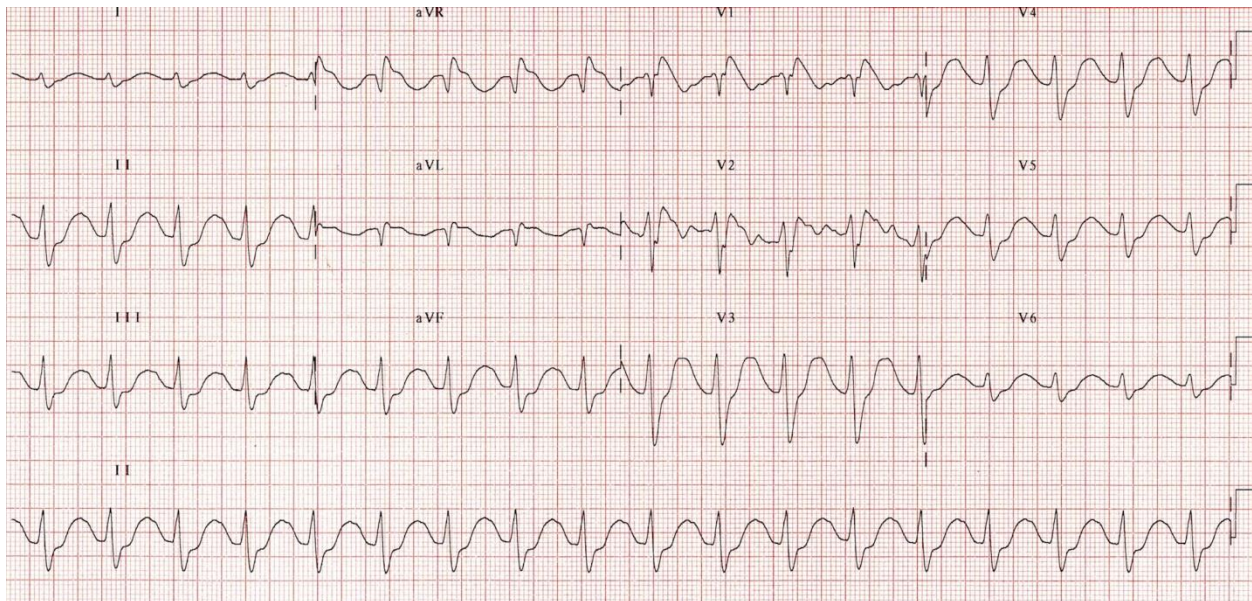


## Cocaine Does What?

A 28 y/o female arrives via EMS and is triaged as altered mental status and extreme agitation. Family had found the patient shaking on her bathroom floor, after calling her on the phone several times with no response. The patient has a history of Schizophrenia and Major depressive disorder and has had suicidal thoughts in the past but has never acted on any of her plans. They also state the patient has an extensive drug abuse history. She had been going to drug rehabilitation up until 4 days ago, when they last spoke with her. She takes several prescription medications but they are not sure what they are. Initial vitals were BP 150/100 mmHg HR 165 BPM RR 20 BPM Temp 37 Celsius and pulse oximetry was 94% on room air. Her POC glucose was 150 mg/dl. On physical examination, she appears extremely restless and altered. The pupils are dilated and symmetric. Her oral mucosa is dry and her breath smells of alcohol. Her heart is tachycardic with no murmurs, the lungs are clear, and the rest of her exam is unremarkable. She is placed her on cardiac monitoring and pulse oximetry. A nasal cannula is also applied, at 2L O<sub>2</sub>/min (with improvement of her saturation), and intravenous access is secured. Initial orders include: EKG, portable CXR, CBC, CMP, Serum Osm, CK, UA, Urine Drug screen, serum EtOH, Salicylate, APAP level, and ABG. Her initial EKG shows:



Before you can even respond to the EKG the urine drug screen has resulted positive for Cocaine and an EtOH level of 230 mg/dL.

What do you see? What's going on?

- In the above case we have confirmed cocaine intoxication in the setting of acute ethanol use. Cocaine is a stimulant that **inhibits the reuptake of several neurotransmitters including norepinephrine and epinephrine and induces the release of dopamine and serotonin.**
- We have been taught that ACS in the setting of cocaine overdose was a common finding secondary to its adrenergic effects. However, another important effect of cocaine in the ECG should also be noted. Cocaine inhibits fast-acting sodium channels of the heart, slowing depolarization and showing some of the classic signs illustrated above:
  - **Widening of the QRS**
  - **R' wave in aVR (terminal 40 msec)**

- **Rightward axis deviation**

- The wide complex tachycardia can decompensate into **ventricular arrhythmias** and thus, it is very important to search for this finding.
- This is particularly common in Body packers and Stuffers who ingest a large quantity of cocaine at a time
- Also of note is the co-ingestion of alcohol with cocaine. Cocaine is metabolized in the liver and in the serum. In the liver it is metabolized to its active metabolite **Benzoyllecgonine and in the serum it is metabolized to Ecgonine**. However, in the presence of alcohol, cocaine is metabolized to **cocaethylene** which has a **longer duration of action**. When in combination with intranasal cocaine the peak plasma concentration is increased by 20%. So, together, ethanol prolongs the effects of a toxin that induces cardiac arrhythmias.

What do you do?

- In this case, we immediately treated the wide tachyarrhythmia with IV **sodium bicarbonate** and the QRS narrowed in response
  - It helps to know that many toxidromes with widened QRS such as with TCAD toxicity and diphenhydramine and other metabolic causes of widened QRS have a similar mechanisms of action (Na channel blockade). Bicarbonate administration in a patient with a widened QRS of unknown etiology and looking for QRS narrowing is a reasonable and safe intervention when no other information about the patient is available.
  - Correction of acidemia by the use of sodium bicarbonate is a secondary mechanism by which the QRS narrows.
- Avoid Class 1A and 1C Antiarrhythmics as they may worsen the ECG findings.
- Also, avoid beta blockers as a treatment for the tachycardia and hypertension. The use of beta blockers has been associated with the “unopposed alpha effect”. Blocking beta receptors allows unopposed effect of the vasoconstricting alpha system, leading to worsened hypertension and more coronary vasoconstriction.

#### Case Conclusion

After IV administration of 2 ampules of sodium bicarbonate, the QRS narrowed and the patient was admitted to a telemetry bed for continued monitoring.

#### References / Further Reading

1. Goldfrank's Toxicologic Emergencies, 9th Ed pgs 89-93, 1365-69.
2. Markovchick, Vincent, Pons, Peter, Bakes, Katherine. Emergency Medicine Secrets. Elsevier Health Sciences, Dec 3, 2010
3. Lionte, Catalina, Bologna, Cristina. Toxic and Drug Induced Changes of the ECG. “Gr. T. Popo” University of Medicine and Pharmacology
4. Marx. John, Walls, Ron., James adams; Rosen's Emergency Medicine Concepts and clinical Practice. Vol. 2 Pg 2001-2004
5. <http://www.ncbi.nlm.nih.gov/pubmed/19031381>