Antibiotics smart use

Fb/Nurse-Info

Penicillins

Spectrum

G +ve	Spirocheats
Anaerobs	**NOT** G –ve • E Coli • Shigella • Salmonella • Psodomonas

Side Effects

Very Safe

- So used in long term Prophylaxis
- Allergy
- Enceph;opathy
- Electrolytes load

Route

Parentral

Excretion

Kidney

By Tubular Secretion

Mechanism of Action

Cell Wall

Cidal

Penicillins

Oral

Penicillin V

Long Acting

Benzathine Penicillin

- 2-4 weeks
- Ttt of lymphoedema

Broad Spectrum

Amoxicillin +clavulanic Acid = ***Augmentin***

Ampicillin +Sulbactam = ***Unasyn***

Anti Beta Lactamase

Flucxacillin

Flucluxacillin

The Prototype

Crystalline Penicillin

- Benzyle Penicillin
- Penicillin G

Reversed Spectrum

Selexid

In UTI

AntiPsodomonal

Carbiniclin

Ticaracillin +clavulanic Acid = ***Timentin***

Pipracillin

Cephalosporins

Spectrum

G –ve	G+ve
Some against **anaerobes** **Mefoxine**	

Mechanism of Action

Cell wall

Cidal

Like Pinicillins

Side Effects

Safe

- Allergy may present

Share Pinicillins in allergy in 10% of cases

Route

Oral • Parentral

1st • 2nd • 3rd • 4th

1. Resist beta lactamase
2. Parenteral
3. G –ve effective
4. Broader spectrum

Excretion

Kidney

By Tubular Secretion

Cephalosporins

First Generation

Cephradine

Velosef ®

Second Generation

Mefoxine

Effective against anaerobes

Third Generation

Cefoprazone

Cefobid®

Cefotoxime

Meningitis

Ceftriaxone

Rocephen®

Long half life

Once A day

Forth Generation

Maxipime®

Other Beta lactam

Imipenim +

Cilastitin

Enzyme Inhibitor

Inhibit distruction by Kidney

= *Tienam* ®

- The broadest spectrum ever
- Parentral

Aztreonam

Azactam ®

- Very narrow spectrum
- G –ve onle
- Parentral

Beta Lactamase Inhibitors

Clavulanic Acid

+ Amoxicillin •

Augmantin

+Ticaracillin •

Tementin

Sulbactam

+ Cephoperazon •

Sulperazon

+Ampicillin •

Unasyn

Tazobactam

Macrolids

Spectrum

G +ve	NOT G-ve
Anaerobes	

- Bowel Preparation
- Like Pinicillin

Side Effects

GIT upsets

Route

Oral

Mechanism of Action

Ptn Synthesis

Static •Cidal

According to the dose

Excretion

Biliary

Hepatic

Macrolids

Erythromycin

- Like Pinicillin
- Used in Pinicillin Allergy
- Bowel Preparation

Clarythromycin

AntiHelicobacter pylori

Azithromycin

Zithromax ®

Long Half life

1 tablet daily

Used in chest infection

Haemophilus influenza

Aminoglycosids

Spectrum

G –ve	G +ve
NOT effective against anaerobes	

Mechanism of Action

Ptn Synthesis

Cidal

Should enter the cell

Needs energy = O2

So can not act on anaerobes

Side Effects

Nephrotoxic

Ototoxicity

Neurotoxcity

Route

Parentral

Not absorbed by bowel

Excretion

Kidney

By GF

Not by excretion

So lower the dose in cases with renal impairment

Aminoglycosids

Tobramycin

Nebcin ®

~~The safest~~

Amikacin

Amikin ®

~~Broadest Spectrum~~

Garamycin

- Very potent
- Very toxic
- ~~Very cheep~~

Streptomycin

In TB

Kanamycin

- Very toxic
- Very old

Neomycin

- Bowel Preparation with

Metronidazol

Quinolones

Spectrum

G –ve	G +ve
• UTI • Enteric Infection Better than AminoGlycosid Because its less side efects	

Side Effects

Safe

Musculoskeletal Side Effects

- Young Age • Arthropathy
- Old Age • Tendonitis

Not recommended in young age

Route

Oral & Parentral

Mechanism of Action

DNA Synthesis

Gyrase Inhibitor

Topoisimerase Inhibitor

Relax supercoils of DNA to be duplicated

Cidal

Excretion

Kidney

By GF

Quinolones

Ceprofloxacin

Drug of Choice in

- Entric Infection
- UTI
- Prostatitis

Ofloxacin

Tarvid ®

- UTI
- Typhoid

Levofloxacin

Tavanic ®

- Pneumococci
- G +ve

Lincosamine

Clindamycin
Dalacin C ®

Side Effects
AntiBiotic Associated colitis = Psudomembranous colitis

By **Cl. Difficil**

ttt
- Vencomycin

Mechanism of Action
Ptn Synthesis

Spectrum
G +ve	**Anaerobes** •Oral cavity Problems •Clonic Surgery •Appendicictomy •Female genital tract infection

Route
Parentral

Excretion
Kidney

Metronidazole

and Tinidazole

Route

Oral

IV expensive

Suppositories

Excretion

Kidney

Side Effects

Metallic taste

Neurotoxic

Nausea

Alcohol • Disulfuram like

Spectrum

- Amebiasis
- Trichomonas
- Giardia
- **Anaerobs**
- Hilicobacter pylori

Vancomycin

Route

Oral

Mechanism of Action

Cell Wall Synthesis

MRSA

Methicillin resistent staph. Aureus

Produced By **Fluxacillin** & **Flucluxacillin**

Pseudomembranous colitis

Produced By **Clindamycin**

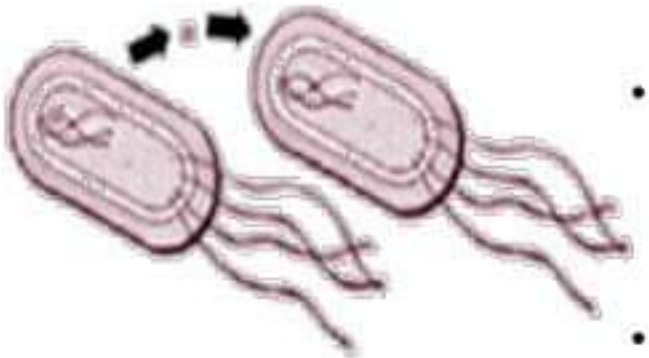
Cl. Difficile

Endocarditis

AntiAnaerobics

- Metronidazole
- Penicillins
- Erythromycin
- Tienam
- Clindamycin
- Mefoxine

Resistance



- Adult humans contains 10^{14} cells, only 10% are human – the rest are bacteria
- Antibiotic use promotes Darwinian selection of resistant bacterial species
- Bacteria have efficient mechanisms of genetic transfer – this spreads resistance
- Bacteria double every 20 minutes, humans every 30 years
- Development of new antibiotics has slowed – resistant microorganisms are increasing

Is an antibiotic necessary ?

- Useful only for the treatment of bacterial infections
- Not all fevers are due to infection
- Not all infections are due to bacteria
- **There is no evidence that antibiotics will prevent secondary bacterial infection in patients with viral infection**

Arroll and Kenealy, Antibiotics for the common cold. Cochrane Database of Systematic Reviews. Issue 4, 2003

Meta-analysis of 9 randomised placebo controlled trials involving 2249 patients

Conclusions: There is not enough evidence of important benefits from the treatment of upper respiratory tract infections with antibiotics and there is a significant increase in adverse effects associated with antibiotic use.

Is an antibiotic necessary ?

- Not all bacterial infections require antibiotics
- Consider other options :
  - antiseptics
  - surgery

Choice of an antibiotic

- Aetiological agent
- Patient factors
- Antibiotic factors

The aetiological agent

- Clinical diagnosis
  - clinical acumen
    - the most likely site/source of infection
    - the most likely pathogens
  - empirical therapy
    - universal data
    - local data

Importance of local antibiotic resistance data

- Resistance patterns vary
  - From country to country
  - From hospital to hospital in the same country
  - From unit to unit in the same hospital
- Regional/Country data useful only for looking at trends NOT guide empirical therapy

The aetiological agent

- Laboratory diagnosis
  - interpretation of the report
  - what is isolated is not necessarily the pathogen
  - was the specimen properly collected?
  - is it a contaminant or colonizer ?
  - sensitivity reports are at best a guide

Patient factors

- Age
- Physiological functions
- Genetic factors
- Pregnancy
- Site and severity of infection
- Allergy

Antibiotic factors

- Pharmacokinetic/pharmacodynamic (PK/PD) profile
  - absorption
  - excretion
  - tissue levels
  - peak levels, AUC (Area under the serum concentration time curve), Time above MIC (minimum inhibitory concentration)
- Toxicity and other adverse effects
- Drug-drug interactions
- Cost

Cost of antibiotic

- Not just the unit cost of the antibiotic
- Materials for administration of drug
- Labour costs
- Expected duration of stay in hospital
- Cost of monitoring levels
- Expected compliance

Choice of regimen

- Oral vs parenteral
- Traditional view
  - "serious = parenteral"
  - previous lack of broad spectrum oral antibiotics with reliable bioavailability
- Improved oral agents
  - higher and more persistent serum and tissue levels
  - for certain infections as good as parenteral

Advantages of oral treatment

- Eliminates risks of complications associated with intravascular lines
- Shorter duration of hospital stay
- Savings in nursing time
- Savings in overall costs

Duration of treatment

- In most instances the optimum duration is unknown
- Duration varies from a single dose to many months depending on the infection
- Shorter durations, higher doses
- For certain infections a minimum duration is recommended

Recommended minimum durations of treatment

Infection	Minimum duration
Tuberculosis	4 - 6 months
Empyema/lung abscess	4 - 6 weeks
Endocarditis	4 weeks
Osteomyelitis	4 weeks
Atypical pneumonia	2 - 3 weeks
Pneumococcal meningitis	7 days
Pneumococcal pneumonia	5 days

6 steps which remind prescribers of the rational approach to therapeutics.

Step I. Define the patient's problem

- A patient usually presents with a complaints or a problem. Its obvious that making the right diagnosis is a crucial step in starting the correct treatment.
- Whenever possible, making the right diagnosis is based on integrating many pieces of information
- Patients' complaints are mostly linked to symptoms. A symptom is not a diagnosis, although it will usually lead to it.

Step II. Specify the therapeutic objective

What do you want to achieve with treatment?

- Before choosing a treatment it is essential to specify your therapeutic objective. What do you want to achieve with the treatment?
- Specifying your therapeutic objective will prevent a lot of unnecessary drug use.
- Specifying your therapeutic objective will also help you avoid unnecessary prophylactic prescribing, for example, the use of antibiotics to prevent wound infection, which is very common cause of irrational drug use.

Step IIIa: Verify whether your prescribed treatment is suitable

- non-pharmacological treatment
  - Exercise, counseling, radiotherapy…

- Pharmacological treatment
  - Selecting the correct group of drugs
  - Selecting the drug from the chosen group
  - Verifying the suitability of the chosen pharmaceutical treatment for each patient

Step IIIb: Is the standard dosage schedule suitable for this patient?

- The aim of a dosage schedule is to maintain the plasma level of the drug within therapeutic window.

Step IIIc: Is the standard duration of treatment suitable for this patient?

- Many doctors not only prescribe too much of a drug for too long, but also frequently too little of a drug for too short a period.

- In one study about 10% of patients on benzodiazepines received them for a year or longer.

Step IV: Prescription writing & Start the treatment

- The prescription is the link between the prescriber, the pharmacist (or dispenser) and the patient so it is important for the successful management of the presenting medical condition.

- The advice should be given first, with an explanation of why it is important. Be brief and use words the patient can understand. Write clearly!

Step V: Give information, instructions and warnings

Compliance:

Compliance (Sometimes called "adherence" is the extent to which patients follow treatment instructions.

There are four types of noncompliance leading to medication errors:

- The patient fails to obtain the medication.
- The patient fails to take the medication as prescribed.
- The patient prematurely discontinues the medication
- The patient (or another person) takes medication inappropriately .

For example the patient may share a medication with others for any of several reasons.

Continued

- This step is important to ensure patient adherence.
- On average, 50% of patients do not take prescribed drugs correctly; take them irregularly, or not at all.
- The most common reasons are that symptoms have ceased, side effects have occurred, the drug not effective, or the dosage schedule is complicated for patients.

Patient adherence to treatment can be improved in three ways:

- prescribe a well chosen drug treatment
- create a good doctor-patient relationship
- take time to give the necessary information, instructions and warnings.

Step VI: Monitor (stop) the treatment

- Monitoring the treatment enables you to determine whether it has been successful or whether additional action is needed. To do this you need to keep in touch with your patient, and this can be done in two ways:
  - **1-Active monitoring**
  - **2-Passive Monitoring**

Step 6: Monitor (and stop?) the treatment

Was the treatment effective?

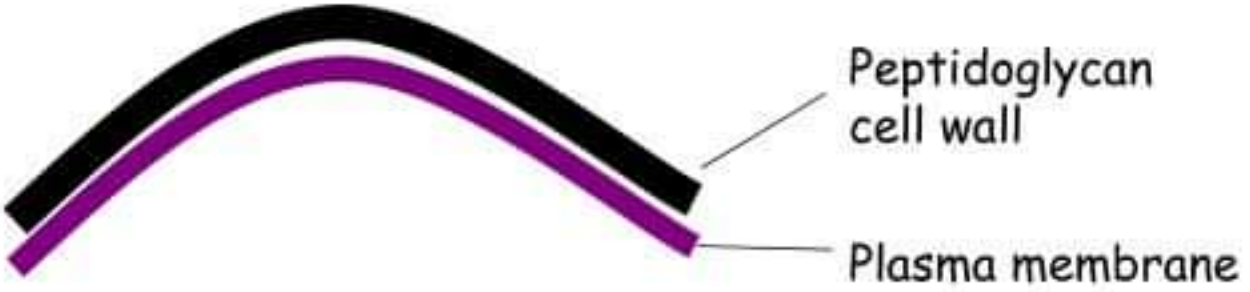
a) **Yes, and disease cured:** **Stop the treatment**

b) **Yes, but not yet completed:** **Any serious side effects?**
- **No: treatment can be continued**
- **Yes: reconsider the dosage or drug choice**

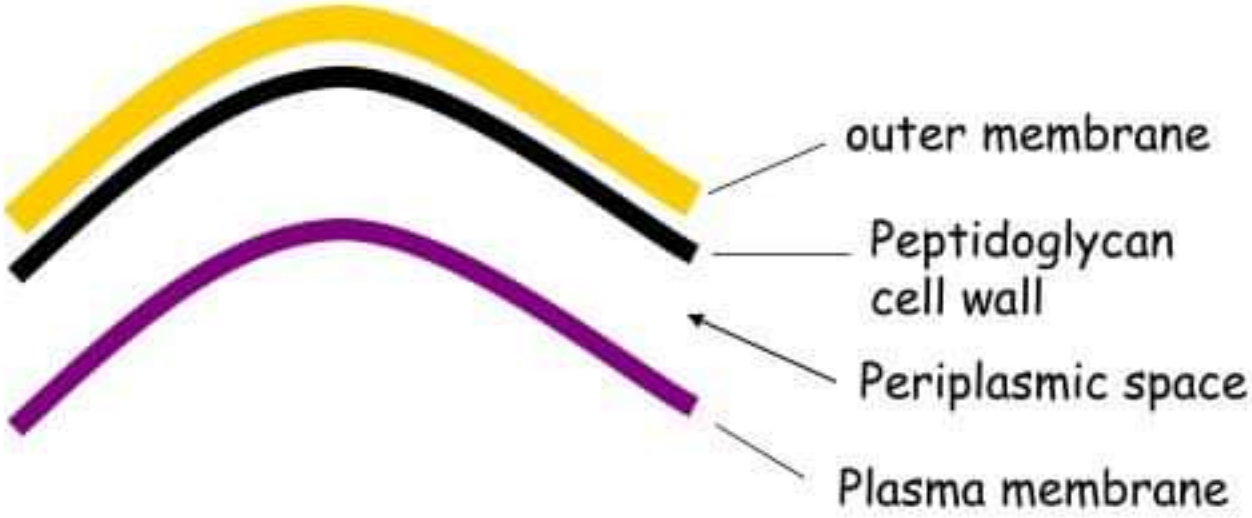
c) **No, disease not cured:** **verify all steps:**
- **Diagnosis correct?**
- **Therapeutic objective correct?**
- **P-drug suitable for this patient?**
- **Drug prescribed Correctly?**
- **Patient instructed correctly?**
- **Effect monitored correctly?**

Classification of bacteria

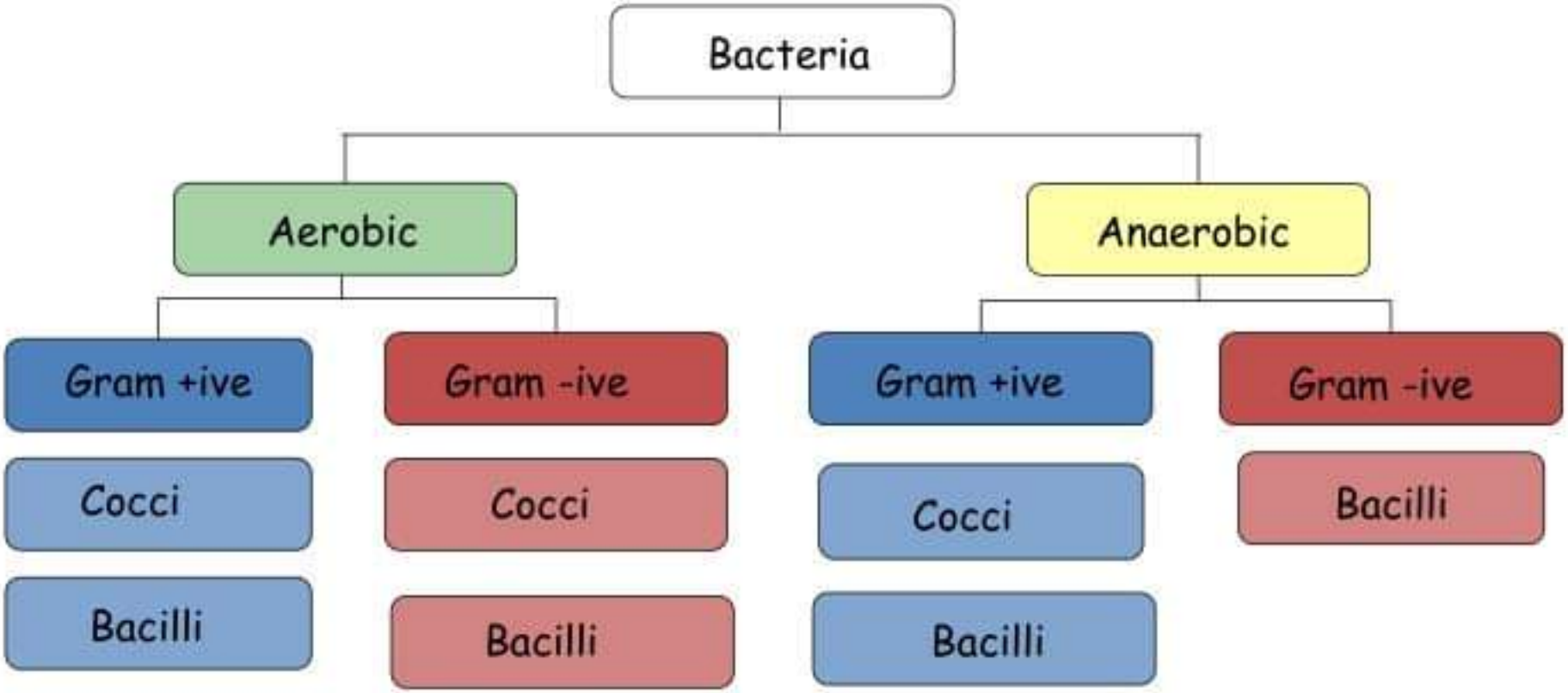
Gram Positive



Gram negative



Classification of bacteria



Gram positive bacteria

- Aerobic
  - Strep pneumoniae
    - CAP, septic shock, meningitis
  - Staph aureus
    - Cellulitis, septic shock, endocarditis
  - Strep A
    - pharyngitis
- Anaerobic
  - Clostridium
    - Tetanus
    - Abdominal sepsis

Gram negative bacteria

- Aerobic
  - E. Coli
    - UTI, septic shock
  - Klebsiella
    - UTI, septic shock, pneumonia
  - Pseudomonas
    - UTI, pneumonia, septic shock
- Anaerobic
  - Bacteroides
    - Abdo sepsis

Cephalosporins

- Classified in "generations"
- 1st generation mainly Gram positive cover, successive generations increasing potency against Gram negative
- E.g.
  - 1st - cephalexin
  - 2nd - cefuroxime
  - 3rd - cefotaxime / ceftriaxone

Cefotaxime & ceftriaxone readily cross BBB - used in meningitis

Can cephalosporins be given in penicillin allergy?

- Traditionally 10% cross-reactivity stated
  - Based on 1975 study
- Historically contraindicated in patients with severe immediate allergic reaction to penicillin (urticaria / anaphylaxis)
- Recent epidemiological studies
  - Suggest for 2nd generation - cross reactivity much less

BNF 61 (March 2011)

"The principal side-effect of the cephalosporins is hypersensitivity and about 0.5-6.5% of penicillin-sensitive patients will also be allergic to the cephalosporins. Patients with a history of immediate hypersensitivity to penicillin should not receive a cephalosporin. If a cephalosporin is essential in these patients because a suitable alternative antibacterial is not available, then cefixime, cefotaxime, ceftazidime, ceftriaxone, or cefuroxime can be used with caution; cefaclor, cefadroxil, cefalexin, and cefradine should be avoided".

Carbapenems

- Similar mode of action to other β-lactams
- Greater affinity for PBP-2
  - Faster bacterial death

- Extremely broad spectrum
- E.g. imipenem / meropenem
- Used for severe hospital aquired infections

SIRS

- Systemic inflammatory response syndrome
  - 2 or more of the following criteria:
    - Temperature < 36 ^{0}C or > 38 ^{0}C
    - HR > 90
    - $PaCO_2$< 32mmHg
    - RR > 20
    - WBC > 12.0 < 4.0, or > 10% immature (band) forms

(? Include change in mental state / hyperglycaemia in absence of diabetes)

Medical Conditions Killed By Antibiotics:

- Strep throat- a bacterial infection of the tissues in the back of the throat and the tonsils or adenoids.
- Urinary tract infection (UTI) - an infection in the organs and tubes that process and carry urine out of the body.
- Sinusitis – a sinus infection or inflammation of the mucous membranes that line the inside of the nose and facial sinuses.
- Ear infection- an infections where fluid is trapped in the middle ear.

Side effects:

- diarrhea that is watery or bloody;
- fever, chills, body aches, flu symptoms;
- easy bruising or bleeding, unusual weakness;
- urinating less than usual or not at all;
- severe skin rash, itching, or peeling;
- agitation, confusion, unusual thoughts or behavior; or
- seizure (black-out or convulsions).
- nausea, vomiting, stomach pain;
- vaginal itching or discharge;
- headache;
- swollen, black, or "hairy" tongue; or
- thrush (white patches or inside your mouth or throat).

5 Rights!

- Right patient
- Right time and frequency of administration
- Right dose
- Right route of administration
- Right drug

Antibiotics

- Antibiotics ≠ Anti-inflammatory drugs
- Antibiotic