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Original Article

Antibiotic Prophylaxis Practices in Orthopedic Surgeries: A Public Health Audit of Guideline Adherence

Tahir Aslam[1], Muhammad Usama Anjum[2], Bilal Safdar[3], Bushra Iftikhar[4], Tooba Syed[5], Emaan Khurshid[6], Muzafar Ali[7]

[1] MBBS, PGR Orthopedic Surgery, Allied Hospital, Faisalabad, Pakistan
[2] MBBS, PGR Orthopaedic Surgery, Allied Hospital, Faisalabad, Pakistan
[3] Combined Millitary Hospital Lahore Medical College, Lahore, Pakistan
[4] Pharm D, MPhil Pharmacology, University of Central Punjab, Lahore, Pakistan
[5] MBBS, Ayub Medical College, Abbottabad, Pakistan
[6] PharmD final year, Department of Pharmacy, University of Peshawar, Pakistan
[7] MBBS, Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan

***Corresponding author: Muzafar Ali, 20LM330@my.lumhs.edu.pk**

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ABSTRACT

Background: Surgical antibiotic prophylaxis is essential in preventing surgical site infections (SSI) in orthopedic procedures; however, inappropriate use may reduce effectiveness and contribute to antimicrobial resistance. Objective: To assess adherence to antibiotic prophylaxis guidelines in orthopedic surgeries and examine its association with postoperative infections. Methods: A clinical audit was conducted over six months in a tertiary care hospital in Faisalabad, Pakistan, including 148 adult patients undergoing orthopedic surgery. Data on antibiotic choice, timing, dose, route, and duration were collected and compared with international guidelines. SSI occurrence and microbiological findings were analyzed. Statistical analysis included descriptive measures and comparative tests with odds ratios and 95% confidence intervals. Results: Full guideline adherence was observed in 24.3% of cases. Correct timing was achieved in 58.1%, and correct duration in 29.1%. Ceftriaxone was the most commonly used antibiotic (48.0%), while cefazolin was used in 15.5% of cases. The overall SSI rate was 8.8%, with lower incidence in the adherent group (2.8%) compared to the non-adherent group (10.7%) (OR 4.17; 95% CI 0.52–33.3; p=0.18). Prolonged postoperative antibiotic use was the most frequent deviation. Conclusion: Antibiotic prophylaxis practices showed low adherence to standard guidelines, particularly in timing and duration. Improved stewardship and protocol-based interventions are needed to optimize antibiotic use and reduce SSI risk. Keywords: antibiotic prophylaxis, orthopedic surgery, surgical site infection, guideline adherence, antimicrobial stewardship, Pakistan.

INTRODUCTION

Orthopedic surgery constitutes a substantial proportion of operative care in tertiary hospitals and encompasses trauma management, implant fixation, arthroplasty, and reconstructive procedures aimed at restoring function and mobility. Despite these benefits, surgical site infection (SSI) remains a significant complication that contributes to prolonged hospitalization, increased healthcare costs, need for revision surgery, and long-term morbidity, particularly in implant-associated procedures where biofilm formation complicates eradication (1). The burden of SSI is disproportionately higher in low- and middle-income countries, where estimates suggest that approximately 11% of surgical patients develop postoperative infections, reflecting gaps in infection prevention practices and resource limitations (2).

Antibiotic prophylaxis is a cornerstone of SSI prevention in orthopedic surgery when applied according to established principles. International guidelines, including those from the American Society of Health-System Pharmacists, Infectious Diseases Society of America, Surgical Infection Society, Society for Healthcare Epidemiology of America, the Centers for Disease Control and Prevention, and the World Health Organization, consistently recommend that prophylactic antibiotics should be appropriately selected, administered intravenously within a defined pre-incision window, and discontinued within a limited postoperative period, typically not exceeding 24 hours in clean orthopedic procedures (3,4).

Evidence from large observational studies and interventional trials has demonstrated that appropriate timing of antibiotic administration is critical to achieving adequate tissue concentrations at the time of incision, thereby reducing SSI risk (5). Conversely, prolonged postoperative antibiotic use has not shown additional benefit in preventing infection and may contribute to antimicrobial resistance and adverse drug effects (6).

Despite the clarity of these recommendations, adherence in real-world clinical settings remains variable. Orthopedic practice, in particular, is influenced by factors such as the use of implants, fear of deep-seated infection, high trauma burden, and variability in institutional protocols, which often lead to deviations from guideline-based prophylaxis (7). Studies across diverse healthcare settings have consistently reported inappropriate antibiotic selection, delayed or mistimed administration, and excessive postoperative continuation, highlighting a persistent gap between evidence-based recommendations and clinical practice (8). In addition, the use of broad-spectrum antibiotics such as third-generation cephalosporins in routine prophylaxis, instead of narrower first-line agents like cefazolin, has been associated with increased ecological pressure and may not confer superior protection against SSI (9). Emerging evidence further suggests that deviation from recommended β-lactam prophylaxis may be associated with higher SSI rates, emphasizing the importance of rational antibiotic selection (10).

From a public health perspective, irrational use of perioperative antibiotics contributes significantly to antimicrobial resistance, a growing global health threat. Hospitals in resource-constrained settings face compounded challenges, including high patient turnover, limited infection control infrastructure, and inconsistent antimicrobial stewardship implementation. In Pakistan, available evidence indicates suboptimal adherence to surgical antibiotic prophylaxis guidelines across multiple specialties, including orthopedic surgery, with patterns of prolonged duration and inappropriate antibiotic choice being common (11,12). However, nationally representative data on SSI and antibiotic prophylaxis practices remain limited, underscoring the need for institution-level audits to generate context-specific evidence and guide targeted interventions (13).

A clinical audit provides a systematic approach to evaluating current practice against established standards, identifying deviations, and informing quality improvement strategies. In the context of orthopedic surgery in a high-volume tertiary care hospital, where both elective and emergency procedures are performed, antibiotic prescribing practices are shaped by multiple clinical and operational factors, including urgency of surgery, contamination risk, and individual clinician preferences. Understanding these patterns and their association with postoperative outcomes is essential for strengthening antimicrobial stewardship and improving patient safety.

Within this framework, the present study was conducted to assess adherence to standard antibiotic prophylaxis guidelines in orthopedic surgeries at a tertiary care hospital in Faisalabad, Pakistan. Specifically, the study aimed to evaluate the appropriateness of antibiotic selection, timing, route, and duration, and to examine the association between non-adherence and the occurrence of surgical site infections. Additionally, the study sought to describe the microbiological profile and resistance patterns observed in infected cases. It was hypothesized that non-adherence to established prophylactic guidelines would be associated with a higher incidence of postoperative surgical site infections and suboptimal antimicrobial utilization patterns.

MATERIALS AND METHODS

This study was conducted as a clinical audit with an observational analytical framework to evaluate perioperative antibiotic prophylaxis practices in orthopedic surgeries and their adherence to established international guidelines. The audit design was selected to systematically compare routine clinical practice against predefined standards and to identify gaps relevant to antimicrobial stewardship and infection prevention (14). The study was carried out in the Orthopedic Surgery Department of a tertiary care hospital in Faisalabad, Pakistan, over a six-month period from January 2024 to June 2024. This

setting includes a high-volume surgical service managing both elective and emergency orthopedic procedures, including trauma-related surgeries, implant fixation, and joint-related interventions.

The study population comprised adult patients aged 18 years and above who underwent orthopedic surgical procedures during the study period and received antibiotic prophylaxis as part of perioperative care. Participants were included through consecutive sampling to reflect real-world clinical practice. Patients receiving therapeutic antibiotics for established infections prior to surgery, those undergoing minor procedures not requiring formal prophylaxis, and cases with incomplete or missing essential clinical documentation were excluded. This selection approach ensured that the analysis was limited to true prophylactic scenarios in accordance with guideline definitions (15).

Data were collected prospectively and retrospectively from multiple clinical sources, including patient medical records, medication charts, anesthesia records, operation theatre logs, nursing notes, laboratory reports, and microbiology records. A structured and pre-validated audit proforma was used to ensure standardized data collection across all cases. The proforma captured demographic characteristics, clinical diagnosis, type of surgery, urgency of procedure (elective or emergency), use of implants, duration of surgery, and perioperative antibiotic details. Antibiotic-related variables included drug selection, class, dose, route of administration, timing of first dose relative to surgical incision, intraoperative redosing where applicable, and total duration of postoperative antibiotic administration.

Adherence to prophylaxis guidelines was assessed using criteria derived from internationally recognized recommendations, including appropriate antibiotic selection based on procedure type, intravenous administration, administration within the recommended preoperative window (typically within 60 minutes before incision), and discontinuation within 24 hours postoperatively for routine clean procedures (3,4).

Each component was evaluated individually, and overall adherence was defined as compliance with all criteria in a given patient. Surgical site infection was defined according to standardized clinical criteria, including the presence of purulent discharge, localized signs of inflammation, wound dehiscence, or microbiologically confirmed infection occurring within 30 days of surgery, or within 90 days for implant-related procedures (4).

To minimize bias and improve data validity, multiple data sources were cross-verified, particularly for critical variables such as antibiotic timing, which was confirmed using anesthesia records where discrepancies were identified in ward documentation. Potential confounders, including type of surgery, emergency versus elective status, and implant use, were recorded and considered during analysis. Although the audit design did not involve randomization, efforts were made to reduce selection bias through consecutive case inclusion and standardized data abstraction procedures (16).

The sample size was determined based on feasibility within the audit period and the expected surgical volume of the department, ensuring adequate representation of both elective and emergency procedures. Data were entered into a secure database and analyzed using SPSS version 25 (IBM Corp., Armonk, NY, USA).

Descriptive statistics were used to summarize demographic and clinical variables, with categorical variables presented as frequencies and percentages, and continuous variables summarized using means with standard deviations or medians with interquartile ranges, depending on data distribution. The association between guideline adherence and surgical site infection was assessed using chi-square or Fisher's exact test, as appropriate. Effect size estimates, including odds ratios with 95% confidence intervals, were calculated to quantify the strength of associations. Missing data were handled through complete-case analysis, with sensitivity checks performed to assess the impact of missing values on key outcomes.

Ethical approval for the study was obtained from the institutional review board of the participating hospital prior to data collection. As the study was conducted as a clinical audit of routine care practices, informed consent was waived; however, patient confidentiality was strictly maintained by anonymizing all data and assigning unique study identifiers. Data integrity was ensured through double-entry verification and periodic review of the dataset by the research team. The methodology was designed to allow reproducibility, with clear documentation of data sources, variable definitions, and analytical procedures, enabling replication in similar clinical settings.

RESULTS

The study included a total of 148 patients undergoing orthopedic surgical procedures, with a predominance of males accounting for 102 cases (68.9%) compared to 46 females (31.1%). The age distribution showed that the largest proportion of patients fell within the 31–45-year category (44 patients, 29.7%), followed by 18–30 years (39 patients, 26.4%), 46–60 years (38 patients, 25.7%), and those older than 60 years (27 patients, 18.2%).

Emergency admissions constituted a greater share of the cohort, with 85 patients (57.4%), while elective surgeries were performed in 63 patients (42.6%). In terms of procedural profile, open reduction and internal fixation (ORIF) was the most common surgery (54 cases, 36.5%), followed by debridement procedures (21 cases, 14.2%) and closed or minor fixation procedures (18 cases, 12.2%). Implant use was documented in 96 patients (64.9%), indicating a high proportion of implant-related interventions within the study population.

Analysis of antibiotic prescribing patterns revealed that ceftriaxone was the most frequently administered prophylactic agent, used in 71 patients (48.0%), while cefazolin, the recommended first-line agent in many guidelines, was used in only 23 patients (15.5%). Other antibiotics included co-amoxiclav in 19 cases (12.8%), cefuroxime in 11 cases (7.4%), and combination therapy with ceftriaxone plus metronidazole in 15 cases (10.1%).

All patients (100%) received antibiotics via the intravenous route. Regarding timing of administration, only 86 patients (58.1%) received the first dose within the recommended preoperative window, whereas 19 patients (12.8%) received it too early and 43 patients (29.1%) received it after incision or with delay. Postoperative duration patterns demonstrated that only 43 patients (29.1%) received antibiotics within 24 hours, while 18 patients (12.2%) continued therapy for 25–48 hours, and a substantial proportion received prolonged courses—60 patients (40.5%) for 3–5 days and 27 patients (18.2%) for more than 5 days.

Evaluation of compliance with guideline-recommended components showed marked variation across domains. Correct antibiotic selection was observed in 95 patients (64.2%), while adherence to correct dosing was high at 135 patients (91.2%).

Route of administration was appropriate in all cases (148 patients, 100%). However, correct timing was achieved in only 86 patients (58.1%), and adherence to recommended duration was limited to 43 patients (29.1%). Overall, full adherence to all guideline components was documented in just 36 patients (24.3%), indicating that nearly three-quarters of the cohort had at least one deviation from standard prophylactic practice. When comparing elective and emergency surgeries, adherence patterns differed significantly. Correct timing was achieved in 46 elective cases (73.0%) compared to 40 emergency cases (47.1%), demonstrating a statistically significant difference ($p = 0.002$).

Similarly, correct duration was observed in 24 elective cases (38.1%) versus 19 emergency cases (22.4%), with a significant association ($p = 0.038$). Full adherence to all components was also higher in elective procedures, occurring in 21 patients (33.3%) compared to 15 patients (17.6%) in the emergency group ($p = 0.027$), highlighting the impact of procedural urgency on compliance.

The overall surgical site infection rate was 8.8%, with 13 cases identified among the 148 patients. A clear difference was observed between adherence groups: only 1 out of 36 patients (2.8%) in the guideline-adherent group developed SSI.

compared to 12 out of 112 patients (10.7%) in the non-adherent group. This corresponded to an odds ratio of 4.17 (95% CI: 0.52–33.3), although the association did not reach statistical significance ($p = 0.18$). Despite the lack of statistical significance, the magnitude of difference suggests a clinically relevant trend toward higher infection risk in the non-adherent group.

Microbiological analysis of infected cases showed that cultures were available in 12 out of 13 SSI cases. Among these, Staphylococcus aureus was the most common pathogen, isolated in 5 cases (41.7%), followed by Escherichia coli in 3 cases (25.0%), Klebsiella species in 2 cases (16.7%), and Pseudomonas aeruginosa in 2 cases (16.7%).

Resistance patterns indicated that Staphylococcus aureus isolates demonstrated resistance to ampicillin with variable resistance to fluoroquinolones, while gram-negative organisms such as E. coli showed resistance to third-generation cephalosporins. One Klebsiella isolate exhibited multidrug resistance, and Pseudomonas isolates demonstrated reduced sensitivity to commonly used cephalosporins.

Table 1. Baseline characteristics of the study population (n = 148)

Variable	Frequency	Percentage
Sex		
Male	102	68.9%
Female	46	31.1%
Age group (years)		
18–30	39	26.4%
31–45	44	29.7%
46–60	38	25.7%
>60	27	18.2%
Admission type		
Elective	63	42.6%
Emergency	85	57.4%
Type of surgery		
ORIF	54	36.5%
Debridement	21	14.2%
Closed/minor fixation	18	12.2%
Arthroplasty-related	17	11.5%
Implant removal/revision	14	9.5%
Other	24	16.2%
Implant used		

Variable	Frequency	Percentage
Yes	96	64.9%
No	52	35.1%

Table 2. Pattern of prophylactic antibiotic prescribing (n = 148)

Variable	Frequency	Percentage
Antibiotic used		
Ceftriaxone	71	48.0%
Cefazolin	23	15.5%
Co-amoxiclav	19	12.8%
Cefuroxime	11	7.4%
Ceftriaxone + Metronidazole	15	10.1%
Other	9	6.1%
Route of administration		
Intravenous	148	100%
First dose timing		
Within recommended window	86	58.1%
Too early	19	12.8%
Delayed/after incision	43	29.1%
Postoperative duration		
≤24 hours	43	29.1%
25–48 hours	18	12.2%
3–5 days	60	40.5%
>5 days	27	18.2%

Table 3. Compliance with guideline components (n = 148)

Audit component	Adherent (n)	Percentage
Correct antibiotic selection	95	64.2%
Correct dose	135	91.2%
Correct route	148	100%
Correct timing	86	58.1%
Correct duration	43	29.1%
Full adherence (all criteria)	36	24.3%

Table 4. Comparison of adherence between elective and emergency surgeries

Variable	Elective (n=63)	Emergency (n=85)	p-value
Correct timing	46 (73.0%)	40 (47.1%)	0.002
Correct duration	24 (38.1%)	19 (22.4%)	0.038
Full adherence	21 (33.3%)	15 (17.6%)	0.027

Table 5. Surgical site infection in relation to guideline adherence

Group	Total (n)	SSI (n)	SSI Rate	Odds Ratio (95% CI)	p-value
Adherent	36	1	2.8%	Reference	—
Non-adherent	112	12	10.7%	4.17 (0.52–33.3)	0.18

Table 6. Microbiological profile and resistance patterns in SSI cases (n = 12 cultured cases)

Organism	Frequency	Percentage	Notable Resistance
Staphylococcus aureus	5	41.7%	Ampicillin, variable fluoroquinolone resistance
Escherichia coli	3	25.0%	Third-generation cephalosporins
Klebsiella spp.	2	16.7%	Multidrug resistance (1 isolate)
Pseudomonas aeruginosa	2	16.7%	Reduced cephalosporin sensitivity

Table 7. Types of inappropriate antibiotic use among non-adherent cases (n = 112)

Type of inappropriate use	Frequency	Percentage
Prolonged duration	69	61.6%
Incorrect timing	43	38.4%
Broad-spectrum use without indication	31	27.7%
Unnecessary combination therapy	18	16.1%
Incomplete documentation	22	19.6%

Among the 112 non-adherent cases, the most frequent form of inappropriate antibiotic use was prolonged postoperative duration, observed in 69 patients (61.6%). Incorrect timing of administration was identified in 43 patients (38.4%), while use of broad-spectrum antibiotics without clear indication was noted in 31 patients (27.7%). Unnecessary combination therapy was present in 18 cases (16.1%), and incomplete documentation of antibiotic indication or regimen was found in 22 cases (19.6%). These findings highlight that prolonged duration and timing errors were the dominant contributors to non-adherence in this cohort.

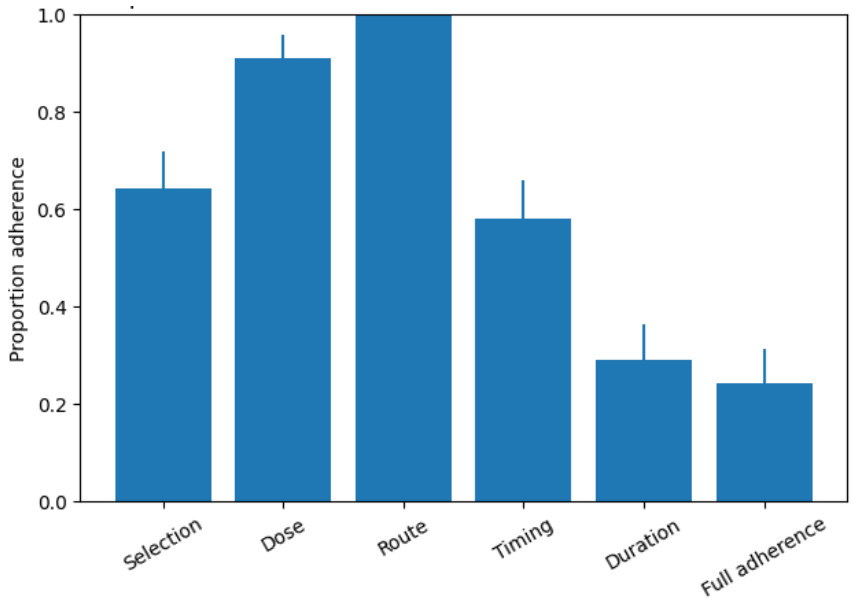

Figure 1 Component-Wise Adherence With 95% Confidence Intervals (N=148)

This figure demonstrates component-wise adherence proportions with 95% confidence intervals across 148 orthopedic surgical cases, revealing a pronounced gradient in compliance. Route adherence was universal at 100% (95% CI: ~97.5–100%), followed by dose at 91.2% (95% CI: ~86.6–95.8%), while antibiotic selection showed moderate adherence at 64.2% (95% CI: ~56.4–72.0%). Timing adherence declined further to 58.1% (95% CI: ~50.1–66.1%), indicating substantial perioperative workflow gaps. The most critical deficiency was observed in duration adherence at 29.1% (95% CI: ~21.8–36.4%), closely mirrored by full adherence at 24.3% (95% CI: ~17.4–31.2%), highlighting that only approximately one in four patients received fully guideline-concordant prophylaxis. The widening confidence intervals in lower adherence domains reflect greater variability and uncertainty, underscoring inconsistent prescribing practices. Clinically, the steep drop from technical compliance (route, dose) to decision-dependent variables (timing, duration) indicates that system-level coordination and stewardship interventions should prioritize optimizing timing protocols and limiting unnecessary postoperative antibiotic continuation to improve overall adherence and reduce infection risk.

DISCUSSION

This clinical audit provides a detailed evaluation of perioperative antibiotic prophylaxis practices in orthopedic surgeries within a tertiary care hospital setting and highlights critical gaps in adherence to established guidelines. The findings demonstrate that while antibiotic prophylaxis was universally implemented, only 24.3% of patients received care fully compliant with all recommended parameters. This discrepancy underscores a fundamental issue not of access or omission, but of suboptimal application, particularly in timing and duration. These results are consistent with previous studies reporting that deviations in these specific components are the most frequent contributors to non-adherence in surgical prophylaxis (17). The high compliance observed in route (100%) and dose (91.2%) reflects procedural standardization, whereas lower adherence in timing (58.1%) and duration (29.1%) indicates dependence on clinical judgment and system coordination, areas more prone to variability.

One of the most clinically significant findings was the widespread prolongation of postoperative antibiotic use, with 58.7% of patients receiving antibiotics beyond 48 hours. This pattern persists despite strong evidence demonstrating no additional benefit of extended prophylaxis in preventing surgical site infections in clean orthopedic procedures (18). The persistence of this practice likely reflects entrenched clinical habits, perceived risk of implant-related infections, and lack of enforced institutional protocols. However, prolonged exposure to antibiotics is associated with increased risk of antimicrobial resistance,

adverse drug reactions, and unnecessary healthcare costs (19). The present findings reinforce the need to shift from defensive prescribing toward evidence-based stewardship.

The timing of the first antibiotic dose was another major area of concern, with 41.9% of patients receiving antibiotics either too early or after incision. Adequate timing is critical for ensuring optimal tissue drug concentrations at the time of bacterial exposure, and deviations from the recommended window have been associated with increased SSI risk (20). The significantly better adherence observed in elective surgeries compared to emergency cases suggests that system-level factors, including workflow coordination and preoperative planning, play a key role. In emergency settings, rapid surgical turnover, incomplete documentation, and time constraints may contribute to missed or delayed dosing. These findings highlight the need for standardized perioperative checklists and shared responsibility among surgical, anesthesia, and nursing teams to ensure timely administration.

The association between non-adherence and increased SSI rates further emphasizes the clinical importance of guideline-concordant prophylaxis. Although the observed difference between adherent (2.8%) and non-adherent (10.7%) groups did not reach statistical significance, likely due to limited sample size, the direction and magnitude of effect are clinically meaningful and align with existing literature (21). Previous observational studies have similarly reported higher infection rates in patients receiving inappropriate prophylaxis, supporting the biological plausibility of this relationship. The wide confidence interval observed in this study reflects variability and limited power but does not negate the observed trend.

Antibiotic selection patterns also revealed deviation from recommended practice, with ceftriaxone being the most commonly used agent (48.0%), while cefazolin was used in only 15.5% of cases. This is notable because first-generation cephalosporins remain the preferred agents for most clean orthopedic procedures due to their efficacy against common skin flora and favorable pharmacokinetic profile (22). The frequent use of broader-spectrum antibiotics without clear indication may reflect local prescribing culture, perceived infection risk, or lack of awareness of updated guidelines. Importantly, emerging evidence suggests that use of non–β-lactam or broader-spectrum agents does not improve outcomes and may, in some cases, be associated with higher SSI rates (23). This reinforces the need for antibiotic stewardship interventions tailored to local practice patterns.

The microbiological findings provide additional insight into the clinical implications of current prescribing practices. Staphylococcus aureus was the most commonly isolated organism, consistent with its known role as a प्रमुख pathogen in orthopedic infections, particularly in implant-related cases. The presence of gram-negative organisms such as Escherichia coli, Klebsiella species, and Pseudomonas aeruginosa reflects the complexity of infection patterns in tertiary care settings, especially in trauma and emergency surgeries. Notably, resistance to commonly used antibiotics, including third-generation cephalosporins, was observed in several isolates. While causality cannot be established in this audit, the findings raise concern that routine use of broad-spectrum antibiotics may contribute to local resistance patterns without providing additional protective benefit (24).

The study has several strengths, including its real-world setting, inclusion of both elective and emergency cases, and comprehensive evaluation of multiple components of antibiotic prophylaxis. However, certain limitations must be acknowledged. The single-center design may limit generalizability, and the observational nature of the audit precludes causal inference. The sample size, particularly for SSI outcomes, may have limited statistical power to detect significant associations. Additionally, potential confounding factors such as comorbidities, wound classification, and duration of surgery were not adjusted in multivariable analysis. Post-discharge surveillance for SSI may also have been incomplete, potentially underestimating infection rates. Despite these limitations, the audit provides valuable insights into current practice and identifies clear targets for improvement.

From a clinical and public health perspective, the findings support the implementation of structured antimicrobial stewardship interventions, including development of local protocols, integration of antibiotic timing into surgical safety checklists, restriction of postoperative antibiotic duration, and regular audit-feedback cycles. Multidisciplinary collaboration between surgeons, anesthetists, pharmacists, and infection control teams is essential to achieve sustained improvement. Re-audit following implementation of these interventions would be critical to assess impact and ensure continuous quality improvement.

CONCLUSION

This clinical audit demonstrates that while antibiotic prophylaxis is routinely administered in orthopedic surgeries, adherence to guideline-recommended practices remains suboptimal, particularly in terms of timing and duration. Prolonged postoperative antibiotic use and inappropriate selection of broad-spectrum agents were common, with non-adherent practices showing a higher rate of surgical site infections. These findings highlight the need for targeted antimicrobial stewardship strategies, standardized institutional protocols, and improved perioperative coordination to optimize antibiotic use, reduce infection risk, and limit the development of antimicrobial resistance in tertiary care settings.

REFERENCES

1. Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. Surgical Infections. 2013;14(1):73-156. DOI: https://doi.org/10.1089/sur.2013.9999

2. Berríos-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. JAMA Surgery. 2017;152(8):784-791. DOI: https://doi.org/10.1001/jamasurg.2017.0904

3. Houck PM, Bratzler DW, Richards C, et al. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. Clinical Infectious Diseases. 2004;38(12):1706-1715. DOI: https://doi.org/10.1086/421095

4. Hawn MT, Richman JS, Vick CC, et al. Timing of antimicrobial prophylaxis and the risk of surgical site infections: results from the Trial to Reduce Antimicrobial Prophylaxis Errors. Annals of Surgery. 2009;250(1):10-16. DOI: https://doi.org/10.1097/SLA.0b013e3181ad5fca

5. Seidelman JL, Mantyh CR, Anderson DJ. Surgical site infection prevention: a review. JAMA. 2023;329(3):244-252. DOI: https://doi.org/10.1001/jama.2022.24075

6. NIHR Global Health Research Unit on Global Surgery. Reducing surgical site infections in low-income and middle-income countries (FALCON): a pragmatic, multicentre, stratified, randomised controlled trial. The Lancet. 2021;398(10312):1687-1699. DOI: https://doi.org/10.1016/S0140-6736(21)01548-8

7. NIHR Global Health Research Unit on Global Surgery. Pragmatic multicentre factorial randomized controlled trial testing measures to reduce surgical site infection in low- and middle-income countries: study protocol of the FALCON trial. Colorectal Disease. 2021;23(1):298-306. DOI: https://doi.org/10.1111/codi.15354

8. de Jonge SW, Boldingh QJJ, Solomkin JS, et al. Effect of postoperative continuation of antibiotic prophylaxis on the incidence of surgical site infection: a systematic review and meta-analysis. The Lancet Infectious Diseases. 2020;20(10):1182-1192. DOI: https://doi.org/10.1016/S1473-3099(20)30084-0

9. Wolfhagen N, Boldingh QJJ, Boermeester MA, de Jonge SW. Perioperative care bundles for the prevention of surgical-site infections: meta-analysis. BJS. 2022;109(10):933-942. DOI: https://doi.org/10.1093/bjs/znac196

10. Ching PR. Care bundles in surgical site infection prevention: a narrative review. Current Infectious Disease Reports. 2024;26:163-172. DOI: https://doi.org/10.1007/s11908-024-00837-9

11. Khan Z, Ahmed N, Rehman AU, et al. Audit of pre-operative antibiotic prophylaxis usage in elective surgical procedures in two teaching hospitals, Islamabad, Pakistan: an observational cross-sectional study. PLOS One. 2020;15(4):e0231188. DOI: https://doi.org/10.1371/journal.pone.0231188

12. Khan Z, Ahmed N, Khan FU, Ur-Rehman A, Rahman H. Pattern of surgical antibiotic prophylaxis for surgical-site infections in most common surgical procedures at two teaching hospitals, Islamabad, Pakistan. Journal of Microbiology and Infectious Diseases. 2019;9(3):104-111. DOI: https://doi.org/10.5799/jmid.614180

13. PakSurg Collaborative. PakSurg 1: determining the epidemiology and risk factors of surgical site infections in Pakistan—a multicentre, prospective cohort study. BMJ Open. 2023;13:e070831. DOI: https://doi.org/10.1136/bmjopen-2022-070831

14. Tan TL, Shohat N, Rondon AJ, et al. Perioperative antibiotic prophylaxis in total joint arthroplasty: a single dose is as effective as multiple doses. The Journal of Bone and Joint Surgery American Volume. 2019;101(5):429-437. DOI: https://doi.org/10.2106/JBJS.18.00336

15. Spangehl MJ. Preoperative prophylactic antibiotics in total hip and knee arthroplasty: what, when, and how. The Journal of Arthroplasty. 2022. DOI: https://doi.org/10.1016/j.arth.2022.01.019

16. Wahl P, Drennan P, Schläppi M, et al. Systemic antibiotic prophylaxis in arthroplasty – a narrative review of how many doses are optimal. EFORT Open Reviews. 2024;9(12):1106-1119. DOI: https://doi.org/10.1530/EOR-24-0022

17. Hannon CP, Wyles CC. Cefazolin is the most effective perioperative antibiotic to prevent periprosthetic joint infection. Arthroplasty Today. 2025;33:101708. DOI: https://doi.org/10.1016/j.artd.2025.101708

18. Antimicrobial prophylaxis in elective orthopaedic surgical procedures at the tertiary care hospital: a prospective observational study. Antibiotics. 2025;14(10):968. DOI: https://doi.org/10.3390/antibiotics14100968

19. Kwiatkowski S, Mulugeta S, Davis S, et al. Optimizing preoperative antibiotics in patients with β-lactam allergies: a role for pharmacy. American Journal of Health-System Pharmacy. 2021;78(Suppl 3):S76-S82. DOI: https://doi.org/10.1093/ajhp/zxab218

20. Non–β-lactam antibiotic use, β-lactam allergy, and surgical site infections. JAMA Surgery. 2025. DOI: https://doi.org/10.1001/jamasurg.2025.3789

21. Abedi A, Parvizi J. “In my experience…” top ten steps for prevention of surgical site infection after joint arthroplasty. Journal of Orthopaedic Experience & Innovation. 2024;5(1). DOI: https://doi.org/10.60118/001c.92106

22. Evidence-based approach for prevention of surgical site infection. Hip & Pelvis. 2024;36(3):161-167. DOI: https://doi.org/10.5371/hp.2024.36.3.161

23. Controversies in antibiotic prophylaxis in orthopaedic surgery. In: Surgical Site Infection Prevention and Management. Springer; 2024. DOI: https://doi.org/10.1007/978-3-031-56270-9_3

24. Madubueze CC, Umaru H, Alada A. Attitudes of Nigerian orthopaedic surgeons to the use of prophylactic antibiotics. International Orthopaedics. 2015;39:2161-2165. DOI: https://doi.org/10.1007/s00264-015-2822-7