

Guidelines for use of IV Gentamicin in Adults ≥ 16 years old

Background

This policy, which was written by the Scottish Antimicrobial Prescribing Group (SAPG) based upon NHS Greater Glasgow and Clyde guidance and adapted for use within Ayrshire and Arran, covers the use of intravenous (IV) gentamicin in adults.

The policy is for the use of gentamicin for the treatment of infection only. Recommendations on gentamicin dosing for surgical prophylaxis etc are provided in separate guidelines on AthenA.

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

- synergistic treatment of endocarditis or *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

- Contra-indications to gentamicin therapy – hypersensitivity, myasthenia gravis
- Cautions to gentamicin therapy:
 - Patients with decompensated liver disease - aminoglycosides are associated with an increased risk of renal failure.
 - Concurrent administration of neurotoxic and / or nephrotoxic agents increases the risk of gentamicin toxicity. Review therapy and consider amending or withholding nephrotoxic drugs during gentamicin treatment. Avoid co-administration with the following:
 - neuromuscular blockers
 - other potentially nephrotoxic (e.g. NSAIDs and ACE Inhibitors) or ototoxic drugs
 - potent diuretics
 - other aminoglycosides

This list is not exhaustive – consult the Summary of Product Characteristics (eSPC) for a full list (www.medicines.org.uk)
 - Chronic Kidney Disease (CKD) Stage 4 or more, known or suspected acute kidney injury in the previous 48 hours ($\geq 50\%$ increase in baseline serum creatinine or oliguria > 6 hours). If gentamicin is clinically indicated, give one dose as per guidance and check with microbiology or an infection specialist before giving a second dose.
 - Pregnancy – use booking weight instead of actual weight.

Prescribing and documentation

- The NHS Ayrshire and Arran gentamicin prescription chart must be used when gentamicin is prescribed as per this guideline, “IV gentamicin in adults ≥ 16 years old.”
- The charts should be used for prescribing treatment doses of gentamicin in conjunction with the existing inpatient prescribing chart (e.g. kardex or electronic prescribing) and medical/nursing documentation.
- These charts contain a step-wise approach to safe and effective prescribing and key points of advice on monitoring, interpreting and re-prescribing.
- An antimicrobial app and/or online calculator is available and should be used to calculate the initial gentamicin dose.

Guidelines for use of IV Gentamicin in Adults ≥16 years old

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 calculator or app (preferred method). The guidelines in Table 1 (below) can be used if the online calculator is not available. The dose amount and dosage interval are based on estimated creatinine clearance (Box 1) and **actual** body weight. In pregnancy, use booking weight.
- If creatinine is not known – give an initial dose of 5 mg/kg gentamicin (maximum 400 mg) or, if Chronic Kidney Disease (CKD) 5, give 2.5 mg/kg (maximum 180 mg) on advice of senior staff. Calculate the dose using **actual** body weight. In pregnancy, use booking weight.
- Give the recommended dose by infusion in 100mL sodium chloride 0.9% over 30 minutes and ensure the time of administration is noted on the medicine chart.

Box 1: Estimation of creatinine clearance (CrCl)

The following 'Cockcroft Gault' equation can be used to estimate creatinine clearance (CrCl)

$$\text{CrCl} = \frac{[140 - \text{age (years)}] \times \text{weight (kg)} \times 1.23 \text{ (male) OR } 1.04 \text{ (female)}}{\text{serum creatinine (micromol/L)}}$$

$$\text{CrCl (mL/min)} = \frac{\text{[140 - age (years)]} \times \text{weight (kg)} \times 1.23 \text{ (male) OR } 1.04 \text{ (female)}}{\text{serum creatinine (micromol/L)}}$$

Cautions:

- Use actual body weight, booking weight (pregnancy) or maximum body weight whichever is lower. For maximum body weight table see appendix 1.
- In patients with low creatinine (< 60 micromol/L), use 60 micromol/L.
- Note: Use of estimated glomerular filtration rate (eGFR) is not recommended.

Table 1: Initial GENTAMICIN doses and dose intervals

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

Note that patients who have unusual clinical characteristics e.g. weight <40kg, weight >120kg, age >90 years may require dose adjustments and require close monitoring. Contact pharmacy for advice.

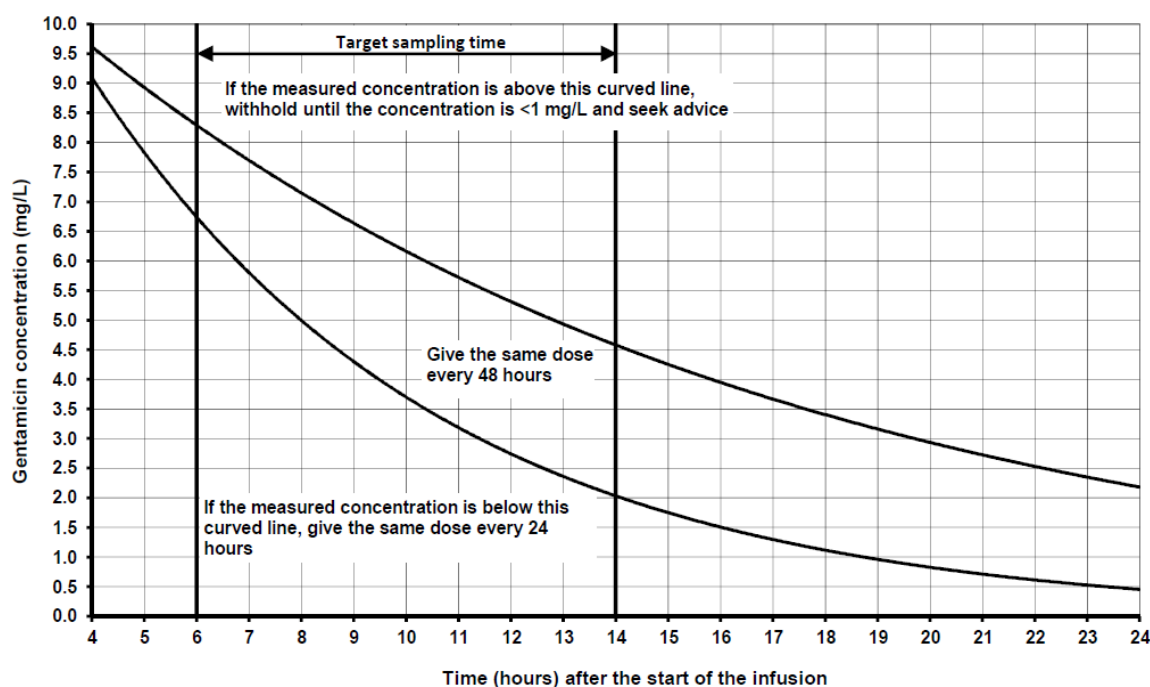
Guidelines for use of IV Gentamicin in Adults ≥ 16 years old

STEP 2: Monitor creatinine and gentamicin concentrations and reassess the dosage regimen

Concentrations are meaningless unless the dose & sample times are recorded accurately

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 gentamicin prescribing chart AND on the sample request form.
- Record the serum concentration on the gentamicin prescribing chart.
- 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 using the gentamicin prescribing chart AND on the sample request form.
- If therapy is to continue, take additional blood samples at least every 24 hours and give a further dose once the measured concentration is < 1 mg/L.

Guidelines for use of IV Gentamicin in Adults ≥ 16 years old

General points

- Document the action taken in the medical notes and on the gentamicin prescribing chart.
- Undertake pre-prescribing checks (Boxes 2 and 3) 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. 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

STEP 3: Assess daily the ongoing need for gentamicin and signs of toxicity

- Take a further blood sample 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 3-4 days of treatment must be discussed with microbiology or an infection specialist. Consider changing to an oral alternative - refer to the IV to Oral switch policy.

Box 2: Renal toxicity

- Monitor creatinine daily. Seek advice if renal function unstable (e.g. change in creatinine of $> 15-20\%$).
- Signs of renal toxicity include increase in creatinine or decrease in urine output/oliguria.
- Consider an alternative agent if creatinine is rising or the patient becomes oliguric.

Box 3: Ototoxicity

- Ototoxicity secondary to gentamicin is independent of drug concentration. It is suggested by any of the following: 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.

Guidelines for use of IV Gentamicin in Adults ≥16 years old

Appendix: 1

Maximum Body Weight Table

This table can be used to determine whether patients are classed as obese (> 20% over ideal body weight) and to determine the maximum body weight for use in the Cockcroft-Gault equation.

Maximum body weight table			
Height (ft inches)	Height (cm)	MBW (kg) (male)	MBW (kg) (female)
4' 8"	142	49	43
4' 9"	145	52	47
4' 10"	147	54	49
4' 11"	150	58	52
5' 0"	152	60	55
5' 1"	155	62	58
5' 2"	158	66	60
5' 3"	160	68	62
5' 4"	163	71	66
5' 5"	165	74	68
5' 6"	168	77	71
5' 7"	170	79	74
5' 8"	173	82	77
5' 9"	175	85	79
5' 10"	178	88	82
5' 11"	180	90	85
6' 0"	183	94	88
6' 1"	185	96	90
6' 2"	188	98	94
6' 3"	191	101	97
6' 4"	193	104	99
6' 5"	195	107	101
6' 6"	198	109	105
6' 7"	201	113	108
6' 8"	203	115	110