MONOGRAPH

Gentamicin (intravenous) Monograph - Paediatric

Scope (Staff):	Medical, Pharmacy, Nursing
Scope (Area):	All Clinical Areas

Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this DISCLAIMER

QUICKLINKS

Dosage/Dosage Adjustments	Administration	Compatibility	Monitoring

DRUG CLASS

Aminoglycoside antibiotic.[1]

Gentamicin is a High Risk Medicine.

INDICATIONS AND RESTRICTIONS

IV: Monitored (orange) antibiotic

- If the use is consistent with a standard approved indication, this must be communicated to ChAMP by documenting that indication on all prescriptions (inpatient and outpatient).
- The ChAMP team will review if ongoing therapy is required and/or if the order does not meet ChAMP Standard Indications
- If use is not for a standard approved indication, phone approval must be obtained from ChAMP before prescribing.

CONTRAINDICATIONS

- Hypersensitivity to gentamicin, any aminoglycoside (e.g. tobramycin or amikacin) or any component of the formulation.[2, 3]

- History of vestibular or auditory toxicity due to use of an aminoglycoside.[1] See 'monitoring' section

PRECAUTIONS

- Use gentamicin with caution in patients with renal impairment, reduce the dose of gentamicin as recommended under 'dose adjustment' and seek infectious diseases, ChAMP or pharmacy advice. Risk factors for nephrotoxicity include duration of treatment, high plasma concentrations, dehydration and treatment with other nephrotoxic medications.[1]
- Use gentamicin with caution in patients with neuromuscular disease e.g. myasthenia gravis as the risk of muscle weakness and respiratory depression is increased.[1]
- There is an increased risk of neuromuscular adverse effects when used in patients with hypocalcaemia, hypermagnesaemia and patients undergoing general anaesthesia or receiving large transfusions of citrated blood.[1]
- Ototoxicity (both auditory and vestibular) may occur with gentamicin use and may be irreversible.[3]

FORMULATIONS

Listed below are products available at PCH, other formulations may be available, check with pharmacy if required:

- 80mg/2mL Vial
- 5mg/mL intrathecal injection (not covered in this monograph) – SAS restrictions also apply.

Imprest location: Formulary One

DOSAGE & DOSAGE ADJUSTMENTS

Neonates: Refer to Neonatal Medication Protocols

Dosing in Overweight and Obese Children: Dosing should be based on adjusted body weight for overweight or obese children.

IV/IM:

General once daily dosing:

- **Children ≥ 4 weeks old to <10 years old:** 7.5mg/kg/dose (to a maximum of 320mg) ONCE daily.[1]
- **Children ≥10 years to 18 years :** 7mg/kg/dose (to a maximum of 560mg) ONCE daily.[1]
- No further dose increases should be made without consulting infectious diseases, ChAMP or clinical microbiology.

Streptococcal and enterococcal endocarditis:

- **All ages**: 1mg/kg/dose (to a maximum dose of 80mg) given 8 hourly in combination with other agents.[4]
- Multiple daily dosing of gentamicin is only recommended for directed therapy of confirmed streptococcal and enterococcal endocarditis.

- Once daily dosing (as per general once daily dosing stated above) should be used for the empiric therapy of endocarditis.[4]
- Refer to ChAMP empiric guidelines: Sepsis and Bacteraemia for further advice regarding recommended combination therapy. Contact infectious diseases, clinical microbiology or pharmacy for advice.

Cystic Fibrosis:

- Tobramycin is the aminoglycoside of choice in patients with cystic fibrosis. Refer to the ChAMP tobramycin monograph for further information.

Surgical prophylaxis:

- All patients ≥1 month old: IV 2mg/kg to 5mg/kg as a single dose given 15 to 60 minutes before surgical incision.[5]
- Majority of procedures will only require a 2mg/kg dose. The 5mg/kg dose should be reserved for cardiac procedures and procedures likely to last longer than 6 hours.[1, 5]

Refer to ChAMP surgical prophylaxis guidelines for specific recommendations.

Renal impairment:

- eGFR calculator
- Where possible, consider using a less nephrotoxic agent.
- Dosage adjustment may be required in cases of impaired renal function (with creatinine clearance of less than 60mL/min).[4, 5]
- All patients with renal impairment should have monitoring based on AUC. See monitoring section for further information.
- In cases where gentamicin is required, suggested initial dosing intervals are stated below. All future doses and intervals are to be determined based on therapeutic drug monitoring.
    - eGFR ≥ 60mL/minute: 24 hourly dosing interval
    - eGFR ≥ 40 to <60mL/minute: 36 hourly dosing interval
    - eGFR <40 mL/minute: consider alternative agents. If essential, give a single initial dose then contact Pharmacy for advice on monitoring and further doses.[5-7]

Hepatic impairment:

- No dosage adjustment is required.[2]

ADMINISTRATION

IV Injection:

- For doses ≤ 120mg, the dose may be diluted to a suitable final volume (up to 20mL) with compatible fluid and administered over 3 to 5 minutes.[8]
- For critically unwell patients, higher doses may be given via a push over 3 to 5 minutes.

IV infusion:

- Dilute to a suitable volume (up to 100mL) with compatible fluid to allow infusion over 30 minutes. [8, 9]

IM injection:

- If IV access is not available this medication may be given by IM injection into a large muscle mass. However the IV route is preferred for patients with suspected shock or sepsis.
- IM injection is NOT suitable for premature neonates.[2]
- Refer to Intramuscular (IM) injections for further information.

COMPATIBILITY

Compatible fluids:

- Sodium chloride 0.9%
- Glucose 5%
- Glucose 10%
- Glucose/sodium chloride solutions
- Hartmann's[8]

Compatible at Y-site:

Compatibilities of IV drugs must be checked when two or more drugs are given concurrently.

MONITORING

Therapeutic drug monitoring:

Monitoring in Neonates:

- Please refer to Neonatal Medication Protocols

Monitoring for patients with normal pharmacokinetics:

- Trough level should be taken immediately prior to the 4th dose and should be below the limit of detection (<0.6mg/L).
- If the trough level is greater than or equal to 0.6mg/L, contact Pharmacy for advice as this indicates reduced clearance of gentamicin and cessation or dose adjustment is required.
- Follow-up levels should be performed twice weekly unless the clinical situation dictates otherwise (e.g. impaired renal function and concurrent use of nephrotoxic drugs where levels should be collected more frequently).

Patients with altered pharmacokinetics:

- Includes patients with Cystic fibrosis (CF), oncology patients, patients with severe burns or patients with impaired renal function.
- These patients should have therapeutic drug monitoring completed with the **SECOND** dose of gentamicin.
- Monitoring should be based on calculating the drug concentration in the body relative to time, monitoring area under the curve (AUC).
- AUC measurement involves a mathematical calculation that requires the recording of the drug concentration at two specific times.

- Refer to the form MR860.91 Gentamicin and Tobramycin AUC Reporting Form for the specific times required.
- This form should be kept in the patients notes on the ward and it will be collected and interpreted by the ward pharmacist who will then calculate the AUC.
- The target AUC for Oncology patients is 60-80mg/L.hr
- **ALL** patients (including those on Hospital in the HOME (HiTH)) require ongoing monitoring of their gentamicin AUC levels at a minimum of once weekly AND/OR following any dose adjustment.

HiTH patients (excluding those with altered pharmacokinetics):

- Require weekly monitoring of their trough levels and renal function monitoring.
- Trough levels should remain below the limit of detection (<0.6mg/L).
- If the trough level is greater than or equal to 0.6mg/L, contact Pharmacy for advice as this indicates reduced clearance of gentamicin and cessation or dose adjustment is required.

Process of therapeutic drug monitoring:

- Blood samples for therapeutic drug monitoring (TDM) for gentamicin may be collected via a capillary blood sample OR via accessing a central venous access device (CVAD) line.
- A capillary blood sample (i.e. finger prick or heel prick for infants <6months) should be used if there is no CVAD in-situ.
- For patients with a CVAD in-situ the following process should be used:[10]
    - Stop all fluids running through the CVAD line.
    - Flush the line with sodium chloride 0.9%. The volume used is three times the internal line-filling volume of the CVAD device (as per table below).
    - Collect an initial blood sample to be **discarded.** The volume taken is three times the internal line-filling volume of the CVAD device PLUS the additional volume of the IV tubing, injection caps and connectors (as per table below). This is to ensure there is no residue gentamicin in the line which may falsely elevate levels.
    - Collect a **therapeutic drug level monitoring sample** of blood to send to PathWest for determination of the AUC.
    - Administer another flush of sodium chloride 0.9% (volume as per table below) to ensure line does not clot after blood sample is taken.
    - Recommence fluids if required

Line type	Approximate internal fill volume of CVAD and line	Flush and discard volume
Peripherally-Inserted Central Catheter (PICC) and Non-tunnelled Central Venous Catheter (CVC)	1mL	3mL
Tunnelled line (broviac) and Implanted (port)	2mL	6mL

Collection tube:

- **Paediatric –** Serum, no gel (RED), Lithium heparin, no gel (DRGNLITH) or Lithium heparin-PST (GREEN) [11]
- **Minimum volume required:** 300microlitres[11]

For further information, refer to the PathWest test directory.

Additional monitoring:

- Renal function and electrolytes should be performed weekly whilst on treatment.
- Patients receiving treatment > 2 weeks with gentamicin (e.g. for osteomyelitis or endocarditis) must be monitored for hearing loss and vestibular toxicity every 1 to 2 weeks.[1]

ADVERSE EFFECTS

Common: Nephrotoxicity (usually reversible, but can be anticipated if treatment extends beyond 7-10 days, or if pre-existing renal impairment). Clinically evident vestibular ototoxicity (nausea, vomiting, vertigo, nystagmus, difficulties with gait) and cochlear ototoxicity (noticeable hearing loss, tinnitus, a feeling of fullness in ear) occur in 2–4% of patients. Ototoxicity may be delayed in onset and may be irreversible.[1, 12]

Infrequent: increased risk of infection, skin reactions[12]

Rare: Anaphylaxis, bronchospasm, oliguria, peripheral neuropathy and neuromuscular blockade, electrolyte disturbances (e.g. hypomagnesaemia), anaemia, azotaemia, eosinophilia, fever, headache, paraesthesia.[1, 12]

STORAGE

- 80mg/2mL ampoule should be protected from light and stored below 25˚C.[8]

INTERACTIONS

This medication may interact with other medications; consult PCH approved references (e.g. Clinical Pharmacology), a clinical pharmacist or PCH Medicines Information Service on extension 63546 for more information.

Please note: The information contained in this guideline is to assist with the preparation and administration of **gentamicin (intravenous)**. Any variations to the doses recommended should be clarified with the prescriber prior to administration

Related CAHS internal policies, procedures and guidelines
Antimicrobial Stewardship Policy
ChAMP Empiric Guidelines and Monographs
KEMH Neonatal Medication Protocols

References

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