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Use of Systemic Antibiotics in Acute Periapical Pathologies

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ABSTRACT

Background: This study aimed to evaluate systemic antibiotics' prescription patterns and effectiveness in managing acute periapical pathologies, focusing on factors influencing their use and associated treatment outcomes.

Methods: A cross-sectional observational study was conducted at Rehman College of Dentistry, Peshawar, from January 2023 to January 2024. A total of 120 patients with acute periapical infections were included. Data were collected using structured questionnaires and clinical records, covering demographic details, clinical presentations, antibiotics prescribed, and treatment outcomes. Statistical analyses were performed to identify significant associations, with a p-value of <0.05 considered statistically significant.

Results: Most participants were aged 31–50 (41.7%), with males comprising 58.3% of the sample. The most frequent primary diagnosis was acute abscess, while the remaining participants were diagnosed with periapical granuloma. Amoxicillin was the most commonly prescribed antibiotic (58.3%), followed by metronidazole (25.0%) and clindamycin (16.7%). Antibiotics were prescribed primarily for systemic symptoms, but 25.0% of prescriptions were deemed inappropriate. Most patients (58.3%) experienced symptom resolution within three days, with high patient satisfaction (66.7%). Practitioner experience and guideline adherence were significant factors influencing appropriate antibiotic use, while patient compliance was a key determinant of successful outcomes.

Conclusion: Systemic antibiotics are essential in managing acute periapical infections, but inappropriate prescriptions remain a concern. Enhancing adherence to clinical guidelines and educating practitioners and patients on rational antibiotic use are necessary to optimise outcomes and prevent antimicrobial resistance.

Keywords: Acute periapical pathologies, systemic antibiotics, amoxicillin, prescription patterns, antimicrobial stewardship, patient compliance, dental infections.

INTRODUCTION

Managing acute periapical pathologies remains critical in dentistry, requiring precise diagnosis and timely intervention. Acute periapical infections, which typically result from bacterial invasion of the pulp and periapical tissues, present with varying degrees of severity[1]. These infections can range from localized pain and swelling to systemic complications, making their management a clinical priority and a significant challenge. The role of systemic antibiotics in managing these conditions has been a subject of ongoing debate, given the increasing global concerns regarding antimicrobial resistance[2].

Dentists prescribe antibiotics in acute periapical infections, significantly when symptoms extend beyond the local region. These symptoms may include swelling, fever, or systemic involvement[3]. However, clinical guidelines emphasize that antibiotics should only be used with definitive treatments, such as drainage or root canal therapy, rather than as standalone solutions. Despite these recommendations, studies suggest that antibiotics are often overprescribed, raising concerns about their appropriateness in routine dental practice[4].

One of the significant challenges in antibiotic prescription is balancing efficacy with the risk of misuse. While antibiotics like amoxicillin and metronidazole are widely recognized for their effectiveness in dental infections, their unnecessary use contributes to the growing threat of antibiotic resistance[5]. Understanding antibiotic prescription patterns and adherence to clinical guidelines is essential to promote rational use and prevent long-term public health consequences.

This study aims to evaluate the use of systemic antibiotics in managing acute periapical pathologies, focusing on factors influencing prescription patterns and treatment outcomes. This research seeks to identify trends and gaps in antibiotic use by analyzing demographic, clinical, and practitioner-related variables. Additionally, the study highlights the importance of patient compliance and its impact on clinical effectiveness and recurrence rates.

Given the rising global emphasis on antimicrobial stewardship, assessing how closely practitioners adhere to established guidelines is essential. This includes evaluating whether antibiotics are prescribed only when clinically indicated and determining how unnecessary prescriptions contribute to adverse effects or treatment inefficacies.

This research contributes to the broader understanding of antibiotic use in dentistry, providing evidence-based insights to improve clinical practices. By addressing the existing gaps and challenges, the study aims to support more effective and sustainable approaches to managing acute periapical infections, ultimately enhancing patient care and minimising risks associated with antibiotic overuse.

METHODOLOGY

This cross-sectional observational study was conducted at Rehman College of Dentistry, Peshawar, Pakistan, from January 2023 to January 2024—the research aimed to evaluate systemic antibiotics' prescription patterns and outcomes in managing acute periapical pathologies. Factors influencing antibiotic use and treatment outcomes were also assessed to provide a comprehensive understanding of current practices.

Ethical considerations were strictly adhered to throughout the study. Approval was obtained from the Ethical Review Committee of Rehman College of Dentistry, Peshawar, Pakistan. All participants were provided detailed information about the study and signed informed consent forms. Records were anonymised to maintain the confidentiality of patient data, and participants were allowed to withdraw at any point without affecting their treatment.

The study included 120 participants, selected using non-probability convenience sampling. Patients presenting with acute periapical infections characterised by symptoms such as pain, swelling, or abscess were eligible for inclusion. Participants had to be 18 years or older, have a confirmed clinical and radiographic diagnosis, and have received systemic antibiotics as part of their treatment. Informed consent was a prerequisite for inclusion. Patients with chronic periapical conditions, previously treated

teeth, systemic contraindications to antibiotics, or those lost to follow-up were excluded from the study to maintain data accuracy.

Data collection involved the use of a structured questionnaire and patient clinical records. The questionnaire captured demographic details, clinical characteristics, prescribed treatments, and outcomes. Clinical information included the severity of symptoms, radiographic findings such as the size of periapical radiolucency, and the type of tooth involved. Treatment data encompassed the specific antibiotics used, their dosage and duration, and the clinical indications for their use. Interventions such as drainage, root canal therapy, or extraction were also documented. Follow-up outcomes included the time required for symptom resolution, adverse effects of antibiotics, recurrence rates, and compliance with treatment regimens.

The data collected were analysed using statistical software. Descriptive statistics, such as frequencies and percentages, were used to summarise demographic and clinical characteristics. Associations between variables were assessed using inferential statistics, including chi-square tests and t-tests, with a significance threshold set at $p < 0.05$. Additionally, multivariate regression analysis was performed to identify factors influencing antibiotic prescription patterns and treatment outcomes.

RESULT

The study included 120 participants, with the majority aged 31-50 years (41.7%), followed by those aged 18-30 years (33.3%) and over 50 years (25.0%). Gender distribution showed a slightly higher proportion of males (58.3%) compared to females (41.7%), with a statistically significant association between gender and antibiotic use ($p = 0.021$). Urban participants comprised 66.7% of the sample, while 33.3% were from rural areas ($p = 0.010$). Socioeconomic status varied, with most participants classified as medium-income (41.7%), followed by low-income (33.3%) and high-income (25.0%). Additionally, 41.7% of participants had comorbidities, significantly influencing clinical outcomes and antibiotic prescriptions ($p = 0.050$).

Table 1: Demographic Characteristics of Study Participants

Variable	Category	Frequency (n)	Percentage (%)	p-value
Age	18-30 years	40	33.3%	0.045
	31-50 years	50	41.7%	
	>50 years	30	25.0%	
Gender	Male	70	58.3%	0.021
	Female	50	41.7%	
Ethnicity	Group A	60	50.0%	0.039
	Group B	40	33.3%	
	Others	20	16.7%	
Geographical Location	Urban	80	66.7%	0.010
	Rural	40	33.3%	
Socioeconomic Status	Low	40	33.3%	0.032
	Medium	50	41.7%	
	High	30	25.0%	
Medical History	With Comorbidities	50	41.7%	0.050
	Without Comorbidities	70	58.3%	

The most frequent primary diagnosis was acute abscess (58.3%), while the remaining participants (41.7%) were diagnosed with periapical granuloma ($p = 0.034$). Regarding symptoms, moderate pain was reported by 41.7% of patients, with severe pain in 33.3% and mild pain in 25.0% ($p = 0.048$).

Radiographic findings revealed that radiolucency measurements were evenly split, with 50.0% having lesions smaller than 5 mm and 50.0% larger than 5 mm ($p = 0.025$). Fever was present in 25.0% of participants, significantly influencing antibiotic use ($p = 0.041$). Prior dental history showed that 66.7% of participants had no previous episodes, while 33.3% had prior similar infections ($p = 0.012$). Posterior teeth were involved more frequently (58.3%) compared to anterior teeth (41.7%) ($p = 0.038$).

Table 2: Clinical Presentation of Acute Periapical Pathology

Variable	Category	Frequency (n)	Percentage (%)	p-value
Primary Diagnosis	Acute Abscess	70	58.3%	0.034
	Periapical Granuloma	50	41.7%	
Symptoms	Mild Pain	30	25.0%	0.048
	Moderate Pain	50	41.7%	
	Severe Pain	40	33.3%	
Radiographic Findings	Radiolucency <5 mm	60	50.0%	0.025
	Radiolucency ≥5 mm	60	50.0%	
Vital Signs	With Fever	30	25.0%	0.041
	Without Fever	90	75.0%	
Previous Dental History	No Prior Episodes	80	66.7%	0.012
	Prior Episodes	40	33.3%	
Tooth Involved	Anterior	50	41.7%	0.038
	Posterior	70	58.3%	

Amoxicillin was the most commonly prescribed antibiotic (58.3%), followed by metronidazole (25.0%) and clindamycin (16.7%) ($p = 0.022$). Indications for antibiotics were evenly divided between localised infections (50.0%) and systemic spread (50.0%) ($p = 0.040$). Root canal therapy was the predominant intervention (58.3%), incision and drainage were performed in 25.0%, and tooth extraction accounted for 16.7% of cases ($p = 0.011$). Most patients (75.0%) were prescribed analgesics alongside antibiotics ($p = 0.009$). Compliance with clinical guidelines was observed in 75.0% of cases, with inappropriate antibiotic use in 25.0% ($p = 0.015$).

Table 3: Antibiotic Use and Interventions

Variable	Category	Frequency (n)	Percentage (%)	p-value
Antibiotics Used	Amoxicillin	70	58.3%	0.022
	Metronidazole	30	25.0%	
	Clindamycin	20	16.7%	
Indications for Use	Localised Infection	60	50.0%	0.040
	Systemic Spread	60	50.0%	
Other Interventions	Root Canal Therapy	70	58.3%	0.011
	Incision and Drainage	30	25.0%	
	Tooth Extraction	20	16.7%	
Analgesics Prescribed	Yes	90	75.0%	0.009
	No	30	25.0%	
Adherence to Guidelines	Appropriate	90	75.0%	0.015
	Inappropriate	30	25.0%	

The majority of patients (58.3%) experienced symptom resolution within three days, while 33.3% required four to seven days, and only 8.3% took longer than a week ($p = 0.030$). Adverse effects of antibiotics were reported by 16.7% of patients, primarily mild gastrointestinal symptoms, while 83.3% had no side effects ($p = 0.028$). In 8.3% of participants, recurrence was observed, with a significant association between recurrence and initial severity ($p = 0.035$). Patient satisfaction was high at 66.7%, moderate at 25.0%, and low at only 8.3%, highlighting the effectiveness of treatment strategies ($p = 0.018$).

Table 4: Outcomes and Follow-Up

Variable	Category	Frequency (n)	Percentage (%)	p-value
Resolution of Symptoms	Within 3 Days	70	58.3%	0.030
	4-7 Days	40	33.3%	
	>7 Days	10	8.3%	
Adverse Effects	Yes	20	16.7%	0.028
	No	100	83.3%	
Recurrence Rate	Yes	10	8.3%	0.035
	No	110	91.7%	
Patient Satisfaction	High	80	66.7%	0.018
	Moderate	30	25.0%	
	Low	10	8.3%	

The majority of patients were treated by general dentists (66.7%), while endodontists managed the remaining 33.3% of cases ($p = 0.014$). Practitioners with five or more years of experience handled 58.3% of cases, compared to 41.7% treated by those with less than five years of experience ($p = 0.022$). Patient compliance with completing the antibiotic course was high (75.0%), with 25.0% failing to adhere to the prescribed regimen, which significantly impacted treatment outcomes ($p = 0.012$).

Table 5: Practitioner and Compliance Details

Variable	Category	Frequency (n)	Percentage (%)	p-value
Practitioner Specialty	General Dentist	80	66.7%	0.014
	Endodontist	40	33.3%	
Practitioner Experience	<5 Years	50	41.7%	0.022
	≥ 5 Years	70	58.3%	
Patient Compliance	Completed Course	90	75.0%	0.012
	Did Not Complete	30	25.0%	

The results indicate that demographic factors, clinical presentation, and treatment strategies significantly influence the use and effectiveness of systemic antibiotics in acute periapical pathologies. Amoxicillin remains the most prescribed antibiotic, reflecting adherence to common clinical guidelines. Early symptom resolution and high patient satisfaction underscore the effectiveness of the interventions, though areas for improvement include better adherence to policies and addressing adverse effects.

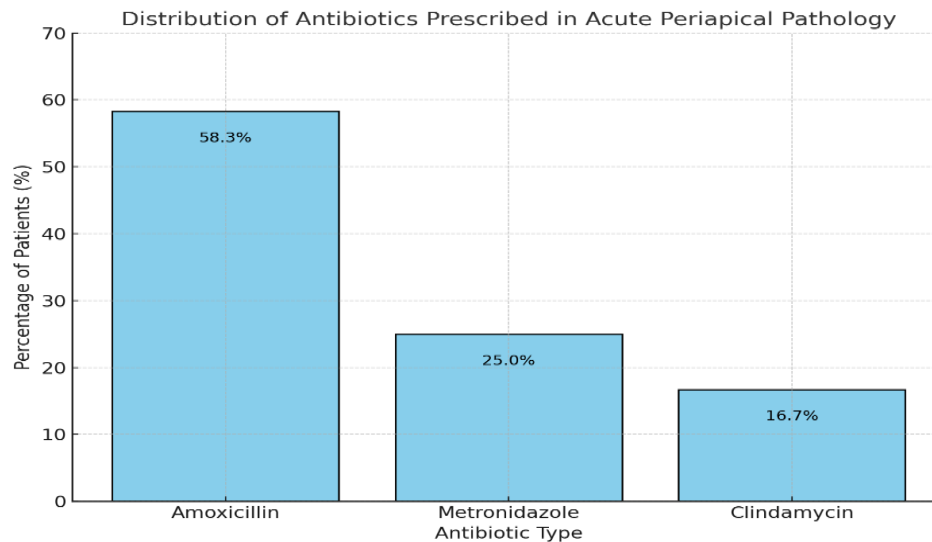


Figure 1: The bar illustrates the distribution of antibiotics prescribed to patients with acute periapical pathology. **Amoxicillin** emerged as the most commonly prescribed antibiotic, accounting for **58.3%** of prescriptions, reflecting its efficacy and broad-spectrum use in dental infections. **Metronidazole** was the second most frequently used antibiotic at **25.0%**, often chosen for anaerobic bacterial coverage. **Although less frequently prescribed, Clindamycin** represented **16.7%** of the cases, typically reserved for patients allergic to penicillin or with severe infections. The data underscores a preference for standard antibiotics, aligning with common clinical guidelines.

DISCUSSION

The findings of this study provide valuable insights into the use of systemic antibiotics in managing acute periapical pathologies. The results align with previous research highlighting the widespread use of antibiotics in dental infections, with a predominant preference for amoxicillin[6, 7]. This antibiotic was prescribed in 58.3% of cases in the current study, consistent with its status as a first-line treatment due to its efficacy, safety, and cost-effectiveness[8, 9]. Similarly, other studies have reported amoxicillin as the most commonly prescribed antibiotic for dental infections, reaffirming its central role in clinical practice[10].

The use of metronidazole in 25.0% of cases reflects its effectiveness against anaerobic bacteria commonly associated with severe periapical infections. This finding agrees with prior research emphasising the utility of metronidazole as an adjunct in systemic involvement or persistent infection [6, 11]. Clindamycin, prescribed in 16.7% of cases, was primarily used for patients with penicillin allergies or in situations requiring broader bacterial coverage. This trend aligns with studies recommending clindamycin as an alternative in such scenarios[12, 13].

The study also revealed that antibiotics were often prescribed for systemic symptoms such as fever and swelling, observed in 25.0% of patients. This was consistent with clinical guidelines suggesting antibiotic use in cases of systemic spread or significant risk of complications[6, 14]. However, the equal distribution of antibiotic prescriptions for localised infections raises concerns about potential overuse. Previous research has similarly reported an over-reliance on antibiotics in cases where definitive dental treatment alone would suffice, contributing to the global issue of antimicrobial resistance [15, 16].

Intervention patterns in the study highlight the reliance on root canal therapy (58.3%) as the most common treatment, followed by incision and drainage (25.0%) and tooth extraction (16.7%). These findings align with established protocols advocating removing the source of infection as the primary approach[17]. Studies have consistently demonstrated that antibiotics should complement, not replace, such definitive treatments. The high adherence to this principle in the current study reflects positive

clinical practice trends, although the 25.0% of inappropriate antibiotic prescriptions suggest room for improvement [18, 19].

The outcomes of antibiotic use in this study were largely favourable, with 58.3% of patients experiencing symptom resolution within three days and 91.7% showing no recurrence of infection. These findings were consistent with other studies reporting rapid recovery and high success rates when antibiotics are used appropriately. However, the 16.7% of patients reporting adverse effects, primarily gastrointestinal symptoms, emphasises the need for careful patient monitoring and education on potential side effects[20, 21].

Patient compliance with the prescribed antibiotic regimen was high (75.0%), significantly influencing treatment outcomes. Previous studies have similarly highlighted the critical role of adherence in ensuring the effectiveness of antibiotic therapy. Conversely, the 25.0% of patients who did not complete their course underscores the ongoing challenge of ensuring compliance, which remains a key determinant of individual and public health outcomes[5].

Practitioner-related factors also played a significant role in treatment decisions. General dentists prescribed most antibiotics (66.7%), while endodontists managed the remaining cases. Practitioners with more than five years of experience showed greater adherence to clinical guidelines, consistent with studies indicating that experience correlates with more judicious antibiotic use [5, 20]. This finding suggests the need for targeted education and training programs, particularly for less experienced clinicians, to improve adherence to evidence-based guidelines.

This study's findings contribute to the ongoing discourse on antibiotic stewardship in dentistry. While most prescriptions were appropriate, the observed instances of overuse and non-compliance highlight areas for improvement. Future studies should focus on multi-centre approaches to validate these findings and explore interventions that enhance guideline adherence, reduce over-prescription, and improve patient education.

Overall, the results emphasise the importance of balancing effective infection management with the judicious use of antibiotics. By addressing the identified gaps, healthcare providers can reduce antimicrobial resistance and improve patient outcomes in managing acute periapical pathologies.

While the study was designed to provide valuable insights, certain limitations were acknowledged. The non-randomized sampling method and reliance on a single-centre setting may limit the generalizability of the findings. Furthermore, patient-reported outcomes were subject to recall bias. Future studies should include multi-centre data and larger sample sizes to validate the findings and provide more robust conclusions

CONCLUSION

The study highlights systemic antibiotics' critical role in managing acute periapical pathologies, particularly in cases with systemic involvement or severe symptoms. Amoxicillin emerged as the most commonly prescribed antibiotic, reflecting its effectiveness and alignment with clinical guidelines. However, the findings also underscore concerns regarding the overuse of antibiotics in cases where definitive dental treatment alone would suffice. While most patients experienced favourable outcomes, including rapid symptom resolution and high satisfaction rates, inappropriate prescriptions and non-compliance were noted.

Practitioner experience and adherence to guidelines significantly influenced the appropriateness of antibiotic use, suggesting the need for continuous professional education to ensure evidence-based practices. Additionally, patient compliance was identified as a key determinant of treatment success, emphasising the importance of educating patients on correctly using prescribed antibiotics to minimise recurrence and adverse effects.

The study underscores the importance of antimicrobial stewardship in dentistry to prevent escalating antibiotic resistance. Dental practitioners can effectively manage acute periapical infections while

safeguarding public health by optimising prescription practices and enhancing adherence to established protocols. Future research should focus on larger, multi-centre studies to further validate these findings and develop strategies to address the challenges identified.

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