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AN OVERVIEW OF ANTIMICROBIAL AGENTS – II

The 15th (the last) lecture for the 2nd-year students
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ANTIMICROBIAL AGENTS – revision

= drugs used to treat infectious diseases

antibiotics – naturally occuring microbial products

chemotherapeutics – synthetic compounds

Different types of antimicrobial agents:

- ANTIBACTERIAL
- ANTIFUNGAL
- ANTIVIRAL
- ANTIPARASITIC

ANTIBACTERIAL AGENTS – revision

1) Inhibitors of cell wall synthesis
2) Inhibitors of protein synthesis
3) Inhibitors of nucleic acid synthesis
4) Miscelanous agents

1. Inhibitors of bacterial cell wall synthesis – revision

β-lactam agents

- penicillins
- cephalosporins
- monobactams
- carbapenems

Glycopeptides

- vancomycin
- teicoplanin

Other inhibitors of bacterial cell wall

- e.g. bacitracin
  - cycloserin
  - isoniazid

Penicillins – revision

Acidolabile:

benzylpenicillin (penicillin G)

procaine penicillin

Acidostable:

phenoxymethylpenicillin (penicillin V)

Resistant to penicillinase:

methicillin, oxacillin, flucloxacillin

Aminopenicillins:

ampicillin, amoxicillin, co-amp., co-amox.

Ureidopenicillins & carboxypenicillins:

co-piperacillin, co-ticarcillin

Acidolabile penicillins – revision

Classical benzylpenicillin (penicillin G):

- **crystallic penicillin G – i.v.**
- **procaine penicillin G – i.m.**
- **benzathin penicillin G – i.m.**

Spectrum: G+ cocci & rods, G- cocci, G- spirals

Acidostable penicillins – revision

phenoxymethylpenicillin (penicillin V):

- **peroral; the same spectrum**

Penicillins resistant to staphylococcal penicillinase – revision

Used against infections caused by ***S. aureus***

Originally **methicillin**
staphylococci resistant to penicillinase = **MRSA**, methicillin-resistant *S. aureus*

Now in use **oxacillin** (but MRSA are also resistant to it)

Combination with ampicillin: **cloxacillin**

Aminopenicillins – revision

Have a broader spectrum:

most strains of *Enterococcus faecalis*

***Listeria monocytogenes* is more sensit.**

Above all <u>many Gram-negative rods</u>:

***E. coli*, *Proteus mirabilis*, bordetellae, salmonellae, shigellae, hemophilli & oth.**

Amoxicillin (p. os)

Co-amoxicillin (+ clavulanic acid)

Ampicillin (inj. prep. only)

Co-ampicillin (+ sulbactam)

Ureidopenicillins – revision

Broad spectrum:

effective also against *Ps. aeruginosa*

Co-piperacillin (+ tazobactam)

Carboxypenicillins – revision

Spectrum similar to ureidopenicillins

effective against resistant hospital strains incl. *Pseud. aeruginosa*

Co-ticarcillin

Cephalosporins – revision

1st generation (spectrum like ampicillin)
- cefazolin
- cefadroxil (p.o.)

2nd generation (more resist. to β-lactamases)
- cefuroxime
- cefuroxime axetil (p.o.)

3rd generation (very effective against G-)
- cefotaxime, ceftriaxone
- ceftazidime, cefoperazone (*P. aerug.*)

4th generation (also against G+)
- e.g. cefepime

Monobactams – revision

Aztreonam (against G- only)

Carbapenems – revision

Imipenem (+ cilastatin = Thienam)
for multiresistant strains incl. G+ cocci and *Kl. pneumoniae* producing ESBL, extended spectrum beta-lactamases)

Meropenem (dtto; diffuses through inflammed meninges)

Ertapenem (against ESBL-producing strains)

2. Inhibitors of bacterial protein synthesis – revision

Tetracyclines: doxycycline (very broad spectrum)

Chloramphenicol (very toxic)

Aminoglycosides:

streptomycin (now for tbc only)

gentamicin, amikacin (G- rods & staphs)

neomycin (toxic, for topical use only)

Macrolides, azalides, ketolides:

Lincosamides:

Newer antïbiotics: e.g. oxazolidinons, streptogramins, glycylglycines etc.

Macrolides, azalides, ketolides – revision

Macrolides:

- Erythromycin (like PNC, + some G- rods)
- Roxithromycin (for atypical pneumoniae)
- Spiramycin (little toxic, toxoplasmosis)

Azalides:

- Azithromycin (better for G- rods)
- Clarithromycin (better for G+)

Ketolides:

- Telithromycin (even better for G+)

Lincosamides – revision

Lincomycin

Clindamycin

Both for G+ (except enterococci), anaerobes, some protozoa

Streptogramins – revision

quinupristin + dalfopristin (Synercid) (for G+)

Oxazolidinons – revision

Linezolid (G+ incl. MRSA & anaerobes)

Lipopeptides – revision

Daptomycin (kills MRSA)

Glycylcyclins – revision

Tigecyclin (broad spectrum, ESBL producents)

3. Inhibitors of nucleic acid synthesis – revision

Sulphonamides: sulfamethoxazol (only in comb.)

Pyrimidines: trimethoprim (bacteriostatic), plus

sulphamethoxazol = bactericidic co-trimoxazole

(most G+ cocci & G- rods, nocardiae, *Toxopl. gondii*, *Pneumocystis jirovecii*)

Quinolones:

nalidixic acid & norfloxacin (urine tract inf.)

ciprofloxacin, ofloxacin (multiresistant G- rods)

Nitroimidazoles: metronidazol, ornidazol (anaerobes & some parasites)

Nitrofurans: nitrofurantoin, nifuratel (urine tract inf.)

Ansamycins: rifampicin, rifabutin (mainly tbc)

rifamixin (travellers diarrhoea)

4. Miscelanous antibacterial agents – revision

Polypeptids: colistin (some G- rods incl. *P. aerugin.*)
polymyxin B (for local use only)

Antimycobacterial agents (in combinations only!)

- streptomycin
- rifampicin
- isoniazid
- ethambutol
- pyrazinamide
- cycloserine
- paraaminosalicylic acid (PAS)
- dapsone (for lepra)

ANTIFUNGAL AGENTS (ANTIMYCOTICS)

Specific antimycotics

- **Imidazoles**
- **Triazoles**
- **Polyenic antimycotics**
- **Other systemic antimycotics**
- **Local antimycotics**

Nonspecific antimycotics (rather antiseptics then chemotherapeutics)

Imidazoles

ketokonazole

other imidazoles – for local use only

e.g. clotrimazole, oxiconazole

Triazoles

flukonazole

posaconazole

vorikonazole

Polyenes

amphothericine B

Other systemic antimycotics

flucytosin

terbinaphine

Newer antimycotics

Ecchinocandines: e.g. anidulafungin

Pneumocandines: e.g. caspofungin

Antipneumocystic agents

co-trimoxazole

pentamidine

Local antimycotics

Imidazoles: e.g. clotrimazole, oxiconazole

Polyenes: e.g. natamycin

Broad-spectrum: amorolfine

ciclopirox olamine

Nystatin

Antimycotic antiseptics: undecylenic acid

chlornitrophenol

ANTIVIRAL AGENTS

Systemicaly used antivirotics

- **Antiherpetics**
- **Anticytomegalovirotics**
- **Antinfluenza agents**
- **Antiretrovirotics**
- **Interferons**
- **Others systemic antivirotics**

Local antivirotics

Antiherpetics

Systemic antiherpetics

- aciclovir
- valaciclovir
- famciclovir
- brivudin

Anticytomegalovirotics

ganciclovir

cidophovir

foscarnet

Antiinfluenza agents

amantadin

oseltamivir

zanamivir

Antiretrovirotics – I

Nucleoside inhibitors of reverse transcriptase

- **zidovudine**
- **lamivudin**
- **abacavir**
- **adefovir dipivoxil**
- **tenofovir**

Non-nucleoside inhibit. of reverse transcript.

- **nevirapin**
- **efavirenz**

Antiretrovirotics – II

Inhibitors of viral protease

- **ritonavir**
- **lopinavir**

Inhibitors of virion fusis with cell surface

- **enfuvirtid**

Inhibitors of viral entry into the cell

- **maraviroc**

Interferons

natural interferon α

recombinant interferon α-2a

recombinant interferon α-2b

interferons β

interferon γ

pegylated interferons

Other systemic antivirotics

ribavirin

Local antivirotics

idoxuridin

trifluridin

topically given aciclovir

fluorouracil

podophylotoxin

ANTIPARASITIC AGENTS

Antiprotozoics

Anthelminthics

Antiectoparasitics

Antiprotozoics – I

Vaginal trichomonosis:
- metronidazol
- ornidazol
- clotrimazol

Giardiosis & amoebic dysentery:
- metronidazol
- ornidazol

Naeglerial meningoencephalitis:
- amphothericin B

Acantamoebic conjunctivitis:
- propamidin isethionate

Antiprotozoics – II

Toxoplasmosis:

- pyrimethamine & sulphadiazine
- spiramycin

Malaria:

- chloroquine, event. & proguanil
- mefloquine
- quinine
- primaquin
- derivatives of artemisin
- atovaquone

Antiprotozoics – III

Leishmanioses:

pentavalent antimony compounds

new forms of amphotericin B

Cryptosporidiosis:

azithromycin

Trypanosomiases:

at first pentamidine

later 3-valent arsenicals, e.g. tryparsamide

Anthelminthics

Intestinal nematode infections:

- albendazole
- mebendazole

Tissue nematodes:

- ivermectin
- albendazole

Flukes:

- praziquantel

Tapeworms:

- praziquantel

Antiectoparasitics

Insecticids

permethrin
malathion
carbaryl

Repellents

benzoic acid derivatives

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Recommended reading material

Paul de Kruif: Microbe Hunters

Paul de Kruif: Men against Death

Axel Munthe: The Story of San Michele

Sinclair Lewis: Arrowsmith

André Maurois: La vie de Sir Alexander Fleming

Hans Zinsser: Rats, Lice, and History

Michael Crichton: Andromeda Strain

Albert Camus: Peste

Victor Heisser: An American Doctor Odyssey

Richard Preston: The Hot Zone

Mika Waltari: The Egyptian

Richard Gordon: Doctor in the House

Richard Gordon: Doctor at Large

Richard Gordon: Doctor at Sea

Richard Gordon: Doctor in Love

Please mail me other suggestions at:

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Thank you for your attention