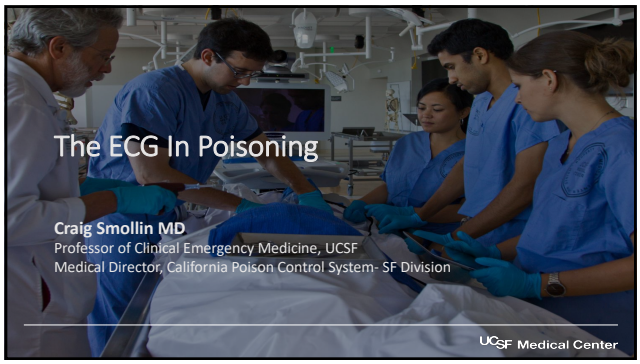

1

Nothing to Disclose

"After this nondisclosure agreement we also need you to sign this disclosure disagreement."

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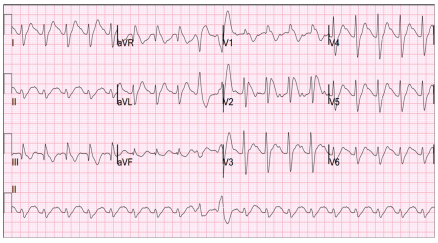
2

ECG #1. A 43-year-old female presents after an intentional ingestion of her medication. Vital signs: HR 130, BP 140/70, T 98.6. Exam significant for dry mucous membranes and dilated pupils.



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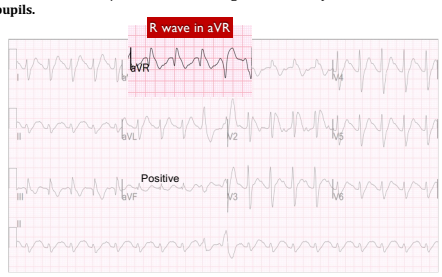

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The predictive value of "R wave" in TCA toxicity

Table 3.
Value of ECG parameters in predicting seizures and arrhythmias.

ECG Parameters	PPV	NPV
R_{aVR} 3 mm or more	43% (13 of 30)	94% (45 of 48)
R/S_{aVR} .7 or more	46% (12 of 26)	92% (48 of 52)
QRS interval 100 msec or more	35% (14 of 40)	92% (36 of 39)

From Leibelt et. al. ECG Lead aVR Versus QRS Interval in Predicting Seizures and Arrhythmias in Acute Tricyclic Antidepressant Toxicity. *Annals of Emergency Medicine Aug '95*

5

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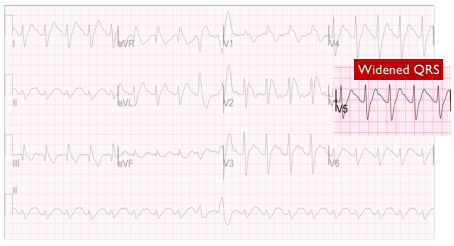

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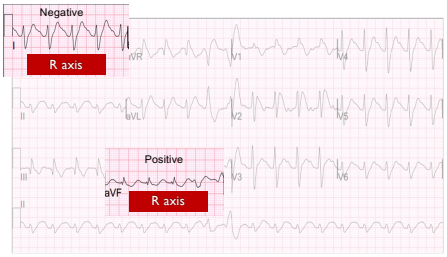

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7

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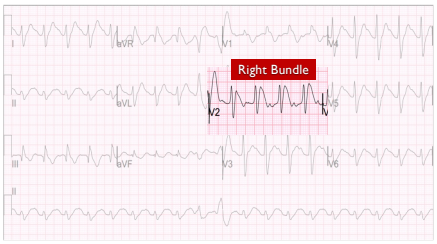

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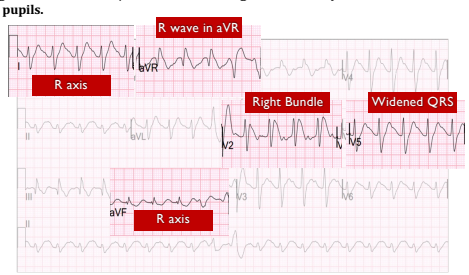

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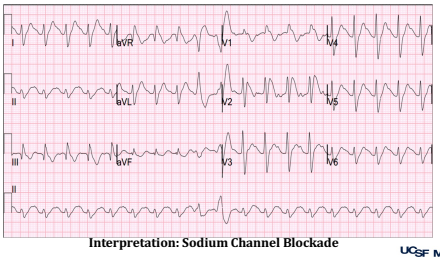

Interpretation: Sodium Channel Blockade

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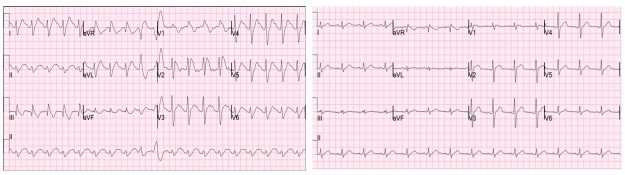
Resolution after Bicarbonate Adminsitration



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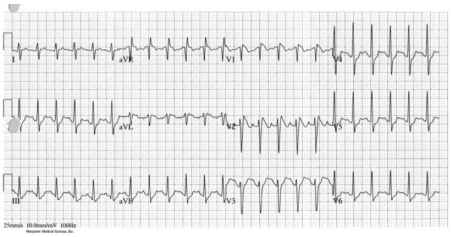
ECG #2. An 18-year-old male with agitation and diaphoresis after cocaine use. Vital Signs: BP 160/70, P 127, RR 20, O2 sat 100%. Physical Exam – Mydriasis, diaphoresis and paranoia.



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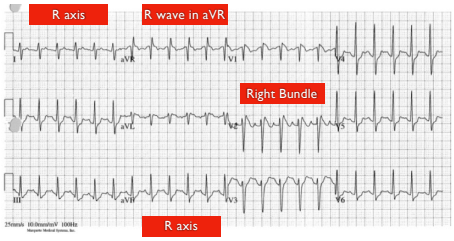

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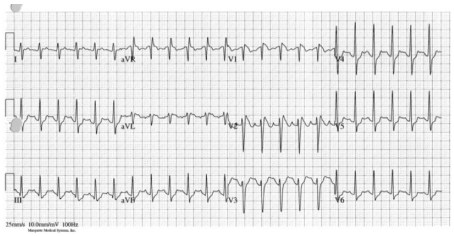

Interpretation: Brugada Patter in Cocaine Intoxication

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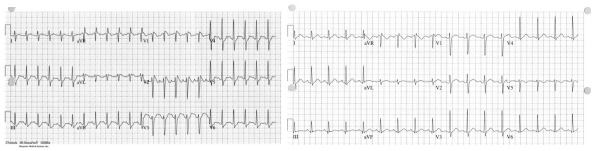
Resolution of Brugada Pattern



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Commonly used drugs with Na channel blockade

Anticonvulsants Carbamazepine	**Drugs of abuse** Cocaine
Antidysrhythmics Class IA and IC Class II (propranolol) Class IV (diltiazem)	**Other antidepressants** Bupropion Mirtazapine Venlafaxine
Antihistamines Diphenhydramine	**Tricyclic Antidepressants** Amitriptyline Desipramine
Antimalarial drugs Chloroquine Hydroxychloroquine Quinine	Doxepin Imipramine Nortryptiline
Antipsychotics Phenothiazines	

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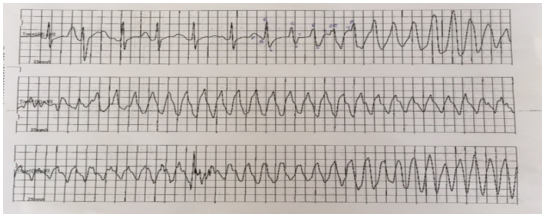
ECG #3. A 31-year-old man which a history of opiate use disorder presents with two episodes of syncope.



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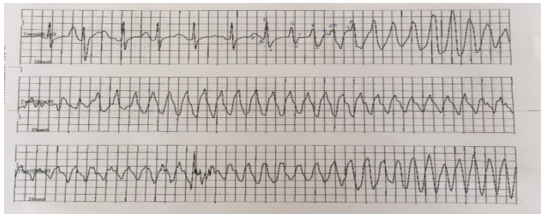
ECG #3. A 31-year-old man which a history of opiate use disorder presents with two episodes of syncope.

Additional history – Patient methadone recently increased to the 150 mg/day.



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ECG #3. A 31-year-old man which a history of opiate use disorder presents with two episodes of syncope.
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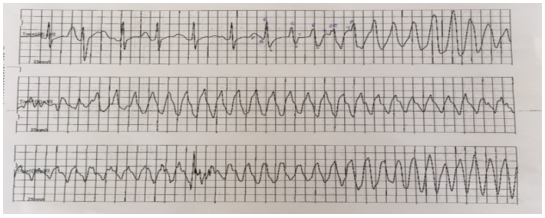

Interpretation: Torsades de Pointe

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Torsades de Pointe: A rare problem…

- FDA-approved medications known to prolong QT interval: **208**
  - Known risk of TdP: **59**
- Inpatient evaluation of 167,546 patients identified 288 cases (0.17%) of drug-induced QT prolongation
  - **49/288** (17%) resulted in arrhythmia

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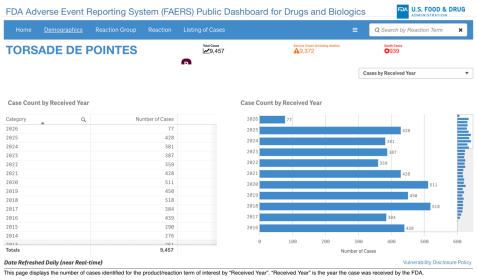
…But still frequently causes arrhythmia



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Risk Factors Associated with TdP

- **Patient-specific factors:**
  - Female sex, Age > 65 years, Underlying heart disease
- **Electrolyte and Metabolic Abnormalities:**
  - Hypokalemia, hypomagnesemia, hypocalcemia, hypothermia
- **Drug-related factors**
  - QT prolonging meds, rapid IV administration, dose, drug-drug interactions
- **ECG and rhythm factors**
  - QTc > 500, Bradycardia
- **Genetic factors**
  - Subclinical LQTS

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https://crediblemeds.org

Known Risk of TdP Drugs that prolong the QT AND are clearly associated with a known risk of TdP, even when taken as recommended.		**Possible Risk of TdP** Drugs that cause QT prolongation BUT currently lack evidence for a risk of TdP when taken as recommended	**Conditional Risk of TdP** Drugs associated with TdP but only under certain conditions (e.g. excessive dose, concurrent hypokalemia)
Amiodarone Azithromycin Chlorpromazine Ciprofloxacin Citalopram Clarithromycin **Droperidol**	Erythromycin **Haldol** Levofloxacin **Methadone** **Ondansetron** Sotalol	Aripiprazole Buprenorphine Levetiracetam Mirtazapine Paliperidone Remdesivir Tramadol Venlafaxine	Diltiazem Fluoxetine Ketoconazole Metoclopramide Olanzapine Quetiapine Risperidone Sertraline

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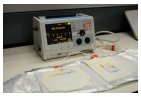
Treatment of Drug Induced TdP

- If no pulse: ACLS (CPR, Defibrillation), Magnesium 2 grams.
- Remove offending agent
- Correct electrolytes (Ca+, Mg+, K+)
- Increase heart rate (Goal > 90 bpm)



Cardiac Pacing

Isoproterenol

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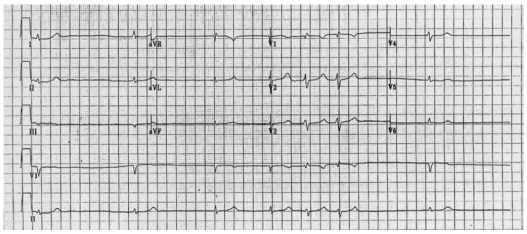
ECG #4. 64-year-old female with two days of weakness, nausea and vomiting. Vital signs: Pulse 40, BP 95/60, RR 20, O2 sat 95% on RA, T 98.6. Exam significant for slow irregular rhythm.



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Toxicology ABCs for Hypotension and Bradycardia

	Drug Class	Clues to the Diagnosis
A	Alpha 2 agonists (e.g. Clonidine)	Miosis, Altered mental status
A	Anticholinesterase drugs (e.g. Organophosphates)	SLUDGE Syndrome
B	Beta Blockers	Hypoglycemia
C	Calcium Channel Blockers	Hyperglycemia
D	Digoxin	Hyperkalemia
E	Ethanol and other sedative hypnotics	Altered Mental Status, Pinpoint pupils (opiates)

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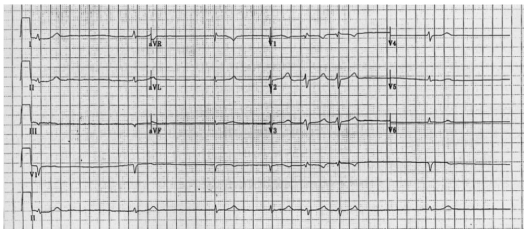
ECG #4. 64-year-old female with two days of weakness, nausea and vomiting. Vital signs: Pulse 40, BP 95/60, RR 20, O2 sat 95% on RA, T 98.6. Exam significant for slow irregular rhythm. **Labs concerning for K = 5.5 mEq/L, SCr = 3.3, Digoxin Level = 4.6 ng/mL**



Interpretation: Slow Atrial Fibrillation

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Cardiac Glycoside Manifestations

- Cell membrane depolarization – atrial and ventricular irritability
- Increased vagal tone – slowed conduction through the AV node
- Increased intracellular calcium – Increased contractility

Can see almost any arrhythmia except rapidly conducting supraventricular tachycardia.

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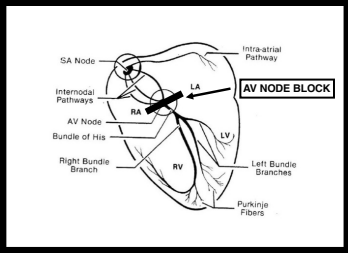
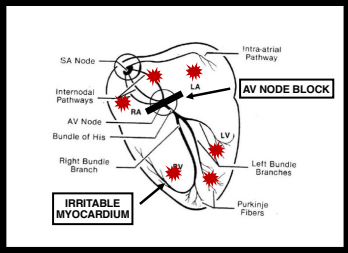
Digoxin Toxicity



29

Digoxin Toxicity



30

Rhythms Associated with Digoxin Toxicity
Premature ventricular contractions (PVCs)
1st degree heart block
2nd degree heart block
3rd degree heart block
Sinus bradycardia
Sinus tachycardia
SA block or arrest
Atrial fibrillation with slow ventricular response
Atrial tachycardia
Atrial tachycardia with block
Junctional escape rhythm
Atrial ventricular dissociation
Ventricular bigeminy
Ventricular trigeminy
Ventricular tachycardia
Torsades de Pointes
Ventricular fibrillation

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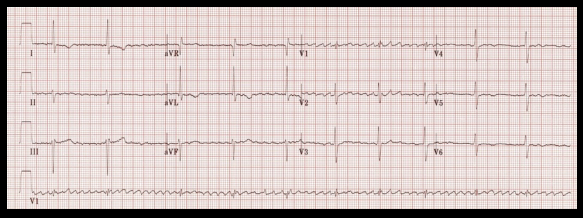
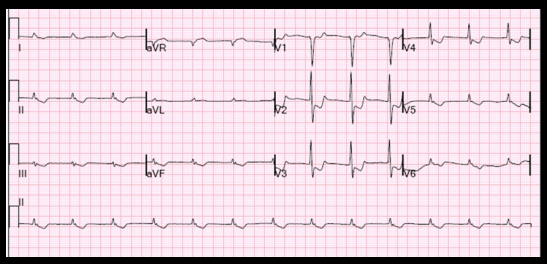
Atrial Flutter with Block



32

Accelerated Junctional Rhythm



33

Foxglove | Bufo Toad | Yellow Oleander | Lily of the Valley

34

Digoxin-Specific Antibody Fragments Indications

- Any digoxin related life-threating dysrhythmia
- K > 5.0 mEq/L in the setting of acute digoxin poisoning
- Chronic elevation of SDC associated with dysrhythmias, significant GI symptoms or altered mental status
- SDC > 15 ng/mL at any time or > 10 ng/mL 6 h post-ingestion, regardless of clinical effects.
- Poisoning with a non-digoxin cardioactive steroid (e.g. plant)

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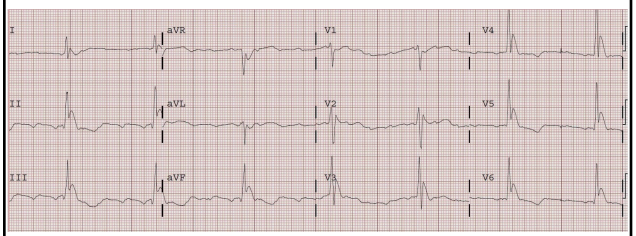
ECG #5. 57-year-old male with history of chronic alcoholism presents after he was found down on the sidewalk.



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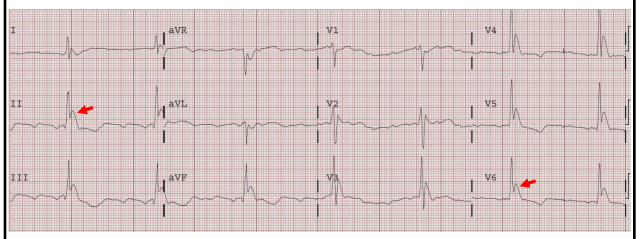
ECG #5. 57-year-old male with history of chronic alcoholism presents after he was found down on the sidewalk. Vital signs significant for rectal temperature of 29 C.



Interpretation: Hypothermia with "J" wave or Osborn waves

37

Electrocardiographic Manifestations of Hypothermia

AMAL MATTU, MD*, WILLIAM J. BRADY, MD,† AND ANDREW D. PERRON, MD†

Hypothermia is generally defined as a core body temperature less than 35°C (95°F). Hypothermia is one of the most common environmental emergencies encountered by emergency physicians. Although the diagnosis will usually be evident after an initial check of vital signs, the diagnosis can sometimes be missed because of overreliance on normal or near-normal oral or tympanic thermometer readings. The classic and well-known electrocardiographic (ECG) manifestations of hypothermia include the presence of J (Osborn) waves, interval (PR, QRS, QT) prolongation, and atrial and ventricular dysrhythmias. There are also some less known (ECG) findings associated with hypothermia. For example, hypothermia can produce ECG signs that simulate those of acute myocardial ischemia or myocardial infarction. Hypothermia can also blunt the expected ECG findings associated with hyperkalemia. A thorough knowledge of these findings is important for prompt diagnosis and treatment of hypothermia. Six cases are presented that show these important ECG manifestations of hypothermia. (Am J Emerg Med 2002;20:314-326. Copyright 2002, Elsevier Science (USA). All rights reserved.)

val (PR, QRS, QT) prolongation, and atrial and ventricular dysrhythmias. There are also some less known ECG findings associated with hypothermia. For example, hypothermia can produce ECG signs that simulate those of acute myocardial ischemia or myocardial infarction. Hypothermia can also blunt the expected ECG findings associated with hyperkalemia.[1] A thorough knowledge of these findings is important for prompt diagnosis and treatment of hypothermia. Six cases are presented that show these important ECG manifestations of hypothermia.

CASE PRESENTATIONS

Case 1

A 75-year-old woman with a history of insulin-dependent diabetes mellitus was brought to the ED by paramedics from her family's home for evaluation of a decreased level of

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Selected Drugs Associated with Hypothermia

- Barbiturates
- Ethanol and other alcohols
- Hypoglycemic Agents
- Opioids
- Phenothiazines
- Sedative Hypnotic Agents
- Tricyclic Antidepressants
- Vasodilators

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Key Points

- Sodium channel blockade leads to characteristic changes on ECG.
- Methadone in high doses can cause QTc prolongation and Torsades.
- Digoxin can cause almost any type of arrhythmia except rapidly conducting SVT.
- Hypothermia is a common manifestation of poisoning and can produce J waves (Osborn waves) on ECG.

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Questions?

41