WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Cefixime Efficacy Against Gram-Positive and Negative Bacteria

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ABSTRACT

Oral formulations of third-generation cephalosporins have grown in importance as a first-line treatment for common bacterial infections. One such medication is cefixime, which has outstanding effectiveness against a variety of pathogens such as Moraxella catarrhalis, Streptococcus pneumonia, and Haemophilus. Crucially, cefixime exhibits outstanding efficacy in combating strains that produce beta-lactamases. The drug's pharmacodynamic characteristics allow for a once-daily dosage, with a half-life of 3.4–5 hours and a Cmax of 4.4 ýg/ml, which is significantly higher than the MIC90 for susceptible pathogens. The bacteriological and clinical effectiveness of cefixime, along with its indications, are covered in this succinct synopsis.

Keywords: cephalosporins, Streptococcus pneumonia, Moraxella catarrhalis, Haemophilus influenzae, Cefixime

Introduction

Cefixime is an oral third-generation cephalosporin that is gaining worldwide recognition. It has been used on a daily basis by numerous doctors to treat bacterial infections in both adults and children. An overview of our current understanding of cefixime based on bacteriological and clinical studies is appropriate given the increased failure rates observed with conventional antibiotics against common infections, the growing awareness of regional variations in antibiotic susceptibility, and the growing use of cefixime in the outpatient setting. The pattern of resistance development has changed in certain countries over the past few years, but in other countries, such as those where Streptococcus pneumonia is prevalent, resistance development has stabilized. The prevalence of Haemophilus influenzae-producing beta-lactamases has gone up overall. Between 1985 and 1994, the incidence rose from 16.9 to 45% in North America. On the other hand, the rate in Germany is currently below 5%, whereas in other countries it can reach as high as 60%. Therefore, appropriate antibiotic usage management strategies need to be tailored to the nation where the drug is used.

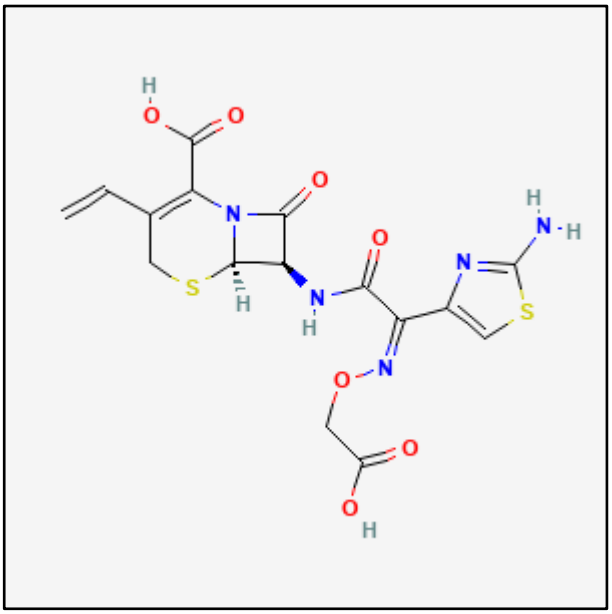

Figure 1: Structure of cefixime

Synthesis Method of Cefixime

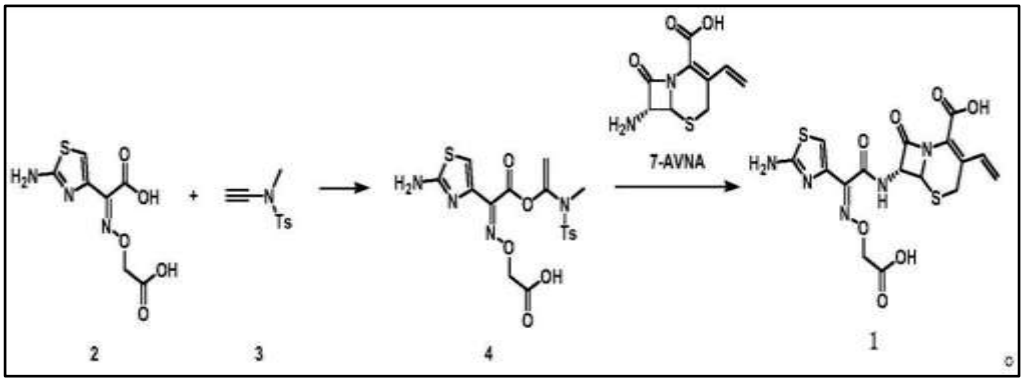

Figure 2: Synthesis method of Cefixime.

Structural Active Relationship of Cefixime

1. The carboxylic acid at C4 is essential.
2. The Acylamino group at C7 is essential.
3. The acetyloxy group at C3 is important and acts as a leaving group when the molecule binds to transpeptidase

Description

Cefixime is an oral cephalosporin antibacterial that is semisynthetic.

Trihydrate molecular weight is 507.50. The formula for the compound is C16H15N5O7S2.3H2O.

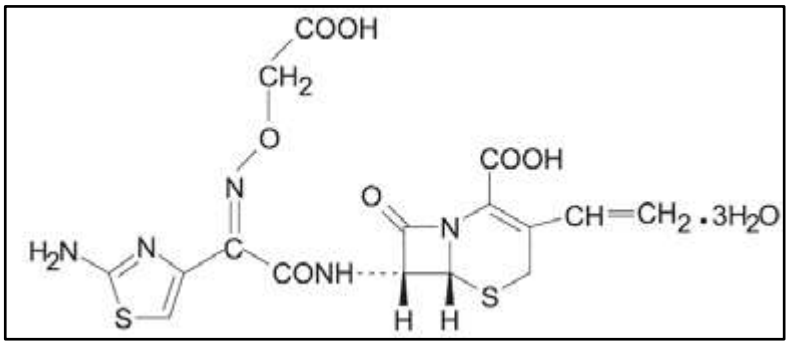

Figure 3: Cefixime Structure

• The 400 mg capsules' inactive ingredients include mannitol, magnesium stearate, low substituted hydroxy propyl cellulose, crospovidone, and colloidal silicon dioxide. Ferric oxide black, ferric oxide red, gelatin, potassium hydroxide, propylene glycol, shellac, sodium lauryl sulfate, and titanium dioxide are the inactive ingredients found in the capsule shell.

Pharmacokinetics

When taken orally, cefixime tablets and suspension are absorbed between 40% and 50% whether food is consumed or not. However, when food is consumed, the time to maximal absorption increases by about 0.8 hours. An average peak serum concentration of 2 mcg/mL is produced by a single 200 mg cefixime tablet. When tested on healthy adult volunteers, the oral suspension yields average peak concentrations that are between 25% and 50% higher than those of the tablets. When tested in normal adult volunteers, oral suspension doses of 200 and 400 mg result in average peak concentrations of 3 mcg/mL (range 1 to 4.5 mcg/mL) and 4.6 mcg/mL (range 1.9 to 7.7 mcg/mL), respectively. If the oral suspension is to be used instead of the tablet, this increased absorption needs to be taken into account.

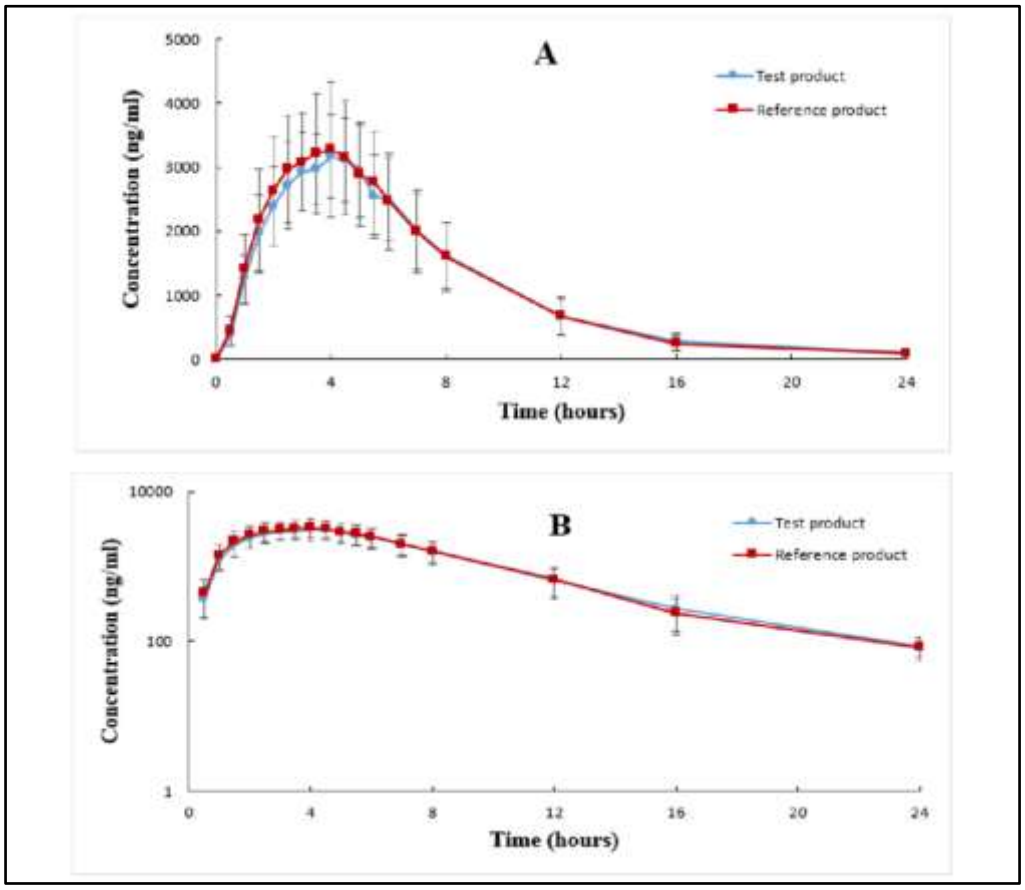

Figure 4: Plasma concentrations-time profiles (A) linear scale and (B) semilog scale.

Distribution

Serum protein binding has a bound fraction of roughly 65% and is concentration-independent. There are insufficient data on cefixime levels in the CSF.

Metabolism and Excretion

There is no proof that cefixime is metabolized in living things. In a 24-hour period, the urine excretes about 50% of the absorbed dose unaltered. Studies conducted on animals have revealed that cefixime excretes more than 10% of its administered dose in the bile. Cefixime's serum half-life in healthy individuals is independent of dosage form and typically lasts 3 to 4 hours, though it can sometimes reach 9 hours in healthy volunteers.

Indication and Usage

Cefixime, also known as Suprax, is an antibacterial medication that should only be used to treat infections that are clearly caused by susceptible bacteria or that have a high suspicion of doing so in order to prevent the emergence of drug-resistant bacteria and preserve the effectiveness of antibiotics. When choosing or altering an antimicrobial therapy, culture and susceptibility data should be taken into account. Local epidemiology and susceptibility patterns may aid in the empirical therapy selection process in the lack of such data.

When susceptible isolates of the specified bacteria cause the following infections in adults and pediatric patients six months of age or older, the cephalosporin antibacterial Suprax (cefixime) is indicated for treatment.

Renal Impairment

It is possible to administer cefixime to someone who has compromised renal function. Patients with creatinine clearances of 60 mL/min or higher may use the standard dose and schedule. 200 mg per day, or half of a 400 mg tablet, may be administered to patients whose clearance is 20 mL/min or less, or to patients who are receiving continuous ambulatory peritoneal dialysis. Both hemodialysis and peritoneal dialysis fail to eliminate substantial drug concentrations from the body.

Microbiological Activity of Cefixime

Penicillin-sensitive S. pneumonia, beta-lactamase-positive Moraxella catarrhalis, and beta-lactamase-positive H. influenza are all susceptible to cefixime's action; penicillin-resistant S. pneumonia is not. Cefixime's pharmacokinetic profile, combined with its broad-spectrum activity, makes it a perfect preparation for various infections.

40–50% are absorbed orally, and 16–26% are excreted in urine and 10% in bile.

The majority of strains are found to be covered with a normal dose of 400 mg when serum concentration is compared to the MIC90 values of common pathogens.

After 4 hours, the serum concentration reaches its peak, with a half-life of 3-5 hours and a Cmax of 4.4 Ìg/ml. When combined, this allows cefixime to be taken once daily. Furthermore, there are significant associations between cefixime concentrations in particular tissues and the locations of infection. For instance, the tonsils, maxillary sinus, sputum, bronchial mucosa, middle ear fluid, bile, gall bladder, urine, and inflamed tissues all have high cefixime levels. It is similar to other cephalosporins and penicillins, and it penetrates better than all other beta-lactams. Nonetheless, quinolones and macrolides continue to have better penetration properties. When taking into account the pharmacokinetics of other oral cephalosporins, 400 mg of cefixime taken once daily results in more consistent plasma levels over an extended period of time. The half-lives of cefuroxime 500 mg, cefprozil 500 mg, cefpodoxime 400 mg, and ceftibuten 400 mg are 1.3, 1.3, 2.5, and 2.0 hours, respectively, whereas cefixime's half-life is 3.5 hours.

Dosage

Adults

A 400 mg daily dose of cefixime is advised. The 400 mg tablet or capsule can be taken once a day, or it can be divided into half and taken every 12 hours. You can take the tablet and capsule without thinking about what you're eating.

When treating Streptococcus pyogenes infections, a therapeutic dosage of cefixime needs to be given for a minimum of 10 days.

Pediatric population

Children from 6 months to 11 years of age or weighing less than 50 kg

It is recommended that cefixime be given as an oral suspension. The recommended dosage for children is 8 mg/kg body weight/day administered as a single dose or in two divided doses.

Drug Interaction

When cefixime is taken concurrently with other medications, postmarketing experience has shown elevated levels of carbamazepine. When cefixime is taken along with anticoagulants and warfarin, there have been reports of increased prothrombin times with or without clinical bleeding.

Carbamazepine

When cefixime is taken concurrently with other medications, postmarketing experience has shown elevated levels of carbamazepine. Drug monitoring could help identify changes in the plasma concentrations of carbamazepine.

Clinical Studies

In approximately 400 children between the ages of 6 months and 10 years, comparative clinical trials were carried out regarding otitis media. Of the patients, 47% had Streptococcus pneumoniae isolated, 34% had Haemophilus influenzae, 15% had Moraxella catarrhalis, and 4% had S. pyogenes.

When beta-lactamase positive isolates of Haemophilus influenzae or Moraxella catarrhalis are taken into account, the overall response rate of these organisms to cefixime is approximately 10% lower than that of Streptococcus pneumoniae and approximately 7% higher than that of the active control drugs.

When evaluated two to four weeks after treatment, sixty-nine to seventy percent of the patients in each group showed resolution of their otitis media signs and symptoms; however, fifteen percent of the patients had persistent effusion.

Undesirable Effects

- Common (≥1/100 to <1/10)
- Uncommon (≥1/1,000 to <1/100)
- Rare (≥1/10,000 to <1/1,000)
- Very rare (<1/10,000)
- Not known

System Organ Class	**Adverse Drug Reaction**	**Frequency**
Infections and infestations	Superinfection bacterial, superinfection fungal	Rare
Pseudomembranous- colitis (see section 4.4)	Very rare	
Vaginitis	Not known	
Blood and lymphatic system	Eosinophilia	Rare
System Organ Class	**Adverse Drug Reaction**	**Frequency**
disorders	Leucopenia, agranulocytosis, pancytopenia, thrombocytopenia, haemolytic anaemia	Very rare
Hypereosinophilia, thrombocytosis, neutropenia, granulocytopenia	Not known	
Immune system disorders	Hypersensitivity	Rare
Anaphylactic shock, serum sickness-like reaction	Very rare	
Metabolism and nutrition disorders	Anorexia	Rare
Nervous system disorders	Headache	Uncommon
Vertigo	Rare	
Psychomotor hyperactivity	Very rare	
Dizziness Cases of convulsions have been reported with cephalosporins including cefixime Beta-lactams, including cefixime	Not known	
Respiratory, thoracic and mediastinal disorders	Dyspnoea	Not known
Gastrointestinal disorders	Diarrhoea*	Common
Abdominal pain, nausea, vomiting	Uncommon	
Flatulence	Rare	
Dyspepsia	Not known	
Hepatobiliary disorders	Hepatitis, cholestatic jaundice	Very rare
Skin and subcutaneous tissue disorders	Rash	Uncommon
Angioneurotic oedema, pruritus	Rare	

Conclusion

Globally, community-acquired pneumonia (CAP) is a major cause of morbidity, mortality, and resource consumption. The antimicrobial management of community-acquired pneumonia (CAP) remains a major source of controversy and a major cause of morbidity and mortality even with significant advancements in therapeutic options. sixteen In certain cases, the mixed etiology and fluctuating susceptibility of the pathogens causing CAP—particularly Streptococcus pneumoniae. Prior to determining the bacterial cause of the infection in the laboratory, initial antimicrobial therapy is typically administered empirically. Hence, knowledge of potential pathogens and resistance patterns aids in making antibiotic selections. A thorough understanding of the potential pathogens' susceptibilities in the area would guarantee a more suitable choice of antimicrobial agent to be used.18–19 Since ciprofloxacin is the most widely available and affordable antibiotic in this setting for treating infections, including RTIs, its effectiveness and safety are compared to those of cefixime.

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