Drug Guideline  Digoxin

Summary: Digoxin is a cardiac glycoside that can be used in patients with both atrial fibrillation and heart failure.

Approved by:  ICU Medical Director
Publication (Issue) Date:  July 2013
Next Review Date:  July 2016
Replaces Existing Drug Guideline:  August 2006
Previous Review Dates:  2005, 2006

1. Introduction:

The Aims / Expected Outcome of this drug guideline:

Digoxin will be administered safely and appropriately without any adverse side effects

Related Policies
•  C3.00 Drug prescribing
•  C3.01 Drug administration
•  C3.01 Administration of IV Medications

2. Drug Guideline: Policy Statement
•  All care provided within Liverpool Hospital will be in accordance with infection control, manual handling and minimisation and management of aggression guidelines.
•  Medications are to be prescribed and signed by a medical officer/authorised nurse practitioner (NP) unless required during an emergency.
•  All drugs administered during an emergency (under the direction of a medical officer/authorised nurse practitioner) are to be documented during the event, then prescribed and signed following the event.
•  Medications are to be given at the time prescribed (as close to the time as is possible when multiple drugs require 'same time' administration and, when the nurse is caring for more than one patient, recognition is given to a possible short delay to administration – antibiotics and other lifesaving drugs are to be prioritised) and are to be signed by the administering nurse.
•  Parenteral medication prescriptions and the drug are to be checked with a second registered or endorsed enrolled nurse prior to administration. The “rights of drug administration” must be followed: right: patient, drug, dose, route, administration, time, reason for the drug, documentation, education and evaluation/outcome.
• Adverse drug reactions are to be documented and reported to a medical officer.
• Medication errors are to be reported using the hospital electronic reporting system: IIMS.
• Guidelines are for adult patients unless otherwise stated

3. Guideline

Actions\(^{1,3,4}\)

• Digoxin exerts a positive inotropic effect on both the normal and failing heart, which is mediated through inhibition of transmembranous active transport of sodium and potassium, which in turn augments calcium ion influx and allows calcium to accumulate in the cardiac myocytes. The increased calcium uptake by the cell improves the efficiency of excitation-contraction coupling of cardiac muscle, resulting in increased myocardial contractility.
• This increase in myocardial contractility and systolic force of contraction causes complete ventricular emptying and, in the failing heart, the following effects may be seen:
  ⇒ increased cardiac output,
  ⇒ reduction of end diastolic ventricular pressure,
  ⇒ reduction in venous pressure, and
  ⇒ improved renal blood flow & resultant diuresis.
• Digoxin has a negative chronotropic effect. It increases efferent vagal impulses, reflexly reduces sympathetic tone, and decreases the sinus rate. Digitalis decreases conduction velocity through the AV node, thereby decreasing the heart rate. It prolongs the refractory period.
• Excreted primarily unchanged by the kidney with a half-life of 36-48 hours.
• With IV administration, effects occur within 5 – 10 minutes compared with oral administration effects occurring within 30-60 minutes.

Indications.
• Control of ventricular rate in atrial fibrillation and atrial flutter.
• Treatment of congestive heart failure (particularly heart failure resulting from chronic overload).

Contraindications
• Complete heart block or second degree atroventricular block especially with a history of Stokes-Adams attacks.
• Arrhythmias caused by cardiac glycoside intoxication.
• Ventricular tachycardia and ventricular fibrillation.
• Supraventricular arrhythmias with accessory atroventricular pathway (eg. Wolff-Parkinson-White syndrome).
• Hypersensitivity to digitalis glycosides.
• Hypertrophic obstructive cardiomyopathy.

Precautions
• Carotid sinus hypersensitivity as it causes an increase in vagal tone.
• Thyroid disease - hyperthyroid patients may be less sensitive and require larger doses. Hypothyroid patients may be more sensitive and require smaller doses.
• Sinoatrial disorders – digoxin may worsen sinus bradycardia or SA block.
• Use with caution in electrolyte imbalances. Hypokalaemia and hypomagnesaemia may increase risk of toxicity. Hypercalcaemia and hyperkalemia increase risk of digitalis induced arrhythmias. With hypocalcemia the use of digoxin may be ineffective.
• Use with caution in patients with impaired renal function because decreased excretion of the drug may increase risk of toxicity.
Significant interactions
- Concomitant administration of ACE inhibitors may cause increase in serum digoxin levels.
- Digoxin when administered with beta-adrenoreceptor blocking agents may increase A-V conduction time and result in complete heart block.
- Drugs that deplete body potassium such as, diuretics, amphotericin, insulin, beta-adrenogenic bronchodilators and corticosteroids may predispose digitalised patients to toxicity.
- Drugs that increase body potassium such as, ACE inhibitors, spirinolactone, suxamethonium and cyclosporin can predispose patients receiving digoxin to heart block.
- Adrenaline and ephedrine should be used with caution when given along with digoxin since the risk of arrhythmias is increased.

Adverse effects
- Sinus bradycardia or sinus arrest.
- Digoxin toxicity can cause various arrhythmias and conduction disturbances.
- PR prolongation, bigeminy or trigeminy.
- A-V block.
- Electrolyte imbalances
- Nausea, vomiting, diarrhoea, abdominal pain, anorexia.
- Headache, dizziness, drowsines
- Vision disturbances - diplopia, yellow or green vision, haloes or borders on objects.

Presentation
500 micrograms (0.5mg) in 2 mL ampoule (250 micrograms/mL).

Administrations Guidelines
Emergency administration:
- Total dose of 500 micrograms - 1.0 mg IV (slow IV injection).
- Administer as divided doses of 250 micrograms to 500 micrograms IV as slow injection over 30 minutes at intervals of 4 -6 hours.
- In elderly patients: the total dose is 250micrograms to 500micrograms, give slowly either as a single dose or in divided doses of 125micrograms to 250micrograms at intervals of 4-6hours.
- Dilute the desired dose in 100ml of 0.9% sodium chloride or 5% glucose and administer over 30 minutes.

Maintenance daily dose (preferred route is oral):
- 250micrograms as a single daily dose or up to 500micrograms daily in divided doses.
- In elderly patients (because of renal impairment), dose is 125microgram daily in divided doses as 1 digoxin PG tablet twice daily.

Clinical Considerations
- Monitor heart rate and blood pressure.
- Rapid intravenous injection may cause vasoconstriction causing transient hypertension.
- Therapeutic range for serum digoxin level is\(^5\): 0.64 - 1.28 nmol/L
  Potential Toxicity: > or = 1.5 nmol/L
  (Conversion: nmol/L x 0.7809 = ng/mL)
- Blood for digoxin level determination should be collected at least six hours after the last dose.
- Reduced dose may be necessary in those patients with renal impairment.
• Observe for symptoms of toxicity which are similar to the mentioned adverse effects but maybe more frequent and more severe. Prolonged PR interval and premature ventricular contractions are the early arrhythmias that occur with toxicity.

• Digibind is available for the treatment of life-threatening digoxin toxicity.

4. Performance Measures
All incidents are documented using the hospital electronic reporting system: IIMS and managed appropriately by the NUM and staff as directed.

5. References / Links
1. MIMS Online, CIAP: NSW Health Department, Copyright MIMS Australia Pty Ltd. February 2012. http://www.use.hcn.com.au

Author: CNC (S.Shunker)
Endorsed by: A Prof. Michael Parr, ICU Director