Title: GENTAMICIN USE

Version: 2 (Vs 1 Aug 2004)

Ratification Date: Nov 2010

Review Date: Nov 2013

Approval: Nottingham Neonatal Service Clinical Guideline Meeting

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Consultation: Nottingham Neonatal Service Staff and Clinical Guideline Meeting

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Distribution: Nottingham Neonatal Service, Neonatal Intensive Care Units, Postnatal Wards.

Target audience: Staff of the Nottingham Neonatal Service and Postnatal Wards

Patients to whom this applies: Patients of the Nottingham Neonatal Service who fit the inclusion criteria of the guideline below

Key Words: Gentamicin, pre-dose, post-dose

Risk Managed: Sub optimal antibiotic dosing and Toxic drug levels

Evidence used: The contemporary evidence base has been used to develop this guideline. References to studies utilised in the preparation of this guideline are given at its end.

Clinical guidelines are guidelines only. The interpretation and application of clinical guidelines remain the responsibility of the individual clinician. If in doubt, contact a senior colleague. Caution is advised when using guidelines after the review date. This guideline has been registered with the Nottingham University Hospitals NHS Trust.

Background

Gentamicin is an aminoglycoside antibiotic. It plays an important role in treating neonatal sepsis and is used as a first line and second line antibiotic. It is bactericidal and active against some Gram-positive and many Gram-negative organisms (broad spectrum). It is also active against Pseudomonas aeruginosa. However it is inactive against anaerobes and is also inactive against all streptococci and enterococci.

Pharmacology

Aminoglycosides are given systemically and excreted by the kidneys. There is little diffusion into the CSF, even with inflamed meninges. Many of the side effects are dose related. Important side effects include ototoxicity and renal impairment. If there is renal impairment, the dose interval should be increased. In more severe renal impairment the dose should be reduced or the drug avoided. Gentamicin should preferably not be given with ototoxic diuretics (furosemide). If concurrent use is unavoidable, then they should be spaced apart as far as possible. Prolonged use should be avoided. Gentamicin may impair neuromuscular transmission and must not be given in myasthenia gravis.
Dose

<table>
<thead>
<tr>
<th>Post-menstrual Age</th>
<th>Dose</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>&lt; 32/40</td>
<td>4mg/kg</td>
<td>36 hourly</td>
</tr>
<tr>
<td>≥ 32/40</td>
<td>4mg/kg</td>
<td>24 hourly</td>
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</table>

NB. Post-menstrual age = Gestation at birth + post-natal age

Round doses down to the nearest **0.5mg**.

Doses **must** be given as a slow bolus over 3-5 minutes

Levels

Take levels at the **3rd dose**, the pre-dose immediately before the dose.

and the A **post-dose** level should only be measured when there is culture confirmation of an organism that is sensitive to gentamicin or a senior member of the team feels it is necessary. The sample should be taken, one hour after the dose.

If levels are adequate, they need only be checked twice weekly. If the levels are inadequate and the dose is changed, recheck levels before and after the second new dose is given.

**Desired levels**

<table>
<thead>
<tr>
<th>Trough</th>
<th>Peak</th>
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<tr>
<td>&lt; 2 micrograms/ml</td>
<td>&gt;5-10 micrograms/ml</td>
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</tbody>
</table>

Renal Impairment

Gentamicin is often started on admission. If it becomes apparent that the baby has renal impairment as part of his/her illness (poor urine output, rising creatinine, significant Hypotension) then a trough level should be taken immediately before the **2nd dose** is due. **And withhold 2nd dose until trough level is reported**.

In the presence of a significant renal diagnosis (baby requiring renal team involvement) then Gentamicin is best avoided.

Adjusting Dosages

- If the trough is 2-3 micrograms/ml ⇒ Increase the interval between doses by 12 hours and review renal function
- If the trough is >3 micrograms/ml ⇒ withhold next dose, discuss with senior staff, repeat trough 12 hours later and review renal function
  - If the peak is >10 micrograms/ml ⇒ Decrease dose by 10-20%
  - If the peak is <5 micrograms/ml ⇒ Increase dose by 10-20%
  - If the peak is 5-7 micrograms/ml **in the presence of severe infection (incl pseudomonas)** ⇒ Discuss with senior staff and consider increasing the dose by 10%

**And Recheck levels at the next dose after the changed dose is given**
Elevated gentamicin levels and hearing

Aminoglycoside use is associated with later high frequency hearing loss but the relationship is unclear. The background rate of newborn sensorineural deafness is 1/1000. The most common risk factors is admission to NICU for >48 hours, a FH of early childhood permanent deafness or craniofacial abnormality, but in half of deaf children no risk factor is identified.

If the pre- or post-dose level is elevated then the parents should be informed of this and that the baby will receive an appointment for a hearing test at 8 months. The local hearing screening manager receives details of all infants with elevated gentamicin levels and informs the Childrens hearing assessment centre.

Processing Levels

Prescribe the initial 3 doses of Gentamicin. Review Culture results, Clinical history and Current Clinical status at 48 hours and decide if more than 2 doses are necessary. If the course continues, proceed to level measurements ‘around’ the 3rd dose.

Specific arrangements for NCH

Gentamicin levels go from the fridge at 9am.

Other samples could be sent at 12 midday on Mondays-Fridays to catch the 1pm shuttle to the QMC, from the pathology laboratory reception (the porters have kindly agreed to do another regular collection at 12.00 midday Monday to Friday).

At weekends the doctors need to remember to phone the microbiology doctor [not technician] for results about 143.00 if they have not already been sent by phone.

Interactions

Be aware of the increased risk of ototoxicity and nephrotoxicity with

- Cephalosporins
- Vancomycin
- Furosemide
- Amphotericin
- Indomethacin

References

- Medicines for Children
- Northern Neonatal Formulary
- BNF
- NCH intranet site
APPENDIX 1   Pre- and post- dose levels Gentamicin Prescribing Chart

**Gentamicin Prescribing (1 per course)**

<table>
<thead>
<tr>
<th>Label</th>
<th>Corrected G.Age</th>
<th>Weight</th>
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<tbody>
<tr>
<td>&lt;32/40 (36 hrly)</td>
<td>Dose at 4mg/kg</td>
<td></td>
</tr>
<tr>
<td>32+/40 (24 hrly)</td>
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</table>

**Tick box and calculate starting dose**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time of dose</th>
<th>Dose</th>
<th>Prescribed by</th>
<th>Checked by</th>
<th>Given by</th>
<th>Batch No.</th>
<th>Level due</th>
<th>Pharm</th>
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**Prescribe initial course of 3 doses and mark dates and times, only, of the fourth dose**

Prescribe the subsequent doses after levels are obtained

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Dose</th>
<th>Prescribed by</th>
<th>Checked by</th>
<th>Given by</th>
<th>Batch No.</th>
<th>Level due</th>
<th>Pharm</th>
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**Initial Prescribing**

Prescribe the first 3 doses only and clearly indicate the timing of a level assay. Add Gentamicin to the treatment card and write ‘see attached sheet’. Staple this sheet to the current drug chart. *Levels are done just before and 1 hour after a dose.*

**Level Monitoring Table**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Level taken /sent</th>
<th>Result due</th>
<th>Result Pre</th>
<th>Result Post</th>
<th>Action</th>
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**Monitoring Guidelines**

Do levels around the 3<sup>rd</sup> dose of Gentamicin when first starting this drug
Do levels around the 2<sup>nd</sup> dose if there are concerns about renal failure
Do levels around the 2<sup>nd</sup> dose of Gentamicin after any dose changes
APPENDIX 2

The guideline below (No. 12.8) was removed from use as an independent guideline when the guideline above (2.7, now renamed C2) was circulated in December 2004. It is to remain as an appendix to guideline C2.

Nottingham Neonatal Service – Clinical Guidelines

Title: Pre- and Post-Gentamicin Levels
Review Date: August 2003
Consultation: Neonatal Units
Distribution: Risk Managed: Reduce risk of side effects due to Gentamicin toxicity

Clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague. Caution is advised when using guidelines after a review date. This guideline has been registered with the Nottingham City Hospital Trust.

1. Introduction/Background

Gentamicin is active against Gram positive or Gram negative organisms, especially Proteus organisms. Enterococci are often resistant.

It is used for urinary tract, pulmonary and miscellaneous infections, septicaemia and burns. For the recommended dose and monitoring times, refer to the Nottingham Neonatal Service Antibiotics Dosage Guide 1991, Policy No. 2.2[1]

2. Patient Group/Indications

Gentamicin toxicity is essentially limited to loss of labrinthine function by degeneration of vestibular sensory cells. It can also be nephrotoxic. Serum levels at which this occurs cannot be defined[2]. Levels need to be assayed around the 4th dose. Pre-dose level to be taken 5 minutes before the dose and the post-dose level to be taken 1 hour after the dose.

3. Identification/Diagnosis

Pre- and post-gentamicin levels may be taken by the medical staff, ANNPs or a nurse who has expanded their role and completed the relevant documentation[3]

4. Management

4.1 General patient management

List of equipment required
1) 2 plain clotting sample bottles (clear, conical shape)
2) Autolets, lancet, platforms
3) Gloves (unsterile)
4) Cotton wool
5) Labels: printed label X 1 per form
   plain labels or patient identification labels x 2 for bottles
6) Microbiology form
7) Spot plaster

- Confirm when the level is due, this will be indicated by a box drawn around the time by the
  person prescribing the Gentamicin
- Wash hands thoroughly and put on gloves\(^d\)
- Take sample of blood from the baby’s heel as per Nottingham Neonatal Service Clinical
  Guideline 12.6\(^5\).
- Fill the bottle to the level 0.5 –1 ml blood
- Ensure bleeding has stopped and, if necessary, apply a plaster.
- Label bottle with child’s name, unit number, date of birth and time of sample
- Administer Gentamicin following the Nottingham Neonatal Service Clinical Guideline 4.12\(^6\)
- Take post-gentamicin level 1 hour following administration of gentamicin, following all the same
  steps as above.
- Complete the printed label and attach to the microbiology form ensuring the following details are
  included: current gestation and weight; dose of gentamicin and start date of this course; exact
  time pre- and post-dose levels taken; urea results; and any other antibiotics the baby is
  receiving.
- Write baby’s name in results book. State that gentamicin levels checked and inform medical
  staff/ANNP. Document on fluid chart that level checked.

4.2 Specific Issues
- Gentamicin levels should only be performed by capillary blood sampling if an arterial line is not
  present.
- If an arterial line is present, the gentamicin levels should be performed by medical staff/ANNP.
- It will remain the responsibility of whoever is prescribing the gentamicin, to indicate when levels
  are required, by placing a box on the appropriate time on the prescription chart.
- It will remain the medical staff's/ANNP’s responsibility to act on the result, but the nurse should
  inform them that a level has been checked.

5. Audit points
- Completed incident forms relating to gentamicin levels
- Audit of this expanded role. Scope of Professional Practice.

6. Allied Guidelines/References

   Infection and Neonatal Antibiotics Dosage Guide. Dr. Isphani/Dr McLain


3. Nottingham Neonatal Service Scope of Professional Practice Framework: Expanded Clinical
   Roles, 1995, P. Fox and C. Vyas

4. Nottingham Neonatal Service Clinical Guideline 5.11. The wearing of gloves on neonatal units,


   fluids to neonates, 1999, P. Fox.