National Clinical Guideline Centre

Antibiotic classifications

Pneumonia

Diagnosis and management of community- and hospital-acquired pneumonia in adults

Clinical guideline 191

Appendix N

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Contents

1 Classifications for the purposes of data pooling

1.1 Rationale for using antibiotic classification

1.1.1 Community-acquired pneumonia

Streptococcus pneumoniae is the most frequently identified cause of community-acquired pneumonia (CAP). *Staphylococcus aureus*, *Mycoplasma pneumoniae, Legionella pneumophila* and *Haemophilus influenza* are also implicated as causes of CAP, depending on the population type and underlying risk factors. *Moraxella catarrhalis*, *Chlamydophyla* spp. and *Coxiella burnetti* are less common causes of CAP.

Our search protocols placed antibiotics into narrow and broad spectrum categories based on their predicted antibacterial activity. Narrow-spectrum agents were subdivided into class 1 agents (benzylpenicillin and oral penicillin V) covering penicillin-susceptible *S. pneumoniae* and class 2 agents (ampicillin and amoxicillin) providing additional cover against amoxicillin-susceptible *H. influenzae*. Broad-spectrum agents including beta-lactam antibiotics with additional activity against beta-lactamase-producing community pathogens (*H. influenzae*, *M. catarrhalis*) and methicillin-susceptible *S. aureus* were split into beta-lactamase stable penicillins (isoxazolyl penicillins such as flucloxacillin, beta-lactam–beta-lactamase combinations, such as co-amoxiclav) and cephalosporins. For CAP, cephalosporins were grouped together due to their similar broad-spectrum activity against susceptible community pathogens.

Tetracyclines are broad-spectrum agents with activity against *S. pneumoniae*, *S. aureus*, *H. influenzae* and atypical pathogens such as *M. pneumoniae* and *C. burnetti*.

Fluoroquinolones were subdivided into those with inadequate anti-pneumococcal activity (ciprofloxacin, ofloxacin) and the newer respiratory fluoroquinolones with broader anti-Gram-positive activity (levofloxacin, moxifloxacin).

1.1.2 Hospital-acquired pneumonia

In addition to community pathogens, aerobic Gram-negative rods such as *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* play a major role in hospital-acquired pneumonia (HAP). Beta-lactam agents with additional anti-pseudomonal activity (carbapenems, monobactams, certain third generation cephalosporins such as ceftazidime and beta lactam-beta–lactamase combinations such as piperacillin-tazobactam) were specifically considered under the HAP category. Other antibiotics with predominant activity against hospital-related pathogens (glycopeptides, aminoglycosides and the oxazolidinones such as linezolid) were also considered.

Table 1: Antibiotic classifications - separate columns denote drugs considered suitable for pooling in meta-analysis

BETA-LACTAMS					FLUOROQUINOLONES			
Narrow-spectrum beta-lactams		Broad-spectrum beta-lactams						
Class 1	Class 2	Beta-lactamase stable penicillins	All cephalosporins[1]	All carbapenems (HAP only)	Non-respiratory fluoroquinolones (1st and 2nd generation)	Respiratory fluoroquinolones (3rd and 4th generation)	MACROLIDES	TETRACYCLINES
Penicillin G (benzylpenicillin)	Ampicillin	Co-amoxiclav	1st GENERATION	Imipenem	Ciprofloxacin	Levofloxacin	Clarithromycin	Doxycycline
Phenoxymethyl-penicillin (penicillin V)	Amoxicillin	Piperacillin-tazobactam	Cefalexin	Meropenem	Ofloxacin	Moxifloxacin	Clindamycin	Tigecycline
		Timentin (ticarcillin-clavulanic acid)	Cefradine	Ertapenem			Erythromycin	Tetracycline
		Flucloxacillin	Cefadroxil				Azithromycin	Minocycline
		Co-fluampicil	2nd GENERATION					
			Cefaclor					
			Cefuroxime					
			3rd GENERATION					
			Cefotaxime					
			Ceftriaxone					
			Ceftazidime					
			Cefixime					
			Cefpodoxime proxetil					
			4th					

BETA-LACTAMS					FLUOROQUINOLONES			
Narrow-spectrum beta-lactams		Broad-spectrum beta-lactams						
Class 1	Class 2	Beta-lactamase stable penicillins	All cephalosporins[1]	All carbapenems (HAP only)	Non-respiratory fluoroquinolones (1st and 2nd generation)	Respiratory fluoroquinolones (3rd and 4th generation)	MACROLIDES	TETRACYCLINES
			GENERATION					
			Cefepime					
			5th GENERATION					
			Ceftaroline fosamil					

1. *All cephalosporins except for first generation agents are considered beta lactamase stable*