

Microbiology Nuts & Bolts Antibiotics Part 1

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Aims & Objectives

- To understand how to choose an antibiotic to treat a specific infection
- To differentiate between empirical and targeted therapy
- To understand what is meant by broad and narrow spectrum antibiotics
- To have a working knowledge of how antibiotics work
- To understand the implications of prescribing an antibiotic

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Requirements

- Table of bacterial causes of infection
- Table of antibiotic spectrum of activity
- Table of antibiotic tissue penetration

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Causes of infection

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Spectrum of activity

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Tissue penetration

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Some words of warning...!

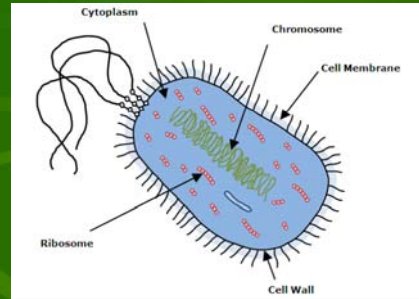
Mycin = derived from a fungus

Learning antibiotics is NOT easy!!

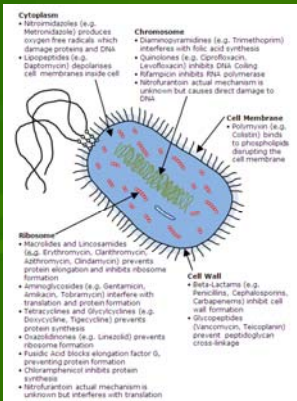
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How antibiotics work



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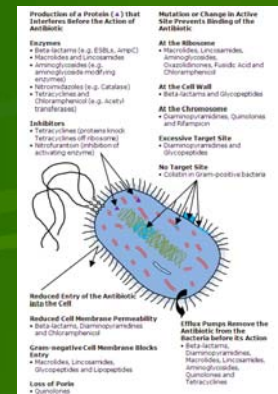
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Antibiotic resistance



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How do you choose an antibiotic?

- Does the patient have an infection?
- What is the likely source of infection?
- What are the likely causative microorganisms?
- Does the patient need an antibiotic?
- Does the patient need urgent treatment?
- Is the antibiotic active against the common microorganisms?
- Does the antibiotic get into the site of infection?
- Does the antibiotic need to be bactericidal?

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How do you choose an antibiotic?

- What route of administration should be used?
- How much antibiotic should be prescribed?
- Are there any cautions and contraindications?
- What are the antibiotics side effects?
- When should the patient be reviewed?
- When can you switch from IV to oral?
- How long should you treat the patient for?
- Do the results of any microbiology tests change what antibiotic should be being used?

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Scenario 1 - CAP

- What are the likely causative microorganisms?
 - *Streptococcus pneumoniae*
 - Viruses
 - *Haemophilus influenzae*
 - *Staphylococcus aureus*
 - *Mycoplasma pneumoniae*
 - *Chlamydia pneumoniae*
 - *Legionella pneumophila*
- Does the patient need an antibiotic?
 - Viral?
- Does the patient need urgent treatment?
 - CURB-65 ≥ 3 or Sepsis

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Scenario 1 - CAP

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>S. aureus</i>	<i>M. pneumoniae</i>	<i>C. pneumoniae</i>	<i>L. pneumophila</i>
Penicillins						
Cephalosporins						
Carbapenems						
Macrolides						
Aminoglycosides						
Diaminopyrimidines						
Fluoroquinolone						
Glycopeptides						
Nitroimidazoles						
Tetracyclines						

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Scenario 1 - CAP

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>S. aureus</i>	<i>M. pneumoniae</i>	<i>C. pneumoniae</i>	<i>L. pneumophila</i>
Penicillins	√?					
Cephalosporins	√					
Carbapenems	√					
Macrolides	√					
Aminoglycosides						
Diaminopyrimidines						
Fluoroquinolone	√?					
Glycopeptides	√					
Nitroimidazoles						
Tetracyclines	√					

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Scenario 1 - CAP

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>S. aureus</i>	<i>M. pneumoniae</i>	<i>C. pneumoniae</i>	<i>L. pneumophila</i>
Penicillins	√?	√?				
Cephalosporins	√	√				
Carbapenems	√	√				
Macrolides	√					
Aminoglycosides						
Diaminopyrimidines						
Fluoroquinolone	√?	√				
Glycopeptides	√					
Nitroimidazoles						
Tetracyclines	√	√				

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Scenario 1 - CAP

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>S. aureus</i>	<i>M. pneumoniae</i>	<i>C. pneumoniae</i>	<i>L. pneumophila</i>
Penicillins	√?	√?	√?			
Cephalosporins	√	√	√			
Carbapenems	√	√	√			
Macrolides	√		√			
Aminoglycosides			√			
Diaminopyrimidines			√			
Fluoroquinolone	√?	√	√?			
Glycopeptides	√		√			
Nitroimidazoles			√			
Tetracyclines	√	√	√			

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Scenario 1 - CAP

- Is the antibiotic active against the common microorganisms?
– Empirical therapy

	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>S. aureus</i>	<i>M. pneumoniae</i>	<i>C. pneumoniae</i>	<i>L. pneumophila</i>
Penicillins	√?	√?	√?			
Cephalosporins	√	√	√			
Carbapenems	√	√	√			
Macrolides	√		√	√	√	√
Aminoglycosides			√			
Diaminopyrimidines			√			
Fluoroquinolone	√?	√	√?	√	√	√
Glycopeptides	√		√			
Nitroimidazoles						
Tetracyclines	√	√	√	√	√	√

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Scenario 1 - CAP

- Does the antibiotic get into the site of infection?

	Lung	Pleural space
Penicillins		
Cephalosporins		
Carbapenems		
Macrolides		
Aminoglycosides		
Diaminopyrimidines		
Fluoroquinolone		
Glycopeptides		
Nitroimidazoles		
Tetracyclines		

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Scenario 1 - CAP

- Does the antibiotic get into the site of infection?

	Lung	Pleural space
Penicillins	√	
Cephalosporins	√	
Carbapenems	√	
Macrolides	√	
Aminoglycosides		
Diaminopyrimidines		
Fluoroquinolone	√	
Glycopeptides	√	
Nitroimidazoles	√	
Tetracyclines	√	

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Scenario 1 - CAP

- Does the antibiotic get into the site of infection?

	Lung	Pleural space
Penicillins	√	√
Cephalosporins	√	√?
Carbapenems	√	√
Macrolides	√	√
Aminoglycosides		
Diaminopyrimidines		
Fluoroquinolone	√	√
Glycopeptides	√	√
Nitroimidazoles	√	√
Tetracyclines	√	√

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Scenario 1 - CAP

- Are there any cautions and contraindications?
– Broad spectrum vs. narrow spectrum
– Co-morbidities e.g. Myasthenia gravis **PLUS** Macrolides **OR** Fluoroquinolones
– Drug interactions e.g. Simvastatin **PLUS** Macrolides
- What are the antibiotics side effects?
– Risk of *Clostridium difficile* e.g. the 4Cs

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Scenario 1 - CAP

- Empirical therapy

	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>S. aureus</i>	<i>M. pneumoniae</i>	<i>C. pneumoniae</i>	<i>L. pneumophila</i>
Penicillins	√?	√?	√?			
Cephalosporins	√	√	√			
Carbapenems	√	√	√			
Macrolides	√		√	√	√	√
Aminoglycosides			√			
Diaminopyrimidines			√			
Fluoroquinolone	√?	√	√?	√	√	√
Glycopeptides	√		√			
Nitroimidazoles						
Tetracyclines	√	√	√	√	√	√

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Scenario 1 - CAP

- How long should you treat the patient for?
 - 7 days
- Do the results of any microbiology tests change what antibiotic should be being used?
 - Narrow down to specific cause i.e. **Targeted therapy**
 - Sputum e.g. *S. pneumoniae*, *H. influenzae*, *S. aureus*
 - Blood cultures e.g. *S. pneumoniae*, *H. influenzae*, *S. aureus*
 - Urinary antigen testing e.g. *S. pneumoniae*, *L. pneumophila*
 - Serology e.g. *M. pneumoniae*, *C. pneumoniae*

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Scenario 1 - CAP

- Targeted therapy

	<i>S. pneumoniae</i>	<i>H. influenzae</i>	<i>S. aureus</i>	<i>M. pneumoniae</i>	<i>C. pneumoniae</i>	<i>L. pneumophila</i>
Penicillins	✓	✓	✓			
Cephalosporins						
Carbapenems						
Macrolides	✓ (PO)		✓ (PO)		✓	
Aminoglycosides						
Diaminopyrimidines						
Fluoroquinolone		✓				✓
Glycopeptides	✓ (IV)		✓ (IV)			
Nitroimidazoles						
Tetracyclines				✓		

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Scenario 2 - UTI

- What are the likely causative microorganisms?
 - *Escherichia coli*
 - *Klebsiella* spp.
 - *Proteus mirabilis*
- Does the patient need an antibiotic?
 - Urethral syndrome?
- Does the patient need urgent treatment?
 - Sepsis

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Scenario 2 - UTI

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>E. coli</i>	<i>Klebsiella</i> spp.	<i>P. mirabilis</i>
Penicillins			
Cephalosporins			
Carbapenems			
Macrolides			
Aminoglycosides			
Diaminopyrimidines			
Fluoroquinolone			
Glycopeptides			
Nitroimidazoles			
Tetracyclines			

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Scenario 2 - UTI

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>E. coli</i>	<i>Klebsiella</i> spp.	<i>P. mirabilis</i>
Penicillins	✓?		
Cephalosporins	✓		
Carbapenems	✓		
Macrolides			
Aminoglycosides	✓		
Diaminopyrimidines	✓		
Fluoroquinolone	✓		
Glycopeptides			
Nitroimidazoles			
Tetracyclines			

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Scenario 2 - UTI

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>E. coli</i>	<i>Klebsiella</i> spp.	<i>P. mirabilis</i>
Penicillins	✓?	✓?	
Cephalosporins	✓	✓	
Carbapenems	✓	✓	
Macrolides			
Aminoglycosides	✓	✓	
Diaminopyrimidines	✓	✓	
Fluoroquinolone	✓	✓	
Glycopeptides			
Nitroimidazoles			
Tetracyclines			

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Scenario 2 - UTI

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>E. coli</i>	<i>Klebsiella</i> spp.	<i>P. mirabilis</i>
Penicillins	√?	√?	√?
Cephalosporins	√	√	√
Carbapenems	√	√	√
Macrolides			
Aminoglycosides	√	√	√
Diaminopyrimidines	√	√	√
Fluoroquinolone	√	√	√
Glycopeptides			
Nitroimidazoles			
Tetracyclines			

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Scenario 2 - UTI

- Does the antibiotic get into the site of infection?

	Urine	Prostate
Penicillins		
Cephalosporins		
Carbapenems		
Macrolides		
Aminoglycosides		
Diaminopyrimidines		
Fluoroquinolone		
Glycopeptides		
Nitroimidazoles		
Tetracyclines		

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Scenario 2 - UTI

- Does the antibiotic get into the site of infection?

	Urine	Prostate
Penicillins	√?	
Cephalosporins	√?	
Carbapenems	√	
Macrolides		
Aminoglycosides	√	
Diaminopyrimidines	√	
Fluoroquinolone	√	
Glycopeptides	√	
Nitroimidazoles		
Tetracyclines	√?	

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Scenario 2 - UTI

- Does the antibiotic get into the site of infection?

	Urine	Prostate
Penicillins	√?	√?
Cephalosporins	√?	√?
Carbapenems	√	√
Macrolides		
Aminoglycosides	√	
Diaminopyrimidines	√	√
Fluoroquinolone	√	√
Glycopeptides	√	
Nitroimidazoles		
Tetracyclines	√?	√?

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Scenario 2 - UTI

- Are there any cautions and contraindications?
 - Broad spectrum vs. narrow spectrum
 - Co-morbidities e.g. Myasthenia gravis **PLUS** Aminoglycosides **OR** Fluoroquinolones
 - Drug interactions e.g. Methotrexate **PLUS** Trimethoprim **OR** Ciprofloxacin
- What are the antibiotics side effects?
 - Risk of *Clostridium difficile* e.g. the 4Cs

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Scenario 2 - UTI

- Empirical therapy

	<i>E. coli</i>	<i>Klebsiella</i> spp.	<i>P. mirabilis</i>
Penicillins	√?	√?	√?
Cephalosporins	√	√	√
Carbapenems	√	√	√
Macrolides			
Aminoglycosides	√	√	√
Diaminopyrimidines	√	√	√
Fluoroquinolone	√	√	√
Glycopeptides			
Nitroimidazoles			
Tetracyclines			

OR Nitrofurantoin

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Scenario 2 - UTI

- How long should you treat the patient for?
 - Simple 3 days
 - Complicated or pyelonephritis 7 days
- Do the results of any microbiology tests change what antibiotic should be being used?
 - Narrow down to specific cause i.e. **Targeted therapy**
 - Urine
 - Blood cultures
 - Depends on sensitivity testing

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Scenario 2 - UTI

- Targeted therapy

	<i>E. coli</i>	<i>Klebsiella spp.</i>	<i>P. mirabilis</i>
Penicillins	√?	√?	√?
Cephalosporins			
Carbapenems			
Macrolides			
Aminoglycosides			
Diaminopyrimidines	√	√	√
Fluoroquinolone			
Glycopeptides			
Nitroimidazoles			
Tetracyclines			

OR Nitrofurantoin

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Scenario 3 – *C. difficile*

- What are the likely causative microorganisms?
 - *Clostridium difficile*
 - Antibiotics **DO NOT** cause *C. difficile* they only predispose to it!
- Does the patient need an antibiotic?
 - Colonisation?
- Does the patient need urgent treatment?
 - Acute abdomen and sepsis

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Scenario 3 – *C. difficile*

- Is the antibiotic active against the common microorganisms?
 - **Empirical therapy**

	<i>C. difficile</i>
Penicillins	
Cephalosporins	
Carbapenems	
Macrolides	
Aminoglycosides	
Diaminopyrimidines	
Fluoroquinolone	
Glycopeptides	
Nitroimidazoles	
Tetracyclines	

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Scenario 3 – *C. difficile*

- Is the antibiotic active against the common microorganisms?
 - **Empirical therapy**

	<i>C. difficile</i>
Penicillins	
Cephalosporins	
Carbapenems	
Macrolides	
Aminoglycosides	
Diaminopyrimidines	
Fluoroquinolone	
Glycopeptides	√ (PO only)
Nitroimidazoles	√
Tetracyclines	

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Scenario 3 – *C. difficile*

- Are there any cautions and contraindications?
 - Drug interactions e.g. Metronidazole increases Warfarin and Phenytoin levels
 - May still require antibiotics for the original problem or complications
 - If nil by mouth then use IV Metronidazole
- What are the antibiotics side effects?
 - Metronidazole can lead to allergy, neutropaenia, hepatitis and peripheral neuropathy

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Scenario 3 – *C. difficile*

- Empirical therapy

	<i>C. difficile</i>
Penicillins	
Cephalosporins	
Carbapenems	
Macrolides	
Aminoglycosides	
Diaminopyrimidines	
Fluoroquinolone	
Glycopeptides	✓ (PO only)
Nitroimidazoles	✓
Tetracyclines	

Depends on severity

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Scenario 3 – *C. difficile*

- How long should you treat the patient for?
 - 10-14 days
 - OR 7 days after other antibiotics stopped
- Do the results of any microbiology tests change what antibiotic should be being used?
 - No need to repeat tests to look for clearance

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Scenario 3 – *C. difficile*

- Targeted therapy

	<i>C. difficile</i>
Penicillins	
Cephalosporins	
Carbapenems	
Macrolides	
Aminoglycosides	
Diaminopyrimidines	
Fluoroquinolone	
Glycopeptides	✓ (PO only)
Nitroimidazoles	✓
Tetracyclines	

OR Fidaxomycin

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Scenario 4 - Meningitis

- What are the likely causative microorganisms?
 - *Streptococcus pneumoniae*
 - *Neisseria meningitidis*
 - *Haemophilus influenzae*
 - *Listeria monocytogenes*
 - Viruses
- Does the patient need an antibiotic?
 - Normally yes – “golden hour”
 - Viral?
- Does the patient need urgent treatment?
 - Yes – “golden hour”

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Scenario 4 - Meningitis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. pneumoniae</i>	<i>N. meningitidis</i>	<i>H. influenzae</i>	<i>L. monocytogenes</i>
Penicillins				
Cephalosporins				
Carbapenems				
Macrolides				
Aminoglycosides				
Diaminopyrimidines				
Fluoroquinolone				
Glycopeptides				
Nitroimidazoles				
Tetracyclines				
Chloramphenicol				

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Scenario 4 - Meningitis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. pneumoniae</i>	<i>N. meningitidis</i>	<i>H. influenzae</i>	<i>L. monocytogenes</i>
Penicillins	✓			
Cephalosporins	✓			
Carbapenems	✓			
Macrolides				
Aminoglycosides				
Diaminopyrimidines				
Fluoroquinolone				
Glycopeptides	✓?			
Nitroimidazoles				
Tetracyclines				
Chloramphenicol	✓			

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Scenario 4 - Meningitis

- Is the antibiotic active against the common microorganisms?
- Empirical therapy

	<i>S. pneumoniae</i>	<i>N. meningitidis</i>	<i>H. influenzae</i>	<i>L. monocytogenes</i>
Penicillins	✓	✓		
Cephalosporins	✓	✓		
Carbapenems	✓	✓		
Macrolides				
Aminoglycosides				
Diaminopyrimidines				
Fluoroquinolone				
Glycopeptides	✓?			
Nitroimidazoles				
Tetracyclines				
Chloramphenicol	✓	✓		

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Scenario 4 - Meningitis

- Is the antibiotic active against the common microorganisms?
- Empirical therapy

	<i>S. pneumoniae</i>	<i>N. meningitidis</i>	<i>H. influenzae</i>	<i>L. monocytogenes</i>
Penicillins	✓	✓	✓?	
Cephalosporins	✓	✓	✓	
Carbapenems	✓	✓	✓	
Macrolides				
Aminoglycosides				
Diaminopyrimidines				
Fluoroquinolone				
Glycopeptides	✓?			
Nitroimidazoles				
Tetracyclines				
Chloramphenicol	✓	✓	✓	

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Scenario 4 - Meningitis

- Is the antibiotic active against the common microorganisms?
- Empirical therapy

	<i>S. pneumoniae</i>	<i>N. meningitidis</i>	<i>H. influenzae</i>	<i>L. monocytogenes</i>
Penicillins	✓	✓	✓?	✓
Cephalosporins	✓	✓	✓	
Carbapenems	✓	✓	✓	✓
Macrolides				
Aminoglycosides				
Diaminopyrimidines				✓?
Fluoroquinolone				
Glycopeptides	✓?			
Nitroimidazoles				
Tetracyclines				
Chloramphenicol	✓	✓	✓	

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Scenario 4 - Meningitis

- Does the antibiotic get into the site of infection?

	CSF
Penicillins	
Cephalosporins	
Carbapenems	
Macrolides	
Aminoglycosides	
Diaminopyrimidines	
Fluoroquinolone	
Glycopeptides	
Nitroimidazoles	
Tetracyclines	

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Scenario 4 - Meningitis

- Does the antibiotic get into the site of infection?

	CSF
Penicillins	✓
Cephalosporins	✓
Carbapenems	✓
Macrolides	
Aminoglycosides	
Diaminopyrimidines	✓?
Fluoroquinolone	
Glycopeptides	✓?
Nitroimidazoles	✓
Tetracyclines	✓?

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Scenario 4 - Meningitis

- Are there any cautions and contraindications?
 - Beta-lactam allergy
- What are the antibiotics side effects?
 - Risk of *Clostridium difficile* with cephalosporins
 - Hepatitis with Beta-lactams
 - Aplastic anaemia with Chloramphenicol

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Scenario 4 - Meningitis

• Empirical therapy

	<i>S. pneumoniae</i>	<i>N. meningitidis</i>	<i>H. influenzae</i>	<i>L. monocytogenes</i>
Penicillins	✓	✓	✓	✓
Cephalosporins	✓	✓	✓	✓
Carbapenems	✓	✓	✓	✓
Macrolides				
Aminoglycosides				
Diaminopyrimidines				✓
Fluoroquinolone				
Glycopeptides	✓			
Nitroimidazoles				
Tetracyclines			✓	
Chloramphenicol	✓	✓	✓	

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Scenario 4 - Meningitis

- How long should you treat the patient for?
 - *S. pneumoniae* - 14 days
 - *N. meningitidis* - 7 days
 - *H. influenzae* - 14 days
 - *L. monocytogenes* - 21 days
- Do the results of any microbiology tests change what antibiotic should be being used?
 - Narrow down to specific cause i.e. **Targeted therapy**
 - CSF - *S. pneumoniae*, *N. meningitidis*, *H. influenzae*, *L. monocytogenes*
 - EDTA Blood PCR - *S. pneumoniae*, *N. meningitidis*

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Scenario 4 - Meningitis

• Targeted therapy

	<i>S. pneumoniae</i>	<i>N. meningitidis</i>	<i>H. influenzae</i>	<i>L. monocytogenes</i>
Penicillins	✓?	✓	✓?	✓
Cephalosporins	✓		✓	
Carbapenems				
Macrolides				
Aminoglycosides				
Diaminopyrimidines				
Fluoroquinolone				
Glycopeptides				
Nitroimidazoles				
Tetracyclines				
Chloramphenicol				

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Scenario 5 - Cellulitis

- What are the likely causative microorganisms?
 - *Staphylococcus aureus*
 - Beta-haemolytic Streptococci groups A, C and G
- Does the patient need an antibiotic?
 - Self-limiting?
- Does the patient need urgent treatment?
 - Sepsis

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Scenario 5 - Cellulitis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. aureus</i>	Beta-haemolytic Streptococci A, C & G
Penicillins		
Cephalosporins		
Carbapenems		
Macrolides & Lincosamides		
Aminoglycosides		
Diaminopyrimidines		
Fluoroquinolone		
Glycopeptides		
Nitroimidazoles		
Tetracyclines		

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Scenario 5 - Cellulitis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. aureus</i>	Beta-haemolytic Streptococci A, C & G
Penicillins	✓	
Cephalosporins	✓	
Carbapenems	✓	
Macrolides & Lincosamides	✓	
Aminoglycosides	✓	
Diaminopyrimidines		
Fluoroquinolone	✓	
Glycopeptides	✓	
Nitroimidazoles		
Tetracyclines	✓	

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Scenario 5 - Cellulitis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. aureus</i>	Beta-haemolytic <i>Streptococci A, C & G</i>
Penicillins	✓	✓
Cephalosporins	✓	✓
Carbapenems	✓	✓
Macrolides & Lincosamides	✓	✓?
Aminoglycosides	✓	
Diaminopyrimidines		
Fluoroquinolone	✓	
Glycopeptides	✓	✓
Nitroimidazoles		
Tetracyclines	✓	✓?

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Scenario 5 - Cellulitis

- Does the antibiotic get into the site of infection?

	Skin	Abscess
Penicillins		
Cephalosporins		
Carbapenems		
Macrolides & Lincosamides		
Aminoglycosides		
Diaminopyrimidines		
Fluoroquinolone		
Glycopeptides		
Nitroimidazoles		
Tetracyclines		

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Scenario 5 - Cellulitis

- Does the antibiotic get into the site of infection?

	Skin	Abscess
Penicillins	✓	
Cephalosporins	✓	
Carbapenems	✓	
Macrolides & Lincosamides	✓	
Aminoglycosides	✓	
Diaminopyrimidines	✓	
Fluoroquinolone	✓	
Glycopeptides	✓	
Nitroimidazoles	✓	
Tetracyclines	✓	

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Scenario 5 - Cellulitis

- Does the antibiotic get into the site of infection?

	Skin	Abscess
Penicillins	✓	✓
Cephalosporins	✓	✓?
Carbapenems	✓	✓
Macrolides & Lincosamides	✓	✓?
Aminoglycosides	✓	
Diaminopyrimidines	✓	
Fluoroquinolone	✓	✓
Glycopeptides	✓	✓
Nitroimidazoles	✓	✓
Tetracyclines	✓	✓

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Scenario 5 - Cellulitis

- Are there any cautions and contraindications?
 - Broad spectrum vs. narrow spectrum
 - Beta-lactam allergy
 - Co-morbidities e.g. Myasthenia gravis **PLUS** Macrolides **OR** Fluoroquinolones
 - Drug interactions e.g. Simvastatin **PLUS** Macrolides, Methotrexate **PLUS** Ciprofloxacin
- What are the antibiotics side effects?
 - Risk of *Clostridium difficile* e.g. the 4Cs
 - Hepatitis with Beta-lactams

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Scenario 5 - Cellulitis

- Empirical therapy

	<i>S. aureus</i>	Beta-haemolytic <i>Streptococci A, C & G</i>
Penicillins	✓	✓
Cephalosporins	✓	✓
Carbapenems	✓	✓
Macrolides & Lincosamides	✓	✓?
Aminoglycosides	✓	
Diaminopyrimidines		
Fluoroquinolone	✓	
Glycopeptides	✓	✓
Nitroimidazoles	✓	✓
Tetracyclines	✓	✓?

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Scenario 5 - Cellulitis

- How long should you treat the patient for?
 - 7 days
- Do the results of any microbiology tests change what antibiotic should be being used?
 - Narrow down to specific cause i.e. **Targeted therapy**
 - Wounds swabs - *S. aureus* (MRSA), Beta-haemolytic Streptococci groups A, C and G

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Scenario 5 - Cellulitis

- Targeted therapy

	<i>S. aureus</i>	Beta-haemolytic Streptococci A, C & G
Penicillins	✓	✓
Cephalosporins		
Carbapenems		
Macrolides & Lincosamides	✓	✓?
Aminoglycosides		
Diaminopyrimidines		
Fluoroquinolone		
Glycopeptides	✓ (MRSA)	
Nitroimidazoles		
Tetracyclines	✓ (MRSA)	

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Scenario 6 - Sepsis

- What are the likely causative microorganisms?
 - Any?
 - Gram-positive cocci - *S. aureus*, *S. pneumoniae*, Beta-haemolytic Streptococci
 - Gram-positive bacilli - *L. monocytogenes*
 - Gram-negative cocci - *N. meningitidis*
 - Gram-negative bacilli - Enterobacteriaceae e.g. *E. coli*, *Pseudomonas aeruginosa*
- Does the patient need an antibiotic?
 - Yes - "golden hour"
- Does the patient need urgent treatment?
 - Yes - "golden hour"

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Scenario 6 - Sepsis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic Streptococci A, C, G	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins						
Cephalosporins						
Carbapenems						
Macrolides						
Aminoglycosides						
Diaminopyrimidines						
Fluoroquinolone						
Glycopeptides						
Nitroimidazoles						
Tetracyclines						

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Scenario 6 - Sepsis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic Streptococci A, C, G	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	✓?					
Cephalosporins	✓					
Carbapenems	✓					
Macrolides	✓?					
Aminoglycosides	✓					
Diaminopyrimidines						
Fluoroquinolone	✓					
Glycopeptides	✓					
Nitroimidazoles						
Tetracyclines	✓?					

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Scenario 6 - Sepsis

- Is the antibiotic active against the common microorganisms?
 - Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic Streptococci A, C, G	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	✓?	✓?				
Cephalosporins	✓	✓				
Carbapenems	✓	✓				
Macrolides	✓?	✓?				
Aminoglycosides	✓					
Diaminopyrimidines						
Fluoroquinolone	✓	✓?				
Glycopeptides	✓	✓				
Nitroimidazoles						
Tetracyclines	✓?	✓?				

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Scenario 6 - Sepsis

- Is the antibiotic active against the common microorganisms?
– Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic Streptococci A G G	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	√?	√?	√			
Cephalosporins	√	√	√			
Carbapenems	√	√	√			
Macrolides	√?	√?	√?			
Aminoglycosides	√					
Diaminopyrimidines						
Fluoroquinolone	√	√?				
Glycopeptides	√	√	√			
Nitroimidazoles						
Tetracyclines	√?	√?	√?			

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Scenario 6 - Sepsis

- Is the antibiotic active against the common microorganisms?
– Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic Streptococci A G G	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	√?	√?	√	√		
Cephalosporins	√	√	√	√		
Carbapenems	√	√	√	√		
Macrolides	√?	√?	√?			
Aminoglycosides	√					
Diaminopyrimidines						
Fluoroquinolone	√	√?				
Glycopeptides	√	√	√			
Nitroimidazoles						
Tetracyclines	√?	√?	√?			

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Scenario 6 - Sepsis

- Is the antibiotic active against the common microorganisms?
– Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic Streptococci A G G	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	√?	√?	√	√	√?	
Cephalosporins	√	√	√	√	√	
Carbapenems	√	√	√	√	√	
Macrolides	√?	√?	√?			
Aminoglycosides	√				√	
Diaminopyrimidines					√?	
Fluoroquinolone	√	√?			√	
Glycopeptides	√	√	√			
Nitroimidazoles						
Tetracyclines	√?	√?	√?			

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Scenario 6 - Sepsis

- Is the antibiotic active against the common microorganisms?
– Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic Streptococci A G G	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	√?	√?	√	√	√?	√?
Cephalosporins	√	√	√	√	√	√?
Carbapenems	√	√	√	√	√	√
Macrolides	√?	√?	√?		√	√
Aminoglycosides	√				√	√
Diaminopyrimidines					√?	
Fluoroquinolone	√	√?			√	√
Glycopeptides	√	√	√			
Nitroimidazoles						
Tetracyclines	√?	√?	√?			

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Scenario 6 - Sepsis

- Bactericidal or bacteriostatic?

	Cidal	Static
Penicillins	√	
Cephalosporins	√	
Carbapenems	√	
Macrolides	√?	
Aminoglycosides	√?	
Diaminopyrimidines	√?	
Fluoroquinolone	√	
Glycopeptides	√	
Nitroimidazoles	√?	
Tetracyclines		√

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Scenario 6 - Sepsis

- Are there any cautions and contraindications?
– Broad spectrum vs. narrow spectrum
– Co-morbidities e.g. Myasthenia gravis PLUS Aminoglycosides OR Fluoroquinolones
- What are the antibiotics side effects?
– Risk of *Clostridium difficile* e.g. the 4Cs

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Scenario 6 - Sepsis

- Empirical therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic <i>Streptococci A G G</i>	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	✓	✓	✓	✓	✓	✓
Cephalosporins	✓	✓	✓	✓	✓	✓
Carbapenems	✓	✓	✓	✓	✓	✓
Macrolides	✓?	✓?	✓?			
Aminoglycosides	✓				✓	✓
Diaminopyrimidines					✓?	
Fluoroquinolone	✓	✓?			✓	✓
Glycopeptides	✓	✓	✓			
Nitroimidazoles						
Tetracyclines	✓?	✓?	✓?			

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Scenario 6 - Sepsis

- How long should you treat the patient for?
 - Depends on underlying cause
 - Source control essential e.g. drain abscesses
- Do the results of any microbiology tests change what antibiotic should be being used?
 - Narrow down to specific cause i.e. Targeted therapy
 - Sputum
 - Blood cultures
 - Urinary
 - CSF
 - EDTA Blood PCR

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Scenario 6 - Sepsis

- Targeted therapy

	<i>S. aureus</i>	<i>S. pneumoniae</i>	Beta-haemolytic <i>Streptococci A G G</i>	<i>N. meningitidis</i>	Enterobacteriaceae	<i>P. aeruginosa</i>
Penicillins	✓?	✓?	✓	✓	✓?	✓?
Cephalosporins		✓				
Carbapenems						
Macrolides						
Aminoglycosides					✓	✓
Diaminopyrimidines					✓?	
Fluoroquinolone					✓	✓
Glycopeptides	✓	✓	✓			
Nitroimidazoles						
Tetracyclines						

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Conclusions

- Treating patients safely and effectively with antibiotics requires using:

The right antibiotic
 ...at the right dose
 ...by the right route
 ...and the right duration
 ...for the right infection
 ...at the right time!

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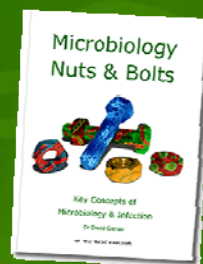
Part 2

- The daily review of antibiotics
- Reasons for failing antibiotic therapy
- IV to oral switching
- Therapeutic drug monitoring (TDM)
- Antibiotics in special groups
 - Renal failure
 - Obesity

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Any Questions?



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