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A Cross-Sectional Survey of ENT Surgeons' Preferences, Prescribing Patterns, and Clinical Experience with Cefpodoxime-Clavulanic Acid in ENT Infections

Ajitkumar Gondane[1], Meghana Kate[2], Vaishnavi Shahare[2], Dattatray Pawar[3], Akhilesh Sharma[4]

[1]Senior Manager, Medical Affairs Division, Alkem Laboratories, Mumbai, India.
[2]Medical Intern, Medical affairs Division, Alkem Laboratories, Mumbai, India.
[3]General Manager, Medical affairs Division, Alkem Laboratories, Mumbai, India.
[4]President and CMO, Medical Division, Alkem Laboratories, Mumbai, India.

Corresponding Author: Dr. Ajitkumar Gondane

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ABSTRACT

Background: Ear, nose, and throat (ENT) infections are a common cause of outpatient visits and antibiotic prescriptions. Rising antimicrobial resistance and the prevalence of β-lactamase–producing pathogens have increased the need for effective broad-spectrum antibiotics. Although cefpodoxime–clavulanic acid is widely used in ENT practice, data on physician prescribing preferences and real-world clinical experience are limited.
Objectives: To evaluate the prescribing patterns, therapeutic positioning, perceived effectiveness, tolerability, and safety of cefpodoxime–clavulanic acid among ENT surgeons in routine clinical practice.
Methods: A cross-sectional questionnaire-based survey was conducted among 100 ENT surgeons from across India attending the 8th International Live Surgery Workshop in Bengaluru. Information was collected on prescription frequency, clinical indications, factors influencing antibiotic selection, therapeutic positioning, effectiveness, tolerability, adverse events, and safety in special populations.
Results: Cefpodoxime–clavulanic acid was prescribed frequently or very frequently by 84.0% of respondents. Common indications included acute otitis media (59.0%), tonsillitis/pharyngitis (58.0%), chronic suppurative otitis media exacerbation (42.0%), post-operative ENT infections (39.0%), and acute bacterial sinusitis (28.0%). The combination was used as first-line therapy by 62.0% of surgeons. Broad-spectrum coverage (64.0%), activity against β-lactamase–producing organisms (30.0%), and clinical efficacy (29.0%) were the main reasons for selection. Overall, 99.0% rated it as effective or very effective, while all respondents rated tolerability as good or very good. Mild gastrointestinal symptoms were the most commonly reported adverse events (35.0%); allergic reactions and treatment discontinuation were rare (2.0% each). Additionally, 95.0% considered the combination safe or very safe in elderly and comorbid patients.
Conclusion: Cefpodoxime–clavulanic acid is widely used in ENT practice and is perceived as an effective, well-tolerated, and safe option for a broad spectrum of ENT infections, supporting its continued role in contemporary ENT management.

Keywords: Antibiotic prescribing patterns; otitis media; sinusitis; tonsillopharyngitis

INTRODUCTION

Ear, nose, and throat (ENT) infections are among the most common reasons for outpatient consultations and antibiotic prescriptions worldwide. Conditions such as acute otitis media, acute bacterial sinusitis, acute tonsillitis, pharyngitis, and post-operative ENT infections contribute substantially to healthcare utilization and patient morbidity across all age groups [1,2]. Although many upper respiratory tract infections are viral in origin, bacterial infections remain a significant cause of illness and frequently necessitate antimicrobial therapy to achieve symptom resolution, prevent complications, and reduce disease recurrence. Effective management of these infections is therefore essential to improving patient outcomes and minimizing the socioeconomic burden associated with prolonged illness and healthcare resource utilization [3,4].

The microbial etiology of ENT infections is diverse and commonly includes pathogens such as Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, Streptococcus pyogenes, and Staphylococcus aureus [5,6]. Over recent decades, the increasing prevalence of antimicrobial resistance and the emergence of β-lactamase–producing organisms have complicated the empirical management of these infections. Resistance mechanisms among common respiratory pathogens have reduced the effectiveness of several conventional antibiotics, thereby necessitating the use of agents with broader antimicrobial coverage and enhanced stability against bacterial resistance mechanisms [7-9]. Consequently, selecting an appropriate empirical antibiotic has become a critical component of evidence-based ENT practice.

Third-generation oral cephalosporins have gained widespread acceptance in the treatment of community-acquired respiratory and ENT infections owing to their favorable antimicrobial spectrum, clinical efficacy, and safety profile [10, 11]. Among these agents, cefpodoxime proxetil is characterized by potent activity against a broad range of Gram-positive and Gram-negative pathogens commonly implicated in ENT infections. Its pharmacokinetic properties, including good oral bioavailability and adequate tissue penetration, make it a valuable therapeutic option in outpatient settings [12,13]. Furthermore, cefpodoxime has demonstrated clinical effectiveness in the treatment of acute otitis media, sinusitis, tonsillopharyngitis, and other respiratory tract infections [14, 15].

The addition of clavulanic acid, a β-lactamase inhibitor, further expands the utility of cefpodoxime by restoring activity against β-lactamase–producing bacterial strains [16]. This combination enhances antimicrobial coverage against resistant organisms that may otherwise compromise treatment success [17]. As a result, cefpodoxime–clavulanic acid has emerged as an attractive therapeutic option for ENT specialists, particularly in clinical scenarios where mixed infections, recurrent disease, previous antibiotic exposure, or local resistance patterns raise concerns regarding treatment efficacy. The combination also offers advantages of convenient oral administration, favorable tolerability, and potential for improved patient adherence, all of which are important considerations in routine clinical practice.

Despite the widespread use of cefpodoxime–clavulanic acid in ENT infections, much of the available evidence originates from clinical trials, observational studies, and microbiological investigations. While these studies provide important information regarding efficacy and safety, they may not fully reflect real-world prescribing behavior, physician preferences, and practical clinical experiences. Treatment decisions in routine ENT practice are often influenced by multiple factors, including perceived clinical effectiveness,

local pathogen epidemiology, antimicrobial resistance trends, patient characteristics, safety considerations, and physician experience. Understanding these factors is important for gaining insight into contemporary prescribing patterns and identifying the attributes that drive clinician confidence in a particular antimicrobial agent.

Physician perception surveys represent a valuable tool for capturing real-world clinical experience and therapeutic preferences. Such surveys provide complementary evidence to conventional clinical studies by exploring how treatments are utilized in everyday practice, the indications for which they are preferred, and the outcomes observed by treating physicians. In the context of antimicrobial stewardship and evolving resistance patterns, documenting clinician experiences with commonly prescribed antibiotic combinations can help inform future treatment strategies and guide clinical decision-making.

Although cefpodoxime–clavulanic acid is frequently prescribed in ENT practice, there is limited published literature evaluating the perspectives, prescribing preferences, and clinical experiences of ENT surgeons regarding its use in real-world settings, particularly in the Indian subcontinent. Data describing the frequency of use, common clinical indications, reasons for selection, perceived effectiveness, tolerability, and safety of this combination among practicing ENT specialists remain scarce. Given the high burden of ENT infections and the ongoing challenges posed by antimicrobial resistance, understanding physician experiences with cefpodoxime–clavulanic acid is of considerable clinical relevance.

Therefore, the present survey was conducted among ENT surgeons across India, with additional participation from neighbouring countries, to evaluate their preference, usage patterns, and clinical experience with cefpodoxime–clavulanic acid in the management of ENT infections. The study aimed to assess prescribing frequency, therapeutic positioning, common indications for use, factors influencing antibiotic selection, perceived clinical effectiveness, tolerability, and safety in routine clinical practice. The findings of this survey are expected to provide real-world insights into the prescribing practices and clinicians' experiences with cefpodoxime–clavulanic acid in the management of ENT infections, thereby contributing to the existing body of evidence supporting its use in contemporary clinical practice.

MATERIALS & METHODS

This descriptive, questionnaire-based, cross-sectional survey was conducted among practicing otorhinolaryngologists (ENT surgeons) attending the 8th International Live Surgery Workshop, Bengaluru, India. The survey aimed to capture clinicians' perspectives on selected aspects of routine ENT clinical practice.

Participant recruitment and sampling strategy: A non-probability convenience sampling approach was employed. Eligible participants were approached during the scientific sessions and designated survey areas of the workshop and were invited to participate voluntarily. Before participation, the purpose of the survey was explained, and verbal informed consent was obtained. Participation was entirely voluntary, and no incentives were provided.

Inclusion and exclusion criteria:

Practicing ENT surgeons attending the workshop who were willing to participate and provide informed consent were included in the survey. Incomplete questionnaires, duplicate responses, and responses from individuals who are not actively practicing in the field of otorhinolaryngology were excluded from the final analysis.

Questionnaire development and validation:

The survey questionnaire consisted of eight structured multiple-choice questions designed to assess clinicians' perspectives

on routine ENT practice. The questionnaire was developed following a review of relevant literature and discussion among the study investigators to identify important clinical challenges and unmet needs commonly encountered in day-to-day practice.

The draft questionnaire underwent content review by three experienced ENT surgeons to evaluate its clinical relevance, clarity, comprehensiveness, and appropriateness. Based on their feedback, minor modifications were incorporated to improve question wording, sequence, and ease of understanding. The revised questionnaire was subsequently pilot tested among a small group of ENT surgeons to ensure clarity and feasibility of administration before its final implementation.

Sample size

As this was an exploratory, conference-based opinion survey without a predefined primary hypothesis, no formal sample size calculation was performed. A target sample of 100 completed questionnaires was considered adequate to obtain a representative range of clinician opinions within the available study period and has been consistent with the sample sizes commonly reported in similar exploratory physician perception surveys conducted during scientific meetings. Completed questionnaires from 100 participating ENT surgeons were included in the final analysis.

Statistical Analysis

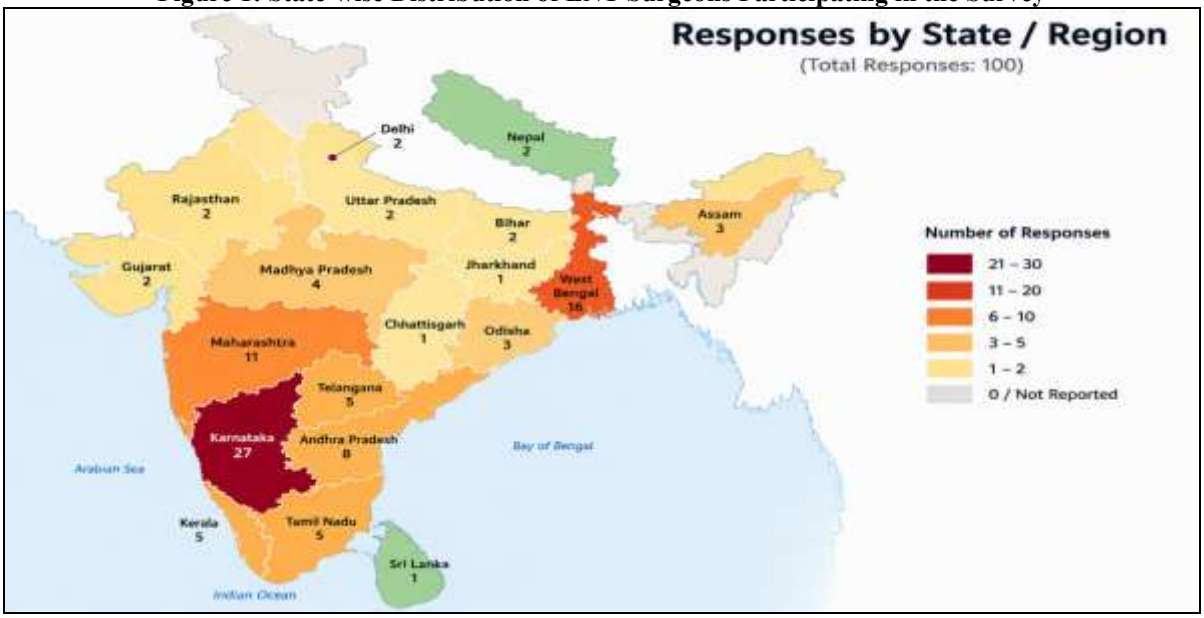
The finalized questionnaire was converted into a Google Forms format and distributed electronically to participants during the workshop. Responses were collected online and exported to Microsoft Excel for data collation and management. Descriptive statistical analysis was performed, and the findings were summarized using frequencies and percentages to present the distribution of responses.

RESULT

Demographic Characteristics of Respondents

A total of 100 ENT surgeons participated in this cross-sectional survey assessing the preference, usage patterns, and clinical experience with cefpodoxime–clavulanic acid in the management of ENT infections. The survey included respondents from various geographical regions across India, ensuring broad national representation. Additionally, a small number of responses were received from neighboring countries, namely Nepal and Sri Lanka, contributing to the diversity of clinical perspectives captured in the survey.

Figure 1: State-wise Distribution of ENT Surgeons Participating in the Survey



Among the participating surgeons, 72 (72.0%) were male and 28 (28.0%) were female. The mean age of male respondents was 42.29 ± 12.57 years, whereas female respondents had a mean age of 33.14 ± 5.32 years. The overall mean age of the study population was 39.73 ± 11.75 years, indicating participation from both early-career and experienced ENT specialists (Table 1).

Table 1: Demographic characteristics of participating ENT surgeons.

Gender	No. of Physicians	Age Mean ± SD
• Male	72	42.29 ± 12.57
• Female	28	33.14 ± 5.32
Overall	100	39.73 ± 11.75

Frequency of Prescription of Cefpodoxime–Clavulanic Acid

The survey findings demonstrated widespread utilization of cefpodoxime–clavulanic acid among ENT surgeons for the management of ENT infections. Nearly half of the respondents [46 (46.0%)] reported prescribing the combination very frequently, while an additional 38 (38.0%) reported frequent use in their routine practice. Collectively, 84.0% of the surveyed surgeons indicated regular prescribing of cefpodoxime–clavulanic acid, underscoring its established role in contemporary ENT practice.

Only 15 (15.0%) respondents reported occasional use, while a single respondent (1.0%) indicated rare use of the antibiotic combination. The absence of substantial infrequent use suggests a high level of familiarity and confidence among ENT specialists regarding the clinical utility of cefpodoxime–clavulanic acid in ENT infections (Figure 2).

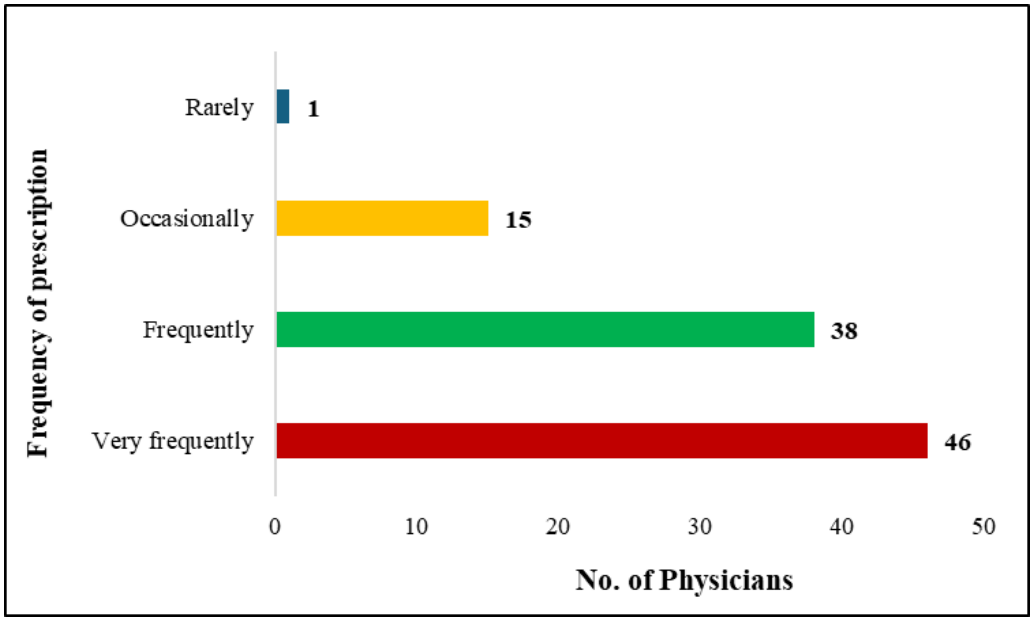


Figure 2: Frequency of prescribing cefpodoxime–clavulanic acid for ENT infections.

Clinical Indications for Prescribing Cefpodoxime–Clavulanic Acid

The participating surgeons reported using cefpodoxime–clavulanic acid across a broad spectrum of ENT infections. Acute otitis media emerged as the most frequently reported indication, with 59 (59.0%) respondents selecting this condition. Acute tonsillitis/pharyngitis was reported by 58 (58.0%) respondents, indicating that the antibiotic combination is widely utilized in upper respiratory tract infections involving the oropharyngeal region.

Furthermore, 42 (42.0%) surgeons reported prescribing cefpodoxime–clavulanic acid for acute exacerbations of chronic suppurative otitis media, reflecting its perceived utility in more complicated and recurrent ear infections. Post-operative ENT infections were identified as a common indication by 39 (39.0%) respondents, suggesting confidence in the antimicrobial coverage offered by the combination in the post-surgical setting.

Acute bacterial sinusitis was reported by 28 (28.0%) respondents and represented another important indication for use. Overall, the findings indicate that cefpodoxime–clavulanic acid is employed across both uncomplicated community-acquired infections and more complex ENT conditions requiring broader antimicrobial coverage (Figure 3).

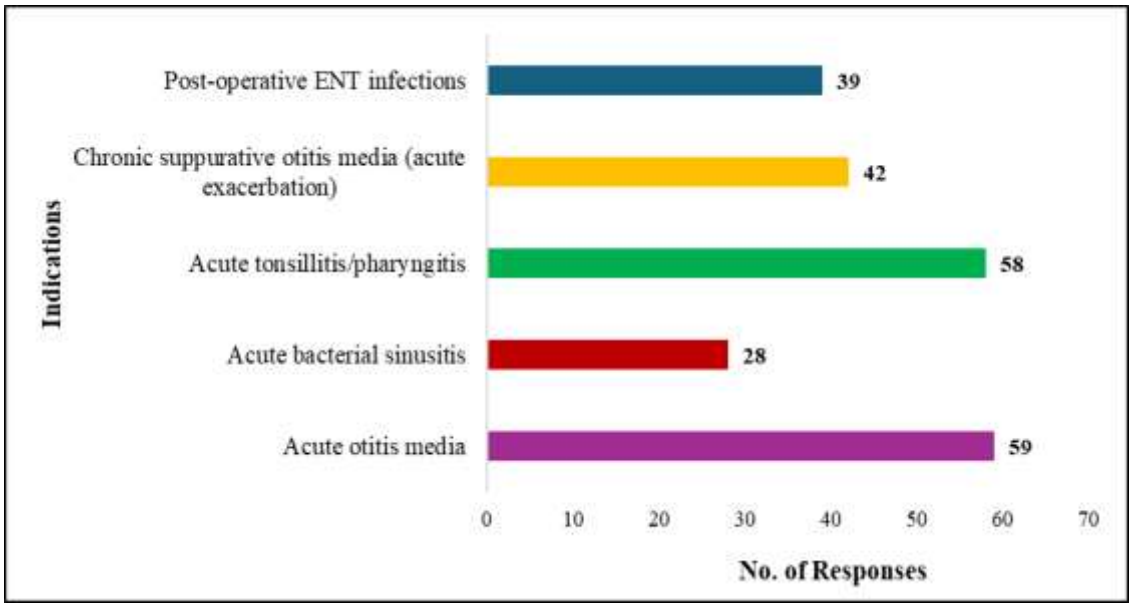


Figure 3: ENT infections for which cefpodoxime–clavulanic acid is commonly prescribed.

Therapeutic Positioning in Clinical Practice

When respondents were asked about the positioning of cefpodoxime–clavulanic acid within their treatment algorithms, a majority reported its use as a first-line therapeutic option. Specifically, 62 (62.0%) ENT surgeons indicated that they routinely prescribe the combination as initial therapy for ENT infections.

A further 33 (33.0%) respondents reported using cefpodoxime–clavulanic acid as a second-line treatment option, typically in situations where first-line agents may be unsuitable, ineffective, or where broader antimicrobial coverage is required. Only 5 (5.0%) respondents reported using the drug as step-down therapy following parenteral antibiotic administration.

Taken together, these findings indicate that cefpodoxime–clavulanic acid is predominantly regarded as an early treatment option rather than being reserved for refractory or severe cases alone (Figure 4).

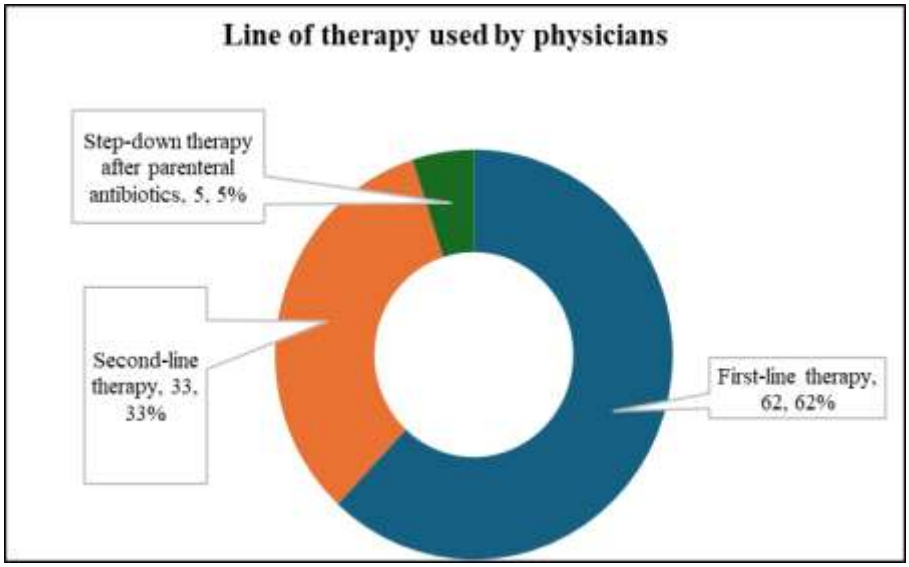


Figure 4: Clinical positioning of cefpodoxime–clavulanic acid in ENT practice

Factors Influencing the Choice of Cefpodoxime–Clavulanic Acid

The reasons underlying the selection of cefpodoxime–clavulanic acid varied among respondents; however, efficacy-related factors emerged as the primary drivers of prescribing decisions.

Broad-spectrum antimicrobial coverage was the most frequently cited reason and was reported by 64 (64.0%) respondents. This was followed by activity against β-lactamase–producing organisms, which was selected by 30 (30.0%) surgeons. Good clinical efficacy was identified by 29 (29.0%) respondents, highlighting the importance of therapeutic outcomes in influencing prescribing behavior. Additional factors included good patient compliance, reported by 18 (18.0%) respondents, and a favorable safety profile, reported by 14 (14.0%) respondents. Availability and cost-effectiveness were selected by only 5 (5.0%) respondents, suggesting that clinical considerations outweighed economic factors in treatment selection. Overall, the data indicate that ENT surgeons primarily value cefpodoxime–clavulanic acid for its broad antimicrobial spectrum and effectiveness against resistant pathogens, while patient-related factors such as compliance and tolerability serve as complementary considerations (Figure 5).

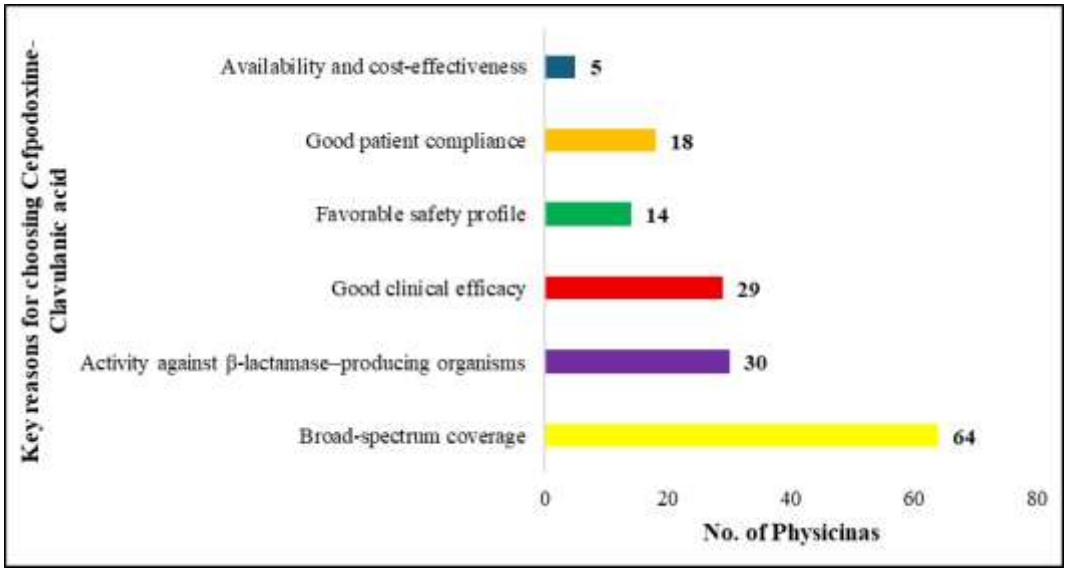


Figure 5: Key reasons for choosing cefpodoxime–clavulanic acid

Physician Assessment of Clinical Effectiveness

Respondents were asked to evaluate the clinical effectiveness of cefpodoxime–clavulanic acid in terms of symptom resolution and infection control based on their routine clinical experience.

More than half of the surveyed surgeons [53 (53.0%)] rated the antibiotic combination as very effective, while 46 (46.0%) considered it effective. Only one respondent (1.0%) rated it as moderately effective, and none reported it to be ineffective. Notably, 99.0% of respondents perceived cefpodoxime–clavulanic acid as either effective or very effective, reflecting a high degree of satisfaction with clinical outcomes achieved using this therapeutic combination. The absence of any ineffective ratings further supports the positive perception of cefpodoxime–clavulanic acid among practicing ENT specialists (Figure 6).

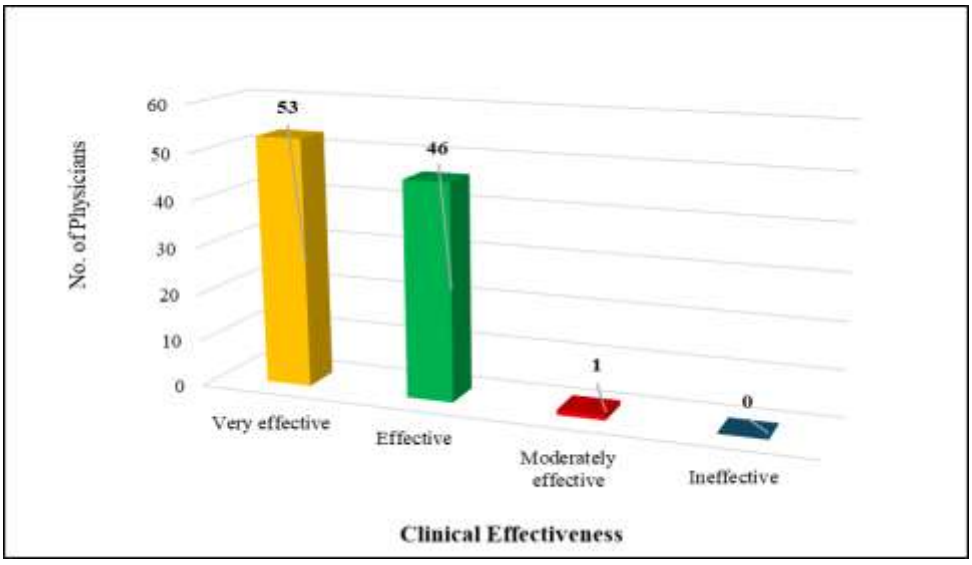


Figure 6: Physician-rated clinical effectiveness of cefpodoxime–clavulanic acid

Assessment of Overall Tolerability

The overall tolerability profile of cefpodoxime–clavulanic acid was rated favorably by all participating surgeons. More than half of the respondents [56 (56.0%)] rated tolerability as very good, while the remaining 44 (44.0%) rated it as good.

Importantly, no respondents categorized tolerability as poor, fair, or unacceptable. These findings suggest consistent clinical experience regarding the favorable tolerability of cefpodoxime–clavulanic acid across diverse patient populations encountered in ENT practice (Figure 7).

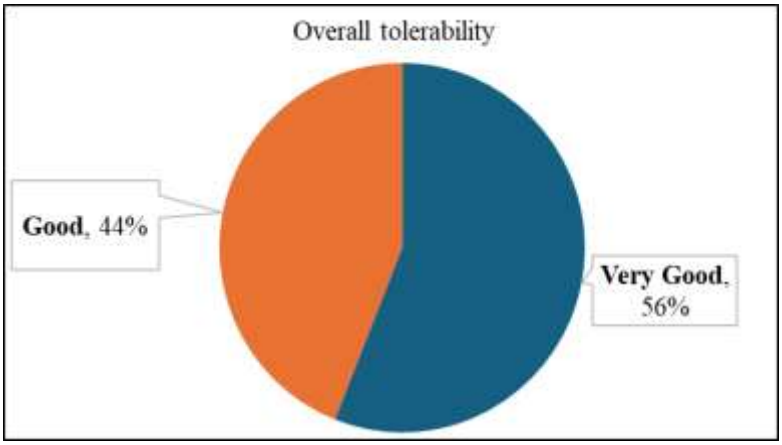


Figure 7: Ratings by physicians

Adverse Events Observed During Clinical Use

The survey also explored the occurrence of adverse events associated with cefpodoxime–clavulanic acid therapy in routine clinical practice.

A majority of respondents [61 (61.0%)] reported that they had not observed any adverse events attributable to the antibiotic combination. Among those reporting adverse events, mild gastrointestinal symptoms were the most commonly encountered and were reported by 35 (35.0%) respondents.

Serious adverse events appeared to be uncommon. Allergic reactions were reported by only 2 (2.0%) respondents, while treatment discontinuation due to intolerance was also reported by 2 (2.0%) respondents and was described as a rare occurrence.

Overall, the observed adverse-event profile was predominantly characterized by mild and manageable gastrointestinal symptoms, with very few reports of hypersensitivity reactions or treatment discontinuation (Figure 8).

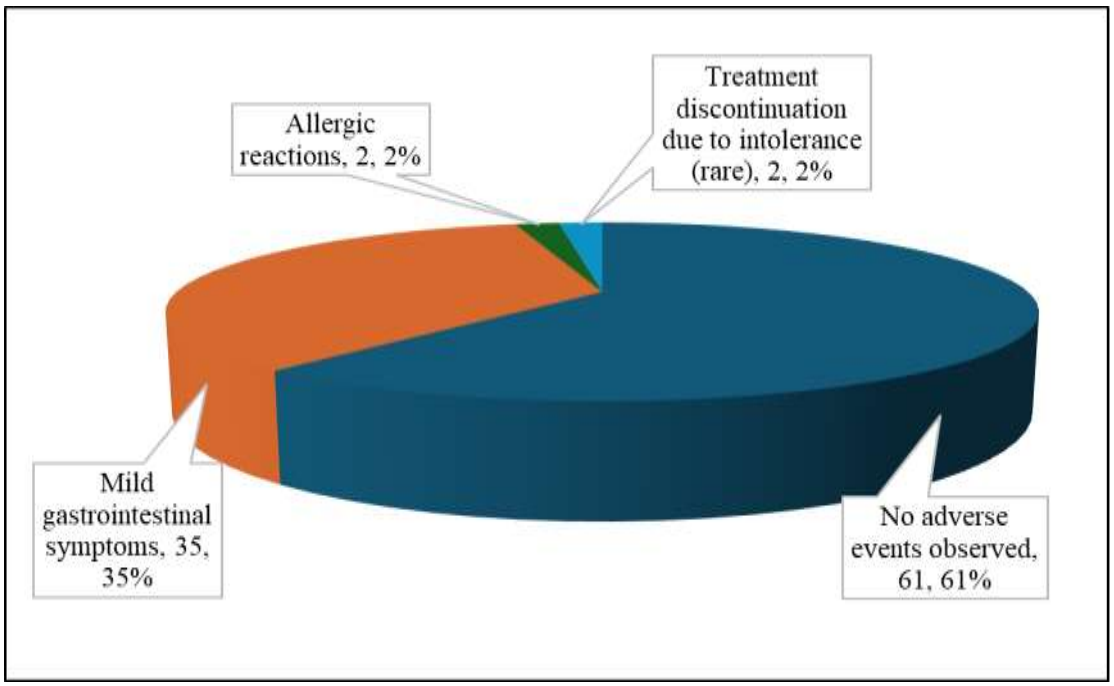


Figure 8: Adverse events observed during clinical use.

Safety in Special Populations

The safety of cefpodoxime–clavulanic acid in special patient populations, including elderly individuals and patients with associated comorbidities, was assessed based on the clinical experience of participating ENT surgeons.

A total of 42 (42.0%) respondents considered the antibiotic combination to be very safe in these populations, while 53 (53.0%) rated it as safe. Only 5 (5.0%) respondents indicated that the drug should be used with caution.

Collectively, 95.0% of the surveyed surgeons regarded cefpodoxime–clavulanic acid as safe or very safe in special populations. These findings suggest a high level of confidence among ENT specialists regarding the use of this antibiotic combination in patients who may be at increased risk of treatment-related complications due to age or underlying medical conditions (Figure 9).

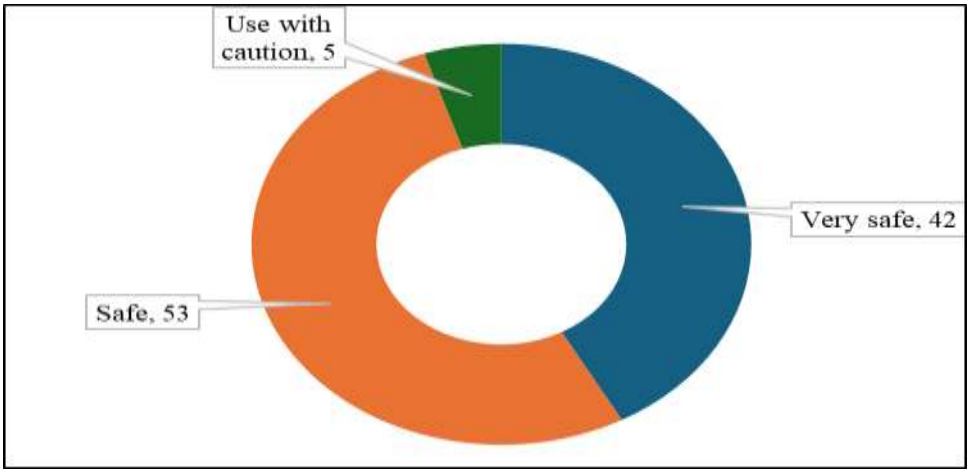


Figure 9: Safety assessment in special populations

Overall Physician Experience with Cefpodoxime–Clavulanic Acid

The survey findings collectively demonstrate a high level of acceptance and utilization of cefpodoxime–clavulanic acid among ENT surgeons. The antibiotic combination was prescribed frequently by the vast majority of respondents and was commonly used for a wide range of ENT infections, including acute otitis media, tonsillitis/pharyngitis, chronic suppurative otitis media exacerbations, sinusitis, and post-operative infections.

Most respondents reported employing cefpodoxime–clavulanic acid as a first-line treatment option, primarily owing to its broad-spectrum antimicrobial activity, effectiveness against β-lactamase–producing pathogens, and favorable clinical outcomes. Furthermore, the combination was consistently rated highly for effectiveness, tolerability, and safety, with minimal reports of significant adverse events.

Overall, the survey highlights a strong positive clinical experience with cefpodoxime–clavulanic acid among ENT surgeons and supports its widespread use in the management of ENT infections.

DISCUSSION

This cross-sectional survey of 100 ENT surgeons across India demonstrated widespread use of cefpodoxime–clavulanic acid in ENT practice, with 84.0% of respondents prescribing it frequently or very frequently.

This high utilization mirrors patterns documented by Goossens et al., who documented widespread outpatient use of beta-lactamase inhibitor combinations across Europe, particularly for respiratory tract infections, with an increasing shift toward broad-spectrum agents [18]. In the Indian context, the high bacterial burden of ENT infections caused by Streptococcus pneumoniae, Haemophilus influenzae, and Moraxella catarrhalis—as documented by Dechen et al [5]—provides a rational epidemiological basis for the preference for agents with broad-spectrum and beta-lactamase-stable activity.

The spectrum of clinical indications spanned both uncomplicated infections (acute otitis media 59.0%, tonsillitis/pharyngitis 58.0%, sinusitis 28.0%) and more complex conditions (chronic suppurative otitis media exacerbation 42.0%, post-operative ENT infections 39.0%), reflecting the versatility of the combination across the ENT surgical spectrum. Brook et al. have documented the polymicrobial, often beta-lactamase-rich bacteriology of chronic suppurative otitis media and post-surgical ENT infections, supporting the rationale for combination therapy in these settings [19,20]. Notably, 62.0% of surgeons positioned cefpodoxime–clavulanic acid as first-line therapy. This preference is consistent with findings from the PERCEPT survey by Jain et al. [17], which similarly documented first-line preference for cefpodoxime-based

combinations among Indian physicians, driven by local resistance patterns and the superior oral bioavailability and tissue penetration of cefpodoxime proxetil as compared to older beta-lactams [12].

Broad-spectrum antimicrobial coverage (64.0%), activity against beta-lactamase–producing organisms (30.0%), and good clinical efficacy (29.0%) were the principal factors driving antibiotic selection, while cost-effectiveness ranked lowest (5.0%), indicating that clinical rather than economic considerations govern prescribing decisions—a pattern corroborated by Kardas et al [21].The escalating prevalence of beta-lactamase production among ENT pathogens, with up to 40% of H. influenzae and virtually all M. catarrhalis isolates affected, makes clavulanic acid an essential component of empirical therapy [8,16].

The extraordinarily high rate of perceived clinical effectiveness in this survey—99.0% of respondents rate the combination as effective or very effective—warrants discussion in the context of the existing evidence base. These physician-reported outcomes align closely with findings from clinical trials and real-world evidence studies. *Lamdhade et al*., in a multicenter retrospective real-world evidence study specifically evaluating cefpodoxime in respiratory tract infections across Indian centers, reported clinical success rates exceeding 90% across multiple infection subtypes findings that are consistent with the perception of high effectiveness reported by ENT surgeons in the present survey [15]. Similarly, Cohen et al. reported clinical cure and improvement rates of 88–95% with cefpodoxime monotherapy in respiratory tract infections, rates that are likely further improved with the addition of clavulanic acid coverage against resistant organisms [14]. Additionally, in a comparative evaluation by *Periti et al*, it was observed that the clinical efficacy and safety of Cefpodoxime Proxetil is similar to Amoxicillin-Clavulanic acid combination [22]. It is important to acknowledge, however, that physician-assessed effectiveness in a survey setting is subject to reporting bias and recall bias, and does not constitute the same level of evidence as randomized controlled trial data. Nonetheless, the high concordance between these real-world perceptions and existing controlled evidence lends validity to the findings.

The tolerability profile was uniformly favorable—56.0% rated it very good and 44.0% good, with no respondent reporting poor tolerability. Mild gastrointestinal symptoms were the only adverse event notes (35.0%), while allergic reactions and treatment discontinuation were each reported by only 2.0% of respondents. These rates compare favorably with amoxicillin–clavulanate, which carries a higher burden of gastrointestinal intolerance owing to its higher clavulanate dose requirement, as noted by *Sader et al* and *Spatz M et al.* [11,23]. In special populations (elderly and comorbid patients), 95.0% of surgeons rated the combination as safe or very safe, consistent with the established renal-adjustable, hepatically well-tolerated pharmacokinetic profile of cefpodoxime proxetil [12] and the acceptable pediatric safety documented by *Fulton et al* [13].This observation is consistent with findings from a study by *Gondane A et al*, which reported that physicians perceive cefpodoxime as an effective and well-tolerated treatment option [24].

These findings must be interpreted with reference to antimicrobial stewardship principles. The use of cefpodoxime–clavulanic acid for acute tonsillitis/pharyngitis in 58.0% of respondents invites scrutiny, given that Streptococcus pyogenes remains universally penicillin-susceptible and narrow-spectrum agents suffice for uncomplicated streptococcal pharyngitis. *Guitor et al*. have cautioned against routine broad-spectrum empirical therapy in settings where targeted agents are effective, given the long-term risk of selecting for resistance [7]. Stewardship programs targeting ENT

prescribers should consider culture-guided, risk-stratified frameworks that reserve beta-lactam/BLI combinations for patients with recurrent disease, previous treatment failure, post-surgical infections, or local resistance patterns that justify empirical escalation [25].

Limitations

The present survey has several inherent limitations: cross-sectional design captures perception rather than objective microbiological outcomes; recall and reporting bias are inherent to self-reported surveys; and the absence of dose, duration, and patient-level data limits interpretation of effectiveness and safety findings. Future prospective, culture-confirmed studies are needed to validate these real-world observations.

CONCLUSION

In conclusion, this survey documents widespread, predominantly first-line use of cefpodoxime–clavulanic acid among ENT surgeons in India, driven primarily by its broad-spectrum antimicrobial activity, efficacy against beta-lactamase-producing organisms, and favorable clinical outcomes. The combination was consistently rated highly for clinical effectiveness, tolerability, and safety across diverse patient populations and ENT infection types. These real-world findings complement the existing clinical trial evidence and provide a contemporaneous perspective on the therapeutic positioning of cefpodoxime–clavulanic acid in ENT practice. Future research should incorporate microbiological endpoints, culture-confirmed outcomes, and prospective longitudinal designs to further validate these observations and inform evidence-based prescribing guidelines tailored to the Indian ENT clinical context.

Declaration by Authors

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