# DIGOXIN

## Epidemiology
Untreated chronic toxicity >10x normal daily dose (>75mcg/kg in child)

## Toxic Dose
- **Toxic dose:** >10x normal daily dose (>75mcg/kg in child)
- **Potentially lethal dose:** >10mg adult, >4mg child → give digibind

### Level:
- <1: therapeutic
- 1-2: supratherapeutic
- >2: potentially toxic
- >15: potentially lethal, needs digibind

## In Paediatrics
Children are more resistant to the effects of digitoxin

## Pharmacology
- **MOA:** Na-K ATPase inhibitor → increased intracellular Ca and Na, decreased intracellular K
- Weak +ive inotrope; AVN blockade, slows conduction, increases vagal tone, decreases action potential duration, increases myocardial automaticity; very large VOD; marked decreased clearance in renal failure; narrow therapeautic index
- **Drugs that increase digoxin level:** amiodarone, flecainide, verapamil, quinidine, spironolactone, erythromycin, roxithromycin, tetracycline

## Peak Level
Reached at 6 hours

## Symptoms
- Chronic overdose is usually asymptomatic; may be yellow vision, decreased VA, chromatopsia, xanthopsia; N+V (within 2-4hrs), abdominal pain, ECG changes as below, lethargy, confusion, psych; death from cardiac collapse at 8-12hrs
- **Potentially life threatening:** K >5.5, decreased BP, arrhythmia, cardiac arrest

## Investigations
- **ECG:** worsened by hypokalaemia, hypomagnesium, hypercalcaemia; changes are due to increased automaticity
- **Arrhythmias:** AF with slow ventricular response <60, atrio-ventricular block, junctional escape rhythm, sinus bradycardia, SAN arrest, atrial tachycardia with variable AV block, VT/VF/TdP, ventricular ectopics (most common)
- **Complex changes:** PR prolongation; scooped ST segment depression – mostly in inferior and anterior leads; “reverse t tick” (indicates use, not toxicity); diminished T wave amplitude; short QT interval; U waves
- **Bloods:** hyperkalaemia (marker of severity, occurs early, may be more accurate than digoxin level; if K >5.5 = 100% mortality without digibind)
- Digoxin level (levels taken >6hrs after ingestion correlate with toxicity; do at 4hrs then Q2hrly until definitive treatment or levels improving; unreliable once digibind given as levels will paradoxically increase)
- Increased Ur and Cr; Mg (worse toxicity if low)

## Treatment
- **Cardiac arrest:** refractory to conventional resus – continue 30mins after digibind given
- **Hyperkalaemia:** insulin (10iu + 50ml 50% dextrose), NaHCO₃ (1-2mmol/kg); aim K <5
  - Try not to use calcium (but role is unclear)
  - **Arrhythmia:** atropine for AV block; may need pacing
    - If ventricular arrhythmia: lignocaine 1mg/kg IV over 2mins (or phenytoin); MgSO₄ may help
    - Do not use as will induce ventricular arrhythmia: cardioversion (use low setting if necessary); isoprenaline
    - Do not use as will induce ventricular arrhythmia and worsen AV block: Ia (procainamide, quinine), Ic
- **Digoxin level:** (levels taken >6hrs after ingestion correlate with toxicity; do at 4hrs then Q2hrly until definitive treatment or levels improving; unreliable once digibind given as levels will paradoxically increase)

## Decontamination
- **Charcoal:** if <1hr
- **MDAC:** if significant toxicity

## Elimination
Not applicable

## Antidote
- **Digibind:** antibodies which bind to digoxin → excreted in urine (may need plasma exchange if renal failure); onset 30mins, max at 4hrs; half life is 12hrs (longer than digoxin); 1 ampoule binds 0.5mg digoxin
  - **Indications:** imminent threat to life or potential for:
    - Refractory life threatening arrhythmia / cardiac arrest
    - Refractory hyperkalaemia >5
    - Digoxin level >20 at 6hrs or >15 at any time
    - >10mg (4mg in child) ingested
  - **In chronic:** Mod-severe gastrointestinal symptoms (any symptoms if decreased renal function)
  - Arrhythmia unlikely to be tolerated for long
  - **Dose:** In acute:
    - Ingested dose (mg) x 0.8 x 2 = no. of ampoules to give (if don’t know dose, use 5 ampoules if stable, 10 ampules if unstable, and repeat 5 after 30mins if no response; give 20 ampoules in cardiac arrest)
    - In chronic: (Digoxin level (mmol/L) x weight (kg)) / 100 = no. of ampoules to give (usually need 2 ampoules → if no response at 30mins, give further 2)

## Disposition
- Monitor 6hrs (from presentation / digibind administration); then can discharge if no gastrointestinal symptoms, normal K, normal digoxin levels, normal ECG
- Chronic usually requires admission