Trust Guideline for the use of Gentamicin in Adults

Document Control:

For Use In:	Norfolk and Norwich University Hospitals		
	All Clinical areas where Gentamicin is prescribed for Adults (see exclusion criteria)		
Search Keywords	Gentamicin, therapeutic drug monitoring, intravenous, once daily dose		
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Version History:

Version	Date	Author	Reason/Change
V8.1	17/11/2020	Caroline Hallam Dawn Whitbourn	Reviewed, no clinical changes
V9	January 2024	Eleanor Scott Caroline Hallam	Document transferred to new Trust Procedural document template

Previous Titles for this Document:

Previous Title/Amalgamated Titles	Date Revised
None	Not applicable

Distribution Control

Printed copies of this document should be considered out of date. The most up to date version is available from the Trust Intranet.

Consultation

The following were consulted during the development of this document:
Antimicrobial Subgroup Committee

Monitoring and Review of Procedural Document

The document owner is responsible for monitoring and reviewing the effectiveness of this Procedural Document. This review is continuous however as a minimum will be achieved at the point this procedural document requires a review e.g. changes in legislation, findings from incidents or document expiry.

Relationship of this document to other procedural documents

This document is a clinical guideline applicable to Norfolk and Norwich University Hospitals please refer to local Trust's procedural documents for further guidance, as noted in Section 5.

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1. Introduction

1.1. Rationale

Gentamicin is an aminoglycoside antibiotic used to treat gram-negative bacterial infections and can also be used synergistically to treat some infections caused by gram-positive bacteria. Gentamicin dosing should be adjusted based on patient's weight and renal function and serum gentamicin levels should be monitored to reduce the risk of serious adverse effects such as nephrotoxicity and ototoxicity.

1.2. Objective

The objective of the guideline is to:

- Guide on the appropriate dosing of gentamicin
- Guide on the appropriate monitoring of gentamicin

1.3. Scope

This guideline covers the prescribing of intravenous (IV) gentamicin for the treatment of infections in adults using the 5mg/Kg dosing regime.

The guidance does not apply to gentamicin use in the following:

- Synergistic treatment of endocarditis.
- Synergistic treatment of staphylococcal bone infection.
- Patients treated in Renal units or receiving haemodialysis or haemofiltration.
- Major burns.
- Ascites.
- Age < 16 years.
- Cystic fibrosis.

Contra-indications and cautions:

- Hypersensitivity.
- Myasthenia gravis.
- Pregnancy.

Cautions to gentamicin therapy:

Patients with decompensated liver disease - aminoglycosides are associated with an increased risk of renal failure.

Chronic Kidney Disease (CKD) Stage 4 or more.

Known or suspected acute kidney injury in the previous 48 hours (50% increase in baseline serum creatinine or oliguria > 6 hours).

Concurrent administration of neurotoxic and/or nephrotoxic agents increases the risk

of gentamicin toxicity. Avoid co-administration of the following:

- Neuromuscular blockers.
- Other potentially nephrotoxic (e.g. Non-steroidal anti-inflammatory drugs (NSAIDs) and Angiotensin-converting enzyme (ACE) Inhibitors) or ototoxic drugs.
- Potent diuretics.
- Other aminoglycosides.

1.4. Glossary

The following terms and abbreviations have been used within this document:

Term	Definition
ACE	Angiotensin-converting enzyme
CKD	Chronic Kidney Disease
CrCl	Creatine Clearance calculated using the Cockcroft-Gault equation
EPMA	Electronic Prescribing and Medicines Administration
Gentamicin	An aminoglycoside antibiotic given by intravenous infusion
IE	Infective Endocarditis
IV	Intravenous
NSAIDs	Non-steroidal anti-inflammatory drugs

2. Responsibilities

2.1. Medical staff

Medical staff are responsible for prescribing gentamicin according to this guideline.

2.2. Nursing staff

Nursing staff are responsible for administering gentamicin according to this guideline.

2.3. Pharmacists

Pharmacists are responsible for auditing compliance and checking prescriptions and administration against this guideline.

3. Processes to be followed

3.1. Step 1: Calculate, prescribe and administer the first dose

- To reduce the risk of mortality, commence gentamicin administration within 1 hour of recognising sepsis.
- *If creatinine is known* – use the online Gentamicin calculator (preferred method) or the guidelines in Table 1 (below). The dose and the dosage interval are based on estimated creatinine clearance and **actual** body weight **except** in **pregnancy** where the booking weight should be used.
- *If creatinine is not known* – give an initial dose of 5 mg/kg gentamicin (maximum 400 mg) or, if patient has CKD 5, give 2.5 mg/kg (maximum 180 mg) on advice of senior staff. Calculate the dose using **actual** body weight **except** in **pregnancy** where the booking weight should be used.
- *Give the recommended dose by infusion in 100 mL sodium chloride 0.9% over 30 minutes and document the time of administration on EPMA.*

Table 1: Initial gentamicin doses and dose intervals

Actual body Weight/booking weight (kg) → **Cr Clearance (mL/min) ↓**	**40-49**	**50-59**	**60-69**	**70-80**	**>80**
<21	2.5mg/kg (max 180mg) then take a sample after 24 hours				
21-30	180mg 48-hourly	200mg 48-hourly	240mg 48-hourly	240mg 48-hourly	260mg 48-hourly
31-40	200mg 48-hourly	240mg 48-hourly	280mg 48-hourly	300mg 48-hourly	320mg 48-hourly
41-50	240mg 48-hourly	280mg 48-hourly	320mg 48-hourly	360mg 48-hourly	400mg 48-hourly
51-60	200mg 24-hourly	240mg 24-hourly	280mg 24-hourly	300mg 24-hourly	320mg 24-hourly
>60	240mg 24-hourly	280mg 24-hourly	320mg 24-hourly	360mg 24-hourly	400mg 24-hourly

CAUTION: If the patient weighs < 40 kg and CrCl is ≥ 21 mL/min, give a single dose of 5 mg/kg then take a sample 6 – 14 hours after the dose and follow the instructions in Step 2.

3.2. Step 2: Monitor creatinine and gentamicin concentrations and reassess the dosage regimen:

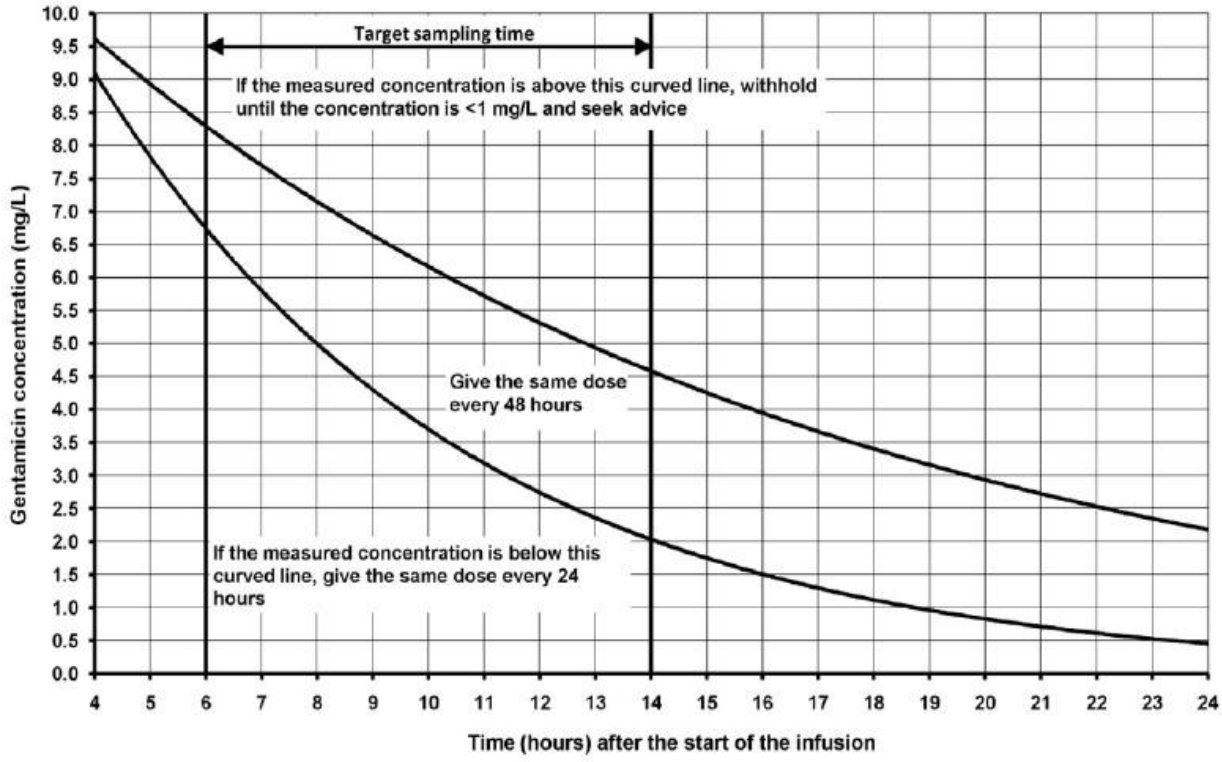
Accurate recording of dosage and sample times is essential for correct interpretation of serum gentamicin levels.

If creatinine clearance is ≥ 21 mL/min

- Take a blood sample 6-14 hours after the start of the first gentamicin infusion.

- Record the exact time of all gentamicin samples on the sample request form.
- Plot the concentration measurement on the graph and reassess the dose / dosing interval as indicated.

- This will indicate one of 3 options:
    1. Continue the present dosage regimen
    2. Adjust the dosage interval
    3. Withhold and resample after 24 hours



If creatinine clearance is < 21 mL/min:

- Take a blood sample 24 hours after the start of the first gentamicin infusion.
- Record the exact time of all gentamicin samples on the sample request form.
- If therapy is to continue, a further dose can be given once the measured concentration is < 1 mg/L.
- Additional blood samples should be taken at least every 24 hours.

General points:

- Document the action taken in the medical notes.
- Undertake pre-prescribing checks to assess the risk of renal toxicity and ototoxicity.
- Prescribe the next dose as appropriate.

- Seek advice from pharmacy or microbiology if you are unsure how to interpret the result or if the concentrations are very low. Doses up to 600 mg may be required for some patients.
- If a blood sample is not taken, is lost or is taken at wrong time and if there is any concern about the patient's renal function, take a sample 20-24 hours after the start of the gentamicin infusion and wait for the result before giving the next dose. Give a further dose once the measured concentration is < 1 mg/L. Otherwise, take a blood sample after the next dose.

If the measured concentration is unexpectedly HIGH or LOW, consider the following:

- Were dose and sample times recorded accurately?
- Was the correct dose administered?
- Was the sample taken from the line used to administer the drug?
- Was the sample taken during drug administration?
- Has renal function declined or improved?
- Does the patient have oedema or ascites?

If in doubt, take another sample before re-prescribing and / or contact pharmacy for advice.

3.3. Step 3: Assess daily the ongoing need for gentamicin and signs of toxicity

- Take further blood samples 6-14 hours after the dose, at least every 2 days.
- If the gentamicin concentration is unexpectedly high or if renal function alters, daily sampling may be necessary.
- To minimise the risk of toxicity, duration of treatment should normally be limited to 72 hours. All gentamicin prescriptions that continue beyond 3 days of treatment must be discussed with microbiology. Consider switching to an oral alternative as appropriate.

Renal toxicity

- Monitor creatinine daily. Seek advice if renal function unstable (e.g.

change in creatinine of > 15-20%), or if patient becomes oliguric.

- Signs of renal toxicity include increase in creatinine or decrease in urine output/oliguria.

Ototoxicity

- Ototoxicity secondary to gentamicin is independent of drug concentration. Monitor for new tinnitus, dizziness, poor balance, hearing loss or oscillating vision.
- Toxicity is associated with prolonged aminoglycoside use (usually > 10 days but may be > 72 hours) and is secondary to drug accumulation within the inner ear.
- Stop treatment if ototoxicity is suspected and refer to microbiology or an infection specialist for advice on future therapy.
- If gentamicin continues for > 7 days, consider referring to audiology for assessment.

4. Related Documents

1. Gentamicin Calculator. Available at: Trust Docs (nnuh.nhs.uk)
2. 'Nurses Guide to Gentamicin in Adult Patients'. Available at: Trust Docs (nnuh.nhs.uk)
3. 'Protocol for the use of parenteral Gentamicin in adults on the Critical Care Complex'. Available at: Trust Docs (nnuh.nhs.uk)
4. 'Joint Trust Guideline for the Antibiotic Treatment of Infective Endocarditis (IE) in Adults' for guidance on dosing of gentamicin for the treatment of endocarditis. Available at: Trust Docs (nnuh.nhs.uk)
5. 'Joint Trust Guideline for the Management of: Once Daily gentamicin in Children'. Available at: Trust Docs (nnuh.nhs.uk)
6. 'Neonatal Gentamicin'. Available at: Trust Docs (nnuh.nhs.uk)

5. Audit of the process

Compliance with the process will be monitored through the following:

Key elements	Process for Monitoring	By Whom (Individual / group /committee)	Responsible Governance Committee /dept	Frequency of monitoring
Initial gentamicin doses and dose intervals	Audit	Antimicrobial Pharmacist	Antimicrobial Subcommitee meeting	Yearly
Blood level monitoring	Audit	Antimicrobial Pharmacist	Antimicrobial Subcommitee meeting	Yearly
Datix reports	Ad hoc	Antimicrobial Pharmacist	Antimicrobial Subcommitee meeting	Ongoing

The audit results are to be discussed at Antimicrobial subgroup committee meetings to review the results and recommendations for further action.

6. Appendices

There are no appendices for this document.

7. Equality Impact Assessment (EIA)

Type of function or policy	Existing

Division	All	**Department**	Pharmacy
Name of person completing form	Eleanor Scott	**Date**	16/01/24

Equality Area	Potential Negative Impact	Impact Positive Impact	Which groups are affected	Full Impact Assessment Required YES/NO
Race	No	No	N/A	No
Pregnancy & Maternity	No	No	N/A	No
Disability	No	No	N/A	No
Religion and beliefs	No	No	N/A	No
Sex	No	No	N/A	No
Gender reassignment	No	No	N/A	No
Sexual Orientation	No	No	N/A	No
Age	No	No	N/A	No
Marriage & Civil Partnership	No	No	N/A	No
EDS2 – How does this change impact the Equality and Diversity Strategic plan (contact HR or see EDS2 plan)?		No effect on equality/diversity		

- **A full assessment will only be required if: The impact is potentially discriminatory under the general equality duty**
- **Any groups of patients/staff/visitors or communities could be potentially disadvantaged by the policy or function/service**
- **The policy or function/service is assessed to be of high significance**

IF IN DOUBT A FULL IMPACT ASSESSMENT FORM IS REQUIRED

The review of the existing policy re-affirms the rights of all groups and clarifies the individual, managerial and organisational responsibilities in line with statutory and best practice guidance.