Unrecognized Killers in Emergency Electrocardiography

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Disclosures

No affiliations with industry

No financial conflicts of interest

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Case 1

- 42 yo. man presents c/o fever, cough, dyspnea, vomiting
  - History of liver CA
  - Appears toxic, severely dehydrated
  - Exam — febrile (102º F), tachycardia, tachypnea, hypoxia (pulse oximetry 84%)
  - CXR shows multilobar pneumonia
  - ECG…

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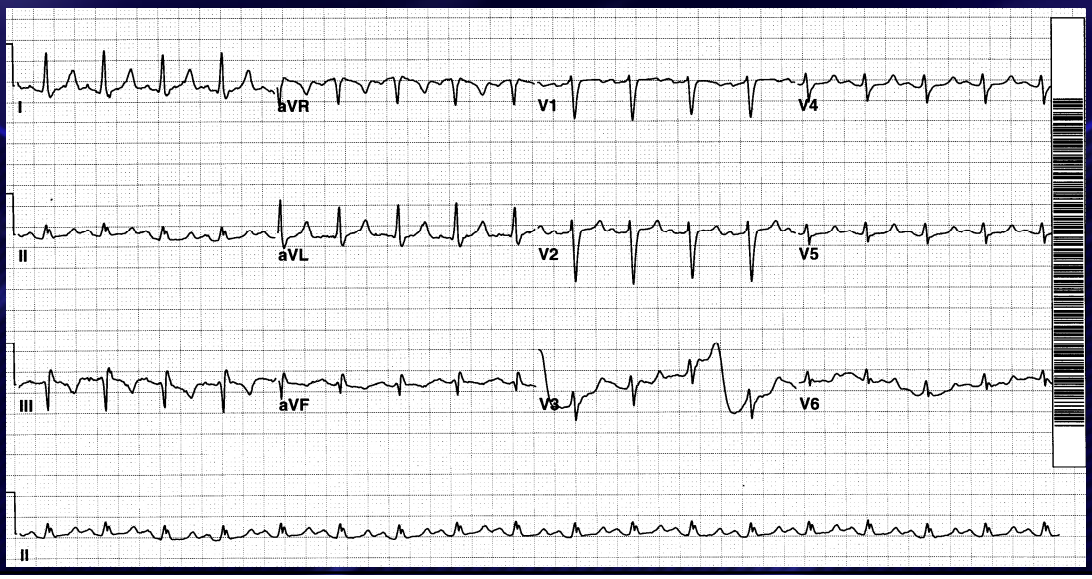
Case 1



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Case 1

- Patient appears to be worsening
  - Becoming lethargic
  - Pulse oximetry 93% on NRB mask

7

Case 1

- Patient appears to be worsening
  - Becoming lethargic
  - Pulse oximetry 93% on NRB mask
  - Rapid sequence intubation

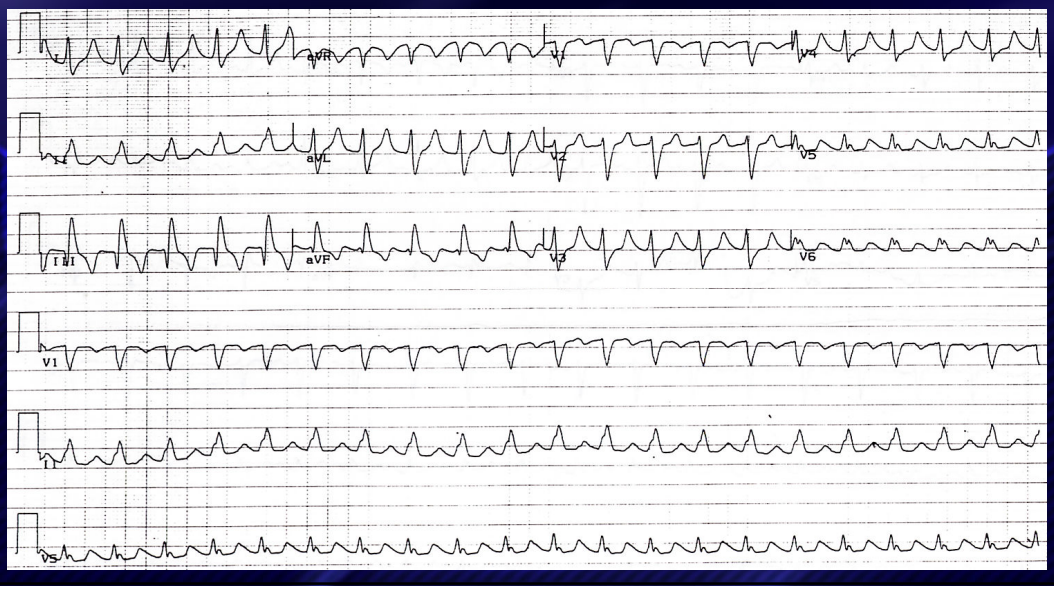
8

Case 1

- Patient appears to be worsening
  - Becoming lethargic
  - Pulse oximetry 93% on NRB mask
  - Rapid sequence intubation
- Monitor shows change in rhythm; ECG…

9

Case 1



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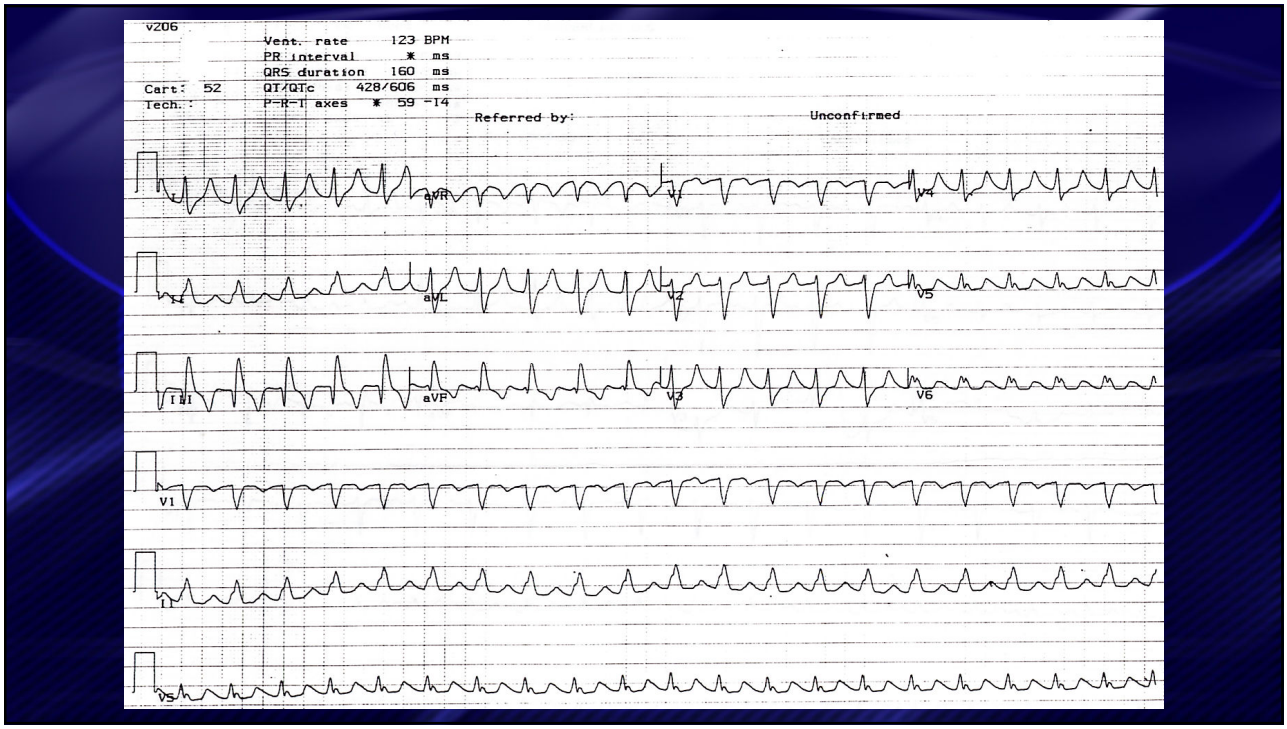

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Case 1

- ECG shows regular wide-complex tachycardia
  - Interpreted as ventricular tachycardia
- Patient is treated with lidocaine
  - Develops asystole after bolus

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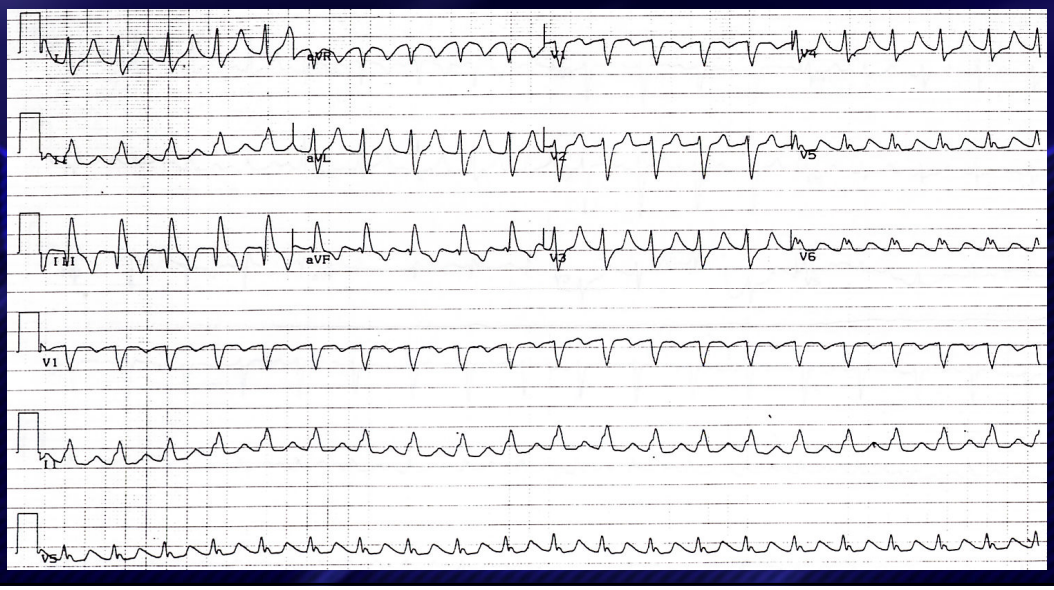
Case 1



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Case 2

- 46 yo W presents after two syncopal episodes associated with palpitations
  - ECG…

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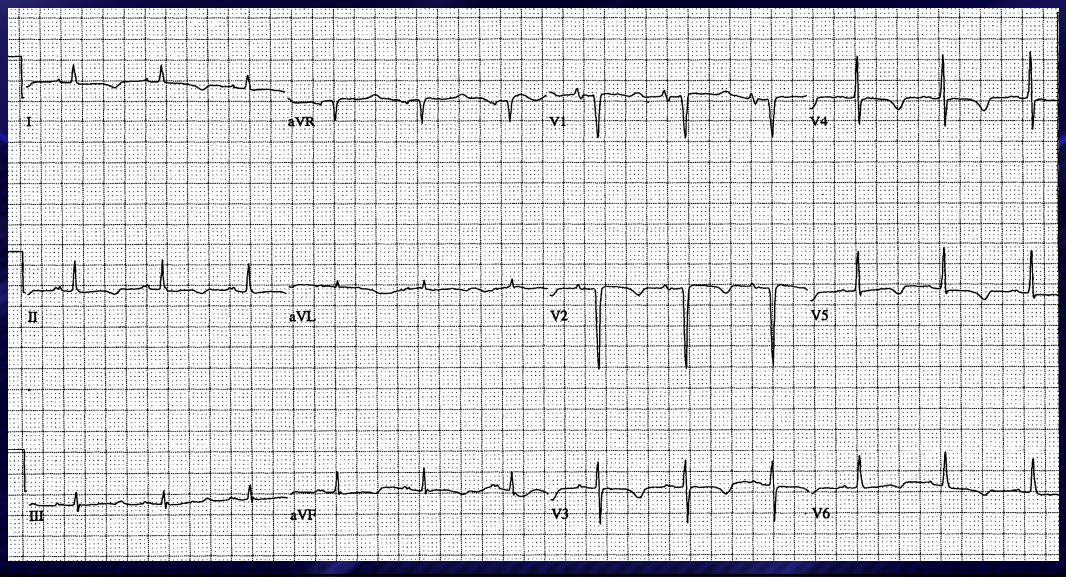
Case 2



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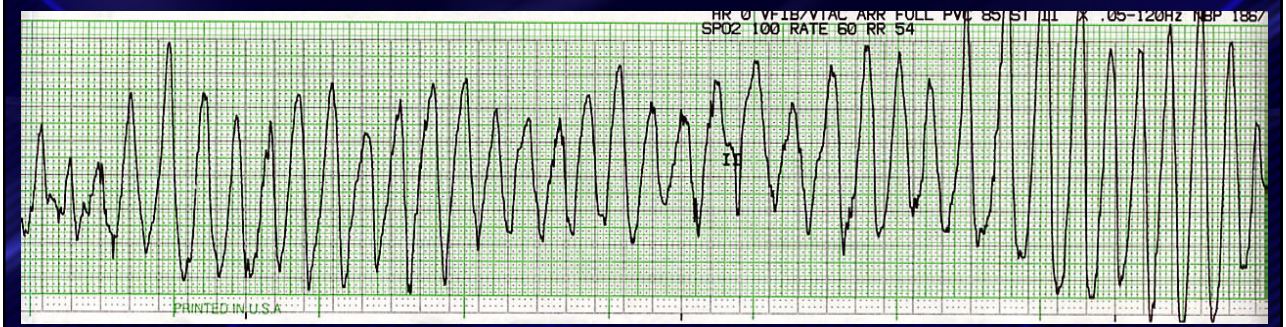
Case 2



Intermittent episodes of polymorphic VT

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Case 2

- Magnesium bolus 2 gms slow IVP…repeated x 2
- Episodes of PVT continue but now patient is hypotensive, nauseous, and diaphoretic between the episodes of PVT

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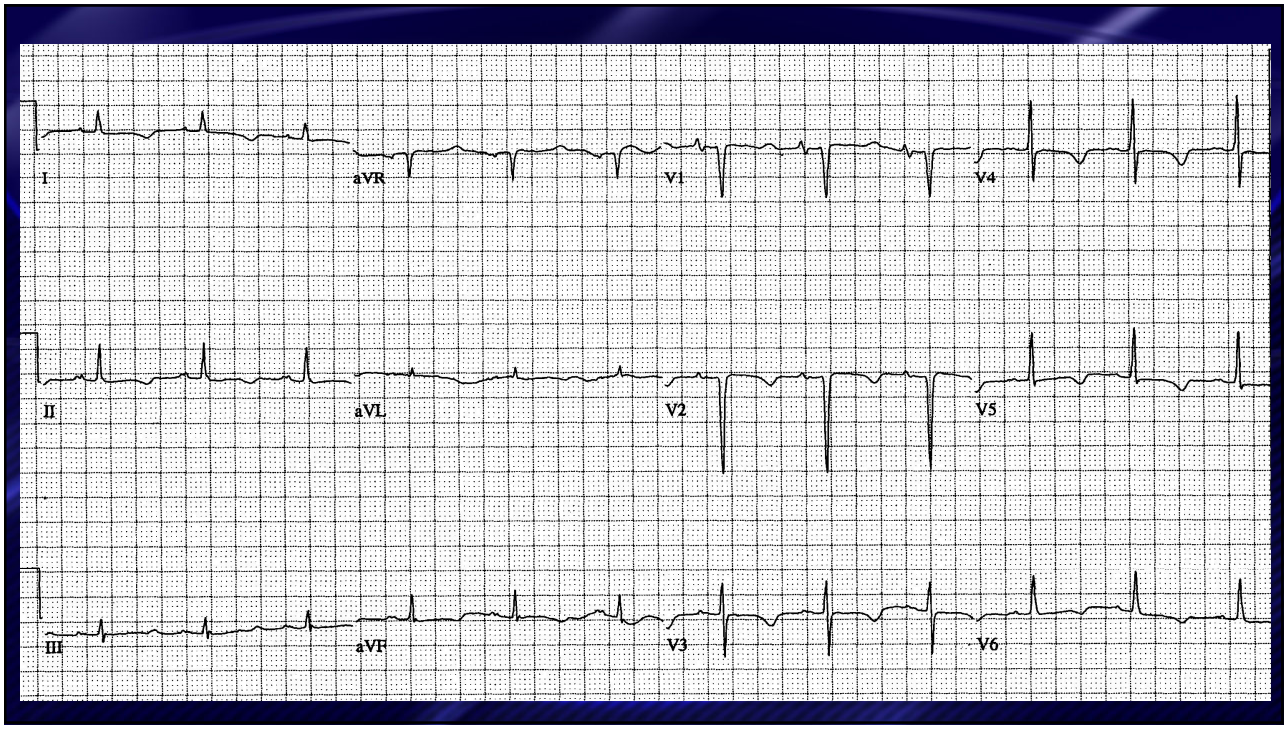

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Case 3

- 55 yo. W with hx/o htn, DM, 1 ppd smoker
  - Presented with SOB and chest heaviness

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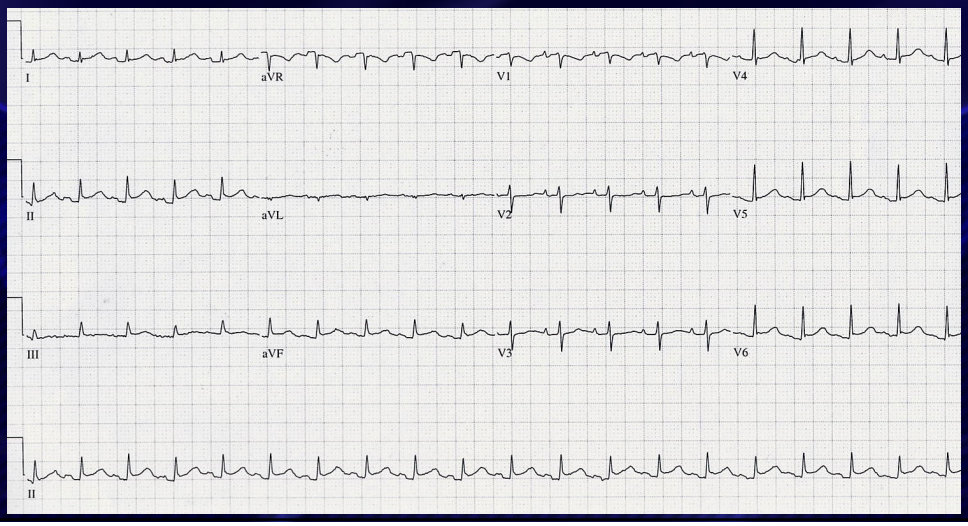
Case 3



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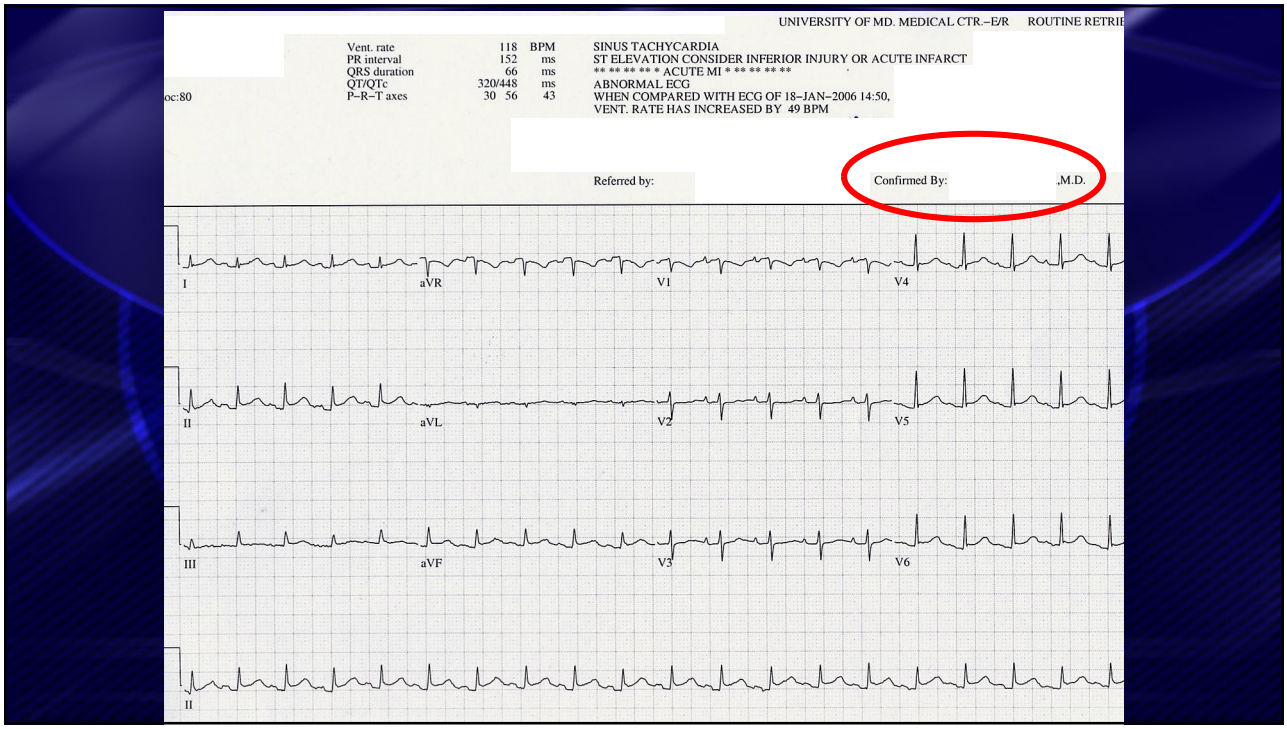

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Case 3

- Cath lab activation → cardiology concurs, rec's…
  - Aspirin
  - Clopidogrel
  - Heparin bolus
  - Send upstairs in 10 minutes

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Case 3

- All medications given, patient transported upstairs to cath lab
- Procedure begins…

23

Case 3

- All medications given, patient transported upstairs to cath lab
- Procedure begins…10 minutes later patient has a brady-asystolic arrest

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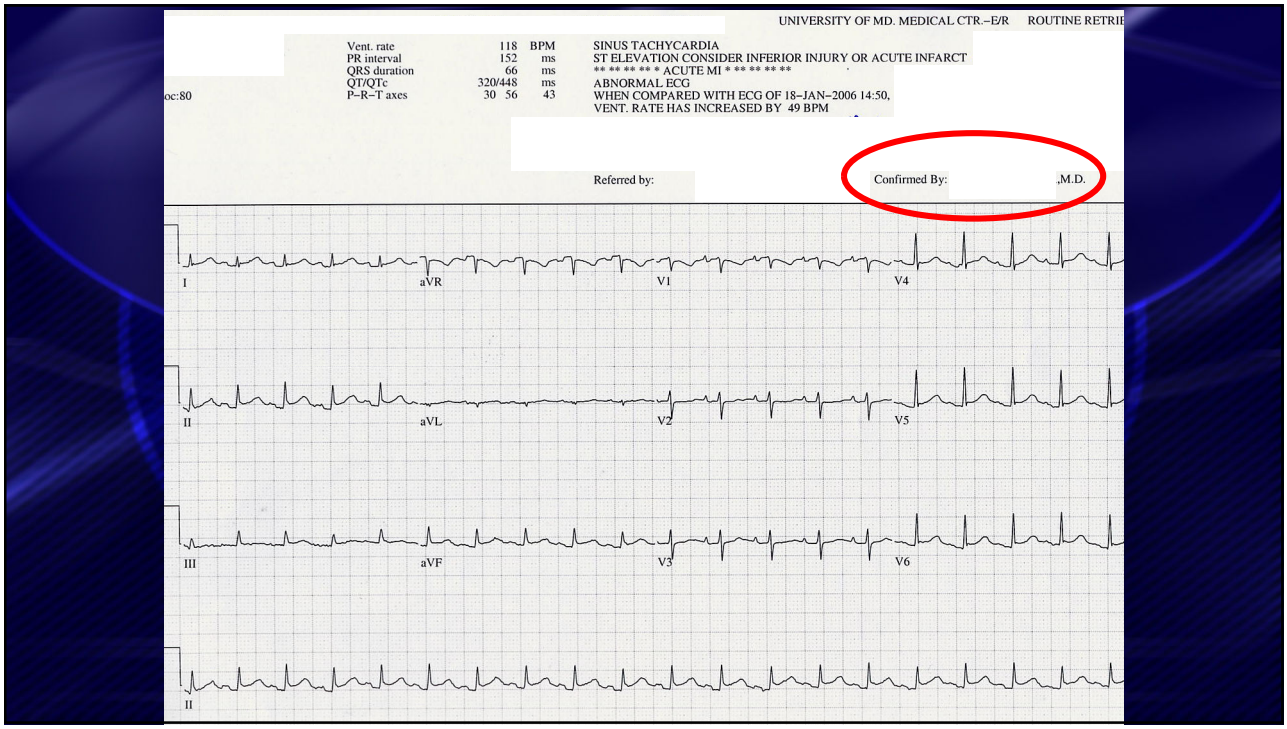
Case 3

- All medications given, patient transported upstairs to cath lab
- Procedure begins…10 minutes later patient has a brady-asystolic arrest
- Cath proceeds during resuscitation attempts
  - No coronary blockages, patient pronounced dead after 30 minutes

25



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Outline

- VT Mimics
- Prolonged QT issues
- Pericardial effusions

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Outline

- VT Mimics
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VT Mimics

- Ventricular tachycardia

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VT Mimics

- Ventricular tachycardia
  - Ventricular rhythm with rate ≥ 120-130 BPM

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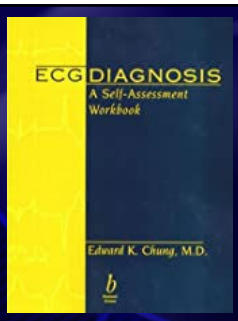
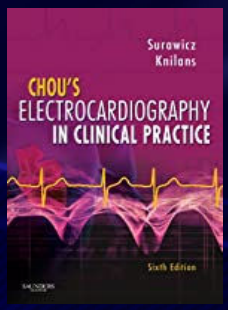
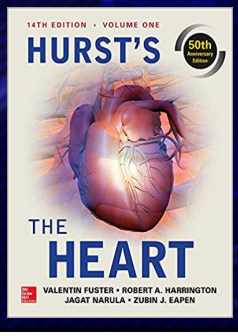


Monomorphic VT is usually at least 140, though "may be as low as 120."



Monomorphic VT is usually at least 140, and AIVR may be as fast as 130.



Monomorphic VT is at least 120.

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VT Mimics

- Ventricular tachycardia
  - If HR < 120-130 BPM, consider
    - hyperkalemia
    - type IA medication toxicity (incl. TCA, cocaine)
    - reperfusion arrhythmias (AIVR)

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VT Mimics

- Ventricular tachycardia
  - If HR < 120-130 BPM, consider
    - hyperkalemia
    - type IA medication toxicity (incl. TCA, cocaine)
    - reperfusion arrhythmias (AIVR)
- What's the problem with treating "slow VT" as *real* VT??

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VT Mimics

- Treatment of "slow VT" may induce asystole

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VT Mimics

- Treatment of "slow VT" may induce asystole
  - Literature indicates WCT due to hyperkalemia may be misdiagnosed as VT
    - Treatment with lidocaine may induce asystole
  - Similar results when AIVR treated with lidocaine
  - Similar results with amiodarone, procainamide

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VT Mimics — Case 1

- 37 yo. man presents with respiratory distress
  - Minimal hx obtainable due to distress
    - History of hypertension, DM

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VT Mimics — Case 1

- 37 yo. man presents with respiratory distress
  - Minimal hx obtainable due to distress
    - History of hypertension, DM
  - Exam is consistent with pulmonary edema, severe hypoxia (pulse oximetry 80%)
  - Initial ECG…

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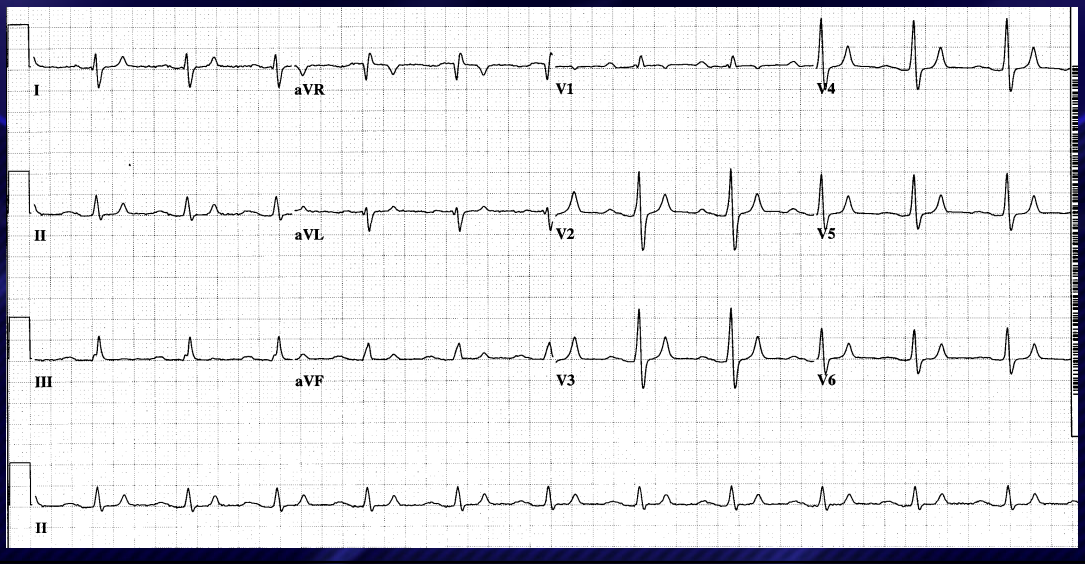
VT Mimics — Case 1



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VT Mimics — Case 1

- Only mild improvement with NRB mask
- NTG drip but patient becoming less responsive
- Decision is made to intubate
  - Etomidate
  - Succinylcholine
- Soon after intubation, rhythm changes…

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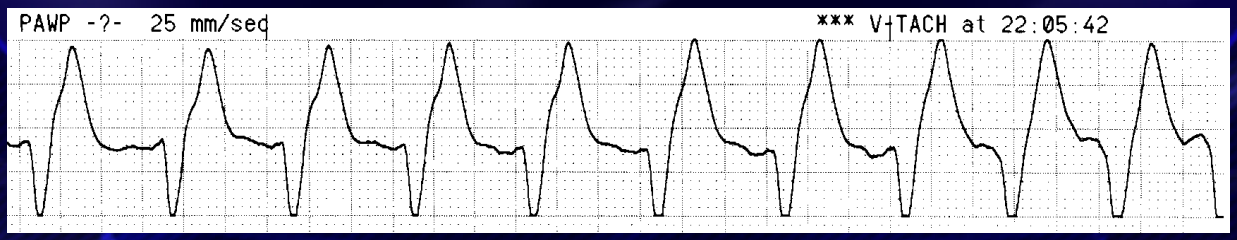
VT Mimics — Case 1



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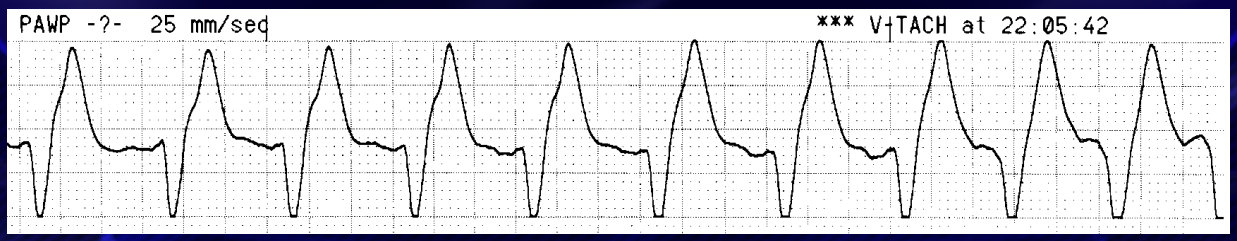
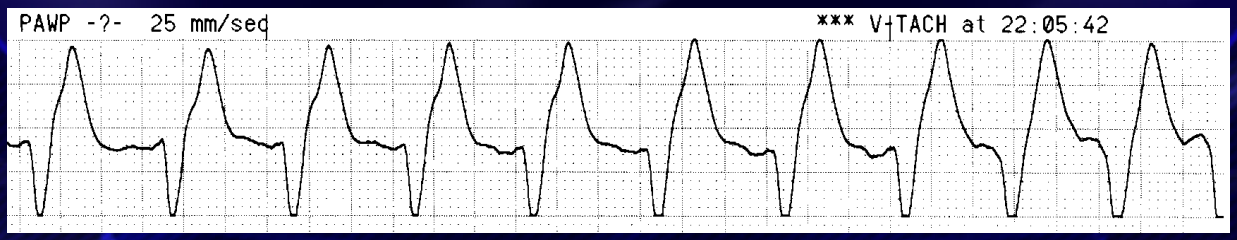
VT Mimics — Case 1



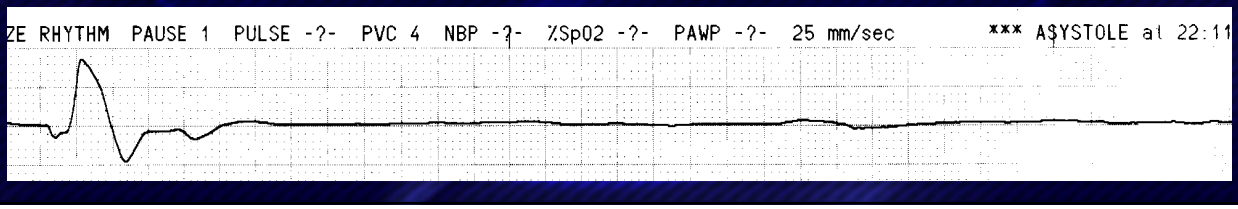
Lidocaine bolus given

42

VT Mimics — Case 1



Lidocaine bolus given



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VT Mimics — Case 2

- 64 yo. man presents c/o nausea, vomiting, lightheadedness, "flu"
  - History of diabetes, renal insufficiency
  - Appears dehydrated, weak
  - Placed on cardiac monitor…

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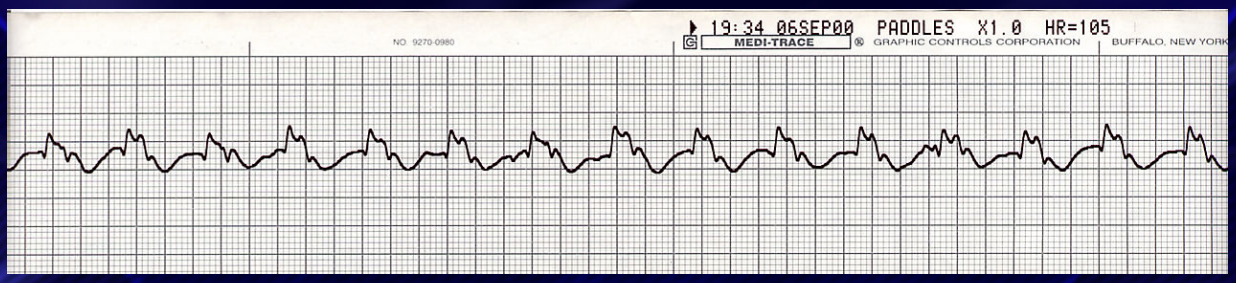
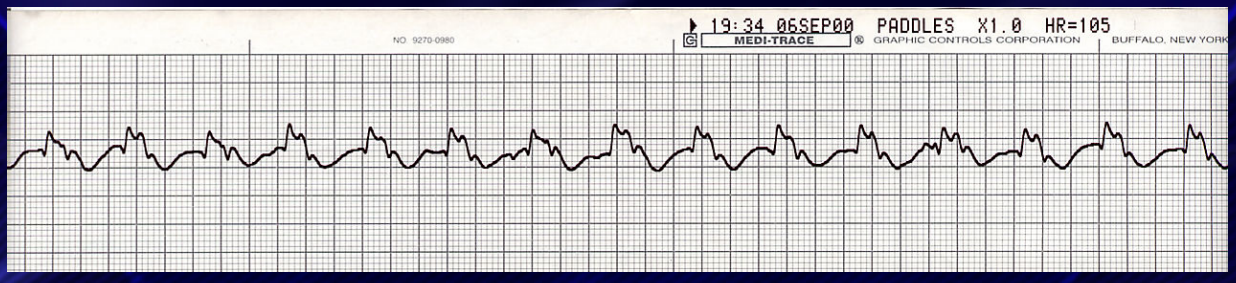
VT Mimics — Case 2



Interpreted as ventricular tachycardia

45

VT Mimics — Case 2



Amiodarone bolus initiated

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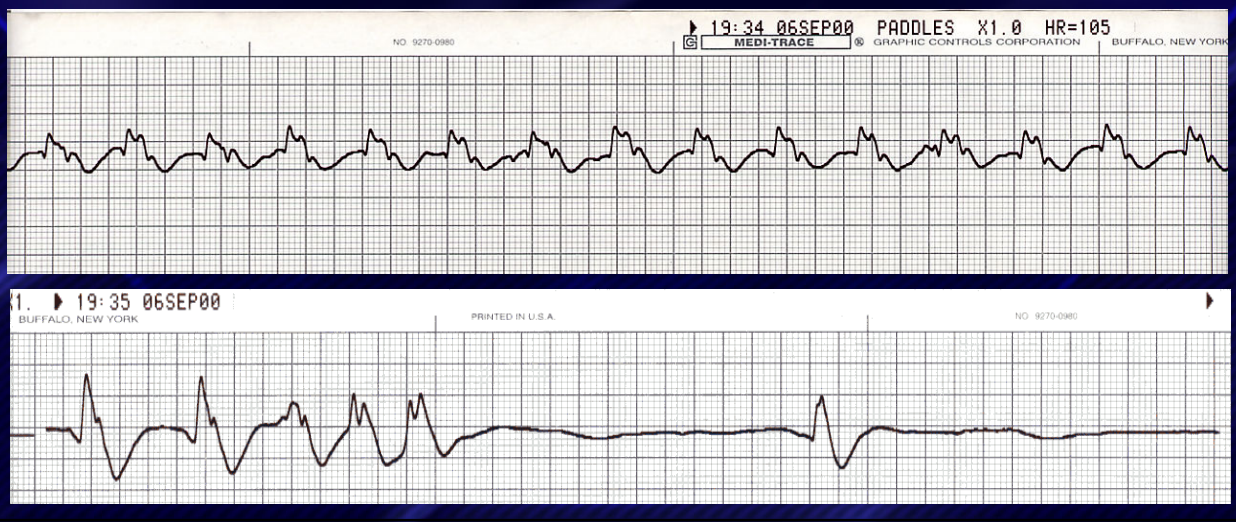
VT Mimics — Case 2



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VT Mimics — Case 3

- 86 yo. man presents c/o substernal chest pressure, diaphoresis, vomiting
  - ECG demonstrates junctional rhythm with RBBB (baseline) and acute inferior MI

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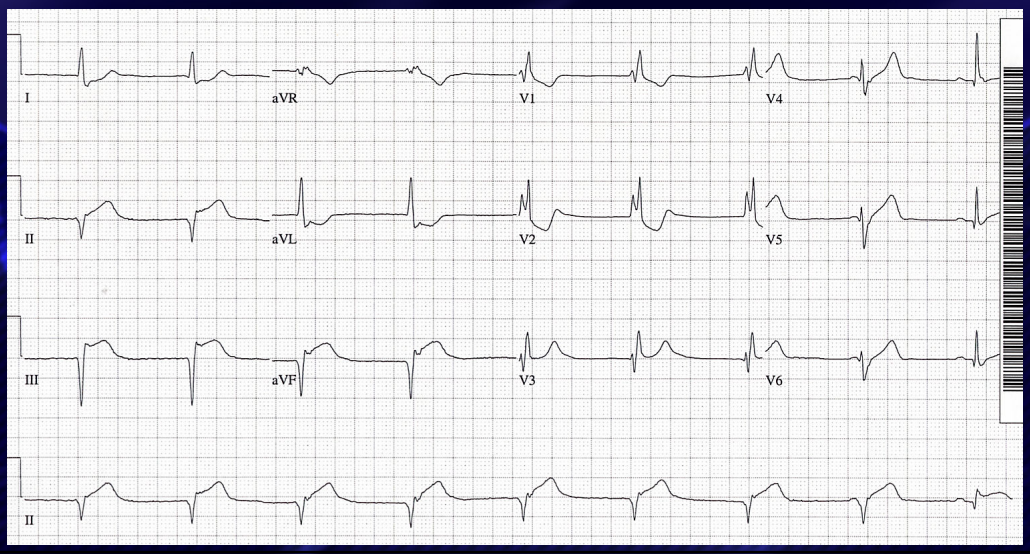
VT Mimics — Case 3



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VT Mimics — Case 3

- Receives atropine
  - Heart rate improves but ST elevation remains
- Thrombolytics are administered

50

VT Mimics — Case 3

- Receives atropine
  - Heart rate improves but ST elevation remains
- Thrombolytics are administered
- 90 min later the rhythm changes…

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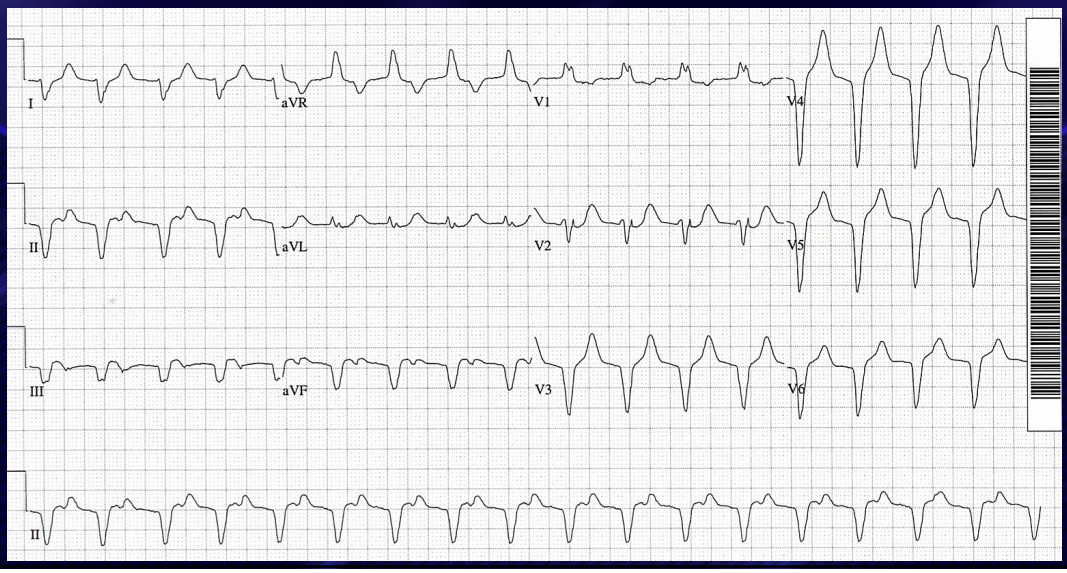
VT Mimics — Case 3



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VT Mimics — Case 3

- Patient receives bolus of amiodarone

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VT Mimics — Case 3

- Patient receives bolus of amiodarone
  - Immediately develops asystole
    - Treated with EPI, atropine, pacing
    - Attempts to resuscitate patient are unsuccessful

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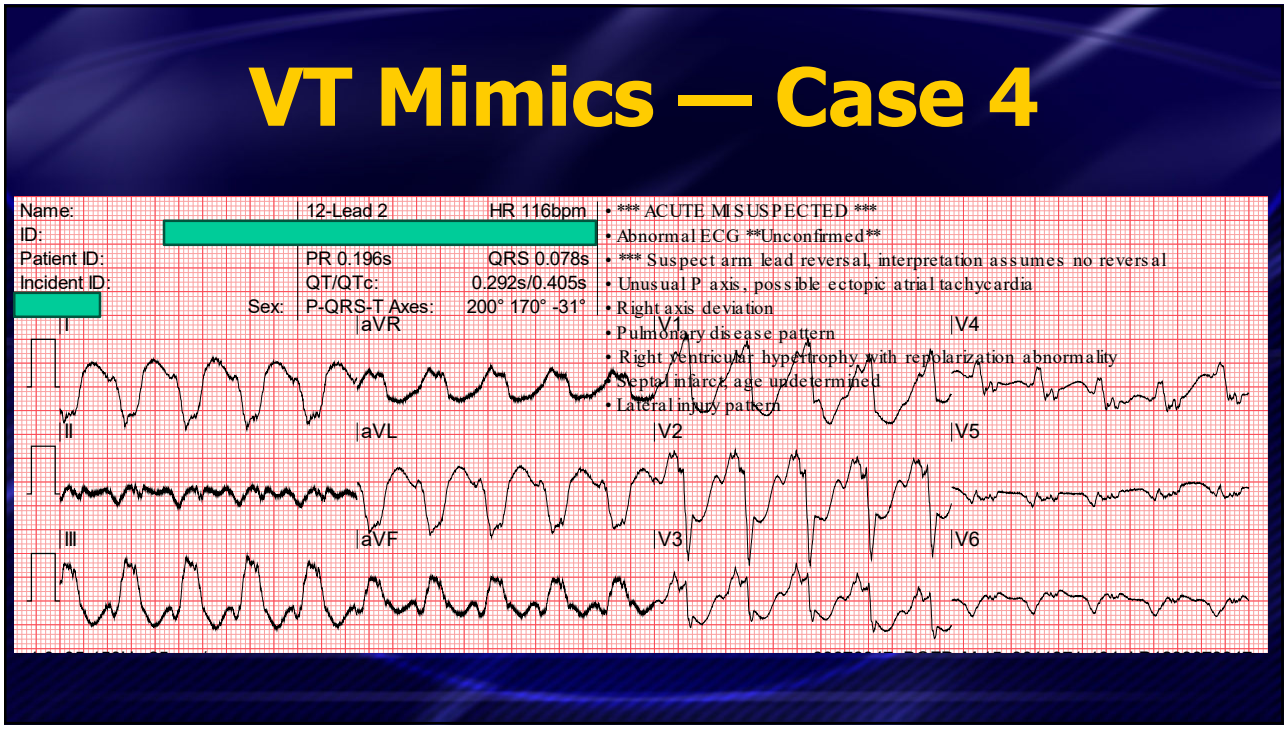
VT Mimics — Case 4



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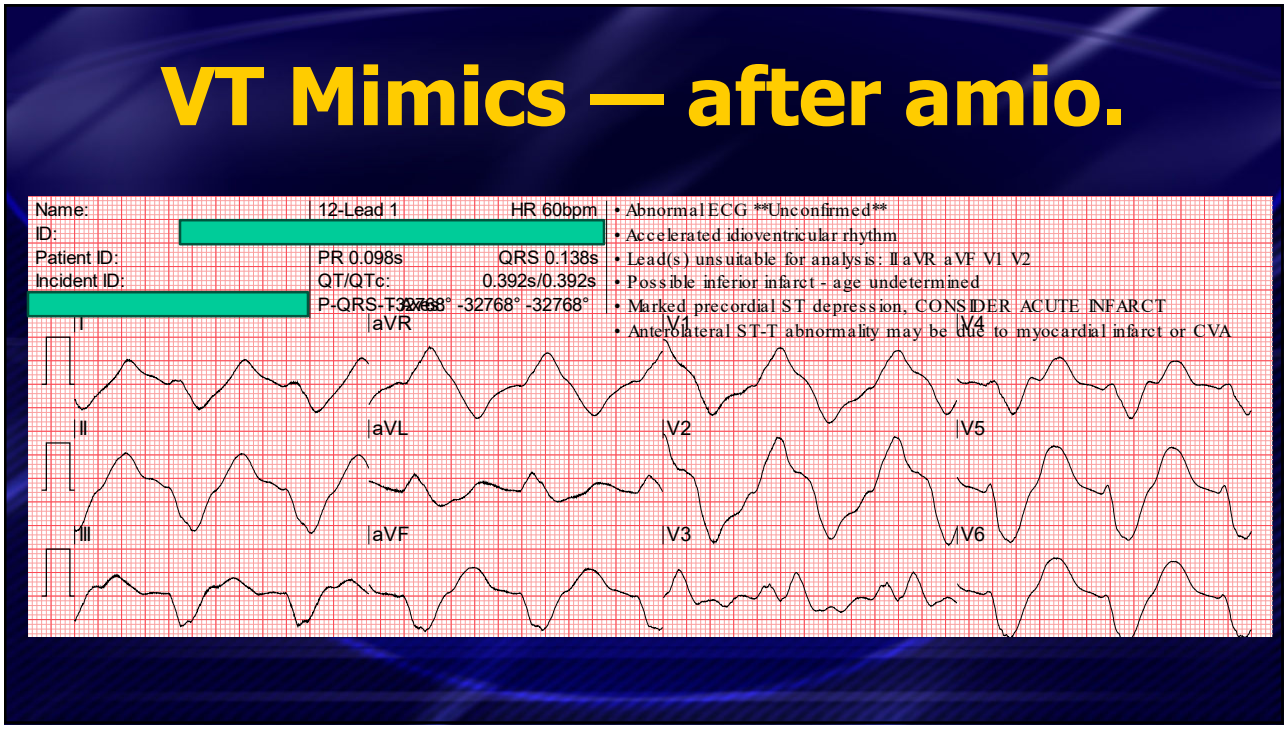
VT Mimics — after amio.



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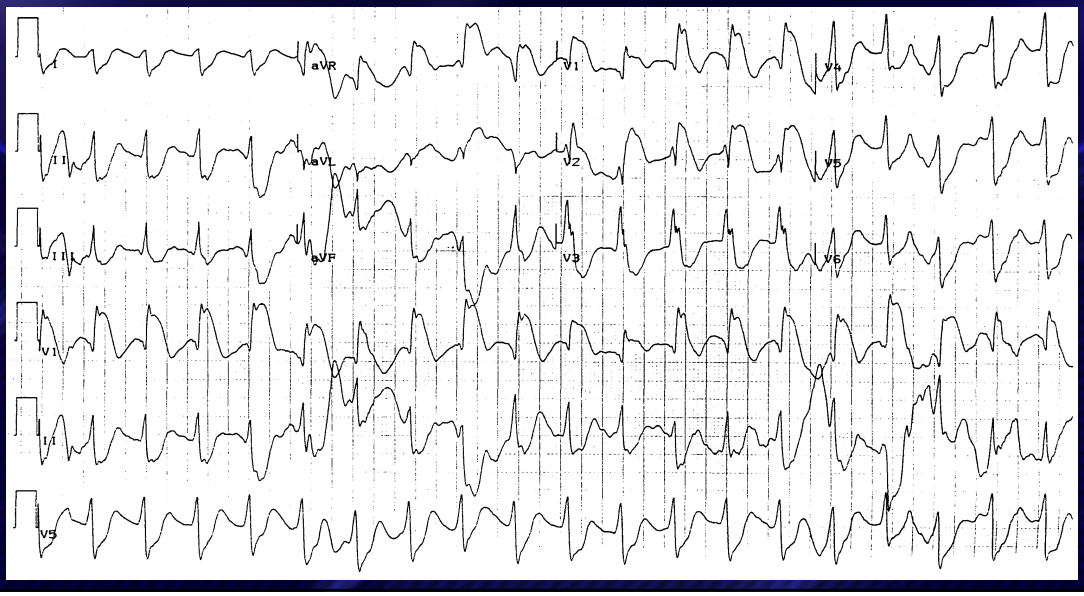
VT Mimics — Case 5



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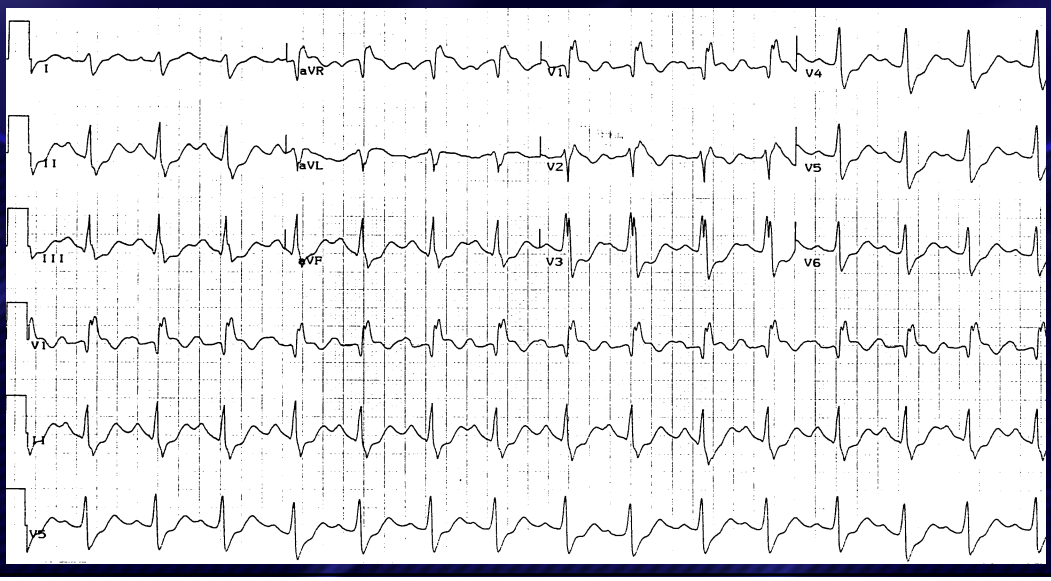
VT Mimics — after bicarb x 2



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VT Mimics — Summary

- Beware "slow VT"

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VT Mimics — Summary

- Beware "slow VT"
  - Consider hyperkalemia, TCA OD, AIVR, etc.
  - Avoid lidocaine and other antidysrhythmics

60

VT Mimics — Summary

- Beware "slow VT"
  - Consider hyperkalemia, TCA OD, AIVR, etc.
  - Avoid lidocaine and other antidysrhythmics
  - When in doubt try HCO_3 (and calcium)

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Outline

- VT mimics
- Prolonged QT issues
- Pericardial effusions

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Outline

- VT mimics
- Prolonged QT issues
- Pericardial effusions

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Prolonged QT

- One of the "can't miss" causes of syncope
- Perhaps a more common cause of syncope than previously recognized

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Prolonged QT

1. Hypokalemia (due to U-wave)
2. Hypomagnesemia
3. Hypocalcemia
4. Sodium-channel blockers (e.g. Type Ia anti-arrhythmics, TCAs, etc.)
5. Miscellaneous: elevated ICP, ACS, hypothermia, hereditary, etc.

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Prolonged QT

- QT-interval will vary based on rate
- Corrected QT-interval (QTc) based on Bazett formula: QTc = QT/√(RR)

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Prolonged QT

- QT-interval will vary based on rate
- Corrected QT-interval (QTc) based on Bazett formula: QTc = QT/√(RR)
- How long is too long?
  - Major risk occurs in patients when QTc ≥ 500 ms
  - Major concern → development of torsades de pointes

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Prolonged QT

- What do you do with a prolonged QT?
  - Search for and treat underlying cause
  - Congenital/idiopathic: beta-blockers
- Treatment of acquired torsades de pointes
  - Cardiovert/defibrillate
  - Magnesium bolus & infusion (with care!!)
  - ISO, EPI, overdrive pacing (goal HR 100-120)
  - Avoid amiodarone, procainamide, lidocaine!

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Prolonged QT – Case 1

- 56 yo. woman presents with severe nausea, vomiting, diarrhea after Chinese food
  - No abdominal pain
  - History of hypertension
    - Takes HCTZ
  - Exam: dehydrated but non-toxic
    - "Routine gastroenteritis"

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Prolonged QT – Case 1

- Started on IVF
- Antiemetic given
- Electrolytes ordered
- One hour after arrival patient found unresponsive in bed

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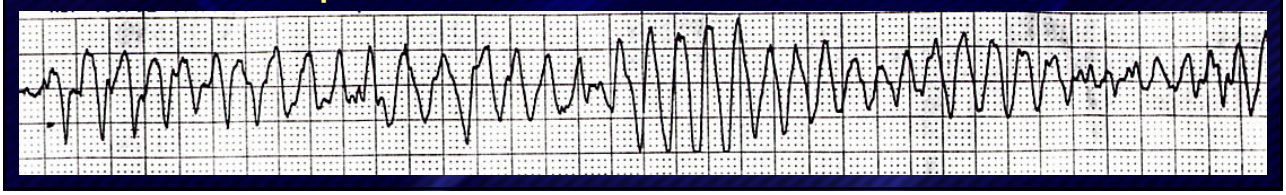
Prolonged QT – Case 1

- Started on IVF
- Antiemetic given
- Electrolytes ordered
- One hour after arrival patient found unresponsive in bed



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Prolonged QT – Case 1

- CPR, defibrillation → ROSC
- Subsequent ECG…

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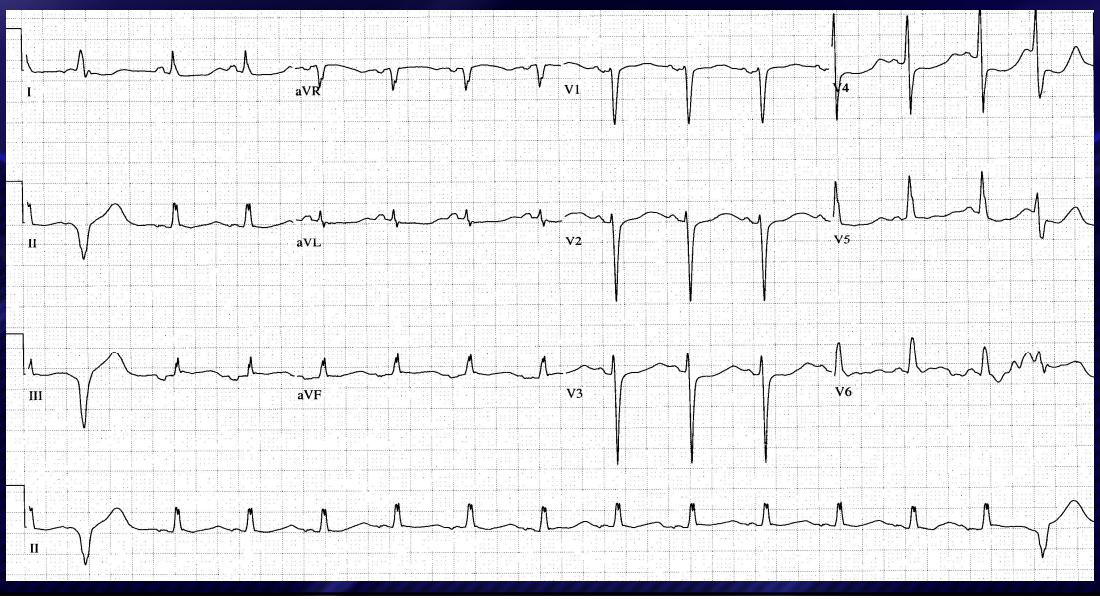
Prolonged QT – Case 1



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Prolonged QT – Case 1

- ECG: Prolonged QTc 645 ms, STD
  - Labs: Mg^{++} 1.0, K^{+} 2.2
  - QTc corrected after electrolytes corrected
- Cath normal
- Patient with residual hypoxic encephalopathy
- Would an initial ECG have warned of potential cardiac arrest?

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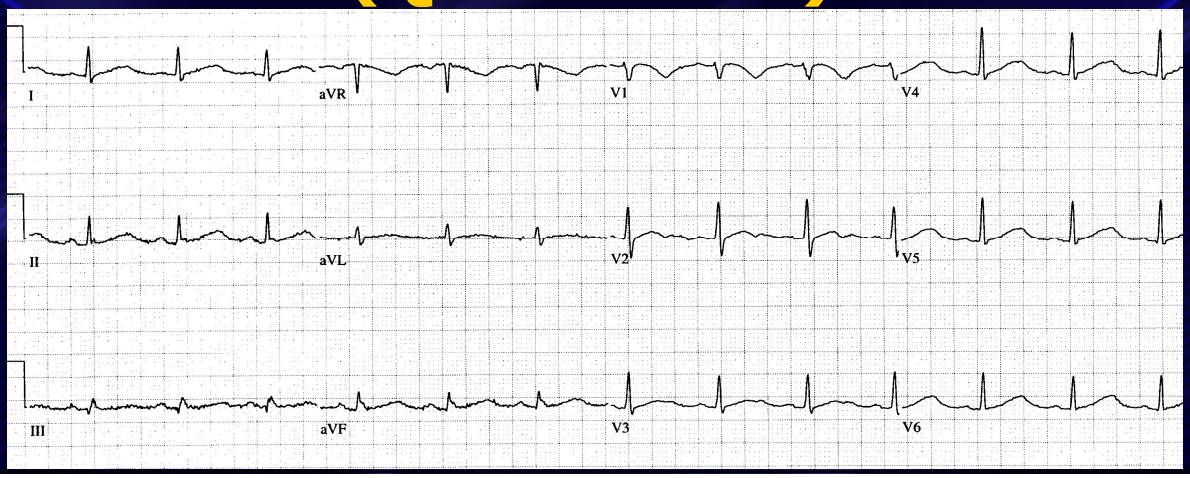
Prolonged QT – Case 2
51 yo. woman with A.G.E.
(QTc 652 ms)



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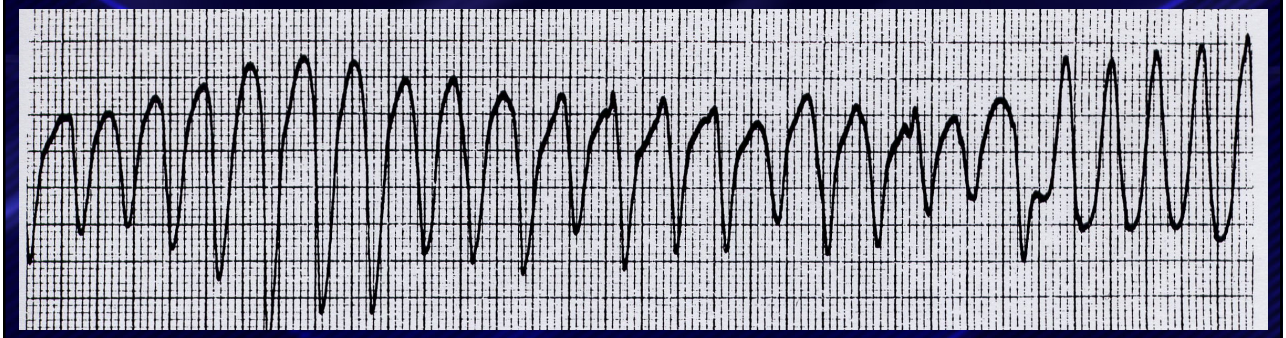
Prolonged QT – Case 2
51 yo. woman with A.G.E. (QTc 652 ms)



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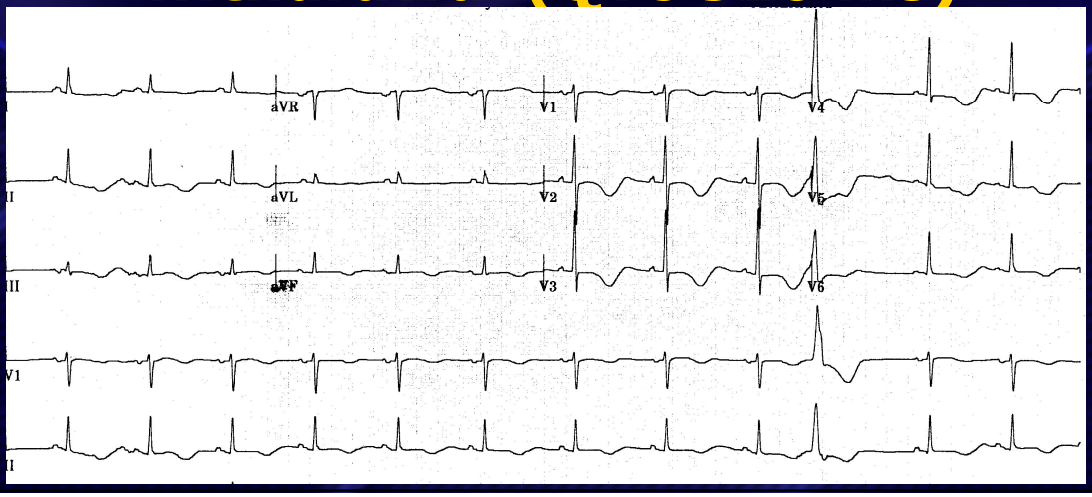
Prolonged QT – Case 3
42 yo. man with N/V from alcohol withdrawal (QTc 520 ms)



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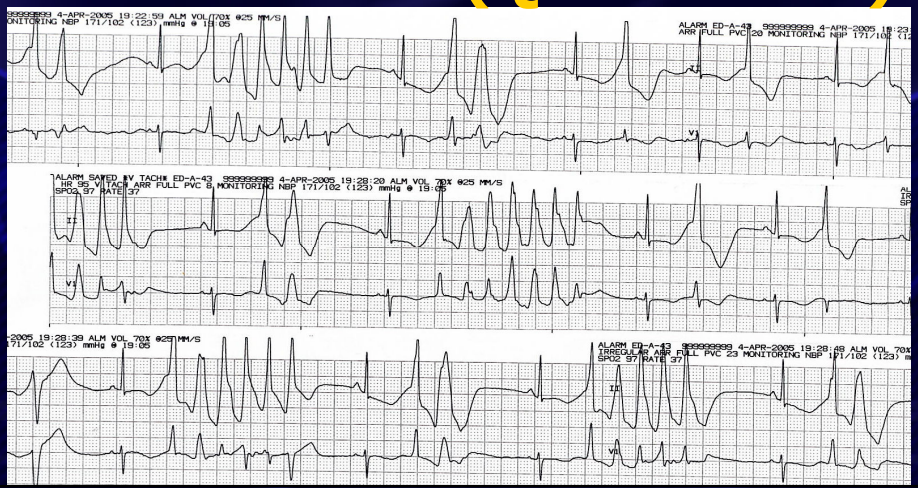
Prolonged QT – Case 3

42 yo. man with N/V from alcohol withdrawal (QTc 520 ms)



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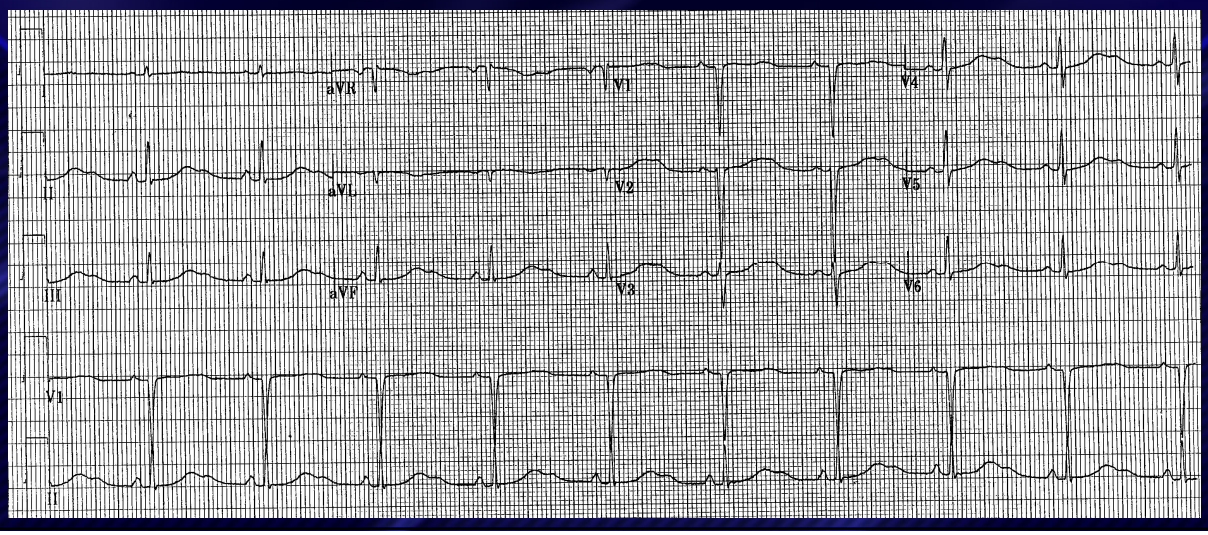
Prolonged QT – Case 4

39 yo W with A.G.E.



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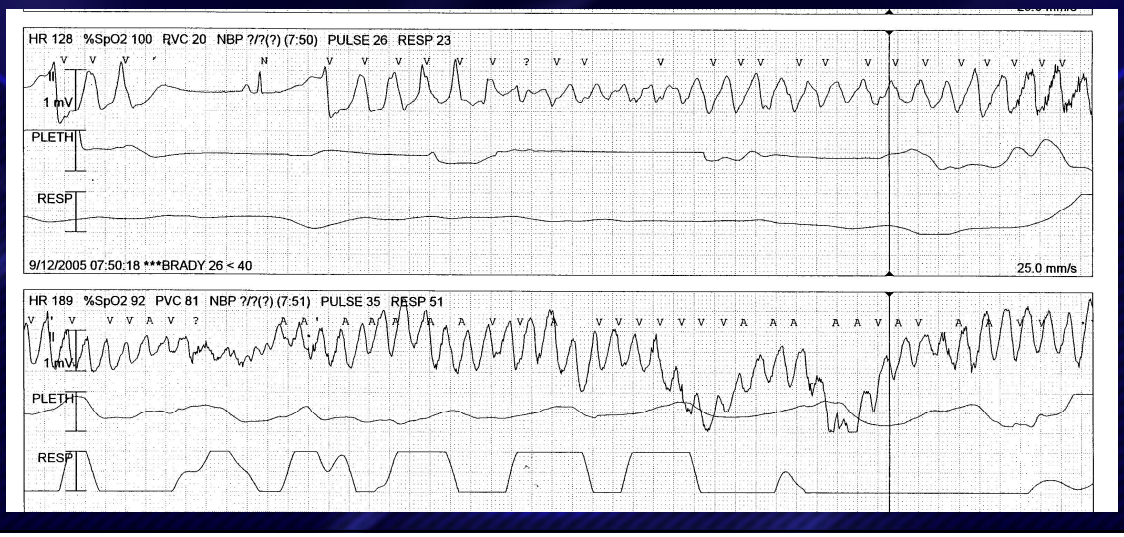
Prolonged QT – Case 4
39 yo W with A.G.E.



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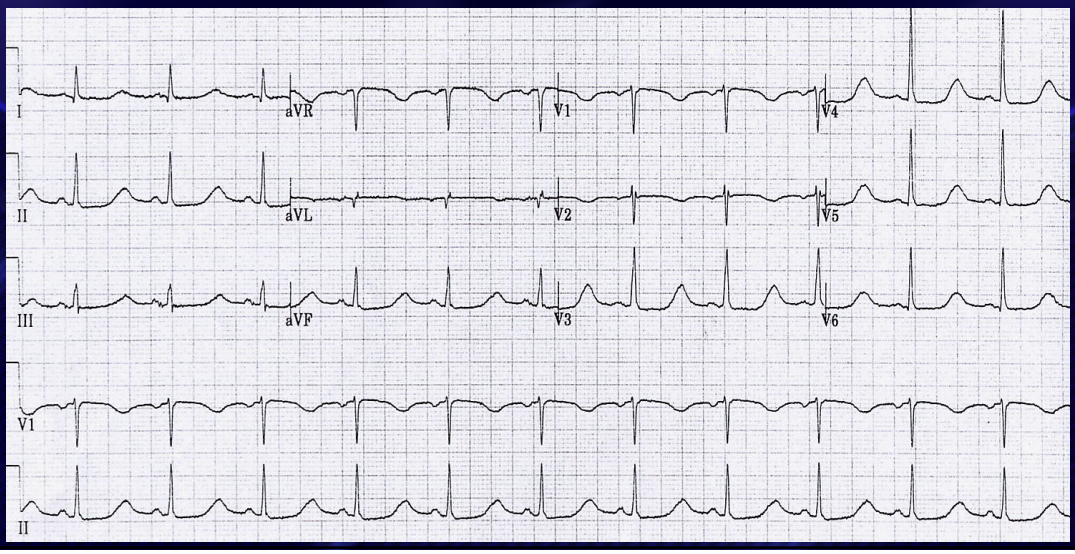
Prolonged QT – Case 5
What's the Dx?



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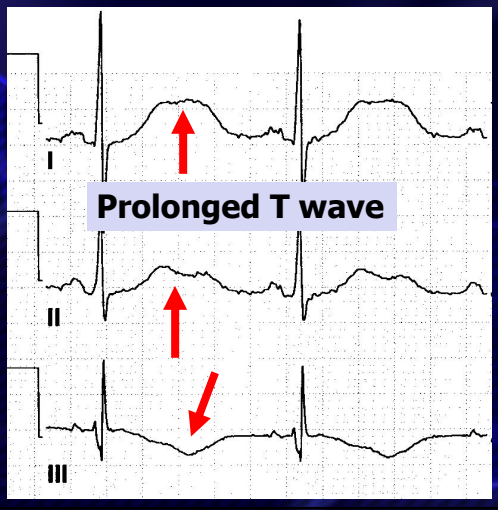
Prolonged QT

Most cases of long QT



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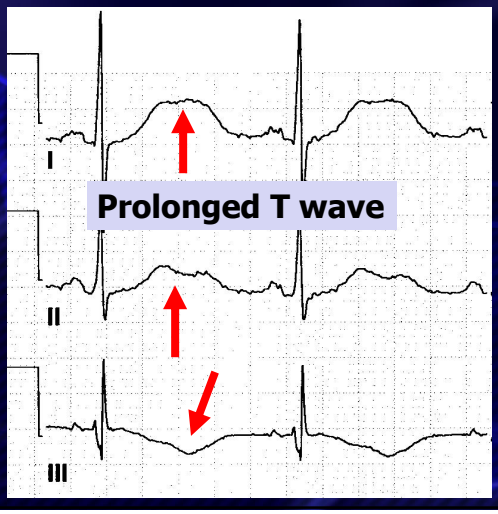
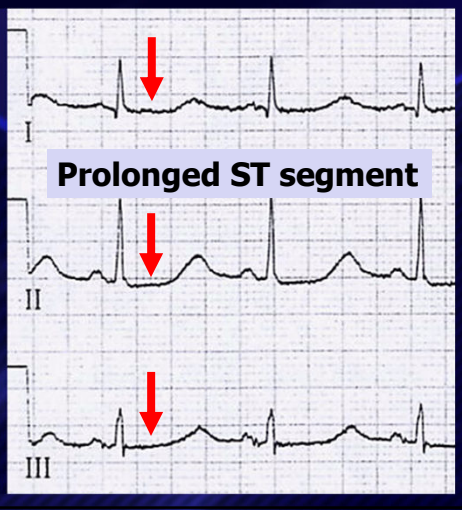
Prolonged QT

Most cases of long QT



This patient



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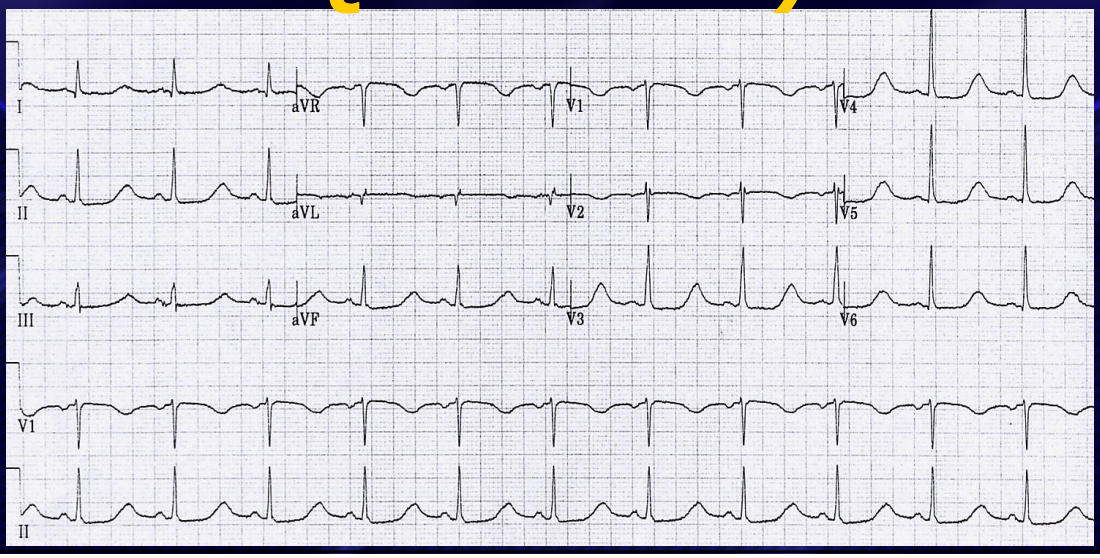
Causes of Prolonged QT

1. Hypokalemia (due to U-wave)
2. Hypomagnesemia
3. Hypocalcemia
4. Sodium-channel blockers (e.g. Type Ia anti-arrhythmics, TCAs, etc.)
5. Miscellaneous: elevated ICP, hypothermia, hereditary, etc.

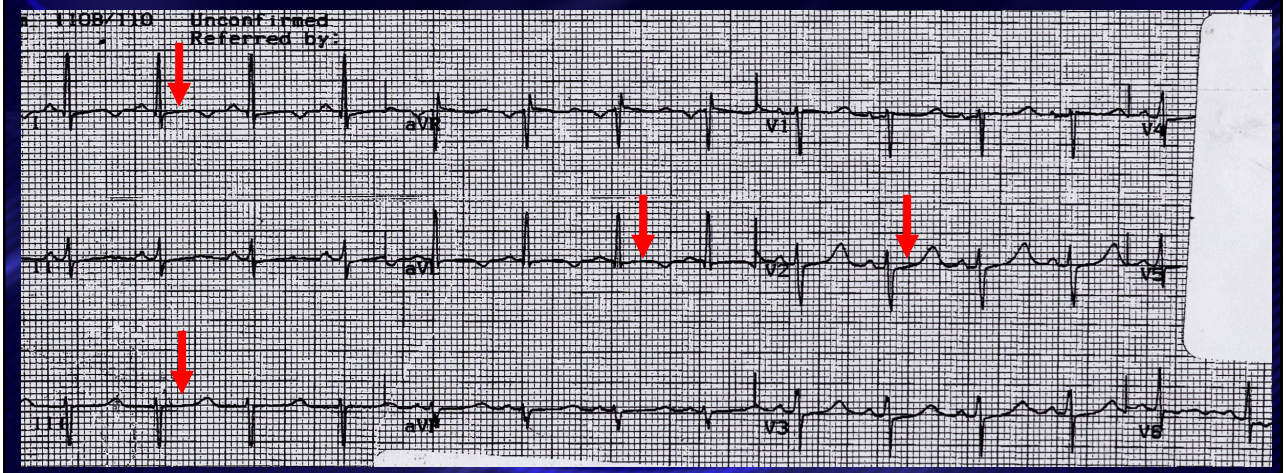
85

Hypocalcemia (Ca 4.7 mg/dL, QTc 653 ms)



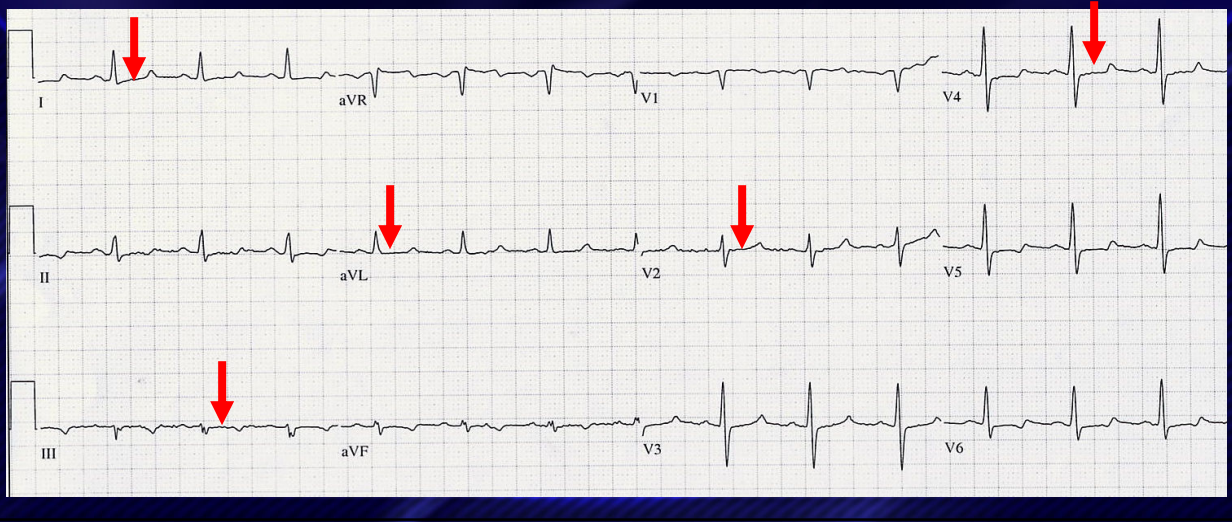
86

Hypocalcemia (Ca 5.5 mg/dL)



87

Hypocalcemia (Ca 5.8 mg/dL, QTc 549 ms)

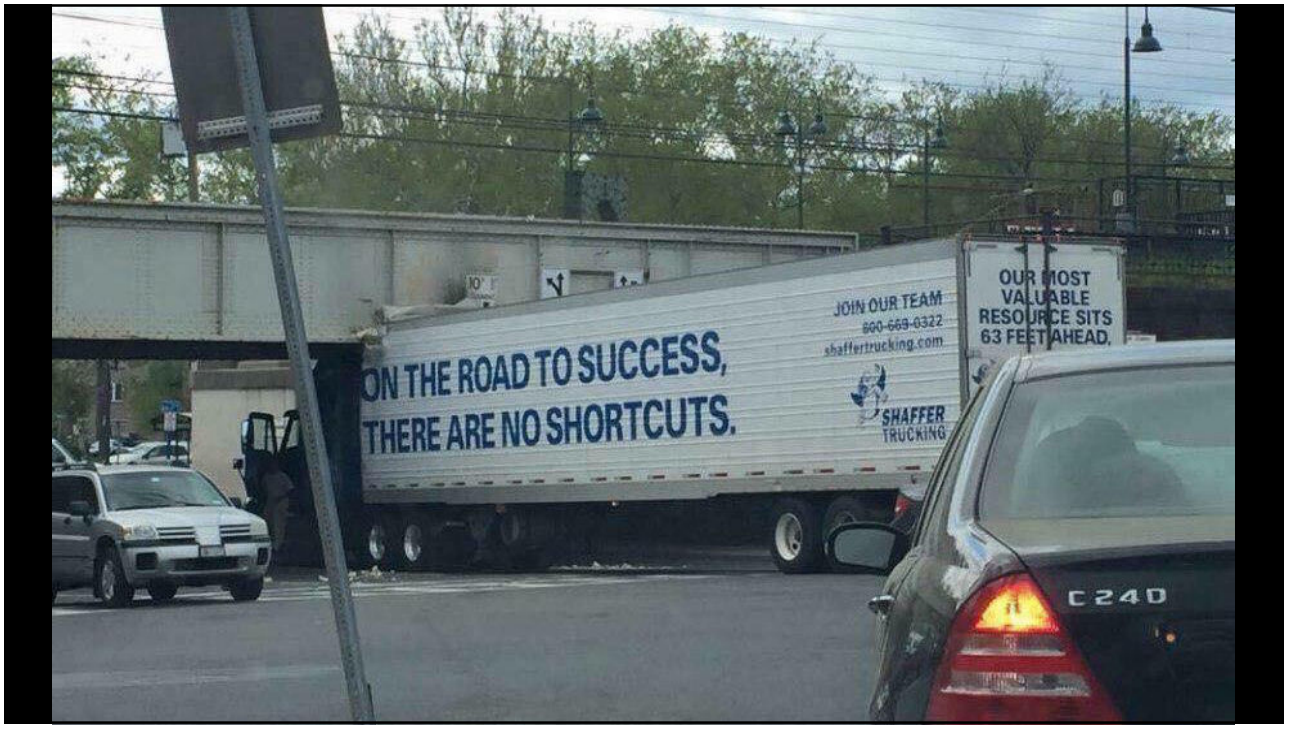


88

Prolonged QT Issues

- If you are <u>really</u> worried about someone's lytes, check their QT while waiting on labs!
  - If QTc ≥ 500 ms, monitor and correct the cause the whenever possible
- Magnesium is not always the cure
- If prolonged ST segment → hypocalcemia

89



90

Outline

- VT Mimics
- Prolonged QT issues
- Pericardial effusions

91

Outline

- VT Mimics
- Prolonged QT issues
- Pericardial effusions

92

Pericardial Effusions

- Classic teaching
  - Electrical alternans
    - Present in < 30% of patients
  - Tachycardia
    - May be blunted in patients taking cardiac meds.
  - Low voltage
  - Cardiomegaly on CXR
    - Sensitive but non-specific

93

Pericardial Effusions

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  - Electrical alternans
    - Present in < 30% of patients
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    - May be blunted in patients taking cardiac meds.
  - Low voltage
  - Cardiomegaly on CXR
    - Sensitive but non-specific

94

Pericardial Effusions

- Classic teaching
  - Electrical alternans
    - Present in < 30% of patients
  - **Tachycardia**
    - May be blunted in patients taking cardiac meds.
  - **Low voltage**
  - Cardiomegaly on CXR
    - Sensitive but non-specific

95

Pericardial Effusions

- Low voltage
  - QRS amplitude in leads I + II + III < 15 mm or in leads $V_1 + V_2 + V_3 < 30$ mm

96

Pericardial Effusions

- Low voltage
  - QRS amplitude in leads I + II + III < 15 mm or in leads $V_1 + V_2 + V_3 < 30$ mm
  - DDx
    - Large pericardial effusions or pleural effusions
    - Obesity, COPD
    - Severe hypothyroidism, end-stage CMPY
    - Infiltrative diseases

97

Pericardial Effusions

- Always consider the diagnosis in a patient with LV + tachycardia
  - Especially if the LV is *new*

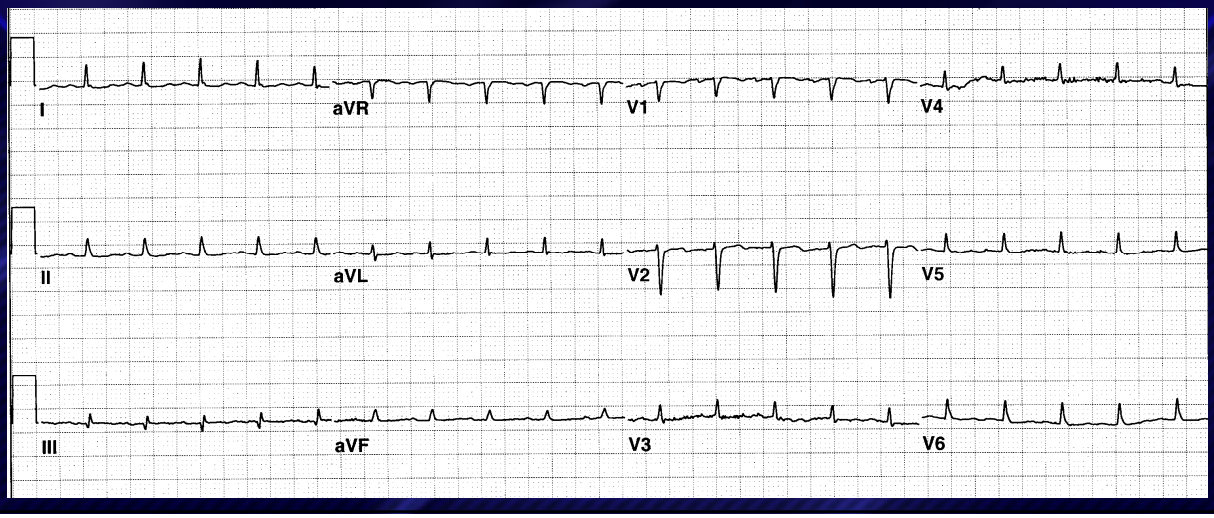
98

Pericardial Effusion — Case 1

- 54 yo. woman presents c/o chest pressure and dyspnea
  - History of breast CA
  - RR 30, HR 123, pulse oximetry 94%
  - Preliminary impression — pulmonary embolism
    - Heparin is initiated
  - ECG…

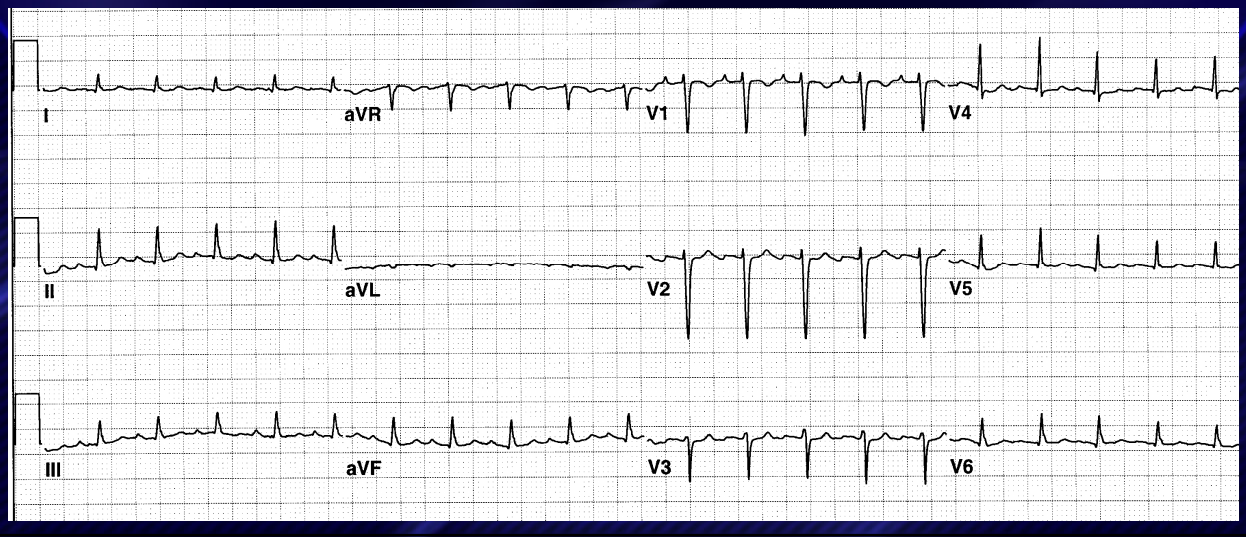
99

Pericardial Effusion — Case 1



100

Baseline ECG



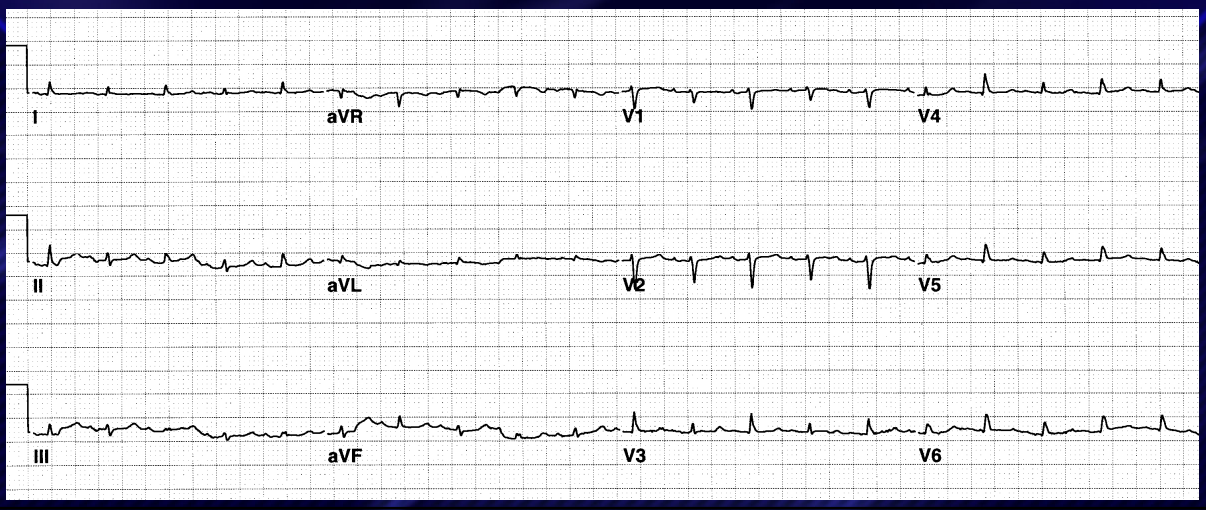
101

Pericardial Effusion — Case 1

- While awaiting CT of chest, patient develops hypotension and diaphoresis
- Repeat ECG…

102

Pericardial Effusion — Case 1



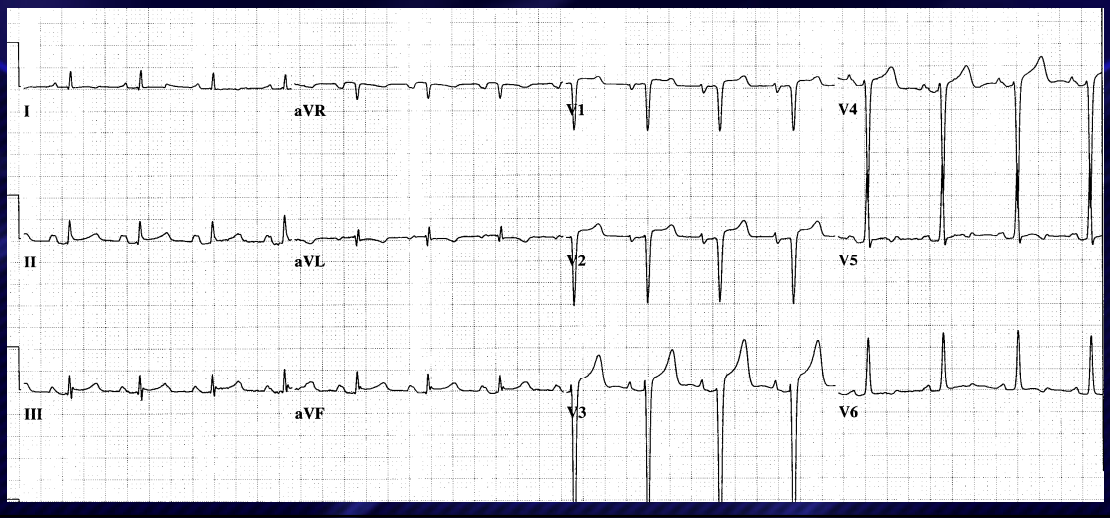
103

Pericardial Effusion — Case 2

- 66 yo. man presents c/o SOB for several days
  - History of MI with cardiac arrest, tobacco use, ESRD
  - HR 100, RR 24, BP 187/85
  - JVD, rales
  - CXR shows massive cardiomegaly (new?)
  - ECG…

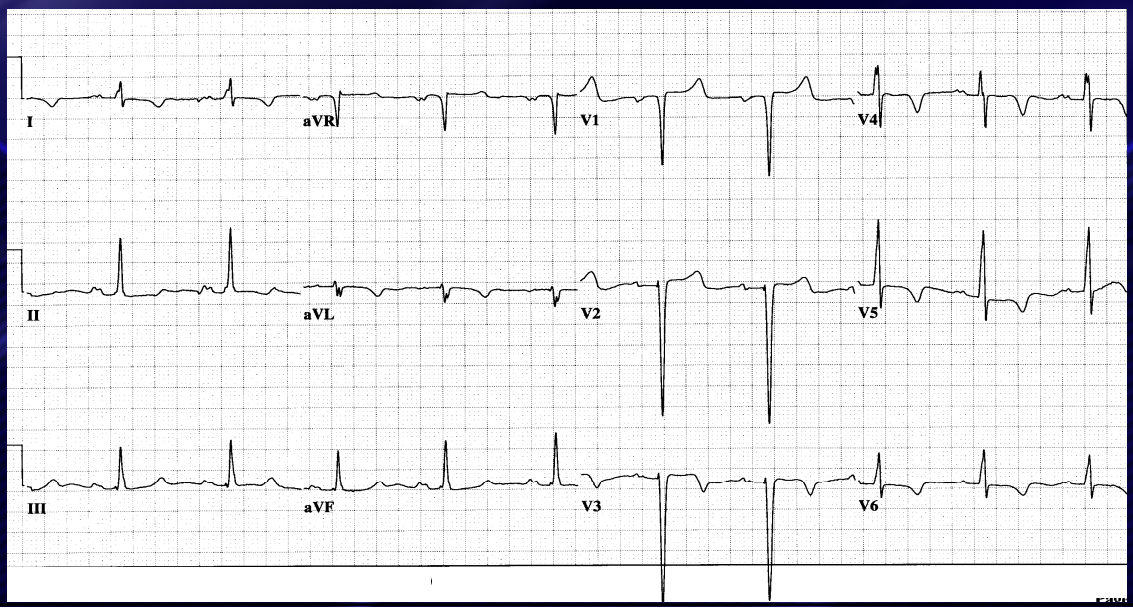
104

Pericardial Effusion — Case 2



105

Baseline ECG



106

Pericardial Effusion — Case 2

- ECG interpreted as showing "± STE in inferior leads and pseudonormalization in lateral leads"

107

Pericardial Effusion — Case 2

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- Patient treated with ASA, heparin

108

Pericardial Effusion — Case 2

- ECG interpreted as showing "± STE in inferior leads and pseudonormalization in lateral leads"
- Patient treated with ASA, heparin
  - Admitting team obtains ECHO to evaluate CMG

109

Pericardial Effusion — Case 2

- ECG interpreted as showing "± STE in inferior leads and pseudonormalization in lateral leads"
- Patient treated with ASA, heparin
  - Admitting team obtains ECHO to evaluate CMG
    → Diagnosed with "near-tamponade"

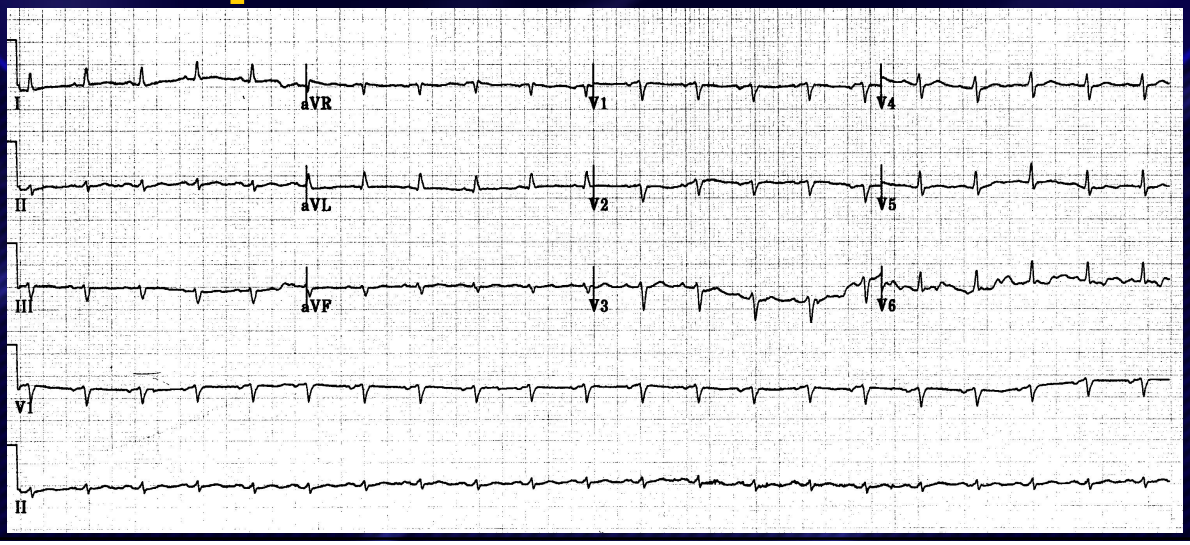
110

Pericardial Effusion — Case 2

- ECG interpreted as showing "± STE in inferior leads and pseudonormalization in lateral leads"
- Patient treated with ASA, heparin
  - Admitting team obtains ECHO to evaluate CMG → Diagnosed with "near-tamponade"
  - Heparin D/C'd, sent for urgent surgery

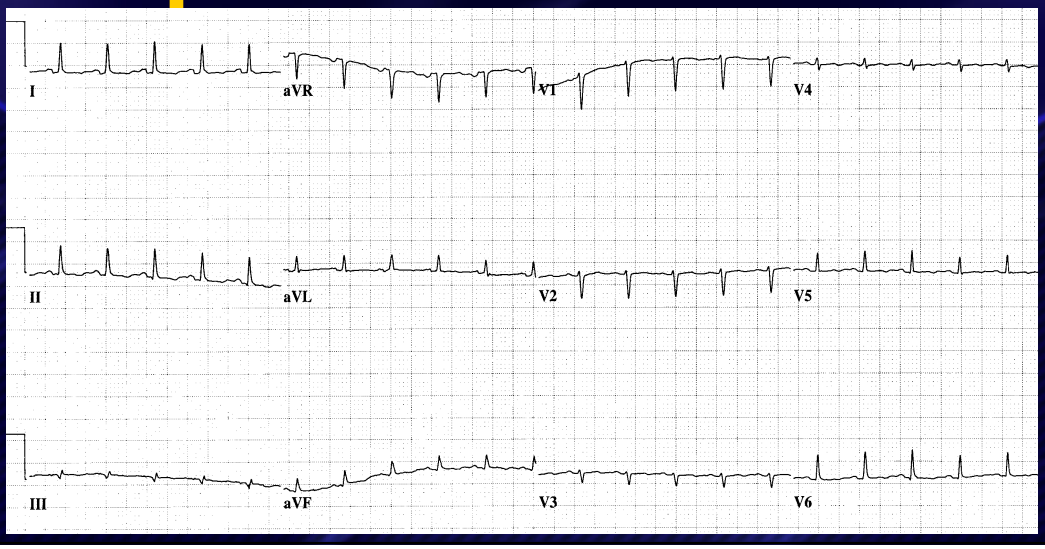
111

63 yo. man with prostate CA presents with SOB



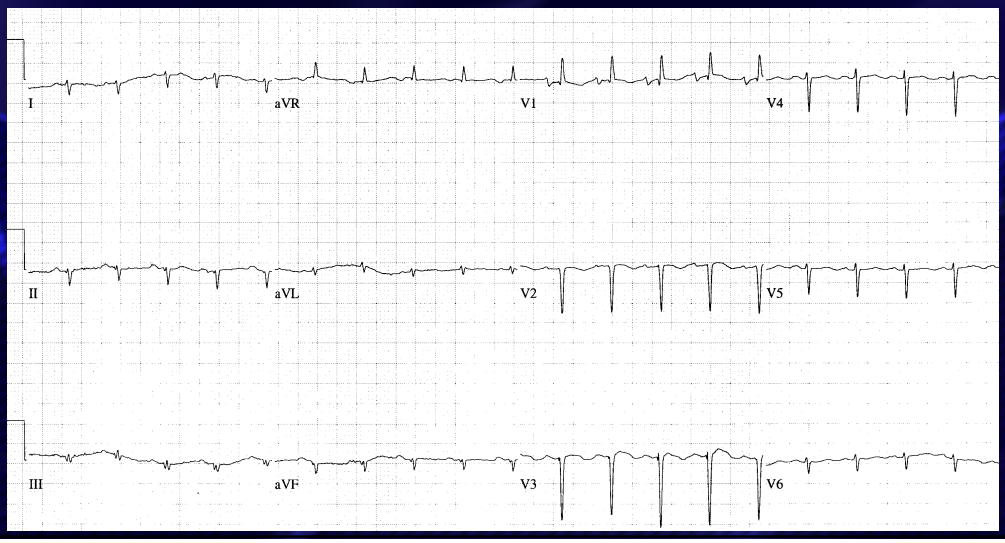
112

46 yo. woman with breast CA presents with SOB



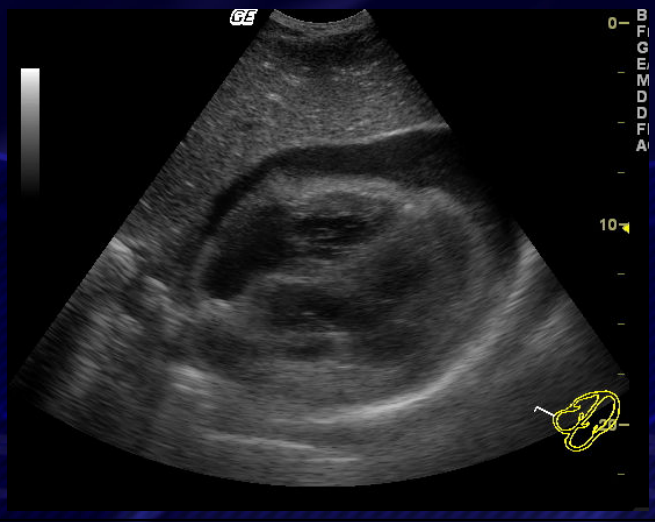
113

36 yo. man IVDA presents with fevers and SOB



114

36 yo. man IVDA presents with fevers and SOB



115

Pericardial Effusions

- Always consider the diagnosis in a patient with LV + tachycardia
  - *Especially if the LV is new*
- Large pericardial effusions often present like PE or STEMI

116

117

Review of Original Cases

- Case 1 — VT Mimics
- Case 2 — Prolonged QT issues
- Case 3 — Pericardial effusions

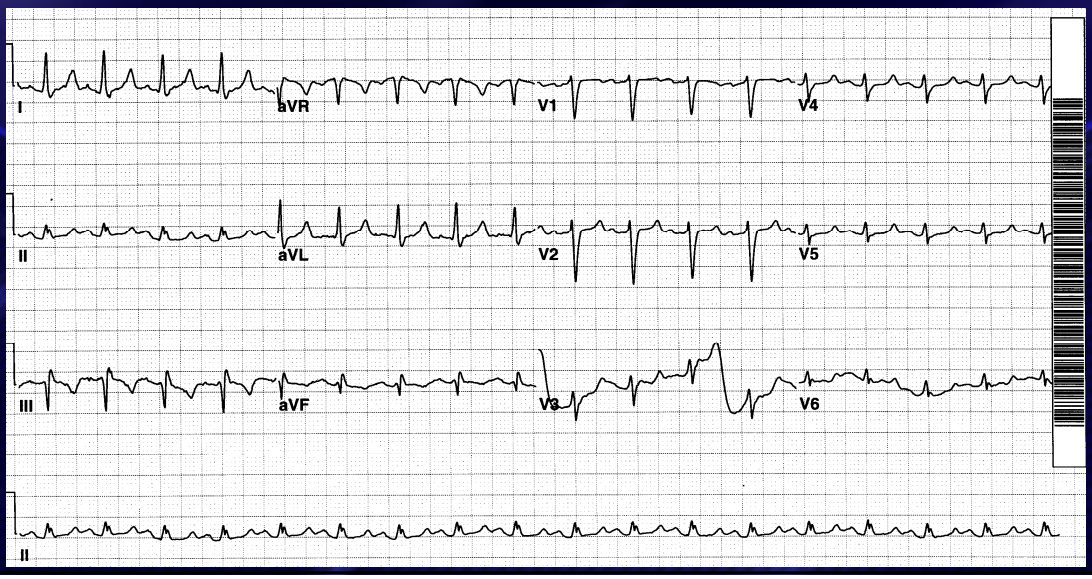
118

Case 1

- 42 yo. man presents c/o fever, cough, dyspnea, vomiting
  - History of liver CA
  - Appears toxic, severely dehydrated
  - Exam — febrile (102º F), tachycardia, tachypnea, hypoxia (pulse oximetry 84%)
  - CXR shows multilobar pneumonia
  - ECG…

119

Case 1

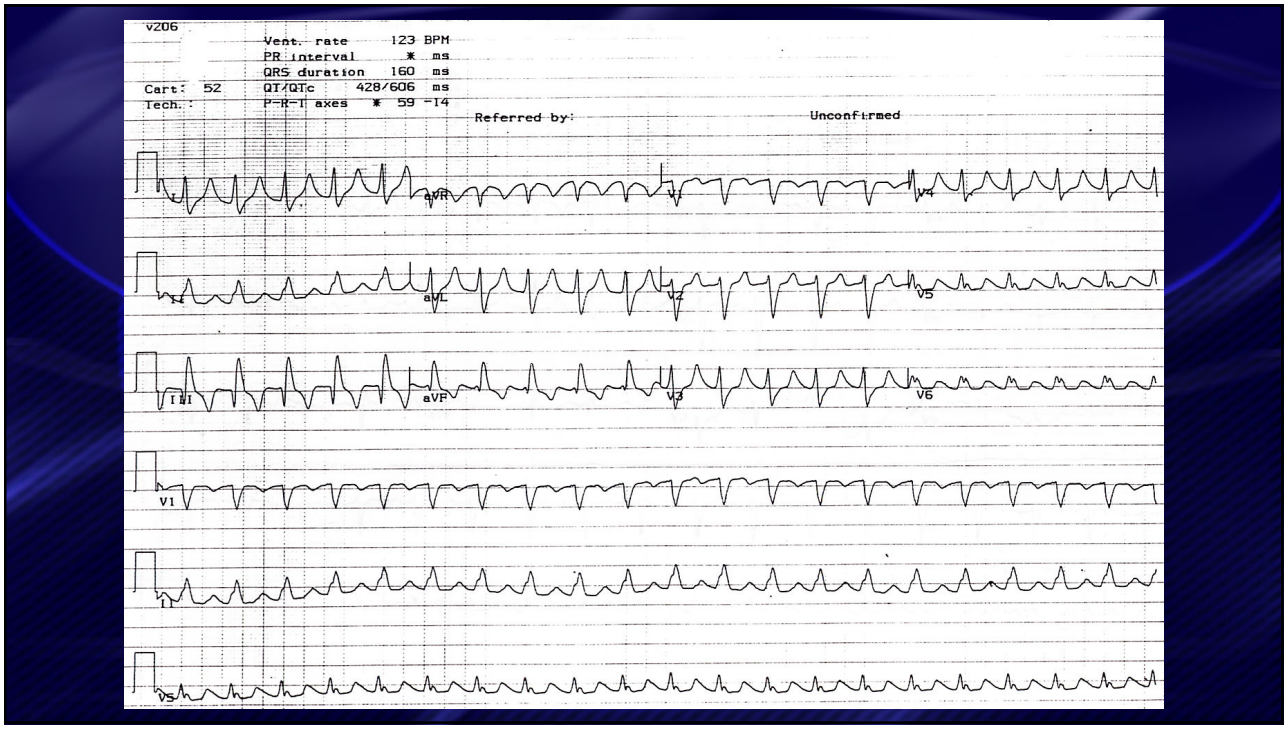


120

Case 1

- Patient appears to be worsening
  - Becoming lethargic
  - Pulse oximetry 93% on NRB mask
  - Rapid sequence intubation
- Monitor shows change in rhythm; ECG…

121

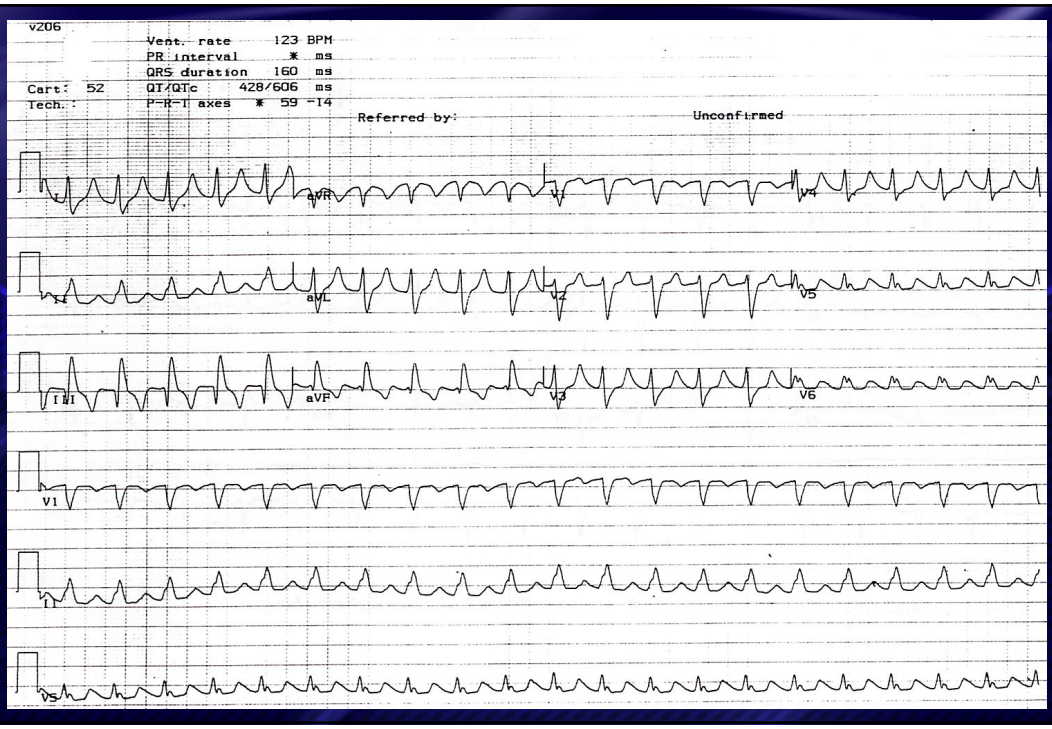


122

Case 1

- ECG shows regular wide-complex tachycardia
  - Interpreted as ventricular tachycardia
- Patient is treated with lidocaine
  - Develops asystole after bolus

123



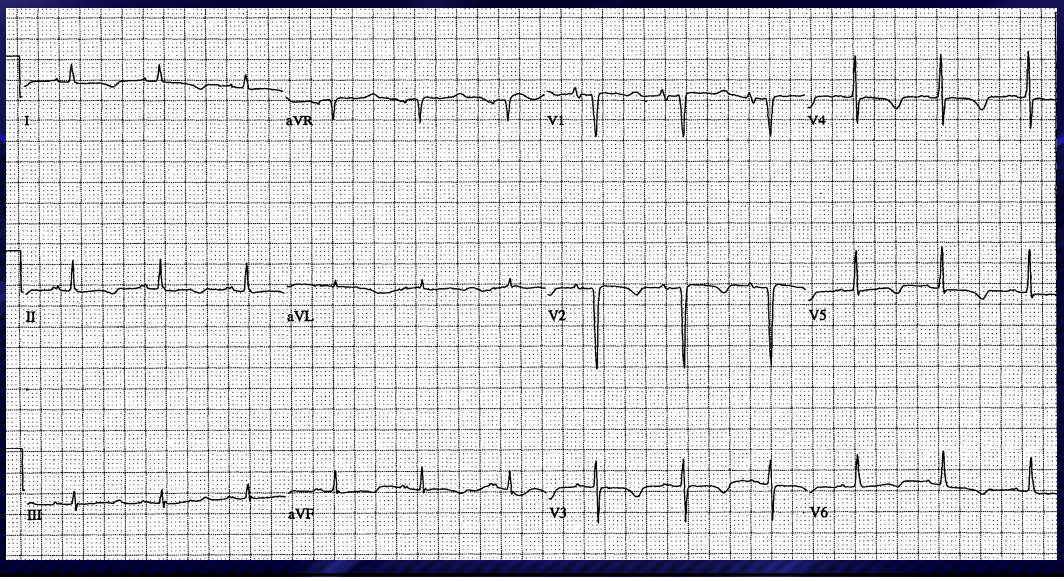
124

Case 2

- 46 yo W presents after two syncopal episodes associated with palpitations
  - ECG…

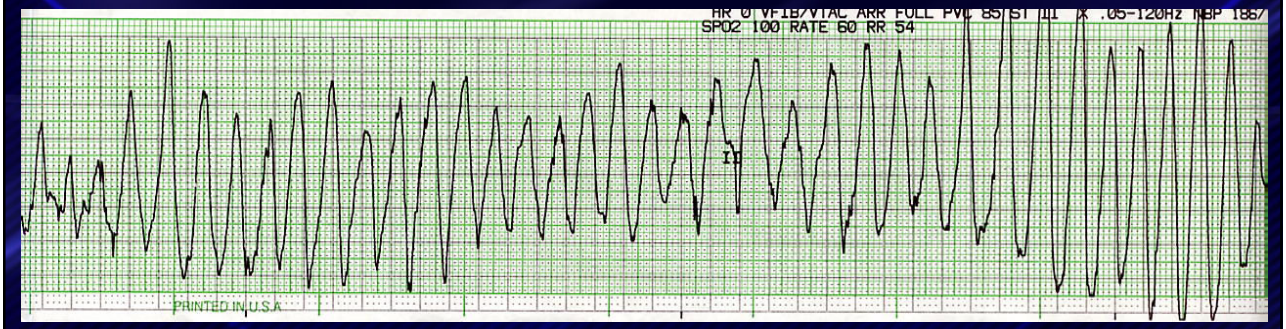
125

Case 2



126

Case 2



Intermittent episodes of polymorphic VT

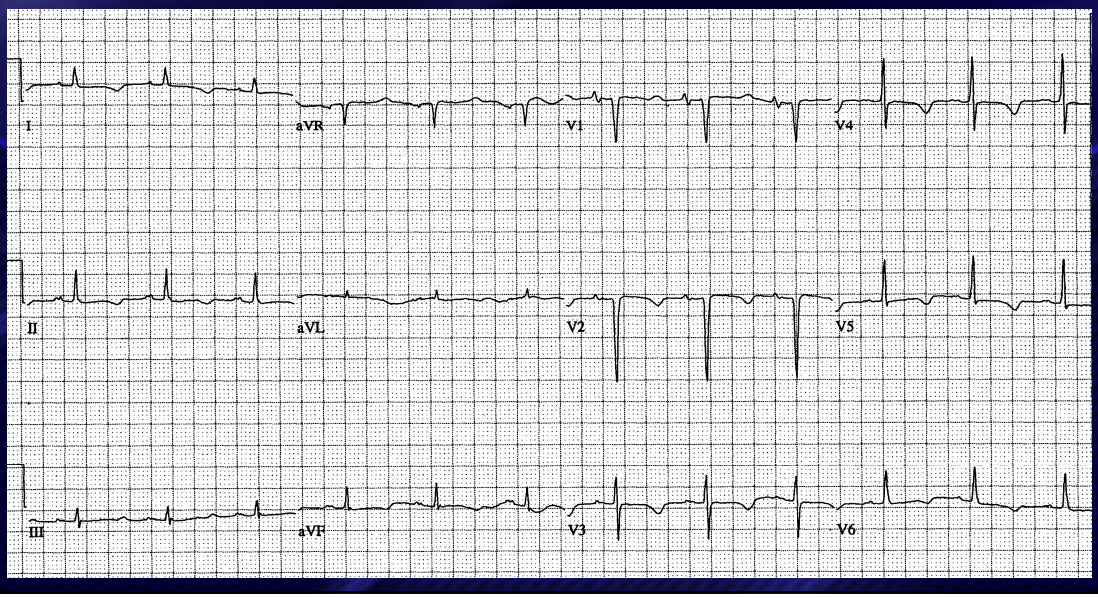
127

Case 2

- Magnesium bolus 2 gms slow IVP…repeated x 2
- Episodes of PVT continue but now patient is hypotensive, nauseous, and diaphoretic between the episodes as well

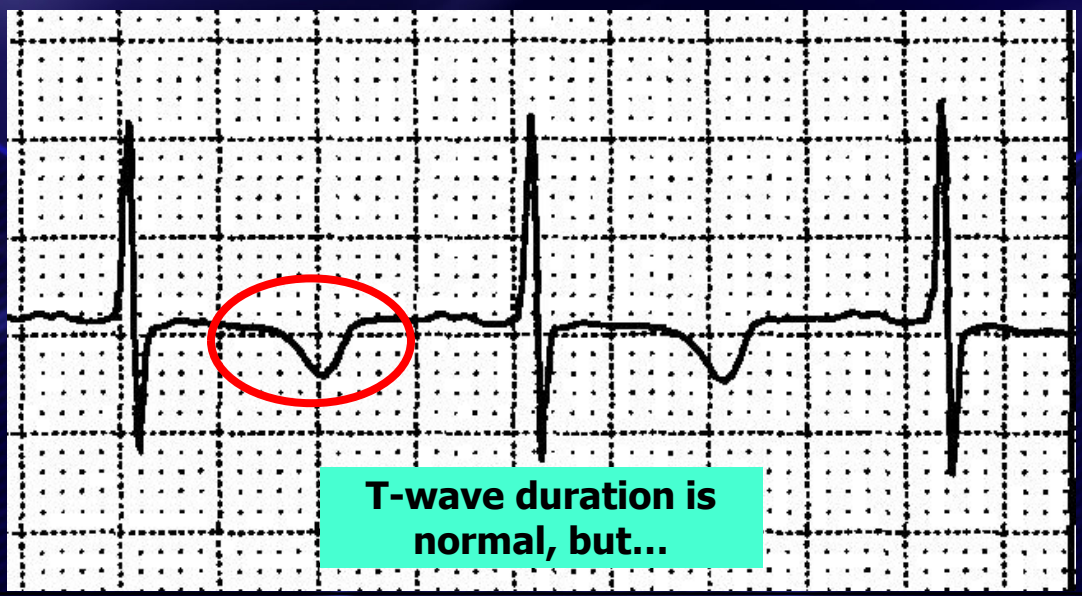
128

Prolonged QT due to…



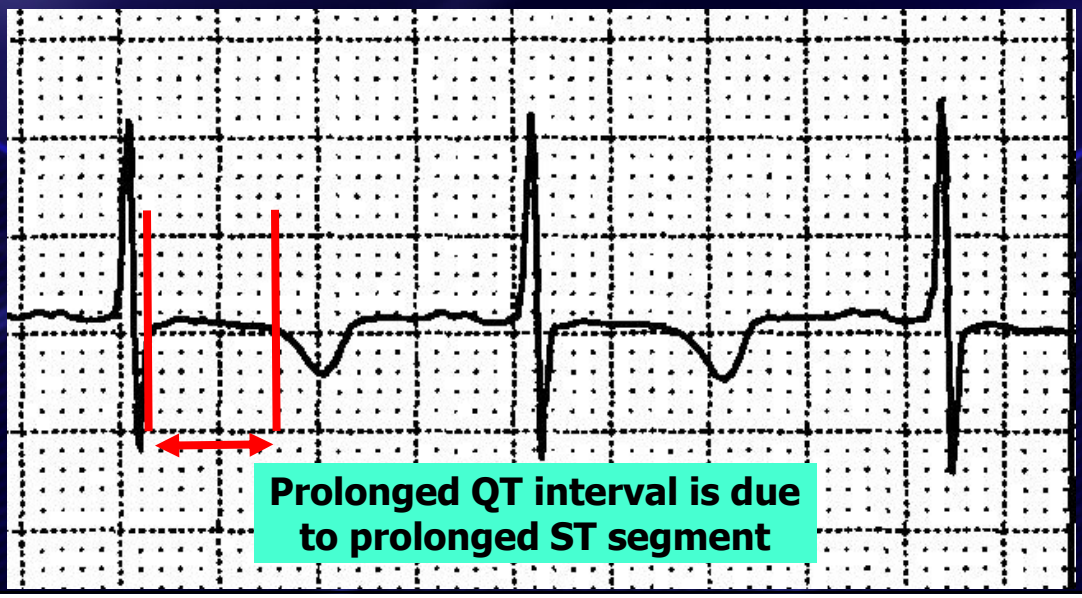
129

Prolonged QT due to…



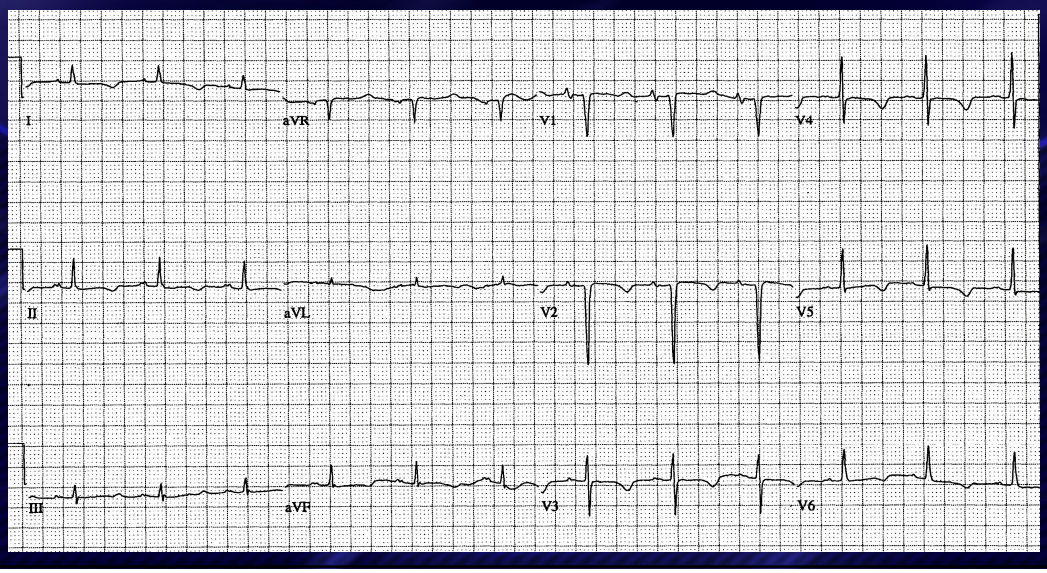
130

Prolonged QT due to…



131

Hypocalcemia (Ca 5.0 mg/dL)

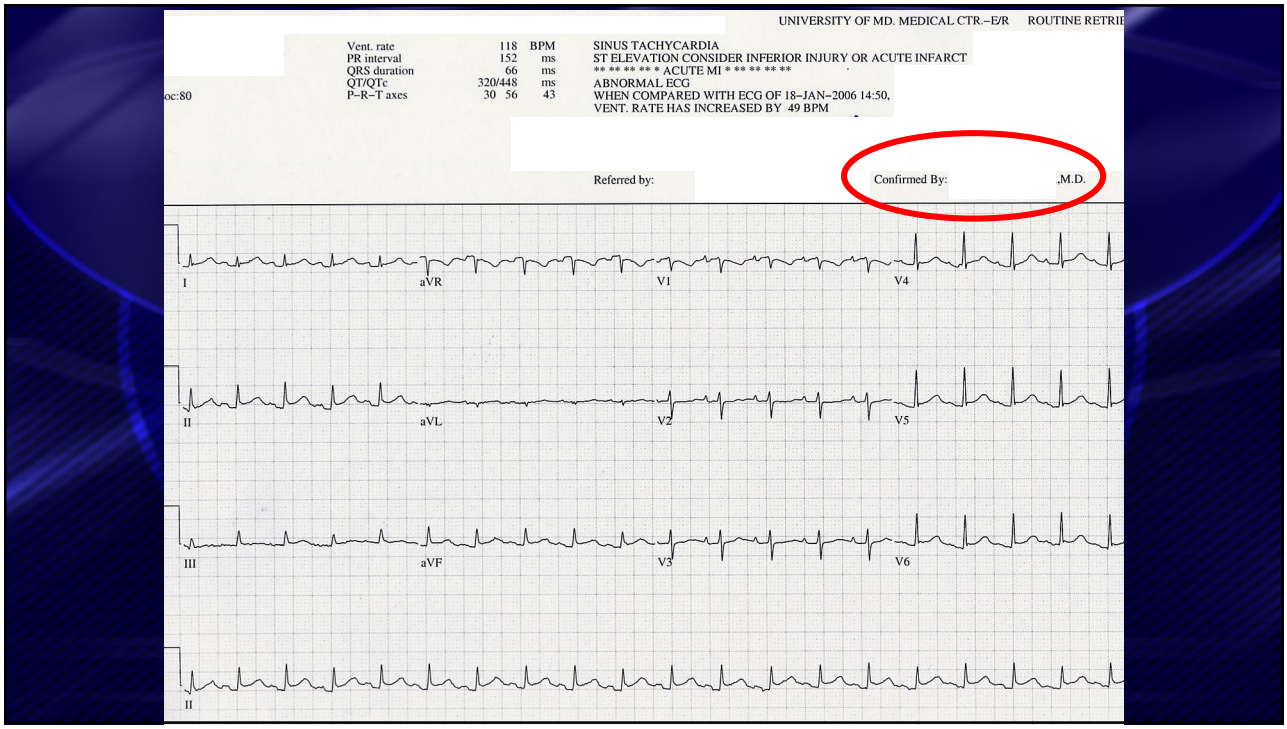


132

Case 3

- 55 yo. W with hx/o htn, DM, 1 ppd smoker
  - Presented with SOB and chest heaviness

133



134

Case 3

- Cath lab activation → cardiology concurs, rec's…
  - Aspirin
  - Clopidogrel
  - Heparin bolus
  - Send upstairs in 10 minutes

135

Case 3

- All medications given, patient transported upstairs to cath lab
- Procedure begins…

136

Case 3

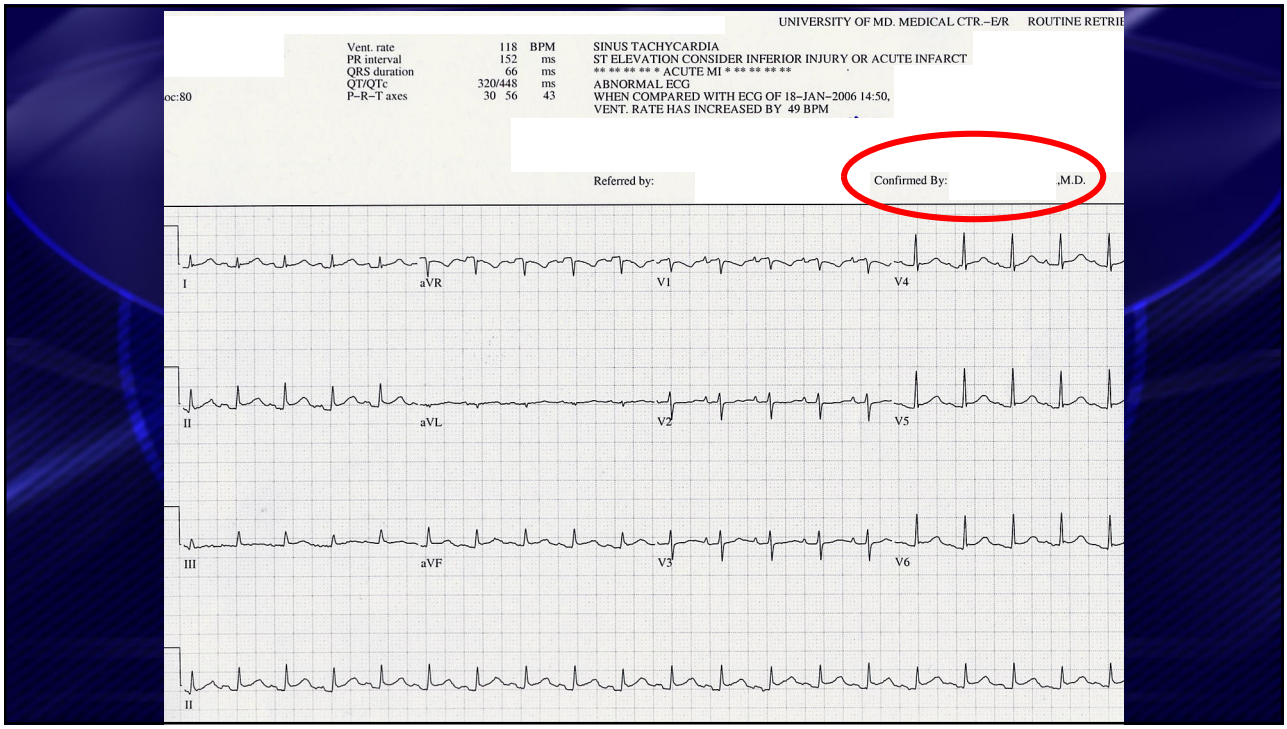
- All medications given, patient transported upstairs to cath lab
- Procedure begins…10 minutes later patient has a brady-asystolic arrest

137

Case 3

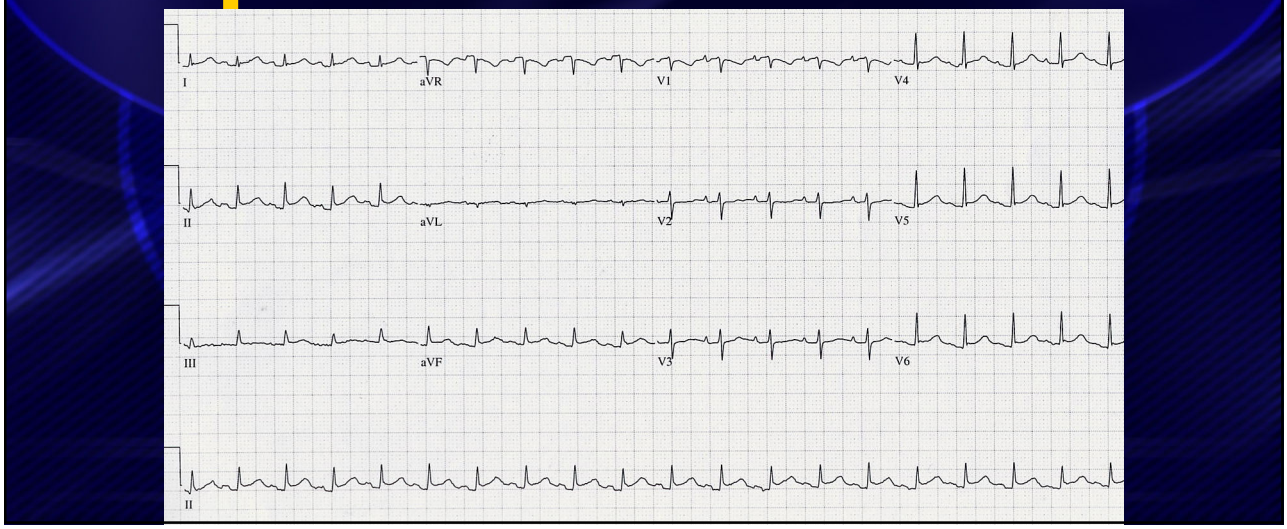
- All medications given, patient transported upstairs to cath lab
- Procedure begins…10 minutes later patient has a brady-asystolic arrest
- Cath proceeds during resuscitation attempts
  - No coronary blockages, patient pronounced dead after 30 minutes

138



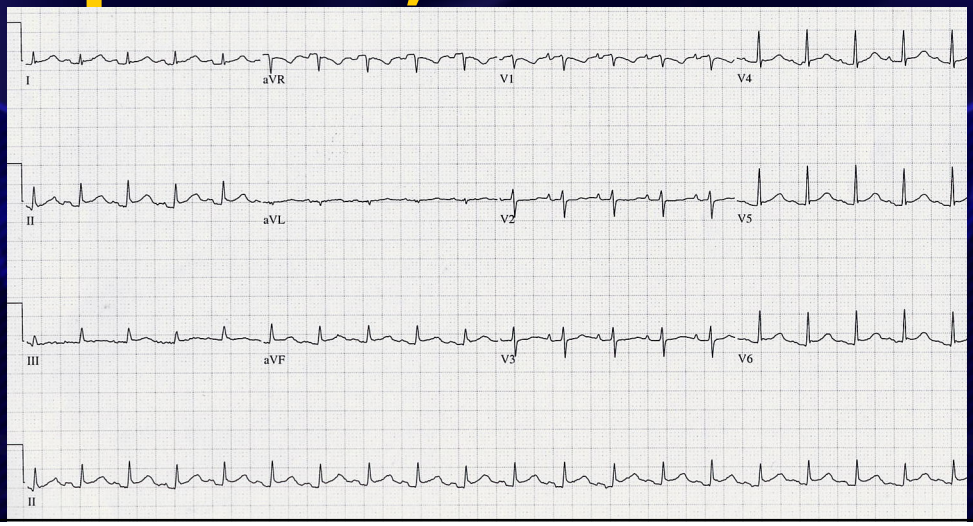
139

ST, low voltage → pericardial effusion



140

Meds → hemorrhagic tamponade, cardiac arrest



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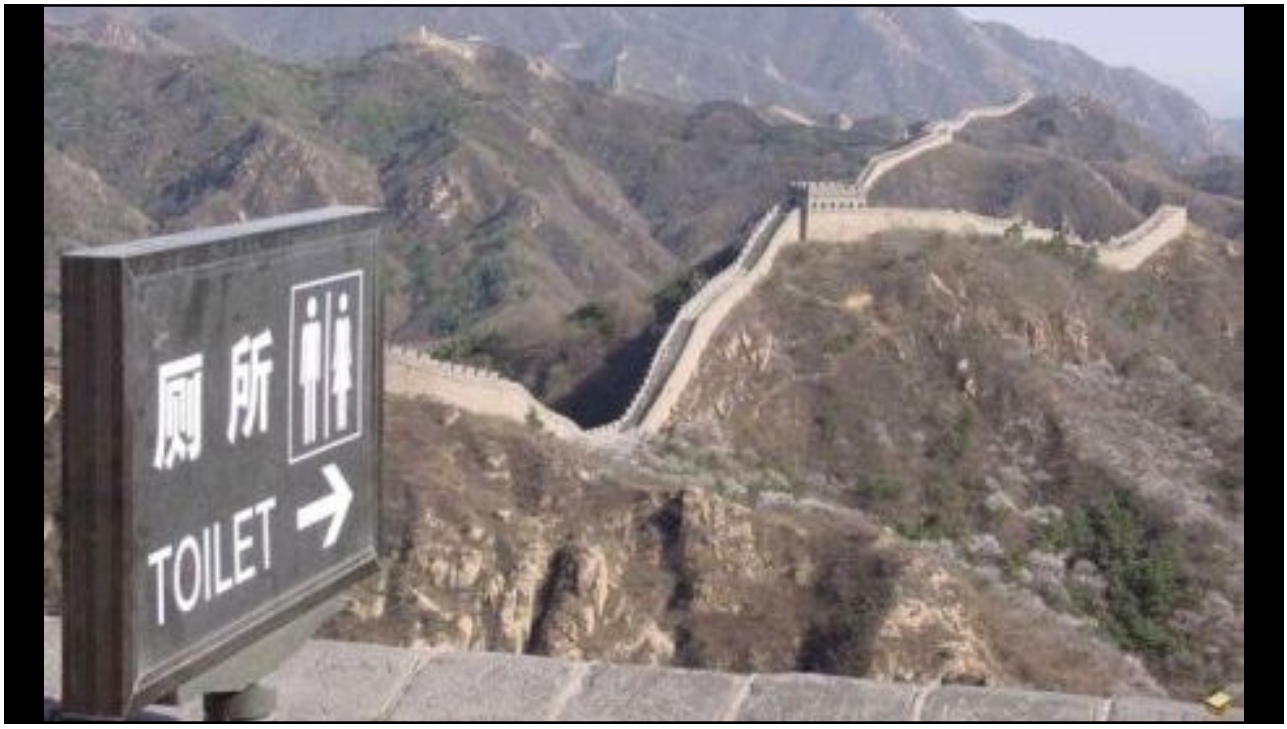


142

Takehome Points

143

Takehome Points

- Beware "slow VT"
  - Consider hyperkalemia, TCA OD, AIVR, etc.
  - Avoid lidocaine and other antidysrhythmics
  - When in doubt try HCO_3 (and calcium)

144

Takehome Points

- If you are <u>really</u> worried about someone's lytes, check their QT while waiting on labs!
  - If QTc ≥ 500 ms, monitor and correct the cause the whenever possible
- Magnesium is not always the cure
- If prolonged ST segment → hypocalcemia

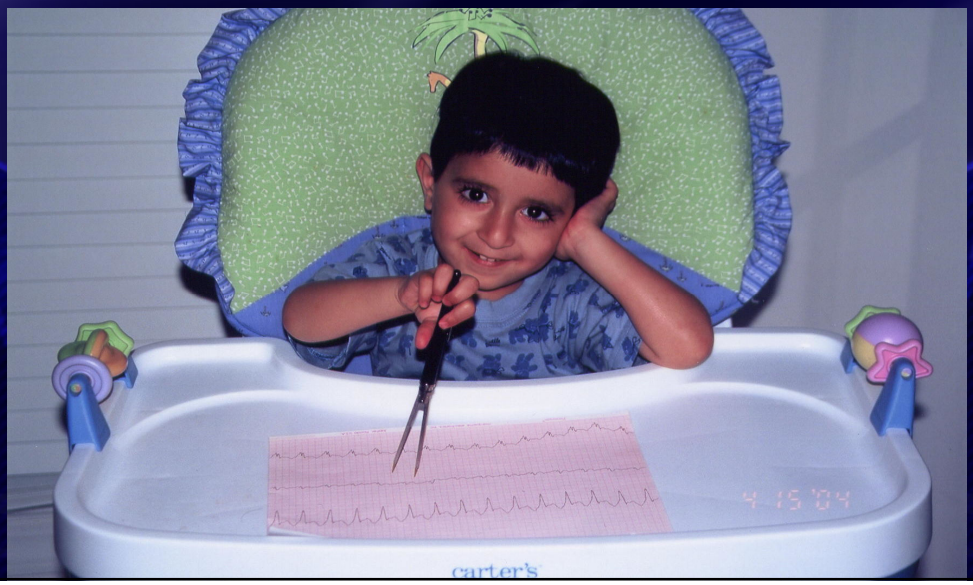
145

Takehome Points

- Always consider the diagnosis in a patient with LV + tachycardia
  - *Especially if the LV is new*
- Large pericardial effusions often present like PE or STEMI

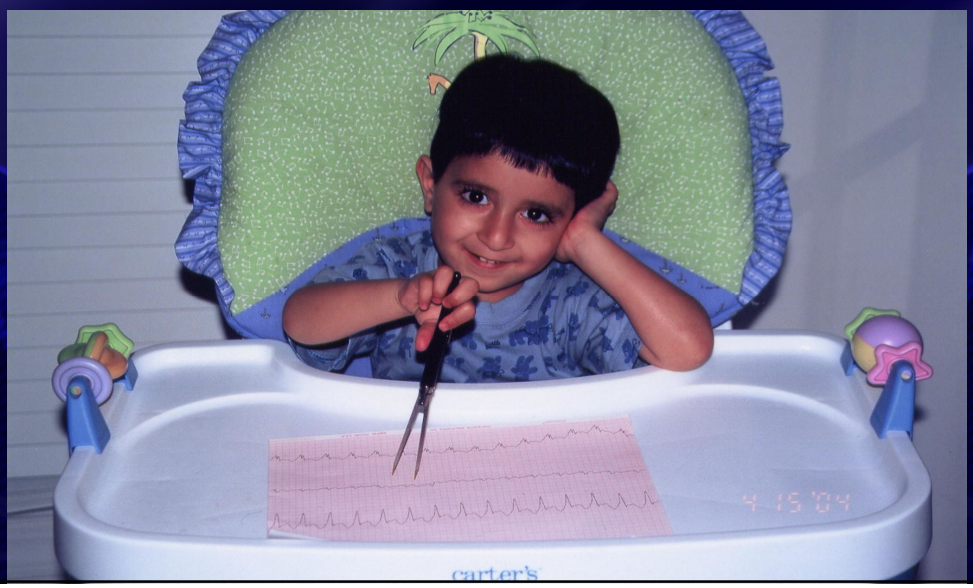
146

Thanks!



147

amalmattu@comcast.net



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