



Drug Guideline: Gentamicin

Summary:

Gentamicin is an aminoglycoside antibiotic that is active against a broad range of Gram-negative bacteria, including *Pseudomonas aeruginosa* but not *Stenotrophomonas maltophilia*. Over 90% of aerobic Gram-negative isolates remain susceptible to gentamicin.

Approved by: ICU Medical Director

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Next Review Date: February 2019

Replaces Existing Drug Guideline: Gentamicin

Previous Review Dates: 2009, 2012

1. Introduction:

The risk addressed by this policy:

Patient Safety

The Aims / Expected Outcome of this policy:

Gentamicin will be administered safely and appropriately without any adverse side effects.
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Related Standards or Legislation



NSQHS Standard 1 Governance



National Standard 4 Medication Safety

Related Policies

LH_PD2013_C03.01	Drug Administration
LH_PD2013_C03.03	Drug Calculation Formulas
LH_PD2013_C03.00	Drug Prescribing
LH_PD2013_C03.12	Administration of Intravenous (IV) Medications

2. 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.
- Gentamicin may be administered via a peripheral cannula or central venous access device.
- **If administered peripherally the infusion must be diluted appropriately as it may cause pain and inflammation at the site.**
- Gentamicin must be administered by volumetric infusion pump.
- Patient's renal function should be closely monitored.

3. Principles / Guidelines

Actions

- Gentamicin is an antibacterial aminoglycoside. It acts by inhibiting protein synthesis of susceptible bacteria. It is active against a broad range of Gram-negative bacteria, including *Pseudomonas aeruginosa* but not *Stenotrophomonas maltophilia*. Over 90% of aerobic Gram-negative isolates remain susceptible to gentamicin.
- About 25 to 30% of the administered dose of gentamicin is bound by serum protein; it is released as the drug is excreted. Gentamicin is excreted principally unchanged in the urine by glomerular filtration.

Indications

- For the treatment of infections caused by sensitive gram-negative organisms and as an adjunct treatment for endocarditis due to *Streptococcal* or *Enterococcal species*.
- For the treatment of serious infections caused by susceptible strains of the following microorganisms: *Pseudomonas aeruginosa*, *Proteus species.*, *Escherichia coli*, *Klebsiella species*, *Enterobacter species* and *Serratia species*.

Contraindications

- Previous hypersensitivity reaction to an aminoglycoside.
- Previous vestibular or auditory toxicity due to an aminoglycoside

Precautions

Unless there is no appropriate safer alternative and in the absence of streptococcal or enterococcal endocarditis, aminoglycosides should be avoided if treatment extends more than 48 hours.

Consider giving an alternative antibiotic to gentamicin in patients with the following:

- Pre-existing significant sensorineural hearing problems.
- Pre-existing vestibular problems (including dizziness, vertigo or tinnitus)
- Family history of a first degree relative with aminoglycoside attributed neurotoxicity
- Pre-existing renal damage (baseline creatinine clearance <40mL/min).
- Patients with neuromuscular disorders (Myasthenia Gravis or Parkinson's disease) as muscle weakness may be aggravated due to the curare like effect on the neuromuscular junction.
- Chronic liver disease and severe cholestasis (serum bilirubin > 90 micromol/L)Pregnancy - because of their chemical similarity, aminoglycosides must be considered potentially nephrotoxic and ototoxic to the fetus. It should also be noted that therapeutic blood levels in the mother do not equate with safety for the fetus.

Gentamicin has been used frequently for severe sepsis in pregnancy but is classed as a category D drug (see eTGA) therefore its use should be avoided if alternatives are available.

- Lactation - compatible but may cause diarrhoea in the infant
- Monitor serum levels and renal function during therapy.

Significant Interactions ^{1,2}

- Ethacrynic acid, frusemide and other potent diuretics, due to the risk of ototoxicity or aminoglycoside toxicity.
- Other neurotoxic and/or nephrotoxic antibiotics, including other aminoglycosides, polymyxin B, colistin, cisplatin, vancomycin, amphotericin, clindamycin, sulphamethoxazole and cephalosporins.
- Neuromuscular blocking agents, e.g. suxamethonium, halogenated hydrocarbon inhalation, anaesthetics, opioid analgesics, massive transfusions with citrated anticoagulated blood – may increase blockade (treatment with anticholinesterase agents or calcium salts may help reverse the blockade).
- Gentamicin is inactivated by solutions containing penicillins. For this reason, gentamicin and penicillins should not be combined in IV injections/infusions.

Adverse Effects ^{1,2}

- Hypomagnesaemia, hypocalcaemia, hypokalaemia.
- Elevated liver enzymes.
- Nephrotoxicity – decreased creatinine clearance.
- Ototoxicity – auditory and vestibular changes
- Neurotoxicity – vertigo, ataxia.

Presentation^{1,2}

80mg/2mL gentamicin ampoule.

Administration Guidelines

Dilute in 100mL of sterile 0.9% normal saline or other compatible fluid, if being given into a central venous access device.

If given peripherally, dilute to 200mL.

Severe life-threatening infections:

Dose:

- 7mg/kg; 5mg/kg if the patient has moderate (creatinine clearance 40-60mL/min) renal impairment.
- Dilute in sterile 0.9% normal saline 100mL. Give dose over 30 minutes.

Note:

Non obese patients; calculate the dose using their actual body weight.

Obese patients; Estimate their lean body weight

or

Use the formula for adjusted body weight (ABW) for dosing:

Males: $LBW = 50 + (\text{cm above } 152 \text{ cm in height})$

Females: $LBW = 45 + (\text{cm above } 152 \text{ cm in height})$

then $ABW = LBW + [0.4 \times (TBW - LBW)]$

Dosage Interval:

Start at once daily (24 hourly) dosing (*Except for endocarditis where dosing interval is 8 to 12 hourly – see below*)

Monitoring and Dosage Adjustment

Aminoglycosides such as gentamicin have predominantly concentration dependent killing. Consequently, trough level monitoring to avoid toxicity is used in the absence of computerized methods.

- Trough level monitoring is not indicated if gentamicin treatment does not extend beyond 48 hours unless renal function is unstable.
- Trough levels should be collected immediately before the prescribed dose is given.
- Do not wait for the trough level result before giving the prescribed dose (the trough level is used to adjust the subsequent dose).
- Adjust gentamicin dose aiming for a **target trough of <1.0 mg/L**.
- Because aminoglycosides have predominantly concentration dependent killing, switch to another drug class, increase the dosage interval above 24 hourly or seek specialist advice if trough gentamicin level >1.0 mg/mL at a dose of 200mg daily IV (as opposed to reducing the dose further).

Endocarditis

Gentamicin dosing in endocarditis is different to that in severe sepsis. It is given more often and the aim is for gentamicin to be synergistic with penicillin.

Dose: 1 mg/kg

Dosage interval: 8 to 12 hourly

Drug levels: take trough levels only: aim for target trough < 1.0 mg/L

Note: The inactivation of gentamicin by penicillins may occur in vivo, especially in those patients with renal failure who maintain a higher level of the penicillin for a longer period of time. Therefore, when gentamicin and penicillins are used together in patients with renal failure, the time of administration should be staggered by several hours.

Clinical Considerations

- Routine monitoring of aminoglycoside plasma concentrations is recommended for all patients receiving directed therapy. The aim is to delay the onset of nephrotoxicity and reduce the risk of vestibular as well as auditory ototoxicity. While nephrotoxicity is usually reversible, ototoxicity is much less commonly reversible.
- Monitor renal function. Serum creatinine should be checked, and creatinine clearance calculated before commencing an aminoglycoside, Daily serum creatinine, urea and nitrogen should also be checked.

Dose and administration for Dialysis.

- Intermittent hemodialysis: the dose should be given post treatment. Dose adjustment is the same as for patients with impaired renal function.

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 Australia "MIMS Online" website, CIAP, Copyright MIMS Australia Pty Ltd. 2015. <http://www.ciap.health.nsw.gov.au>
2. eTherapeutic Guidelines: CIAP November 2014, <http://www.ciap.health.nsw.gov.au>
3. Gentamicin: Drug Information. 2015. UpToDate. <http://uptodate.com>
4. The Society of Hospital Pharmacists of Australia 2015, The Australian Injectable Drugs Handbook, 6th Edition, CIAP 2015 online <http://www.ciap.health.nsw.gov.au>
5. Australian Medicines Handbook January 2015, <http://www.use.hcn.com.au>, .

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