
- ◆ Tamponade
- ◆ Thrombosis (pulmonary)
- ◆ Thrombosis (coronary)
- ◆ Tablets (ODs, drugs, etc)
- ◆ Tension (pneumothorax, asthma)



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Rhythms to Learn

- ◆ Electromechanical dissociation (EMD)
- ◆ Idioventricular rhythms
- ◆ Pulseless asystolic rhythms
- ◆ Bradyasystolic rhythms
- ◆ Ventricular junctional escape rhythms
- ◆ "Pseudo-EMD"

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Pulseless Electrical Activity



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Sinus Tachycardia With No Pulse



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PEA? Asystole?



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Pulseless Electrical Activity?



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Pulseless Electrical Activity?



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Cardiac Tamponade

- ◆ Clinical signs
 - Pulsus paradoxus
 - Pericardial friction rub may be present
 - Heart size on x-ray may be normal or enlarged
 - Echocardiogram

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Pericardial Tamponade



- ◆ Chest x-ray
 - Widened mediastinum
 - Pneumo- or hemothorax
- ◆ Electrical alternans



- Note rounded bottle shape to left side of heart
- Compare with next 2 slides

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Cardiac Tamponade

- ◆ Pathophysiology
 - Impairment of ventricular diastolic filling caused by pressure of pericardial sac
 - And by bulging of ventricular septum into LV
 - Stroke volume and cardiac output fall

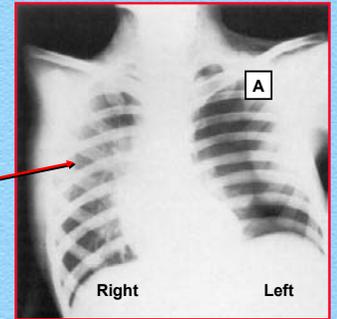
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Pneumothorax

- ◆ Definition
 - Entry of air into pleural space, causing lung collapse

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Tension Pneumothorax

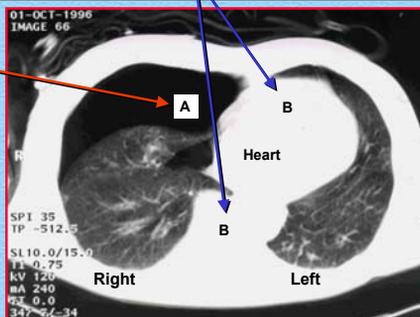


A: Air under tension in left thorax

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B: pressure of tension pneumothorax pushing midline structures (heart, mediastinum) into patient's left thoracic cavity

A: air, under tension, in thoracic cavity



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Tension Pneumothorax

- ◆ Definition
 - Air under pressure
 - Venous return inhibited
 - Mediastinum displaced
 - Vena cava kinked
 - Cardiac output decreased
 - Cardiovascular collapse developed

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Tension Pneumothorax

- ◆ Clinical manifestations in patient with
 - Spontaneous breathing
 - Respiratory distress
 - Flurid face
 - Tracheal deviation
 - Distended neck veins
 - Tachycardia
 - Hypotension

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Tension Pneumothorax

- ◆ Treatment
 - Provide as soon as diagnosis is apparent to prevent cardiovascular collapse and cardiac arrest
 - Do not wait for x-ray confirmation
 - Use large-bore needle tap

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Tension Pneumothorax

- ◆ Equipment
 - Povidone-iodine solution
 - 14-gauge catheter-over-needle device
- ◆ Technique
 - Cleanse overlying skin
 - Insert needle at 2nd or 3rd intercostal space, midclavicular line, over top of rib
 - Leave catheter in pleural space open to air

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Tension Pneumothorax

- ◆ Complications of treatment
 - Misdiagnosis—pneumothorax created
 - Lung laceration
 - Internal mammary or intercostal vessel laceration
 - Hemothorax

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Critical Actions—PEA

- ◆ Perform all steps in Primary ABCD Survey, CPR
- ◆ Operate monitor
- ◆ Recognize PEA
- ◆ Direct intubation and assess ventilation
- ◆ Direct IV access

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Critical Actions (cont'd)

- ◆ Assess patient, name conditions causing PEA
- ◆ Determine management
- ◆ Administer fluid challenge
- ◆ Administer epinephrine (if no specific treatment)
- ◆ Administer atropine if rate is slow

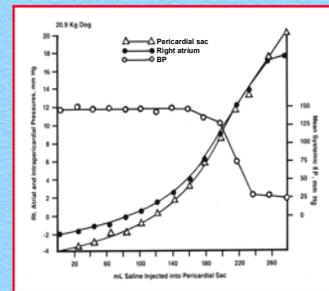
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Common Perils and Pitfalls

1. Not assessing patient
2. Not considering possible causes of PEA
3. Only treating with epinephrine
4. Not troubleshooting ventilation/intubating patient
5. Not giving volume infusion
6. Defibrillation
7. Not performing chest compressions

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Production of Cardiac Tamponade



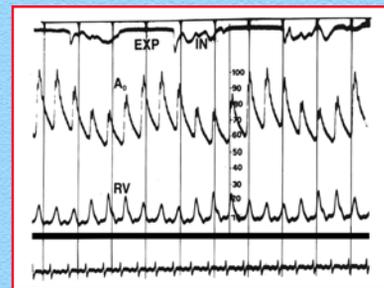
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Cardiac Tamponade

- ◆ Clinical manifestations
 - Central venous pressure elevated
 - Early rapid ventricular filling inhibited
 - Intracardiac pressures equalized during diastole
 - Pulsus paradoxus usually present

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Pressures in Patient With Cardiac Tamponade



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Pericardiocentesis

- ◆ Indications
 - Immediate threat to life
 - Severe hemodynamic impairment
 - Fall in systolic blood pressure >30 mm Hg

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Pericardiocentesis

- ◆ General principles
 - As of 2000 = echocardiography used to guide pericardiocentesis
 - Direct subxyphoid techniques only used in dire medical emergency
 - ECG and hemodynamic monitoring
 - Full resuscitation equipment available

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Pericardiocentesis

- ◆ Equipment
 - 16-gauge short-bevel large-bore needle
 - 30- or 50-mL syringe
 - Echo- or ECG-guided (V lead)
 - Local anesthetic
 - Sterile supplies and povidone-iodine solution

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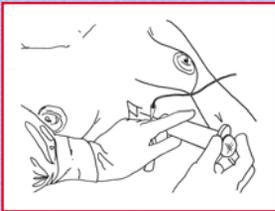
Pericardiocentesis

- ◆ Technique
 - Patient in supine position, upper torso elevated
 - ECG limb leads attached to patient
 - Use echocardiography guided procedure (rarely: ECG-guided, V lead)
 - Subxiphoid approach
 - Continuous aspiration

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Pericardiocentesis

- ◆ For historical interest: ECG-guided needle advancement



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Pericardiocentesis

- ◆ Hazards
 - Cardiac arrhythmias
 - Laceration of myocardium or coronary arteries
 - Injection of air into cardiac chambers
 - Hydrothorax or pneumothorax
 - Hemorrhage from laceration may produce tamponade

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