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ANTIMICROBIAL RESISTANCE AND DRUG PROFILE OF AMPICILLIN

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Abstract:

Antibiotics are a group of medicines used to treat infections caused by germs (bacteria and certain parasites). A parasite is a type of germ live in another living being (host). Antibiotics are sometimes called antibacterial or antimicrobials. Antibiotics are available in the form of parental, oral, topical (creams, ointments, or lotions) to treat certain infections. It is important to remember that antibiotics only work against infections that are caused by bacteria and certain parasites. Antibiotics are one of the most commonly prescribed groups of medications, especially in developing nations, owing to the vast number of infectious diseases prevalent in the community. Since the time of discovery of the phenomenal antimicrobial, penicillin, there has been a great rise in the number of antimicrobials in the market. Antibiotic resistance is increasing to dangerously high levels at national level as well at Global front. Novel resistance mechanisms are emerging and spreading globally, threatening our capability to treat common infectious diseases. Ampicillin, an extended spectrum penicillin, is effective against gram positive as well as gram negative microorganisms. Also, being acid resistant, it can be given orally. It reports good minimum inhibitory concentration (MIC) against most of medically important microorganisms like S.aureus: 0.6-1 mg/L, Escherichia coli: 4 mg/L, H. influenzae: 0.25 mg/L, Streptococcus pneumoniae: 0.03-0.06mg/L. It has been used in the treatment of enteric fever, respiratory tract infections, urinary tract infections, skin and soft tissue infections. This paper briefly provides information about antimicrobial resistance and drug profile of ampicillin.

Keywords: *Antibiotic, Resistance, novel modalities, ampicillin.*

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INTRODUCTION:

Antibiotics are a group of medicines used to treat infections caused by germs (bacteria and certain parasites). A parasite is a type of germ live in another living being (host). Antibiotics are sometimes called antibacterial or antimicrobials. Antibiotics are available in the form of parental, oral, topical (creams, ointments, or lotions) to treat certain infections. It is important to remember that antibiotics only work against infections that are caused by bacteria and certain parasites [1]. They do not work against infections that are caused by viruses (for example, the common cold or flu), or fungi (for example, thrush in the mouth or vagina), or fungal infections of the skin. There are various antibiotics available that exists in different brand names. Antibiotics are usually grouped together based on their mechanism of action. The main categories of antibiotics include:

- ✓ PENICILLINS: Phenoxymethylpenicillin, Flucloxacillin, Amoxicillin.
- ✓ CEPHALOSPORINS: Ceftriaxone, Cefadroxil, Cefalexin, Cefuroxime.
- ✓ TETRACYCLINES: Tetracycline, Doxycycline, Lymecycline.
- ✓ AMINO GLYCOSIDES: Gentamicin, Tobramycin, Streptomycin.
- ✓ MACROLIDES: Erythromycin, Azithromycin, Clarithromycin, Clindamycin.
- ✓ SULFAMETHOXAZOLE AND TRIMETHOPRIM: Co-trimoxazole
- ✓ IMIDAZOLES: Metronidazole and Tinidazole.
- ✓ FLUORO QUINOLONES: Ciprofloxacin, Levofloxacin, Norfloxacin [2].

Antibiotics are one of the most commonly prescribed groups of medications, especially in developing nations, owing to the vast number of infectious diseases prevalent in the community. Since the time of discovery of the phenomenal antimicrobial, penicillin, there has been a great rise in the number of antimicrobials in the market. Antibiotic resistance is increasing to dangerously high levels at national level as well at Global front. Novel resistance mechanisms are emerging and spreading globally, threatening our capability to treat common infectious diseases. Emergence and growth of superbugs is endangering our lives by making existing antibiotics worthless. Antimicrobial resistance is a prevalent danger. Antimicrobial resistance is a serious global threat. There is a global menace of antibiotic resistant "super bug", though the extent and the severity of the problem varies. Resistance hampers therapeutic options and drives clinicians to use newer and more expensive drugs. In serious cases, multi-resistance provides no treatment options. To overcome resistance, a continuous supply of new antibiotics offers an obvious way; but the pipeline of agents in development by the Pharmaceutical industry is very limited. There is an ever-evolving need to develop and evaluate newer alternative strategies for countering a worsening clinical situation to overcome resistance and reduce the morbidity and mortality associated with infections caused by antibiotic-resistant bacteria. The widespread distribution of Antimicrobial resistance has not been paralleled by the development of newer antimicrobials. This happens due to the process of drug discovery and clinical trials of new antimicrobials taking longer time and only a fewer new agents been approved for use. In modern era, where obstacles like chemo-resistance and mutations torment medicine, scientists across the world are looking to adapt lateral approaches in encountering diseases. The emergence of pathogens with a variety of resistance mechanisms has intensified the challenges associated with infection control and treatment strategies. Therefore, prudent use of currently available antimicrobial agents, as well as implementing measures to limit spread of resistance is paramount. Although several new antimicrobials have been recently approved or are in the pipeline showing promise in the battle against resistance, the appropriate use of these agents is required as the true benefits of these treatments are to be recognized in the clinical care setting [3, 4].

Ampicillin

Ampicillin, an extended spectrum penicillin, is effective against gram positive as well as gram negative microorganisms. Also, being acid resistant, it can be given orally. It reports good minimum inhibitory concentration (MIC) against most of medically important microorganisms like S.aureus: 0.6-1 mg/L, Escherichia coli: 4 mg/L, H. influenzae: 0.25 mg/L, Streptococcus pneumoniae: 0.03-0.06mg/L. It has been used in the treatment of enteric fever, respiratory tract infections, urinary tract infections, skin and soft tissue infections [5]. Ampicillin is bactericidal. It adheres to bacterial penicillin-binding proteins, and inhibits bacterial cell wall synthesis. Spectrum of action includes non- penicillinase producing gram positive bacteria. It is also effective against gram-negative organisms such as Neisseria gonorrhoeae, Neisseria meningitidis, Haemophilus influenzae, Escherichia coli, Proteus mirabilis, Salmonella and Shigella. Ampicillin should be used in gram negative systemic infection when organism sensitivity is known.

Dosage schedule:

Listeria endocarditis: 200 mg/kg/day IV divided q6hr; administer concomitantly with aminoglycoside for at least 4-6 weeks.

Genitourinary tract infections (excluding Gonorrhea)

<40 kg: 50 mg/kg/day IV/IM divided q6-8hr.
≥40 kg: 500 mg PO/IV/IM q6hr.

Gastrointestinal tract infections
<40 kg: 50 mg/kg/day IV/IM divided q6-8hr.
≥40 kg: 500 mg IV/IM q6hr; larger doses may be necessary in severe or chronic infection.

Urinary tract infection
1-2 g IV q4-6hr with or without an aminoglycoside.

Gonorrhea
3.5 g IV administered once simultaneously with 1 g of probenecid.

Respiratory tract infections
≥40 kg
- 250 mg PO q6hr
- 250-500 mg IV/IM q6hr

<40 kg
- 25 to 50 mg/kg/day IV or IM divided q6-8hr

Bacterial meningitis/Septicemia
150-200 mg/kg/day IV divided q6-8hr; initiate with IV infusion; may continue with IM injections if preferred; range 6-12 g/day [6]

Maternal dose for neonatal prophylaxis
2 g IV initially, followed by 1 g q4hr until delivery.

Pharmacokinetic parameters:
About 42% of ampicillin is absorbed after an oral dose. It is widely distributed into pleural, peritoneal and synovial fluids, lungs, prostate, liver and gall bladder. It also penetrates middle ear effusions, maxillary sinus, bronchial secretions, tonsils and sputum. It readily crosses the placental barrier. Protein-binding is 15% to 25%. It is metabolised partially liver. Excreted in urine by renal glomerular filtration and renal tubular secretion. It also excreted through breast milk. Half-life is about 1 to 1 ½ hrs. In patients with extensive renal impairment, half -life is extended up-to 10 to 24 hrs.

Therapeutic uses: Listeria endocarditis, genitourinary tract infections, gastrointestinal tract infections, urinary tract infection, respiratory tract infections, bacterial meningitis/septicemia and maternal dose for neonatal prophylaxis.

Adverse effects: Lethargy, hallicinations, seizures, anxiety, confusion, agitation, depression, dizziness, fatigue, nausea, vomiting, diarrhoea, glossitis, stomatitis, abdominal pain and enterocolitis.

Contraindications:
- ✓ Hypersensitivity to drug or class or component.
- ✓ Anaphylactic reaction to beta lactam.
- ✓ Mononucleosis.
- ✓ Caution if asthma.
- ✓ Caution if HIV.
- ✓ Caution if seizure disorder.
- ✓ Caution if renal impairment [7].

CONCLUSION:

As more resistant organisms are being seen in clinical practice, there is an urgent need for more potent antibiotics. There are only a few drugs which belong to a completely novel class; the rest are only a development of old and existing classes. If we do not take good care of the existent antibiotics by responsible prescribing, we will be at risk of losing even these more efficacious antibiotics. Antibiotics tend to lose their efficacy over time due to the emergence and dissemination of resistance among bacterial pathogens. Strains with resistance to multiple antibiotic classes have emerged among major Gram-positive and Gram-negative species including Staphylococcus aureus, Enterococcus spp., Pseudomonas aeruginosa, Acinetobacter spp. Enterobacteriaceae, and Neisseria gonorrhoeae. With some Gram-negatives, resistance may involve most or even all the available antimicrobial options, resulting in extremely drug-resistant or totally drug-resistant phenotypes. This so-called ‘antibiotic resistance crisis’ has been compounded by the lagging in antibiotic discovery and development programs occurred in recent years, and is jeopardizing the essential role played by antibiotics in current medical practices.

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