Gentamicin dosing in children

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Total number of pages:	**"[No of pages, including appendices]"**
Is this document to be published in any other format?	**1) Will be hyperlinked from the PIER first-line empirical antibiotic therapy for specific childhood infections guideline** **2) Content will be added to the microguide**

Does this document replace or revise an existing document? No
If so please identify here which document/s

Contents

1.1 Introduction

Gentamicin is commonly prescribed on PICU, NICU and to children with complex co-morbidities. Gentamicin is commonly prescribed incorrectly and there is often confusion about the timing of therapeutic levels and the action required in the event of abnormal results.

1.2 Scope

This guideline applies to all prescribers of gentamicin and pharmacists checking prescriptions.

Changes:-

i) Clear guidance of gentamicin dosing in children with renal impairment.
ii) Clearer guidance on dosing changes required if therapeutic range not achieved.
iii) Guidance of gentamicin dosing in children being treated for infective endocarditis.

1.3 Purpose

To reduce prescribing errors due to gentamicin (dosing and monitoring).

2 Implementation

Dosing recommendations will be added to the Wessex empirical antibiotic guideline and Wessex microguide.

3 Process for Monitoring Effectiveness

Monitoring of clinical incidents related to drug prescribing.

Appendix A

Paediatric Regional Guideline Consultation Documentation:

Trust	Name of person consulted* (print)	Designation of signatory[$]	Signature
Chichester			
Dorchester	Will Verling	Paediatric consultant	
Hampshire Hospitals Foundation Trust	Ayo Kadri Katie Yallop	Paediatric consultant Paediatric consultant	
Poole	Steve Wadams	Paediatric consultant	
Portsmouth	Amanda Freeman	Paediatric consultant	
Salisbury	Nick Brown	Paediatric consultant	
Southampton	Sanjay Patel	Paediatric ID consultant	
IOW	Arun Gulati	Paediatric consultant	

* this person agrees they have read the guidelines, consulted with relevant colleagues and members of MDT, managers and patients, young people & their families as appropriate. Any queries raised during consultation and review process should be documented with responses and any changes made to guideline.

[$] this can be electronic for ease

WESSEX GENTAMICIN DOSING GUIDELINES: neonates, infants and children (For endocarditis see Gentamcin Endocarditis Guidelines)

For indications for starting/stopping gentamicin, see Wessex empirical Ab guidelines

Table 1: NEONATES (under 28 days)

Dose based on chronological age not gestational age	**Dose**
<7 days (normal renal function*)	Prescribe 5mg/kg every 36 hours
≥7-28 days (normal renal function***)**	Prescribe 5mg/kg every 24 hours Once age>28 days, use dosing guidelines in **Table 2**
Monitoring: Target trough level < 1mg/L. Request a trough level to be taken ideally 2-4 hours before the 2nd dose. Record blood sampling time on request form and administration chart. CHECK the result before giving the next dose. Interpret the result of the assay before the following dose. **See Table 3** for interpretation of level and dose adjustment.	
***If renal impairment or decreased urine output** (defined as <1ml/kg/hr in neonates), request a trough level to be taken 2-4 hours before the following dose. Record blood sampling time on request form and administration chart. Send sample to biochemistry immediately. CHECK the result BEFORE giving the next dose. DELAY next dose of gentamicin until the level is <1mg/L. **See Table 3** for interpretation of levels and dose adjustment.	

Table 2: INFANTS and CHILDREN (1month – 18years) If obese use ideal body weight from centile chart + 40%

A: Normal, stable renal function e.g. Child previously fit and well; no history of renal impairment; no trend of rising serum creatinine or urea; no reduction in urine output; not requiring inotropes. Estimated creatinine clearance > 90ml/min/1.73m^2	**B: Possible mild-moderate renal impairment** e.g. Rising creatinine, urea and/ or phosphate ; child requiring inotropic support; post-op cardiac surgery; history of renal impairment. Estimated creatinine clearance 50-90ml/min/1.73m^2
Prescribe 7mg/kg every 24 hours (max 500mg) **Monitoring:** Request a trough level to be ideally taken 20-22 hours following the1st dose. Record blood sampling time on request form and administration chart. DO NOT DELAY giving the next dose (do not need to wait for result before administering the dose). Interpret the result of the assay before the following dose. **See Table 3** for interpretation of levels and dose adjustment. **Target trough level < 1mg/L**	**Prescribe 7mg/kg every 24 hours (max 500mg)** **Monitoring:** Request a trough level to be ideally taken 20-22 hours after the 1st dose. Record blood sampling time on request form and administration chart. Send sample to biochemistry immediately. CHECK the result BEFORE giving the next dose. DELAY next dose of gentamicin until the level is <1mg/L. **See Table 3** for interpretation of levels and dose adjustment. **Target trough level < 1mg/L**
C: Moderate renal impairment and haemofiltration patients Estimated creatinine clearance 20-50ml/min/1.73m^2	**D: Severe renal impairment and peritoneal dialysis patients** Estimated creatinine clearance less than 20ml/min/1.73m^2.
Prescribe 5mg/kg every 24 hours **Monitoring:** Request a trough level to be taken ideally 20-22 hours after the 1st dose. Record blood sampling time on request form and administration chart. Send sample to biochemistry immediately. CHECK the result BEFORE giving the next dose. DELAY next dose of gentamicin until the level is <1mg/L. **See Table 3** for interpretation of levels and dose adjustment. **Target trough level < 1mg/L**	**Prescribe 2.5mg/kg stat.** **Monitoring:** Check level every 24 hours until < 1mg/l. Repeat 2.5mg/kg stat dose when levels <1mg/L. **Target trough level < 1mg/L**.

Table 3: INTERPRETATION of GENTAMICIN LEVELS and DOSE ADJUSTMENT

Before interpreting levels, consider the following points:-

- Was the blood sample taken at the correct time, and is it a true trough specimen?
- Was the blood sample taken from the intravenous line used to infuse gentamicin?
- Was gentamicin used as a line lock?
- Has the patients' renal function or hydration status deteriorated or improved?
- Was the dose calculated on an actual or estimated body weight?

Caution : renal function and gentamicin levels may require more frequent monitoring in patients receiving other nephrotoxic drugs e.g. aciclovir, ciclosporin, NSAIDs. If possible, avoid administration of gentamicin with other ototoxic drugs e.g. furosemide.

Target trough (pre-dose) level is <1mg/L

Avoid prolonged periods (more than 8 hours) when trough levels are below 1mg/L
Avoid prolonged periods (more than 48 hours) when trough levels are above 1mg/L.

If level <1mg/L

- For neonates, re-dose and prescribe every 36 hours if age < 7days or every 24 hours if age ≥ 7days
- For group A, re-dose and prescribe every 24 hours. Re-check levels and renal function twice weekly.
- For groups B & C, re-dose and re-check level 20-22 hours later. If this is also <1mg/L, prescribe every 24 hours and re-check levels twice weekly.

If level 1-2mg/L

- Re-check level every 6 hours until level <1mg/L, then re-dose and increase dosing interval by 12 hours.
- Re-check levels 2-4hrs before next dose is due, and ensure level is <1mg/L before next dose is given.

If level >2mg/L

- Re-check level every 12 hours until level <1mg/L, then re-dose with a dosing interval increased by 12-24 hours.
- Re-check levels 2hrs before next dose is due, and ensure level is <1mg/L before next dose is given.

If level remains above 1mg/L for >48hrs

- For neonates, reduce dose to 2.5mg/kg and redoes when level <1mg/L
- Re-dose as Group D when level is <1mg/L

Table 4: PREPARATION and ADMINISTRATION of DOSES for ALL AGE GROUPS:

Administration: Doses may be given as a 30 minute infusion, or a slow iv injection over 5 minutes. May be diluted with sodium chloride 0.9% or glucose 5%.

For patients on intermittent furosemide, administration times should be spaced as far apart as possible from gentamicin.

Give stat dose, and draw blood for level 20-22 hours later. (No need to check peak level)

Note: Treatment should not be continued beyond 7 days without discussing with the Paediatric Infectious Diseases team or a medical microbiologist. The risk of nephrotoxicity and ototoxicity increases with prolonged courses.

GENTAMICIN (synergistic dosing) for ENDOCARDITIS

Table 1E: NEONATES (under 1 month) with endocarditis

Starting dose: 1mg/kg, frequency determined by age and renal function (seek advice from neonatal pharmacist)

Target levels: Trough (pre-dose) < 1mg/L; Peak (1 hour post dose) 3-5mg/L

See Table 3E for interpretation of levels and dose adjustment.

Table 2E: INFANTS and CHILDREN (1month – 18years) with endocarditis **(In obesity use ideal body weight)**

A: Normal, stable renal function e.g. Child previously fit and well; no history of renal impairment; no trend of rising serum creatinine or urea; no reduction in urine output; not requiring inotropes. Estimated creatinine clearance > 90ml/min/1.73m^2	**B: Possible mild-moderate renal impairment** e.g. Rising creatinine, urea and/ or phosphate ; child requiring inotropic support; post-op cardiac surgery; history of renal impairment. Estimated creatinine clearance 50-90ml/min/1.73m^2
Starting dose: 1.5mg/kg 8-hourly **Monitoring:** Request a *trough* level to be taken immediately before the 3rd dose ***and*** a *peak* level to be taken 1 hour after the 3rd dose. Record blood sampling times on request form and administration chart. Interpret the result of the assay before the following dose. **See Table 3E** for interpretation of levels and dose adjustment. **Target levels:** Trough (pre-dose) < 1mg/L; Peak (1hr post dose) 3-5mg/L	**Starting dose: 1mg/kg 8-hourly** **Monitoring:** Request a *trough* level to be taken immediately before the 3rd dose ***and*** a *peak* level to be taken 1 hour after the 3rd dose. Record blood sampling times on request form and administration chart. Interpret the result of the assay before the following dose. **See Table 3E** for interpretation of levels and dose adjustment. **Target levels:** Trough (pre-dose) < 1mg/L; Peak (1hr post dose) 3-5mg/L
C: Moderate renal impairment and haemofiltration patients Estimated creatinine clearance 20-50ml/min/1.73m^2	**D: Severe renal impairment and peritoneal dialysis patients** Estimated creatinine clearance less than 20ml/min/1.73m^2.
If haemofiltration is interrupted for more than 4 hours check level before giving next dose, and review dosing. **Starting dose: 1mg/kg 12-hourly** **Monitoring:** Request a *trough* level to be taken immediately before the 3rd dose ***and*** a *peak* level to be taken 1 hour after the 3rd dose. Record blood sampling times on request form and administration chart. Interpret the result of the assay before the following dose. **See Table 3E** for interpretation of levels and dose adjustment. **Target levels:** Trough (pre-dose) < 1mg/L; Peak (1hr post dose) 3-5mg/L	**Starting dose: 1mg/kg 24-hourly** **Monitoring:** Request a *trough* level to be taken immediately before the 3rd dose ***and*** a *peak* level to be taken 1 hour after the 3rd dose. Record blood sampling times on request form and administration chart. Interpret the result of the assay before the following dose. **See Table 3E** for interpretation of levels and dose adjustment. **Target levels:** Trough (pre-dose) < 1mg/L; Peak (1hr post dose) 3-5mg/L

Table 3E: INTERPRETATION of GENTAMICIN LEVELS and DOSE ADJUSTMENT (endocarditis dosing)

Before interpreting levels, consider the following points:-

- Was the blood sample taken at the correct time, and is it a true trough specimen?
- Was the blood sample taken from the intravenous line used to infuse gentamicin?
- Was gentamicin used as a line lock?
- Has the patients' renal function or hydration status deteriorated or improved?
- Was the dose calculated on an actual or estimated body weight?

Caution : renal function and gentamicin levels may require more frequent monitoring in patients receiving other nephrotoxic drugs e.g. aciclovir, cyclosporine, NSAIDs. If possible, avoid administration of gentamicin with other ototoxic drugs e.g. furosemide.

Target trough (pre-dose) level = <1mg/L, target peak (1-hour post dose) = 3-5mg/L.
• If post dose level < 3mg/L: Increase dose • Trough (pre-dose) level >1mg/L: Increase dose interval • Re-check pre-dose and post-dose levels at the 3rd or 4th dose after a change to the dosing schedule • Repeat drug level monitoring and U&E twice weekly or more frequently for patients with renal impairment or fluid shifts.

Table 4E: PREPARATION and ADMINISTRATION of DOSES for ALL AGE GROUPS:

Administration for endocarditis doses: slow iv injection over 5 minutes.

For patients on intermittent furosemide, administration times should be spaced as far apart as possible from gentamicin.

Note: Treatment should not be continued beyond 7 days without discussing with a medical microbiologist or paediatric infectious diseases team. The risk of nephrotoxicity and ototoxicity increases with prolonged courses.