Ingestions: Assessment and Management of Acute Oral Poisonings

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“All things are poison and nothing is without poison; only the dose makes a thing a poison.”

Theophrastus Phillipus Auroleus Bombastus von Hohenheim (1493 - 1541)
“Paracelsus”
Christopher P. Holstege, MD

Disclosure

No relevant financial relationships
Case Example
The Toxic Time Bomb

• 16 y/o f ingested ? quantity of an antidepressant one hour ago
• awake, drowsy & mumbling speech
• P 110, R32, BP 128/84
• pupils are 8mm
• lungs clear
• heart tachycardic
• axilla dry
• abdomen soft, no bowel sounds
• monitor: sinus tach, QRS 80 msec
The Toxic Time Bomb

- 16 y/o f ingested ? quantity of an antidepressant one hour ago
- awake, drowsy & mumbling speech
- P 110, R32, BP 128/84
- pupils are 8mm
- lungs clear
- heart tachycardic
- axilla dry
- abdomen soft, no bowel sounds
- monitor: sinus tach, QRS 80 msec
Anticholinergic

- Hot as a hare
- Dry as bone
- Red as a beet
- Blind as a bat
- Mad as a hatter

- Also see: tachycardia, seizures, urinary retention, hypoactive bowel sounds, slurred speech
The Toxic Time Bomb

What did she take?
(single pill – question of identification)
The Toxic Time Bomb

In many case, it is not a single agent but numerous
The Toxic Timebomb

What did she take?

Imipramine
The Toxic Timebomb

**Presentation**

- P 122, R 8, BP 90 by palp
- Gag reflex is diminished
- snoring resp after she drifts to sleep
- without stimulation she is apneic
The Toxic Timebomb

Presentation

Monitor: sinus tach, QRS 160 msec
The Toxic Timebomb

Presentation

- Difficult intubation
- Sats begin to drop
The Toxic Timebomb

**Presentation**

- Difficult intubation
- Sats begin to drop
- Suddenly:
The Toxic Timebomb

Now what?

What is the role of ACLS/PALS in toxic resuscitations?

Clin Toxicol 2016;55(10):924-1109

- Total of 55 U.S. Poison Centers
- Data uploaded every 8 minutes
- 2,792,130 calls to U.S. PCs in 2015
  - 2,168,371 human exposure calls to U.S. PCs
  - 55,516 animal exposures
  - 560,467 information calls
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<tr>
<th>Reason</th>
<th>N</th>
<th>% Human exposures</th>
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<td><strong>Unintentional</strong></td>
<td></td>
<td></td>
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<tr>
<td>Unintentional - General</td>
<td>1,137,838</td>
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<tr>
<td>Unintentional - Therapeutic error</td>
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<td>Unintentional - Misuse</td>
<td>130,847</td>
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<tr>
<td>Unintentional - Environmental</td>
<td>56,798</td>
<td>2.6</td>
</tr>
<tr>
<td>Unintentional - Bite / sting</td>
<td>46,604</td>
<td>2.1</td>
</tr>
<tr>
<td>Unintentional - Occupational</td>
<td>27,565</td>
<td>1.3</td>
</tr>
<tr>
<td>Unintentional - Food poisoning</td>
<td>21,423</td>
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</tr>
<tr>
<td>Unintentional - Unknown</td>
<td>3,708</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
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<tr>
<td><strong>Intentional</strong></td>
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<td></td>
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<tr>
<td>Intentional - Suspected suicide</td>
<td>252,959</td>
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<tr>
<td>Intentional - Misuse</td>
<td>56,820</td>
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<tr>
<td>Intentional - Abuse</td>
<td>51,673</td>
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<tr>
<td>Intentional - Unknown</td>
<td>20,050</td>
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<td><strong>Subtotal</strong></td>
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<td><strong>Adverse Reaction</strong></td>
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<td>Adverse reaction - Drug</td>
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<td>Adverse reaction - Other</td>
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<td>Adverse reaction - Food</td>
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<td><strong>Subtotal</strong></td>
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<tr>
<td><strong>Unknown</strong></td>
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<td>Unknown reason</td>
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<tr>
<td><strong>Subtotal</strong></td>
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<tr>
<td><strong>Other</strong></td>
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<tr>
<td>Other - Malicious</td>
<td>7,440</td>
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<tr>
<td>Other - Contamination / tampering</td>
<td>7,432</td>
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<td>Other - Withdrawal</td>
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<td><strong>Subtotal</strong></td>
<td>16,464</td>
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<tr>
<td><strong>Total</strong></td>
<td>2,168,371</td>
<td>100.0</td>
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<td>Site of management</td>
<td>N</td>
<td>%</td>
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<tr>
<td>------------------------------------------------</td>
<td>---------</td>
<td>-----</td>
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<tr>
<td>Managed on site, nonhealth care facility</td>
<td>1,459,251</td>
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<tr>
<td>Managed in healthcare facility</td>
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<tr>
<td>Treated/evaluated and released</td>
<td>299,870</td>
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<td>Admitted to critical care unit</td>
<td>101,785</td>
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<td>Patient lost to follow-up / left AMA</td>
<td>86,067</td>
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<td>Admitted to psychiatric facility</td>
<td>73,579</td>
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<tr>
<td>Admitted to noncritical care unit</td>
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<td>Subtotal (managed in HCF)</td>
<td>634,761</td>
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<td>Other</td>
<td>20,530</td>
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<td>Refused referral</td>
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<td>Unknown</td>
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<td>Total</td>
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<td>Substance (Major Generic Category)</td>
<td>All substances</td>
<td>%a</td>
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<td>Analgesics</td>
<td>287,843</td>
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<td>Cleaning Substances (Household)</td>
<td>195,974</td>
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<td>Cosmetics/Personal Care Products</td>
<td>192,596</td>
<td>7.43</td>
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<td>Sedative/Hypnotics/Antipsychotics</td>
<td>151,433</td>
<td>5.84</td>
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<td>Antidepressants</td>
<td>118,812</td>
<td>4.58</td>
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<td>Antihistamines</td>
<td>105,457</td>
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<td>Cardiovascular Drugs</td>
<td>103,339</td>
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<td>Foreign Bodies/Toys/Miscellaneous</td>
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<td>Pesticides</td>
<td>84,129</td>
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<td>Topical Preparations</td>
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<td>Alcohols</td>
<td>70,218</td>
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<td>Stimulants and Street Drugs</td>
<td>67,879</td>
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<td>Vitamins</td>
<td>66,661</td>
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<td>Cold and Cough Preparations</td>
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<td>Anticonvulsants</td>
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<td>Antimicrobials</td>
<td>57,839</td>
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<td>Hormones and Hormone Antagonists</td>
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<td>Bites and Envenomations</td>
<td>51,409</td>
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<td>Gastrointestinal Preparations</td>
<td>48,565</td>
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<td>Dietary Supplements/Herbals/Homeopathic</td>
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<td>Plants</td>
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<td>Chemicals</td>
<td>40,614</td>
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<td>Fumes/Gases/Vapors</td>
<td>34,261</td>
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<td>Other/Unknown Non-drug Substances</td>
<td>31,157</td>
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<td>Hydrocarbons</td>
<td>30,445</td>
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Table 18. Categories Associated with Largest Number of Fatalities (Top 25)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Substance (Minor Generic Category)</th>
<th>All substances</th>
<th>%\textsuperscript{b}</th>
<th>Single substance exposures</th>
<th>%\textsuperscript{c}</th>
</tr>
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<tbody>
<tr>
<td>Miscellaneous Sedative/Hypnotics/Antipsychotics</td>
<td>406</td>
<td>13.34</td>
<td>20</td>
<td>3.85</td>
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<td>Miscellaneous Cardiovascular Drugs</td>
<td>379</td>
<td>12.45</td>
<td>51</td>
<td>9.83</td>
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<tr>
<td>Opioids</td>
<td>257</td>
<td>8.45</td>
<td>28</td>
<td>5.39</td>
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<tr>
<td>Miscellaneous Stimulants and Street Drugs</td>
<td>225</td>
<td>7.39</td>
<td>54</td>
<td>10.40</td>
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<tr>
<td>Miscellaneous Alcohols</td>
<td>203</td>
<td>6.67</td>
<td>26</td>
<td>5.01</td>
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<td>Acetaminophen Alone</td>
<td>143</td>
<td>4.70</td>
<td>52</td>
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<td>Acetaminophen Combinations</td>
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<td>28</td>
<td>5.39</td>
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<td>Miscellaneous Antidepressants</td>
<td>111</td>
<td>3.65</td>
<td>11</td>
<td>2.12</td>
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<tr>
<td>Selective Serotonin Reuptake Inhibitors (SSRI)</td>
<td>96</td>
<td>3.15</td>
<td>0</td>
<td>0.00</td>
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<tr>
<td>Miscellaneous Fumes/Gases/Vapors</td>
<td>72</td>
<td>2.37</td>
<td>44</td>
<td>8.48</td>
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<td>Tricyclic Antidepressants (TCA)</td>
<td>64</td>
<td>2.10</td>
<td>11</td>
<td>2.12</td>
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<tr>
<td>Miscellaneous Antihistamines</td>
<td>61</td>
<td>2.00</td>
<td>7</td>
<td>1.35</td>
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<td>Miscellaneous Unknown Drug</td>
<td>61</td>
<td>2.00</td>
<td>21</td>
<td>4.05</td>
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<tr>
<td>Anticonvulsants: Gamma Aminobutyric Acid and Analogs</td>
<td>59</td>
<td>1.94</td>
<td>1</td>
<td>0.19</td>
</tr>
<tr>
<td>Nonsteroidal Antiinflammatory Drugs</td>
<td>58</td>
<td>1.91</td>
<td>8</td>
<td>1.54</td>
</tr>
<tr>
<td>Serotonin Norepinephrine Reuptake Inhibitors (SNRI)</td>
<td>57</td>
<td>1.87</td>
<td>3</td>
<td>0.58</td>
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<tr>
<td>Miscellaneous Muscle Relaxants</td>
<td>54</td>
<td>1.77</td>
<td>1</td>
<td>0.19</td>
</tr>
<tr>
<td>Acetylsalicylic Acid Alone</td>
<td>49</td>
<td>1.61</td>
<td>18</td>
<td>3.47</td>
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<tr>
<td>Oral Hypoglycemic</td>
<td>46</td>
<td>1.51</td>
<td>5</td>
<td>0.96</td>
</tr>
<tr>
<td>Miscellaneous Anticonvulsants</td>
<td>45</td>
<td>1.48</td>
<td>4</td>
<td>0.77</td>
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<tr>
<td>Miscellaneous Chemicals</td>
<td>40</td>
<td>1.31</td>
<td>18</td>
<td>3.47</td>
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<tr>
<td>Cannabinoids and Analogs</td>
<td>34</td>
<td>1.12</td>
<td>4</td>
<td>0.77</td>
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<tr>
<td>Miscellaneous Hormones and Hormone Antagonists</td>
<td>32</td>
<td>1.05</td>
<td>1</td>
<td>0.19</td>
</tr>
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<td>Miscellaneous Diuretics</td>
<td>27</td>
<td>0.89</td>
<td>0</td>
<td>0.00</td>
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<td>Miscellaneous Anticoagulants</td>
<td>26</td>
<td>0.85</td>
<td>5</td>
<td>0.96</td>
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</tbody>
</table>
History

- The history in the overdose patient is notoriously poor.
- If they are truly suicidal, they will not tell you the truth.
- If they are attention seeking, they will exaggerate what they have taken.
- If the history does not correlate with the physical examination and ancillary tests, believe the latter.
Physical Examination

• Complex and not as simple as many books make it appear.
• Findings vary depending on the phase and degree of toxicity.
• Pre-existing medical disease must be taken into consideration.
• Complications (e.g., hypoxic brain injury) can further confuse the picture.
Vital Signs: Temperature

- Uncouplers of Oxidative Phosphorylation
- Anticholinergics
- Malignant Hyperthermia
- Serotonin Syndrome
- Neuroleptic Malignant Syndrome
Neurologic

• Frequent Mental Status Checks
  – Monitoring for agitation or somnolence
• Gag Reflex
• Seizures
  – Non-convulsive status epilepticus
• Movement Disorders
  – Dystonic, dyskinesias
• Don’t be mislead by empty pill bottles
• Rule-out structural & infectious etiologies
Eyes

Miosis
- Antipsychotics
- Cholinergics
- Clonidine
- Nicotine (timing)
- Opioids (some)

Mydriasis
- Anticholinergics
- Meperidine
- Withdrawal
- Sympathomimetics
- Phencyclidine
Pulmonary

- **Pulmonary Edema**
  - e.g., opioids, salicylates

- **Toxic Pneumonitis**
  - e.g., hydrocarbons, smoke

- **Aspiration Pneumonitis**
  - #1 cause of morbidity in the poisoned patient
Gastrointestinal

- Hyperactive Bowel Sounds
  - Cholinergics
  - Sympathomimetics
- Hypoactive Bowel Sounds
  - Anticholinergics
Skin

• Needle Marks
  – antecubital, neck, supraclavicular, groin, feet

• Color
  – rubor, cyanosis, jaundice

• Axilla Moisture

• Pressure Sores

• Transdermal Patches
Breath Odors

- Bitter Almond: amygdalin, cyanide
- Burned Rope: marijuana
- Fruity: acetone, isopropyl alcohol
- Garlic: arsenic, organophosphates
- Mothballs: naphthalene, paradichlorobenzene
- Pear: chloral hydrate
- Rotten Eggs: hydrogen sulfide, mercaptans
- Wintergreen: methyl salicylate
Personnal Items
Toxic Syndromes
Putting together the physical exam to help make the diagnosis

- Anticholinergic
- Cholinergic
- Drug withdrawal
- Opioid
- Sympathomimetic
The Toxic Timebomb

Now what?

What is the role of ACLS/PALS in toxic resuscitations?
ECG Manifestations: The Poisoned Patient

Christopher P. Holstege, MD*, David L. Eldridge, MD, Adam K. Rowden, DO

Division of Medical Toxicology, Department of Emergency Medicine, University of Virginia, P.O. Box 800774, Charlottesville, VA 22908-0774, USA

Emergency physicians routinely evaluate and manage poisoned patients. In 2003, more than 2 million human exposure cases were reported to poison centers throughout the United States [1]. Of those cases, 22% were treated in a health care facility with most of those cases evaluated in the emergency department. Cardiovascular drugs were listed as the fifteenth most frequently encountered human exposure (66,401) and the fifth leading cause of poisoning deaths.

Drug-induced changes and abnormalities on the 12-lead electrocardiogram (ECG) are common. There are numerous drugs that can cause ECG changes and lead to cardiac dysrhythmias. The diagnoses and subsequent management of patients manifesting ECG changes following poisonings can challenge even the most experienced physician. Drugs that are advocated in Advanced Coronary Life Support protocols for cardiac dysrhythmias may not apply or may even worsen the condition of overdose patients [2].

Despite that drugs have widely varying indications for therapeutic use, many unrelated drugs share a common cardiac pharmacologic effect if taken in overdose. The purpose of this article is to group together agents that cause similar electrocardiographic effects, review their pharmacologic ac-
The interpretation of electrocardiogram (ECG) in the poisoned patient can challenge even the most experienced clinician.

There are numerous drugs that can cause ECG changes.

The incidence of ECG changes in the poisoned patient is unclear and the significance of various changes may be difficult to define.
Sodium Channel Blockers

Na\textsuperscript{+} Channel Blocker Toxicity

- Measured Potential (mv)
- Time (mS)

Fig 11
Sodium Channel Blockers

- Amantadine
- Carbamazepine
- Chloroquine
- Class IA antiarrhythmics
  - Disopyramide
  - Quinidine
  - Procainamide
- Class IC antiarrhythmics
  - Encainide
  - Flecainide
  - Propafenone
- Propafenone
- Citalopram
- Cocaine
- Cyclic Antidepressants
  - Amitriptyline
  - Amoxapine
  - Desipramine
  - Doxepin
  - Imipramine
  - Nortriptyline
  - Maprotiline
- Diltiazem
- Diphenhydramine
- Hydroxychloroquine
- Loxapine
- Orphenadrine
- Phenothiazines
  - Medoridazine
  - Thioridazine
- Propranolol
- Propoxyphene
- Quinine
- Verapamil
Electrocardiogram
Potassium Efflux Channel Blockers

![Diagram of K⁺ Efflux Blocker Toxicity with Action Potential and ECG](image)
Potassium Efflux Channel Blockers

- Antihistamines
  - Astemizole
  - Clarithromycin
  - Diphenhydramine
  - Loratidine
  - Terfenadine
- Antipsychotics
  - Chlorpromazine
  - Droperidol
  - Mesoridazine
  - Pimozide
  - Quetiapine
  - Risperidone
  - Thioridazine
  - Ziprasidone
- Arsenic trioxide
- Bepridil
- Chloroquine
- Cisapride
- Citalopram
- Clarithromycin
- Class IA antiarrhythmics
  - Disopyramide
  - Quinidine
  - Procainamide
- Class IC antiarrhythmics
  - Encainide
  - Flecainide
  - Moricizine
  - Propafenone
- Class III antiarrhythmics
  - Amiodarone
  - Dofetilide
  - Ibutilide
  - Sotalol
- Cyclic Antidepressants
- Erythromycin
- Fluoroquinolones
- Halofantrine
- Hydroxychloroquine
- Methadone
- Pentamidine
- Quinine
- Venlafaxine
Rhythm Strip
Therapeutic trends in the treatment of barbiturate poisoning

The Scandinavian method

The “Scandinavian method” of treating barbiturate poisoning is presented. As a result of close and constant attention to the support of vital function (the cardiovascular system, respiration, renal function, electrolyte homeostasis) and the prevention of infection, the mortality rate from barbiturate poisoning in our clinics has been brought down to 1.5 per cent whereas previously it was over 10 per cent. The details of this method, the history of its development, and the basis of its use are explained.

Carl Clemmesen and Eric Nilsson Copenhagen, Denmark, and Lund, Sweden
Psychiatric Department, Bispebjerg Hospital, Copenhagen, and University Hospital, Lund

The present review of the treatment of barbiturate poisoning does not embrace the world-wide literature on this subject. A review of this sort should perhaps have such a background, but the countless articles publication of this department will be referred to later.

Rising incidence

Barbiturate poisoning and its treatment
• Always start with the ABC’s
  – protect that airway
• Seizures
  – Benzodiazepines (e.g., midazolam)
  – Ketamine
• Agitation
  – use combination of physical and chemical restraints
  – physical restraints without chemical restraints leads to rhabdomyolysis
  – benzodiazepines and some antipsychotics are the agents of choice
“Excited Delirium”
Excited Delirium

The syndrome of excited delirium

James R. Gill

Abstract The excited delirium syndrome (EDS) is a life-threatening condition caused by a variety of factors including drug intoxication and psychiatric illness. Fatal instances of excited delirium frequently come to the attention of the medical examiner/coroner due to the circumstances and potential causes. Excited delirium may include paranoid, aggressive, and incoherent behavior which may lead to an encounter with law enforcement. In some instances, the person may die while in the presence of law enforcement. This circumstance further broadens the scope of attention for EDS and highlights the need for increased awareness.

Keywords Forensic pathology · Agitated delirium · Excited delirium · Cocaine psychosis · Restraint

Introduction

There has been debate in medicine as to how to characterize the syndrome of excited (or agitated) delirium and if it even exists [1–7]. In 2009, the American College of Emergency Physicians issued a white paper on the excited delirium syndrome. EDS and excited delirium are similar concepts.
Excited Delirium

Definition:

• The term “Excited Delirium” has been used to refer to a subcategory of delirium that has primarily been described in the forensic literature. It has also been referred to as “Agitated Delirium” and is closely associated with the “Sudden Death in Custody Syndrome.”

• Originally, the concept of excited delirium was described in the forensic literature and has been synonymous with death, but over time the term has made its way into the emergency medicine, psychiatric, law enforcement, prehospital, and medicolegal literature.

• It has generally been used to describe patients displaying altered mental status with severe agitation and combative or assaultive behavior that has eluded a unifying, prospective clinical definition.

• There has been debate in medicine as to how to characterize it and if it even exists.
Treatment

• Midazolam
  – $C_{\text{max}} = 17 \text{ min}; T_{1/2} = 2-5 \text{ hours}$

• Haloperidol
  – $C_{\text{max}} = 20 \text{ min}; T_{1/2} = 20 \text{ hours}$

• Ketamine
  – $C_{\text{max}} = 12 \text{ min}; T_{1/2} = 1 \text{ hour}$
Activated Charcoal

- **Tremendous Surface Area**
  - adsorbs toxins into pores on the surface
  - dose 1gm/kg

- **Not effective for:**
  - toxic alcohols, heavy metals, hydrocarbons

- **Multidose for**
  - Salicylates, theophylline, phenobarbital, sustained release products

- **Complications**
  - aspiration pneumonitis
  - bowel obstruction
  - electrolyte imbalances if given with a cathartic

- **Contraindications**
  - central nervous system depression with unprotected airway
  - pending endoscopy
  - ingestion of agents not bound to activated charcoal
  - lack of bowel sounds in repeat dosing
  - repeat dosing with cathartic combination
Antidotes

• **Naloxone**
  – reverses respiratory/CNS depression due to opioids
  – titrate dose, with large doses possibly necessary
  – effect of agent may last longer than naloxone & renal failure
  – consider restraint before giving

• **Flumazanil**
  – reverses respiratory/CNS depression due to benzodiazepines
  – 0.2mg in 10cc and titrate dose
  – effect of agent may last longer than flumazanil
  – contraindicated in chronic benzodiazepine use, cyclic antidepressant
Antidotes examples

- Acetaminophen
- Benzodiazepines
- Beta blockers
- Calcium channel blockers
- Cardiac glycosides
- Crotalid envenomation
- Cyanide
- Ethylene glycol
- Iron
- Isoniazid
- Methanol
- Methemoglobinemia
- Opioids
- Organophosphates
- Sulfonylureas
- N-acetylcysteine
- Flumazenil
- Glucagon
- High dose insulin therapy
- Digoxin immune Fab
- Crotalidae polyvalent immune Fab
- Hydroxocobalamin
- Fomepizole; Thiamine; Pyridoxime
- Deferoxamine
- Pyridoxine
- Fomepizole, Folate
- Methylene blue
- Naloxone
- Atropine; Pralidoxime
- Octreotide
Dialysis

Toxins amendable to hemodialysis:

• Bromide
• Caffeine
• Ethylene Glycol
• Lithium
• Methanol
• Salicylate
• Theophylline
Complications

- Anoxic brain injury
- Aspiration pneumonia
- Seizures
- Rhabdomyolysis
- Dysrhythmias
“We’re almost free, everyone!... I just felt the first drop of rain.”