2.3 Percentage of patients in whom doses of empirical aminoglycoside therapy are continued beyond 48 hours

Purpose

This indicator addresses the effectiveness of monitoring the duration of empirical treatment with intravenous aminoglycoside antibiotics and the appropriate and timely responsiveness to susceptibility results.

Background and evidence

Aminoglycosides have rapid bactericidal activity and comparatively low levels of resistance in most community and healthcare-associated Gram-negative pathogens.[1,2] For this reason they are recommended for short-term empirical therapy of serious infections possibly caused by Gram-negative organisms.[1,2] However, as a group of medicines they have a narrow therapeutic index and are potentially ototoxic and nephrotoxic. Risk factors for toxicity include renal impairment; complex medical conditions; pre-existing hearing or vestibular impairment; and exposure to other potentially nephrotoxic or ototoxic medicines.[1-3]

The risk of serious adverse effects increases with increasing treatment duration.[1-3] Short term therapy has been shown to have a very low incidence of nephrotoxicity, whilst prolonged therapy has been shown to be an independent risk factor for nephrotoxicity.[3] Therefore, when used empirically, it is recommended that no further doses of aminoglycoside should be given beyond 48 hours.[2] Susceptibility results should be used to guide ongoing therapy. Aminoglycoside therapy should only be continued if a susceptible Gram-negative organism is identified and the patient has an indication for directed therapy.

If susceptibility results are not available by 72 hours and empirical intravenous therapy is still required, the aminoglycoside-containing regimen should be ceased and an alternative regimen used.[1] Monitoring of aminoglycoside plasma concentrations is not required if the clinical plan is to cease therapy within 72 hours of commencement.[2]

Key definitions

Aminoglycoside refers to the drugs amikacin, gentamicin and tobramycin.

Empirical therapy refers to short-term treatment pending the outcome of investigations. When used empirically, no further doses of aminoglycosides should be given beyond 48 hours after the initial dose.[2]

Continued beyond 48 hours refers to all intravenous doses of aminoglycoside antibiotics administered beyond 48 hours after the initial dose. The number of doses given during the first 48 hours depends on the prescribed dosing interval. In adults the dosage interval is determined by the patient's renal function.[2] Specialist advice should be sought with regard to appropriate dosing in paediatric patients.

The times for acceptable empirical doses according to the prescribed dosing interval are shown in the table below:

Dosing interval	Intravenous administration times of empirical doses (hours)	
8 hourly	0, 8, 16, 24, 32, 40, 48	Thereafter empirical therapy should be ceased unless the criteria for directed therapy are met.
24 hourly	0, 24, 48	
36 hourly	0, 36	
48 hourly	0, 48	

Directed therapy refers to treatment with aminoglycosides when results of investigations have shown that this is the most appropriate therapy for the patient, such as in the following circumstances:[2]

- infections when resistance to other safer antimicrobials has been shown
- combination therapy for serious *Pseudomonas aeruginosa* infections and brucellosis
- low doses as synergistic treatment for streptococcal and enterococcal endocarditis.

It is important to note that therapy cannot be classed as directed unless susceptibility results are used to guide antibiotic choice; pending susceptibility results cannot be used to justify continuation of empirical aminoglycoside therapy beyond 48 hours.[1]

Data collection for local use

Please refer to the section *Using the National Quality Use of Medicines Indicators for Australian Hospitals* for guidance on sample selection, sample size, measurement frequency and other considerations.

Inclusion criteria: Adult and paediatric patients who receive a dose of aminoglycoside greater than 48 hours after the initiation of intravenous therapy. Patients on all dosing schedules of aminoglycosides should be included.

Exclusion criteria: Patients in whom aminoglycoside therapy is "directed therapy" from initiation of therapy.

Recommended data sources: Medical records, medication charts and microbiology results.

The data collection tool for QUM Indicator 2.3 assists data collection and indicator calculation.

Data collection for inter-hospital comparison

This indicator may be suitable for inter-hospital comparison. In this case, definitions, sampling methods and guidelines for audit and reporting need to be agreed in advance in consultation with the coordinating agency.

Indicator calculation

$$\frac{\text{Numerator}}{\text{Denominator}} \times 100\%$$

Numerator = Number of patients who received doses of empirical aminoglycoside therapy beyond 48 hours

Denominator = Number of patients who received aminoglycoside therapy beyond 48 hours in sample

Limitations and interpretation

Data collection for this indicator relies on documentation of the reasons for continuing aminoglycoside therapy in the medical record. This may take the form of an explanation of treatment rationale according to microbiological assessment. In the absence of explicit documentation that therapy is directed, it is assumed that treatment is empirical and that treatment has not been reviewed after 48 hours. Clear and comprehensive documentation supports quality patient care[4] and is a critical component of management with high risk medicines such as aminoglycosides. Poor communication can result in adverse medicine events.[5]

It is recommended to keep records of the age of each patient, clinical area, indication and the aminoglycoside dosing schedule to enable relevant analyses and to inform post-audit interventions.

This indicator does not assess the appropriateness of the choice of empirical antibiotic therapy, nor the appropriateness of therapeutic drug monitoring of aminoglycosides. These are acknowledged as important QUM issues that may need to be addressed separately.

Further information

Medication Safety Self Assessment for Australian Hospitals[6] (MSSA) can help identify potential strategies for improvement with this and other indicators. The MSSA encourages development of robust systems for safe prescribing, dispensing, administration and monitoring of medicines. The MSSA is available at **www.cec.health.nsw.gov.au**

This indicator can be used to assist hospitals in meeting the National Safety and Quality Health Service Standard 1 [items 1.2.1, 1.2.2, 1.5.2, 1.6.1, 1.6.2], Standard 3 [items 3.1.1, 3.4.1, 3.4.2, 3.4.3, 3.14.1, 3.14.3, 3.14.4] and Standard 4 [items 4.2.1, 4.2.2, 4.5.1, 4.5.2, 4.11.1].[7]

References

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5. MacKinnon NJ, ed. Safe and Effective: The eight essential elements of an optimal medication-use system. Canadian Pharmacists Association, 2007.
6. Medication Safety Self Assessment for Australian Hospitals: Institute for Safe Medication Practices USA (Adapted for Australian use by NSW Therapeutic Advisory Group and the Clinical Excellence Commission), 2007.
7. Australian Commission on Safety and Quality in Health Care. National Safety and Quality Health Service Standards. Sydney, ACSQHC, 2012.