PENICILLINS

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PENICILLINS

I. CLASS AND GENERIC NAMES
- A. Natural penicillins
  1. Penicillin G
  2. Benzathine penicillin G
  3. Procaine penicillin G
  4. Penicillin V
- B. Penicillinase-resistant penicillins
  1. Methicillin
  2. Nafcillin
  3. Cloxacillin
  4. Dicloxacillin
  5. Flucloxacillin
  6. Oxacillin
- C. Aminopenicillins
  1. Ampicillin
  2. Hetacillin
  3. Pivampicillin
  4. Bacampicillin
  5. Epicillin
  6. Cyclacillin
  7. Amoxicillin
- D. Carboxypenicillins
  1. Carbenicillin
  2. Ticarcillin
  3. Temocillin
  4. Indanylcarbenicillin
  5. Carfecillin
- E. Ureidopenicillins
  1. Azlocillin
  2. Mezlocillin
  3. Piperacillin
  4. Amdinopenicillin
  5. Amdinocillin
- F. Penicillins combined with beta-lactamase inhibitors
  1. Amoxicillin plus clavulanate
  2. Ticarcillin plus clavulanate
  3. Ampicillin plus sulbactam

II. MAIN INDICATIONS
- A. Natural penicillins
  1. Streptococcus species
  2. Most enterococcus
  3. Non-penicillinase-producing Staphylococcus species
  4. Non-penicillinase Neisseria gonorrhoeae
  5. Anaerobes other than the Bac-teroides species
- B. Penicillinase Resistant Penicillins
  1. Methicillin (oxacillin) sensitive staphylococcus species
  2. Streptococcus species
- C. Aminopenicillins
  1. Streptococcus species (equivalent activity to natural penicillins)
  2. *Enterococcus* species (increased activity compared to natural penicillins)
  3. Poor activity against most staphylococcus species
  4. Activity against some gram negative organisms including Escherichia coli, *Proteus mirabilis*, *Shigella* and *Salmonella* and *Haemophilus influenzae*
- D./E. Carboxypenicillins/Ureidopenicillins
  1. Not active against most staphylococcus species
  2. Streptococcus species
  3. Increased gram negative activity with coverage against most *Enterobacteriaceae* and *Pseudomonas aeruginosa* (usually in combination with aminoglycoside)
- F. Penicillins Combined with Beta-lactamase Inhibitors
  1. Methicillin (Oxacillin) sensitive Staphylococcus species
  2. Gram negative organisms similar to those of the previous group

3. Anaerobic coverage including Bacteroides species

III. MAIN PROPERTIES/ ADVANTAGES
- A. Bactericidal
- B. Good tissue distribution and penetration
- C. Primarily renal excretion
- D. Relatively safe

IV. DISADVANTAGES
- A. Short serum half life - approximately 30 minutes for natural penicillins to 60 minutes for the extended spectrum penicillins
- B. Many unstable for oral use due to destruction by gastric acids
- C. Non active against Methicillin (Oxacillin) resistant staphylococcus species

V. ADVERSE EFFECTS
- A. Allergic or hypersensitivity reactions (3-10%)
  1. True anaphylaxis (1 in 7,000 to 25,000 cases)
  2. Other allergic reactions: drug-induced fever, cutaneous vasculitis, skin rashes, serum sickness
- B. Gastrointestinal irritation on oral administration
- C. Neurologic
- D. Hematologic
- E. Renal toxicity
- F. Electrolyte disturbance

CEPHALOSPORINS

I. CLASSIFICATION AND TRADE NAMES
- A. 1st Generation
  1. Cefazolin (Ancef®, Kefzol®)
  2. Cephalothin (Keflin®, Seffin®)
  3. Cephapirin (Cefadyl®)
  4. Cephalexin (Keflex®)
  5. Cefadroxil (Duricef®)
  6. Cephradine (Anspor®, Velasef®)
- B. 2nd Generation
  1. Cefamandole (Mandol®)
  2. Cefoxitin (Mefoxin®)
  3. Cefuroxime (Zinacef®)
  4. Cefurxime (Ceftin®)
  5. Cefotetan (Cefotan®)
  6. Cefonocid (Monocid®)
  7. Cefaclor (Ceclor®)
  8. Ceforanide (Precef®)
- C. 3rd Generation
  1. Cefotaxime (Claforan®)
  2. Ceftizoxime (Cefizox®)
  3. Ceftriaxone (Rocephin®)
  4. Moxalactam (Moxam®)
  5. Ceftazidime (Fortaz®, Taxidime®)
  6. Cefoperazome (Cefobid®)
  7. Cefpirome
  8. Cefpiramide
  9. Cefixime (Suprax®)

II. MAIN INDICATIONS
- A. First generation
  1. Methicillin (Oxacillin)-sensitive staphylococcus species (penicillinase and non-penicillinase producing organisms)
  2. Streptococcus species (no enterococcus species)
  3. Gram negative organisms including *E. coli, P. mirabilis* and *Klebsiella* species
  4. Anaerobic organisms (no Bacteroides species)
- B. Second generation
  1. Methicillin (Oxacillin)-sensitive staphylococcus species (typically less active than first generation agents with exceptions)
  2. Streptococcus species
  3. Increased activity against selective gram negative bacilli, including H. influenzae, Klebsiella species and indole-negative proteus
  4. Specific agents with activity against *H. influenzae, Enterobacter, Serratia,* indolepositive *Proteus* and *Neisseria* species.
  5. Anaerobic organisms with certain agents covering bacteroides species
  6. No activity against Pseudomonas species
- C. Third generation
  1. Methicillin (Oxacillin) sensitive staphylococcus species, (less active than previous generations)
  2. Streptococcus species
  3. Gram negative bacilli
  4. Anaerobic coverage similar to previous group
  5. Sub-group with activity against *p. aeruginosa* most active ceftazidime and cefoperazone (may be used in combination with aminoglycosides)
- D. Organisms resistent to cephalosporins
  1. Methicillin (Oxacillin) resistent staphylococcus species

2. Enterococcus species
3. *Xanthomonas Maltophilia*
4. *Acinetobacter*
5. *Clostridian Difficile*

E. Surgical prophylactic agents

III. ROUTE OF ADMINISTRATION AND DOSAGE

A. 1st Generation

1.	Cefazolin	IM, IV	1-2g Q8o
2.	Cephalothin	IV	1-2g Q4-6o
3.	Cephapirin	IV	-
4.	Cephalexin	PO	0.5-1gm Q6o
5.	Cefadroxil	PO	500 mg Q12o
6.	Cephradine	PO	500 mg Q6o

B. 2nd Generation

1.	Cefamandole	IM, IV	1-2g Q 6o
2.	Cefoxitin	IM, IV	2 g Q6-8o
3.	Cefuroxime	IM, IV	0.75-1.5g Q8o
4.	Cefurxime	PO	250-500 mgQ12o
5.	Cefotetan	IM, IV	1-3gm Q12o
6.	Cefonocid	IM, IV	1-2gm Q24o
7.	Cefaclor	PO	250-500mg Q8o
8.	Ceforanide	IM, IV	

C. 3rd Generation

1.	Cefotaxime	IM, IV	1-2g Q8O
2.	Ceftizoxime	IM, IV	1-2gm Q8-12o
3.	Ceftriaxone	IM, IV	2 gm Q24o
4.	Moxalactam	IM, IV	1-2gm Q8-12o
5.	Ceftazidime	IM, IV	1-2 gm Q8-12o
6.	Cefoperazome	IM, IV	2 gm Q 8-12o
7.	Cefpirome	not available	
8.	Cefpiramide	not available	
9.	Cefixime	PO	400mg Q24o

IV. MAIN PROPERTIES - ADVANTAGES

A. Bactericidal
B. Good half life
C. Good tissue distribution and penetration
D. Good oral activity
E. Relatively safe agents

V. DISADVANTAGES

A. Inactivity against certain organisms (see previous list)
B. Parental use limited mainly to intravenous route

VI. ADVERSE EFFECTS

A. Hypersensitivity or allergic reactions
   1. Most common - rash, urticaria, exanthem or pruritus
   2. True anaphylaxis extremely rare
   3. Cross reactivity with penicillins approximately 3 7%.
B. Minimal nephrotoxicity (do not potentiate toxicity of aminoglycosides)
C. Diarrhea with or without C. difficile colitis
D. Effects on hemostasis
   1. Impaired aggregation of platelets
   2. N-methyl-thiotetrazole (NTT) side chain (see E.)
E. N-methyl-thiotetrazole (NTT) side chain
   1. NTT side chain interferes with metabolism of vitamin K or disturbs synthesis of vitamin K dependent clotting factors
   2. Disulfiram reaction with alcohol ingestion
   3. Agents of concern: Cefamandole, Cefmetazole, Cefoperazone, Cefotetan and Moxalactam
E. Neutropenia
F. Thrombophlebitis

VII. NEW AGENTS/ FOURTH GENERATION

A. Cefpirome and Cefepime: Unique combination of anti-staphylococcal and anti-pseudomonal activity