Pulseless Electrical Activity

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Case
Case

• 55 yo M brought by EMS for cardiac arrest
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  - Visiting Baltimore for convention
  - Was with colleagues and told them that he wasn’t feeling well
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- 55 yo M brought by EMS for cardiac arrest
  - Visiting Baltimore for convention
  - Was with colleagues and told them that he wasn’t feeling well
  - Slumped over at the breakfast table and fell to the floor
Case

- 55 yo M brought by EMS for cardiac arrest
  - Friends called 911 immediately, ± CPR
  - EMS arrived (BLS) after 5-10 min
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- 55 yo M brought by EMS for cardiac arrest
  - Friends called 911 immediately, ± CPR
  - EMS arrived (BLS) after 5-10 min
- No pulse or spont. respirations
- Compressions, bagging
Case

Courtesy Dr. Eric Lung
Case

- 55 yo M brought by EMS for cardiac arrest
  - Patient arrives with same rhythm...what do you do?
Questions

• What is PEA??
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• What is PEA??
  – Pulseless electrical activity
  – Formerly referred to as EMD
• “Electromechanical dissociation”
• PEA is defined by a rhythm that should normally produce a pulse
  – Not VF, VT, torsades, rapid afib, etc.
  – Not extreme bradycardia
  – Not brady-asystole (agonal)
• These other rhythms have different protocols for treatment
• Pulseless electrical activity
  – Increasing proportion of SCA rhythms over the past several decades
PEA

• Pulseless electrical activity
  – Increasing proportion of SCA rhythms over the past several decades
• 35-40% of in-hospital cardiac arrests
• 22-30% of OOHCA
• Reduction in % of VF possibly due to increased use of beta-blockers?
Cardiac Arrest “Types”

- Electrical mechanisms associated with SCA are generally divided into tachyarrhythmic and non-tachyarrhythmic categories
Cardiac Arrest “Types”

- Non-tachyarrhythmic categories
  - PEA
  - Asystole
  - Extreme bradycardia, agonal
ACLS and PEA

• What does ACLS recommend for PEA?
ACLS and PEA

- What does ACLS recommend for PEA?
  - Vasopressors → EPI, VP
  - IVF?
  - Atropine if rhythm is slow
  - Compressions?
ACLS and PEA

• What does ACLS recommend for PEA?
  – Would you do compressions on this patient in PEA? Would it hurt??
ACLS and PEA

- What does ACLS recommend for PEA?
  - Dx: pericardial tamponade
  - Compressions might be harmful
What does ACLS recommend for PEA?
- Vasopressors → EPI, VP
- IVF?
- Atropine if rhythm is slow
- Compressions?
- Then quickly determine and treat the underlying cause
ACLS and PEA

- The H’s and T’s
ACLS and PEA

- The H’s and T’s
ACLS and PEA

• H’s

• T’s
ACLS and PEA

- **H’s**
  - Hypovolemia
  - Hypoxia
  - Hydrogen ion (acidosis)
  - HyperK
  - HypoK
  - Hypothermia
  - Hypoglycemia

- **T’s**
ACLS and PEA

**H’s**
- Hypovolemic
- Hypoxia
- Hydrogen ion (acidosis)
- HyperK
- HypoK
- Hypothermia
- Hypoglycemia

**T’s**
- Toxins
- Tamponade
- Tension PTX
- Thrombosis (MI)
- Thrombosis (PE)
- Trauma (hemorrhage)
ACLS and PEA

- Is there an easier method?
A Simplified and Structured Teaching Tool for the Evaluation and Management of Pulseless Electrical Activity

Laszlo Littmann\textsuperscript{a} Devin J. Bustin\textsuperscript{b} Michael W. Haley\textsuperscript{a, c}

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Littman, et al. approach to PEA

- What is the likelihood of the Hs and Ts causing PEA?
  - Which are the truly common causes?

- Is there a simple, rational approach to workup and treatment?
Littman, et al. approach to PEA

- Use the ECG and U/S
Littman, et al. approach to PEA

• Step 1: use the ECG
Littman, et al. approach to PEA

• Is the QRS narrow or wide?
Littman, et al. approach to PEA

- Narrow QRS $\rightarrow$ RV inflow or outflow problem ("pseudo-PEA")
  - Tamponade
  - Tension PTX
  - Mechanical hyperinflation
  - Massive PE
  - Severe hypovolemia or hemorrhage
Littman, et al. approach to PEA

• Narrow QRS → Note that chest compressions can be harmful here!!
  – Tamponade
  – Tension PTX
  – Mechanical hyperinflation
  – Massive PE
  – Severe hypovolemia or hemorrhage
Next, look at the bedside ultrasound if Dx unclear, usually hyperdynamic
- Tamponade
- Tension PTX
- Mechanical hyperinflation
- Massive PE
- Severe hypovolemia or hemorrhage
Littmnan, et al.
approach to PEA

- Next, look at the bedside ultrasound if Dx unclear, usually hyperdynamic
Littman, et al. approach to PEA

- Treat the cause or give VOLUME
  - Tamponade
  - Tension PTX
  - Mechanical hyperinflation
  - Massive PE
  - Severe hypovolemia or hemorrhage
Littman, et al. approach to PEA

• What if the QRS is wide?
Littman, et al. approach to PEA

- Wide QRS → metabolic, tox, or severe LV problem ("true PEA")
Littman, et al. approach to PEA

- Wide QRS $\rightarrow$ metabolic, tox, or severe LV problem ("true PEA")
  - Severe hyperK$^+$
  - Sodium channel blocker toxicity
  - Severe metabolic acidosis
  - Massive MI with pump failure
Littman, et al. approach to PEA

- Next, look at the bedside ultrasound if Dx unclear, usually hypokinetic
  - Severe hyperK⁺
  - Sodium channel blocker toxicity
  - Severe metabolic acidosis
  - Massive MI with pump failure
Littman, et al. approach to PEA

- Give empiric NaHCO$_3$, Ca$^{++}$, consider cath or lytics if MI suspected by Hx
  - Severe hyperK$^+$
  - Sodium channel blocker toxicity
  - Severe metabolic acidosis
  - Massive MI with pump failure (usually die)
Littman, et al. approach to PEA

- What’s missing?
Littman, et al. approach to PEA

- What’s missing?
  - Hypoxia
  - HypoK+
  - Hypoglycemia
  - Hypothermia
Littman, et al.
approach to PEA

- What’s missing?
  - Hypoxia → no evidence
  - HypoK⁺ → no evidence
  - Hypoglycemia → no evidence
  - Hypothermia → use a thermometer!
Littman, et al. approach to PEA

• What’s missing?
  – Other toxins, e.g. BBs and CCBs
  • Typically present with hypotension, sinus brady or sinus arrest, AV blocks
  • If PEA occurs, typically narrow QRS and slow and dx almost always established by then
Summary

PEA – EVALUATION

QRS NARROW
MECHANICAL (RV) PROBLEM
- Cardiac tamponade
- Tension PTX
- Mechanical hyperinflation
- Pulmonary embolism

QRS WIDE
METABOLIC (LV) PROBLEM
- Severe hyperkalemia
- Sodium-channel blocker toxicity

AGONAL RHYTHM

ACUTE MI
Myocardial rupture

BEDSIDE US: LV HYPERDYNAMIC PSEUDO-PEA

LV HYPOKINETIC OR AKINETIC TRUE PEA

Severe hypovolemia or hemorrhage

ACUTE MI
Pump failure
Summary

PEA – MANAGEMENT

QRS NARROW
MECHANICAL (RV) PROBLEM

• Cardiac tamponade
• Tension PTX
• Mechanical hyperinflation
• Pulmonary embolism

→ WIDE OPEN FLUIDS, PLUS:

PERICARDIOCENTESIS
NEEDLE DECOMPRESSION
VENTILATOR MANAGEMENT
THROMBOLYSIS

PEA – MANAGEMENT

QRS WIDE
METABOLIC (LV) PROBLEM

• Severe hyperkalemia
• Sodium-channel blocker toxicity

PHARMACOLOGIC MANAGEMENT

IV CALCIUM CHLORIDE
IV SODIUM BICARBONATE BOLUSES
PEA – MANAGEMENT

QRS NARROW
MECHANICAL (RV) PROBLEM

• Cardiac tamponade
• Tension PTX
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WIDE OPEN
FLUIDS, PLUS:

PERICARDIOCENTESIS

NEEDLE DECOMPRESSION

VENTILATOR
MANAGEMENT

THROMBOLYSIS

Note that chest compressions could be harmful here
Summary

PEA – MANAGEMENT

PHARMACOLOGIC MANAGEMENT

QRS WIDE
METABOLIC (LV) PROBLEM

• Severe hyperkalemia
• Sodium-channel blocker toxicity

IV CALCIUM CHLORIDE
IV SODIUM BICARBONATE BOLUSES
Thanks!
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Thanks!

PDF of slides: lectures.umem.org/Mattu