Digoxin Toxicity

ANWCCS
Simulation Center
Overview

» Cardiac glycoside toxicity potentially fatal with mortality ranging from 3-50%

» Caused by numerous substances usually by digitalis (one form is Digoxin)
Conditions leading to Dig Toxicity

» Renal insufficiency/ESRD
  » ESRD prolongs half-life and reduces volume of distribution

» Advanced age

» Cardiac diseases
  » Active ischemia, myocarditis, cardiomyopathy, amyloidosis, cor pulmonale

» Metabolic factors
  » Hypokalemia, hypomag, hypoxemia, hypernatremia, hypercalcemia, acid-base
Pharmacology

- Dig inhibits Na-K-ATPase
  - Increasing intracellular Na reducing gradient
  - Na-Ca driving force reduced increasing intracellular Ca--increasing cardiac contractility; positive ionotropic effect
- Digoxin also increases the automaticity of Purkinje fibers but slows conduction through the atrioventricular (AV) node. Cardiac dysrhythmias associated with an increase in automaticity and a decrease in AV node conduction may result.
Kinetics

- Digoxin bioavailability is 80%
- Half-life 1.6 days
- Major storage area in body skeletal muscle
- Not removed by HD
- 1/3 body stores/day excreted
  - 30% Unchanged in urine
  - 3% as metabolites in stool
Signs/Syptoms of Dig Overdose

» History suggesting change in Dig dosage
» History of any other new drugs
» Fatigue, blurred vision, disturbed color perception, N/V, anorexia, diarrhea, abdominal pain, HA, dizziness, confusion, delirium, hallucinations
» Bradycardia
» Occasional tachycardia
» Hypotension in severe cases
K

» Hyperkalemia
  » Hyperkalemia in acute settings shows degree of Na-K-ATPase poisoning

» Hypokalemia
  » Potentiates toxicity--correct immediately
Normal Dig ECG
ECG-normal

- T wave changes
- QT interval shortening
- “Scooped” appearance of ST segment
- Increase U wave amplitude
Atrial Tachycardia with AV block
First Degree AV block
Mobitz I
Afib with accelerated Junctional Rhythms
Bidirectional Ventricular Tachycardia
Ventricular Bigeminy
Treatment

» Support treatment if needed-intubation, etc
» Symptomatic bradycardia-atropine
» Do not use transvenous pacing as first line -can lead to arrhythmias
» Avoid Beta agonists (isoproterenol)
» Gut decontamination with activated charcoal (w/in 6-8 hours of acute ingestion)
» Manage K as usual except **do not use calcium salts**
» Replace Mg
Treatment
Digibind

» Digoxin-specific Fab fragments
» Made in sheep
» Bind rapidly to intravascular dig
» Dig stored in other tissues then goes into intravascular space and digibind binds that also
» Digibind/digoxin complex small and is rapidly removed by normal kidneys
» ESRD on HD responds clinically the same to digibind except elimination of complex slow
  » Theoretically can get rebound dig toxicity
When to Use Digibind

» Hemodynamic instability
» Life-threatening arrhythmias
» Severe Bradycardia—even if atropine works
» Plasma K above 5
» Plasma Dig above 10
» Presence of dig toxicity rhythm combined with dig toxic level
References

» Ismail, Nuhad, MD. Digitalis (cardiac glycoside) intoxication. UpToDate. 2007.

» Arnsdorf, Morton, MD. Electrophysiology of arrythmias due to digitalis toxicity. UpToDate. 2007.