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Original Research Article

Expert opinion on the burden, etiology, and management of respiratory tract infection with a special focus on cefpodoxime in Indian settings

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ABSTRACT

Background: To assess clinician-reported practices in managing respiratory tract infections in Indian settings, with a focus on antibiotic use and experiences with cefpodoxime, including infection prevalence, treatment choices, dosing patterns, and clinical outcomes.
Methods: The cross-sectional study used a 23-item questionnaire to gather the expert opinion among clinicians in managing respiratory tract infections, with a focus on antibiotic use and experiences with cefpodoxime in Indian settings. The study covered various aspects such as infection prevalence, treatment choices, dosing patterns, clinical outcomes, and common infection types. Data visualization, including bar charts, was performed using Microsoft Excel 2013.
Results: The study involved 1,243 clinicians practicing across various settings in India. Cefpodoxime was preferred as the first-line anti-infective for upper respiratory tract infections by approximately 74% of clinicians, with 65% selecting a dose of 10 mg/kg/day. It was prescribed in 11-25% of chronic bronchitis cases by nearly 52% of respondents, in less than 10% of bone and joint infections by 51%, and in 25-50% of ENT infections by 43%. For skin and soft tissue infections, 42% reported using it in less than 10% of cases. Diarrhoea was identified as the most common adverse effect by 50% of clinicians, while approximately 51% considered its broad-spectrum activity to be the main advantage.
Conclusions: This study provides a detailed analysis of the clinical use of cefpodoxime, highlighting its frequent use in upper respiratory and ENT infections, with relatively limited use in chronic bronchitis, bone and joint, and skin and soft tissue infections.

Keywords: Respiratory tract infections, Antibiotic treatment, Cephalosporin, Cefpodoxime, Expert opinion

INTRODUCTION

Infectious diseases remain a major global health challenge, particularly in low- and middle-income countries. Upper respiratory infections are among the most common acute illnesses, contributing significantly to healthcare costs and system burden despite their generally low mortality risk.[1] In 2019, upper respiratory infections accounted for an estimated 17.2 billion cases globally, over 42% of all cases reported in the Global burden of disease study.[2,3] Chronic otitis media, the leading cause of conductive hearing loss, affects 65-330 million people, with 90% of cases occurring in developing regions.[4] Skin and soft tissue infections, including pyoderma and cellulitis, are also common worldwide and frequently associated with hospital-acquired infections. From 1990 to 2019, the age-standardized incidence of bacterial skin diseases increased by 7.38%.[5,6]

Infectious diseases remain a significant public health challenge in India, driven by factors such as high population density, inadequate sanitation, climatic

variability, and unequal access to healthcare services. Although India accounts for approximately 18% of the global population, it carries a disproportionately high burden of respiratory illnesses. Among these, severe acute respiratory infection is a leading cause of mortality in children under five years of age.[7]

Cefpodoxime proxetil is an orally administered third-generation cephalosporin prodrug that is converted to its active form, cefpodoxime, by deesterification in the intestinal mucosa. Once activated, cefpodoxime exerts its bactericidal effect by inhibiting bacterial cell wall synthesis. It binds to penicillin-binding proteins, which are essential for the cross-linking of the peptidoglycan layer in the bacterial cell wall. This disruption weakens the cell wall, ultimately leading to cell lysis and death.8 Cefpodoxime exhibits strong activity against a range of Gram-negative pathogens, including Haemophilus influenzae, Haemophilus parainfluenzae, Moraxella catarrhalis, Klebsiella spp., Escherichia coli, and Neisseria gonorrhoeae. It also demonstrates comparable efficacy against Gram-positive organisms such as Streptococcus spp. and Staphylococcus aureus.[9]

Despite substantial evidence supporting cefpodoxime's therapeutic efficacy, the clinicians' opinions on prescribing trends and clinical preferences among healthcare providers remain limited. This study aimed to evaluate the usage patterns, dosage preferences, and perceived effectiveness and safety of cefpodoxime among Indian clinicians in the treatment of respiratory, ENT, skin, bone, and joint infections. It sought to gather insights into its clinical utility, common indications, perceived benefits, and any adverse effects observed in routine practice.

METHODS

A cross-sectional study was carried out among clinical specialists involved in the management of a wide range of infectious diseases in the major Indian cities from June 2024 to December 2024. The study was conducted after getting approval from Bangalore Ethics, an Independent Ethics Committee, which was recognized by the Indian Regulatory Authority, the Drug Controller General of India.

An invitation was sent to leading clinicians in managing a wide range of infectious diseases in the month of March 2024 for participation in this Indian survey. About 1243 clinicians from major cities of all Indian states, representing the geographical distribution, shared their willingness to participate and provide necessary data. The questionnaire booklet titled the REACT study was sent to the clinicians who were interested in participating in the survey. The study questionnaire comprised 23 questions that covered multiple domains, such as the prevalence of respiratory infections, antibiotic selection criteria, dosing practices, treatment outcomes, adverse effects, patient compliance, and perceived therapeutic benefits. The survey also included questions specific to various infection types, including upper and lower respiratory tract infections, ENT infections, and skin and soft tissue infections. Reliability, as determined by a split-half test (coefficient alpha), was adequate but should be improved in future versions of the questionnaire. A study of criterion validity was undertaken to test the questionnaire and to develop methods of testing the validity of measures of Physicians' Perspectives. However, the extraneous variables in this include the clinician's experience, usage of the newer drugs, etc. The two criteria used were the doctors' perspectives from the clinical practice and the assessment of an external assessor and statistician.

Clinicians had the option to skip questions as desired and were instructed to complete the survey independently, without peer consultation. Before participating in the survey, all respondents provided written informed consent.

Statistical analysis

The data were analyzed using descriptive statistics. Categorical variables were presented as percentages to provide a clear understanding of their distribution. The frequency of occurrence and the corresponding percentage were used to represent the distribution of each variable. To visualize the distribution of the categorical variables, bar charts were created using Microsoft Excel 2013 (version 2409, build 16.0.18025.20030).

RESULTS

The survey included 1,243 clinicians, with the majority (38.54%) indicating that 21–30% of their patients suffer from upper respiratory tract infections. Around 39% estimated that 26–50 patients per month require antimicrobial therapy for respiratory tract infections. The majority of clinicians (90.91%) identified respiratory tract infections as the most common condition requiring antibiotic use in their practice. A significant proportion (43.04%) considered environmental factors to be the most common cause of recurrent respiratory tract infections. According to 61% of respondents, 11–30 patients per month present with a viral etiology for upper respiratory tract infections. Approximately 48% reported that 6–10% of children with lower respiratory tract infections require inpatient care per day. The majority of respondents (63.96%) identified Streptococcus pneumoniae as the most common cause of respiratory tract infections.

Most clinicians (60.18%) reported that Streptococcus pneumoniae is commonly associated with 11–20% of respiratory tract infection cases. Around 59% indicated that S. pneumoniae is most frequently reported in children. The majority of clinical experts (60.66%) stated that 11–25% of their patients experience exacerbations of chronic bronchitis. Approximately 61% reported that antibiotic selection is primarily guided by the severity of the disease. A substantial proportion of clinicians (73.53%) preferred cefpodoxime as the first-line anti-infective for upper respiratory tract infections (Table 1), and most participants

(65.25%) selected 10 mg/kg/day as the preferred dose (Figure 1).

Over half of the clinicians (52.37%) indicated that they prescribe cefpodoxime in 11–25% of patients with exacerbations of chronic bronchitis (Table 2). Half of the clinicians (50.60%) reported prescribing cefpodoxime in less than 10% of bone and joint infection cases (Fig. 2). Nearly 43% indicated prescribing it in 25–50% of ENT infection cases (Figure 3). Around 42% of experts stated that they prescribe cefpodoxime in less than 10% of skin and soft tissue infection cases (Figure 4).

Table 1: Distribution of responses to clinicians' preference for first-line anti-infective in upper respiratory tract infections.

Preferred first-line anti-infective	Response rate (n=243)
Amoxicillin-clavulanic acid	235 (18.91%)
Cefpodoxime	914 (73.53%)
Cefixime	18 (1.45%)
Azithromycin	75 (6.03%)
Not attempted	1 (0.08%)

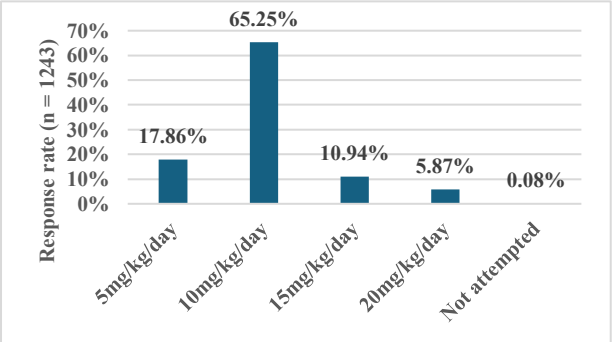

Figure 1: Distribution of responses to clinicians' preferred dose of cefpodoxime for treating upper respiratory tract infections.

Proportion of patients prescribed cefpodoxime	Response rate (n=1243)
<10%	173 (13.92%)
11-25%	651 (52.37%)
25-50%	418 (33.63%)
Not attempted	1 (0.08%)

Table 2: Distribution of responses to clinicians' estimates of cefpodoxime use in patients with exacerbations of chronic bronchitis.

Half of the clinicians (50.28%) identified diarrhea as the most common adverse effect associated with cefpodoxime in their practice (Table 3). Nearly 51% of experts considered cefpodoxime's broad-spectrum activity to be its primary advantage (Table 4). Around 46% of respondents stated that they wait for seven days before switching to the next antibiotic. More than half of the clinicians (54.06%) reported that 10% of patients with respiratory tract infections require a change in antibiotics. According to 36% of participants, 31–60% of patients complete the prescribed course of antibiotics. Half of the experts (50.04%) indicated that 10% of patients with respiratory tract infections require more than one antibiotic for treatment.

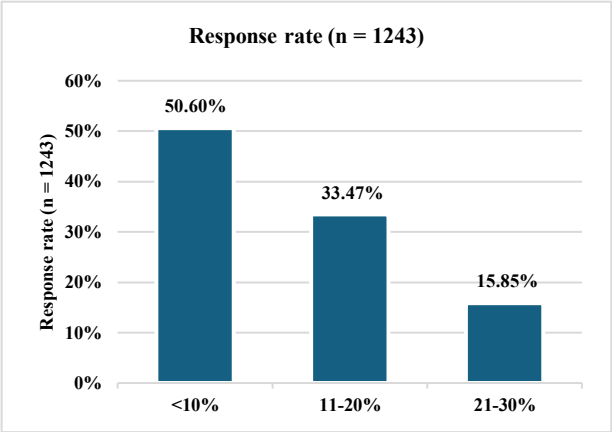

Figure 2: Distribution of responses to clinicians' estimates of cefpodoxime use in bone and joint infections.

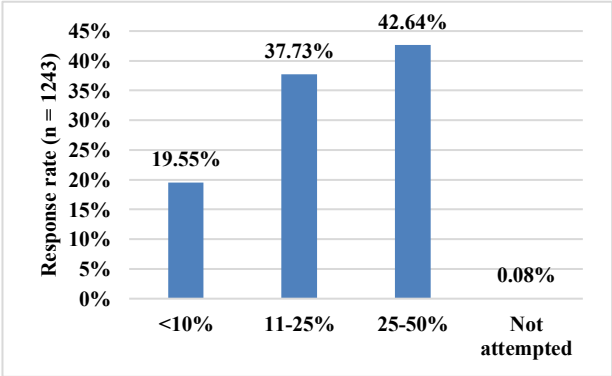

Figure 3: Distribution of responses to clinicians' estimates of cefpodoxime use in ENT infections.

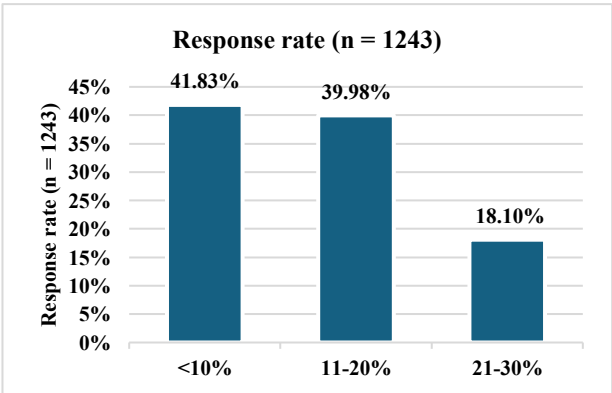

Figure 4: Distribution of responses to clinicians' estimates of cefpodoxime use in skin and soft tissue infections.

Table 3: Distribution of responses to the most common adverse effects of cefpodoxime observed in clinical practice.

Adverse effect	Response rate (n=243)
Diarrhoea	625 (50.28%)
Vomiting	354 (28.48%)
Pain abdomen	154 (12.39%)
All of the above	4 (0.32%)
None of them	105 (8.45%)
Not attempted	1 (0.08%)

Table 4: Distribution of responses to clinicians' views on the advantages of cefpodoxime.

Reported advantage	Response rate (n=243)
Broad spectrum coverage	633 (50.93%)
Favourable pharmacokinetic profile	99 (7.96%)
Good bacteriological and clinical efficacy	454 (36.52%)
All of the above	56 (4.51%)
Not attempted	1 (0.08%)

DISCUSSION

This survey underscores cefpodoxime's well-established role in the empirical treatment of community-acquired respiratory infections in Indian clinical practice. The strong preference for cefpodoxime as a first-line therapy for upper respiratory tract infections reflects clinician confidence in its efficacy and safety, with a significant proportion favouring a consistent dosing regimen of 10 mg/kg/day. Supporting this, a review by Bergogne-Bérézin reported an overall clinical response rate of 88.4% in 181 patients with URTIs, with cure rates of 90.3% in pharyngotonsillitis and 95% in acute sinusitis. Bacterial eradication ranged from 78% to 96.7%, highlighting its robust microbiological efficacy.[10] Additionally, a large prospective study in Egypt involving 1,425 adults with acute maxillary sinusitis and tonsillopharyngitis found an overall cure rate of 83.3%, with higher rates in tonsillopharyngitis (86.3%) than sinusitis (77.4%). Adverse events were rare (0.8%) and mild to moderate, further supporting cefpodoxime's effectiveness and tolerability as an empirical option for adult upper respiratory infections.[11]

Prescribing trends for cefpodoxime vary across different types of infections. In this survey, over half of the clinicians reported using cefpodoxime in 11–25% of patients with exacerbations of chronic bronchitis, indicating moderate usage in lower respiratory tract conditions. In contrast, its use was limited in bone and joint infections, with 50% of respondents prescribing it in less than 10% of such cases. A review by Bergogne-Bérézin noted that in lower respiratory tract infections, cefpodoxime proxetil demonstrated high efficacy, with success rates ranging from 84% to 97% in bronchial infections and favorable outcomes in 81.8% to 100% of bacterial pneumonia cases.[12] In a multicenter trial evaluating acute exacerbations of chronic bronchitis, cefpodoxime achieved a clinical efficacy rate of 97.2%.[13] The PERCEPT survey, involving Indian healthcare professionals, also highlighted the widespread use of cefpodoxime for both upper and lower respiratory tract infections, attributing it to the drug's broad-spectrum efficacy and favorable safety profile. A smaller proportion of respondents (3.7% in adults and 5.6% in pediatric patients) reported using cefpodoxime for bone and joint infections.[14]

In ENT infections, a significant number of clinicians in the current survey reported prescribing cefpodoxime in 25–50% of cases, indicating strong confidence in its efficacy for conditions such as otitis media and sinusitis. However, its use remained low in skin and soft tissue infections, with 42% of clinicians prescribing it in fewer than 10% of cases. An Indian multicenter study involving 1,380 children with acute otitis media found that cefpodoxime proxetil (8 mg/kg/day for 5–10 days) achieved a cure rate of 82.5%, with an additional 16.4% showing clinical improvement. Treatment failure was observed in only 1.1%, resulting in an overall effectiveness rate of 98.9%, underscoring cefpodoxime's high efficacy in pediatric patients.[15] Additionally, a questionnaire-based study of 131 Indian healthcare providers assessed cefpodoxime use in ENT infections. Clinical improvement was reported by 94% of respondents, with rapid fever resolution and reduced erythema. It was commonly prescribed around ENT surgeries and was the most frequently used antibiotic for otitis media. Over 70% rated its efficacy as "excellent," highlighting its widespread and effective use in ENT care.[16]

Tack et al demonstrated that cefpodoxime proxetil is highly effective in treating skin and soft tissue infections, with clinical cure rates of 93% in mild to moderate cases (200 mg twice daily) and 75.9% in severe cases (400 mg twice daily). Pathogen eradication rates were 97.6% and 100%, respectively, highlighting its strong antibacterial activity.[17] In a multicenter, double-blind study, Stevens et al. reported that cefpodoxime proxetil achieved a 99% pathogen eradication rate and 86% clinical cure rate in skin and soft tissue infections. It showed greater efficacy against Staphylococcus species and a lower treatment failure rate (1% vs. 4%) compared to cefaclor, with the added benefit of twice-daily dosing for better compliance.[18]

Regarding safety, half of the clinicians in the current survey identified diarrhea as the most commonly observed adverse effect of cefpodoxime proxetil. This finding aligns with previous studies by Brown et al and Bansal et al, which also reported diarrhea as the most frequent adverse event associated with its use.[15,19] More than half of the experts considered cefpodoxime's broad-spectrum activity to be its key advantage, emphasizing its utility in empirical

treatment settings. Cefpodoxime is stable against most commonly encountered plasmid-mediated beta-lactamases and demonstrates broad-spectrum antibacterial activity against both Gram-positive and Gram-negative bacteria. These properties make it a suitable option for the empirical treatment of a wide range of community-acquired infections in both adult and pediatric patients.[8]

This survey provides valuable insights into clinical practice patterns with cefpodoxime, filling an important gap in understanding how this antibiotic is utilized in clinical settings. The findings have several significant implications for clinical practice, medical education, and healthcare policy. A major strength of the study lies in the use of a well-structured, validated questionnaire to collect expert insights, coupled with a robust sample size that enhances the reliability of the findings. However, the study has certain limitations. Sampling bias may be present, as the responses may not fully represent diverse clinical settings. The reliance on self-reported data introduces the risk of recall bias and may not reflect actual prescribing behaviour. Additionally, the lack of data on patient outcomes, resistance patterns, and guideline adherence limits clinical context.

CONCLUSION

This study offers a comprehensive overview of clinicians' prescribing patterns for cefpodoxime across various infections. While it is most commonly preferred for upper respiratory tract and ENT infections, its use is comparatively limited in conditions such as chronic bronchitis, bone and joint infections, and skin and soft tissue infections. Diarrhoea was the most commonly reported adverse effect, and its broad-spectrum antibacterial activity was regarded as the key advantage by the majority of clinicians.

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