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# Antimicrobial Prophylaxis in General Surgery: Evaluating Practice Patterns and Surgical Site Infection Outcomes

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## INTODUCTION

Surgical site infections (SSIs) are defined by the Centers for Disease Control and Prevention (CDC) as infections that arise within 30 days following a surgical procedure [16]. Based on the extent of contamination, surgical wounds are classified as clean, clean-contaminated, contaminated, or dirty [3]. In low- and middle-income countries (LMICs), SSIs represent the most common form of healthcare-associated infections (HAIs), affecting nearly 10% of surgical patients. Although SSIs are the leading cause of HAIs in surgical wards, they rank as the second most common HAI overall, accounting for approximately 14% to 16% of all hospitalized patients and 23% to 38% of those undergoing surgery [2]. Evidence suggests that the ideal timing for the administration of prophylactic antibiotics is at least 30 minutes and not more than 60 minutes before making the surgical incision [17]. Despite progress in surgical techniques and our understanding of the pathogenesis of wound infections, SSIs remain a significant burden for healthcare systems. Timely initiation of antimicrobial prophylaxis—prior to potential microbial exposure—is essential to curb bacterial proliferation and reduce the incidence of SSIs.It is estimated that up to 60% of SSIs can be prevented through adherence to evidence-based practices, particularly regarding the appropriate timing, selection, and duration of antibiotic prophylaxis. In clinical practice, antibiotics are frequently prescribed for both infection prevention and treatment in surgical settings [2]. Notably, 30% to 50% of hospital-prescribed antimicrobials are used for surgical prophylaxis, and among these, inappropriate use has been reported to range from 30% to 90% [18,19]. The overuse of antimicrobial agents under the pretext of infection prevention remains a critical issue in surgical antimicrobial prophylaxis (SAP).The improper use of antimicrobials not only fails to reduce infection rates but also contributes to antimicrobial resistance, adverse drug events, and complications

such as *Clostridium difficile* infections and acute kidney injury [20]. Therefore, SAP must be optimized across all perioperative stages—before, during, and after surgery. Numerous studies have highlighted frequent deviations from clinical guidelines, including the selection of antimicrobials not aligned with national or institutional protocols [20]. These inconsistencies may stem from factors such as medication shortages, skepticism toward local guidelines, institutional policies, personal clinical preferences, or regional resistance patterns.Research suggests that up to 55% of SSIs can be avoided through consistent implementation of validated preventive strategies [20]. The present study aims to evaluate the patterns of antimicrobial use in surgical prophylaxis at a tertiary care center in central India and assess their association with surgical site infection outcomes.

## MATERIALS & METHOD

### Study Design

This prospective observational study was conducted at the Department of General Surgery, Hamidia Hospital, Gandhi Medical College, Bhopal. The study aimed to evaluate the incidence of surgical site infections (SSIs) in patients receiving prophylactic antimicrobials.

### Participants

All patients undergoing elective and emergency surgeries in the Department of General Surgery at Hamidia Hospital between April 2023 and April 2024 were included in the study. Inclusion criteria encompassed patients who received prophylactic antimicrobials during their surgical procedures. Exclusion criteria included patients who did not receive prophylactic antimicrobials, those with pre-existing infections, etc.

### Data Collection

Patients were monitored for the development of SSIs following the administration of prophylactic antibiotics. Data on prophylactic antimicrobial use and subsequent SSI occurrences were collected and recorded. The diagnosis of SSIs was made by consulting surgeons based on clinical evaluation and standard diagnostic criteria.

### Ethical Considerations

The study was conducted following ethical guidelines and received approval from the Institutional Ethics Committee, Gandhi Medical College, Bhopal.

### Data Analysis

Data were systematically compiled and tabulated for analysis. The results were compared against the standard guidelines provided by the SIGN(Scottish Intercollegiate Guidelines Network) to assess compliance and efficacy of the prophylactic antimicrobial protocols.

### Limitations

Potential limitations of the study included variations in surgical procedures, adherence to prophylactic protocols. These limitations were considered in the interpretation of the results.

## RESULTS

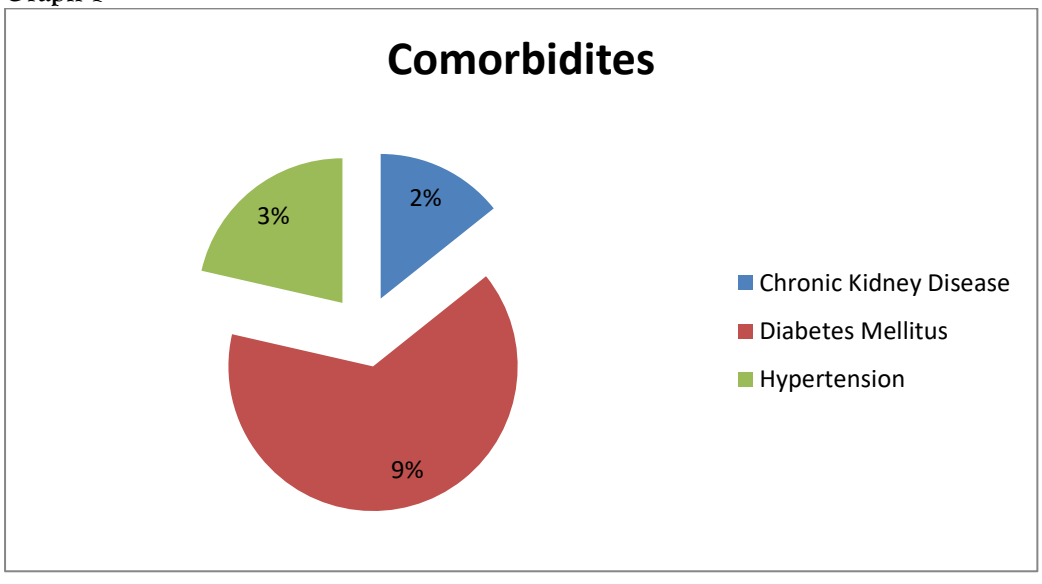
In this study, we examined a total of 100 surgical patients, with 48 from Bhopal and the remainder from surrounding regions. The cohort was predominantly male, comprising 56 males (56%) and 44 females (44%). Lifestyle assessments as per International Labour Organization (ILO) indicated that 15 patients (15%) led sedentary lives, while a significant majority, 79 patients (79%), engaged in moderate activity, and only 4 patients (4%) were categorized as heavy workers. Notably, substance use was prevalent, with 66 patients (66%) identified as smokers and 54 (54%) as alcoholics. Co-morbidities further complicated the patient profiles, including chronic kidney disease in 2 patients (2%), diabetes mellitus in 9 (9%), and hypertension in 3 (3%).In terms of surgical antimicrobial prophylaxis, ceftriaxone was the most frequently administered antibiotic, with 22 patients receiving it at a dosage of 1 gm twice daily, and 16 patients receiving it as a stat dose. Other combinations included ceftriaxone 1 gm twice daily with metronidazole (13 patients) and with amikacin (13 patients). Postoperatively, 40 patients continued on ceftriaxone, while 16 received it alongside metronidazole, and 9 alongside amikacin.The impact of these

interventions was underscored by the monitoring of surgical site infections (SSIs), which were recorded on postoperative days. On day 3, there were 24 infections; this number rose to 34 by day 5, before slightly declining to 28 on day 7. Alarmingly, 86% of the patients experienced SSIs, with positive cultures identified in 26 cases, underscoring a significant and pressing burden of infection that demands immediate attention in surgical practice.

**Table 1: Demographic Characteristics of the Study Population**

| Demographic Variable | Count (n) | Percentage (%) |
|---|---|---|
| **Location** | | |
| Bhopal | 48 | 48% |
| Other regions | 52 | [52%] |
| **Gender** | | |
| Female | 44 | 44% |
| Male | 56 | 56% |
| **Lifestyle** | | |
| Sedentary | 15 | 15% |
| Moderate | 79 | 79% |
| Heavy | 4 | 4% |
| **Substance Use** | | |
| Smokers | 66 | 66% |
| Alcoholics | 54 | 54% |
| **Co-morbidities** | | |
| Chronic Kidney Disease | 2 | 2% |
| Diabetes Mellitus | 9 | 9% |
| Hypertension | 3 | 3% |

**Graph 1**



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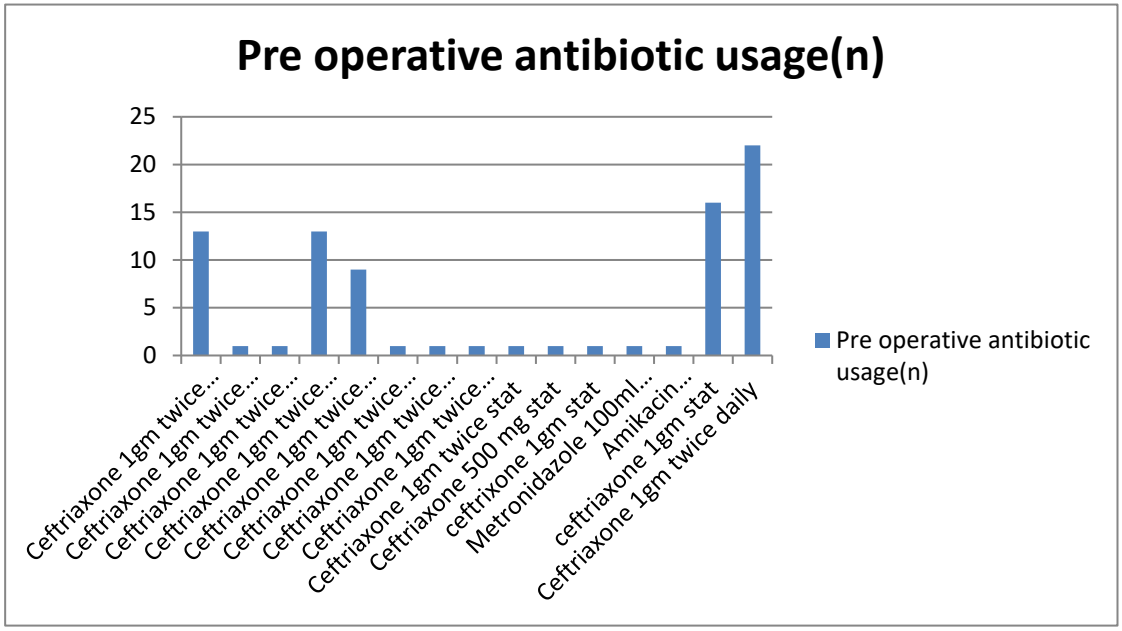
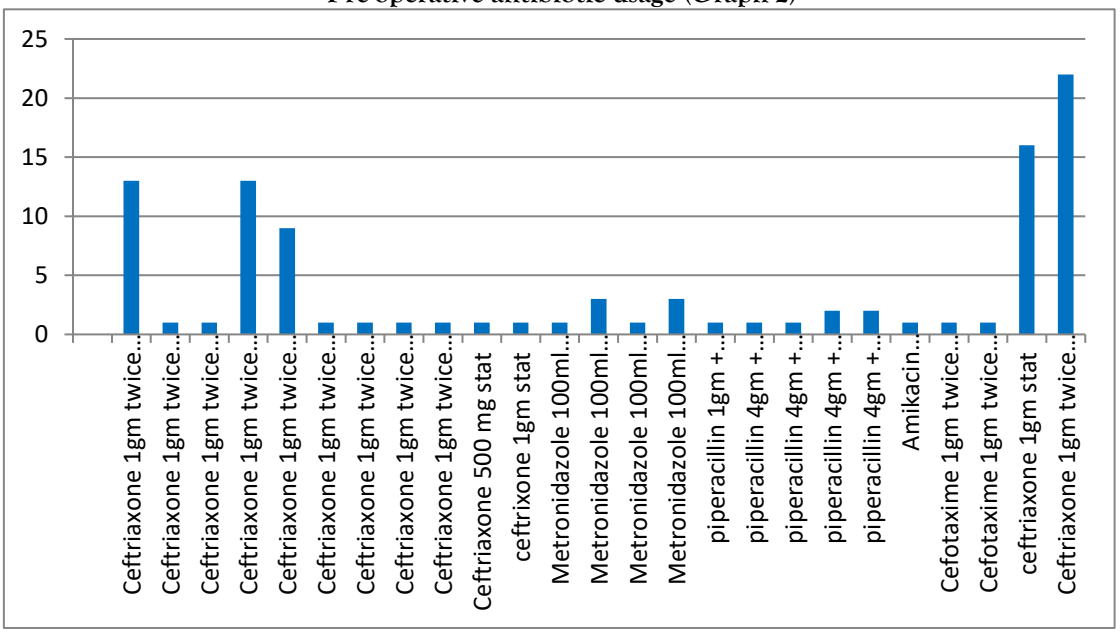



Pre-operative antibiotic usage (Graph-2)



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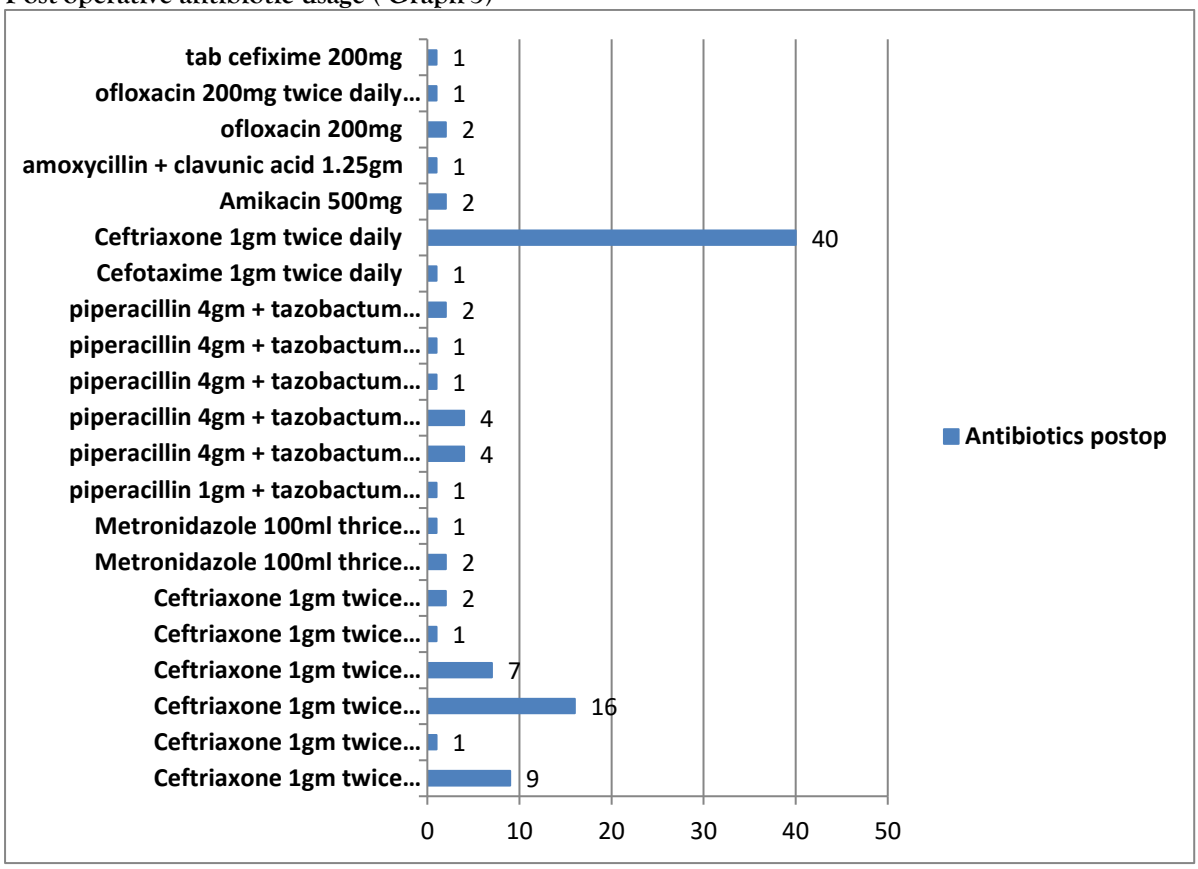
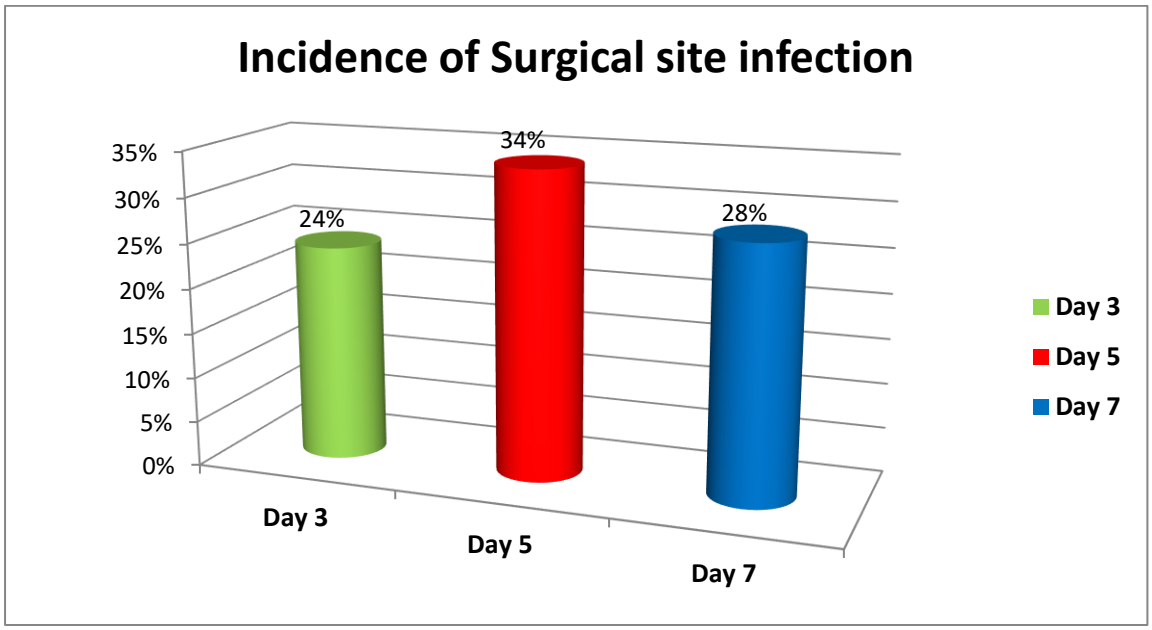
Post-operative antibiotic usage ( Graph-3)




Incidence of Surgical Site Infection Table no. 2

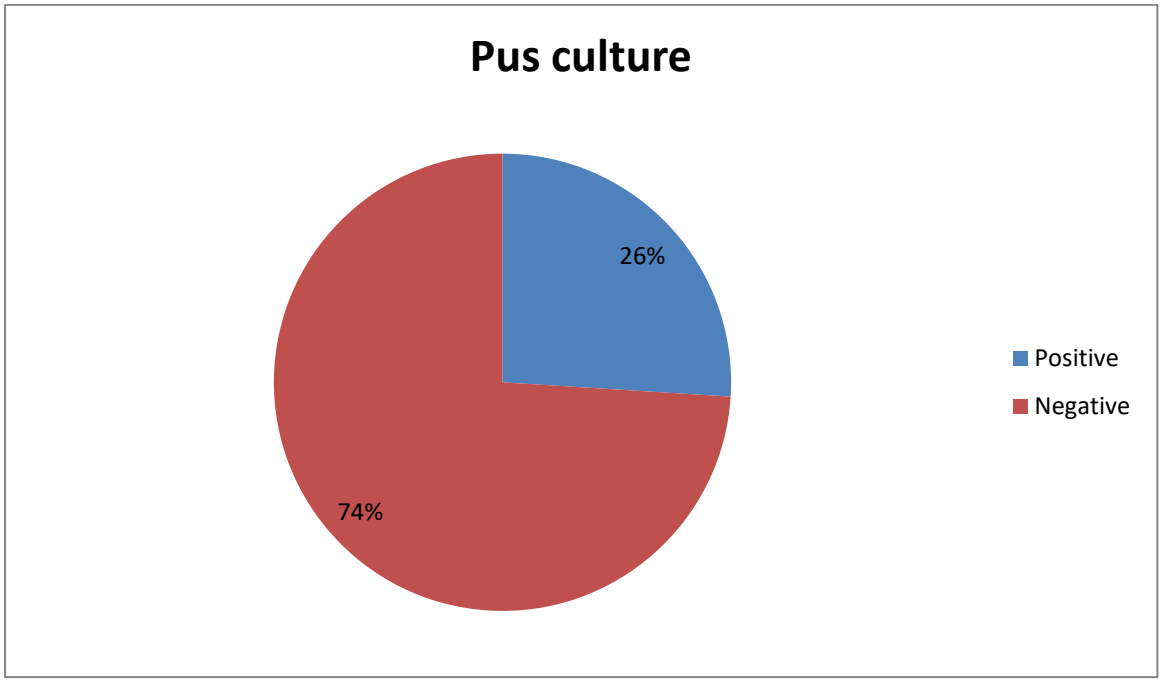
| | Day 3 | Day 5 | Day 7 |
|---|---|---|---|
| SSI | 24% | 34% | 28% |

SSI Graph



**Pus culture & sensitivity testing( Table no.3)**

| | |
|---|---|
| Positive culture | 26% |
| Negative culture | 74% |




**Discussion**

This study provides a comprehensive overview of the surgical patient population in Bhopal and surrounding regions, revealing critical insights into patient demographics, lifestyle factors, co-morbidities, and the efficacy of surgical antimicrobial prophylaxis.Our cohort, consisting of 100 surgical patients, exhibited a notable male predominance, with 56% of the participants being male, which is more than a study done by Belayneh Kefale et al.[1]. This observation aligns with existing literature that often reports a higher proportion of male patients in surgical settings.The lifestyle assessment, conducted according to the International Labour Organization (ILO) guidelines, showed that while a majority (79%) engaged in moderate physical activity, a concerning 15% led sedentary lifestyles. This indicates a potential area for targeted public health interventions to promote physical activity, which may lead to improved surgical outcomes and overall health status.Substance use was identified as a significant concern within the study group, with 66% of patients identified as smokers and 54% as alcoholics. The high prevalence of smoking and alcohol consumption among the surgical population could contribute to poorer postoperative outcomes, including a heightened risk of surgical site infections (SSIs). Previous studies have established strong links between these lifestyle factors and an increased incidence of SSIs, suggesting that preoperative counseling and interventions aimed at smoking cessation and alcohol reduction could be beneficial.Co-morbidities were relatively less prevalent in this cohort. Diabetes mellitus was observed in 9% of patients, a higher prevalence compared to findings by Legesse Laloto T et al.[17], while hypertension was present in 3% of cases, which was comparable to their report. Chronic kidney disease was identified in 2% of the cohort. Although the overall rates of co-morbidities were relatively low, their presence still necessitates careful perioperative management to minimize potential complications.Regarding antimicrobial prophylaxis, ceftriaxone was the predominant antibiotic administered (82%), either as a 1 gm twice-daily dosage or as a stat dose, which was more than reported in a study done by Alamrew K et al.[2]. The widespread use of ceftriaxone, along with

combinations involving metronidazole and amikacin, indicates a targeted approach to preventing infections. However, despite these measures, the monitoring of SSIs revealed concerning findings; 86% of patients experienced SSIs, which was more than reported in a study done by Kerebih Alamrew et al.[2]. The number of infections rose from 24 on postoperative day 3 to 34 by day 5, highlighting a significant challenge in infection control during the postoperative period.The identification of positive cultures in 26 cases further emphasizes the burden of infections, suggesting the possibility of resistant microbial strains that could complicate management and prolong hospitalization. These results are consistent with current literature that points to the growing burden of SSIs and the critical need for stronger infection control measures, appropriate antimicrobial stewardship, and continuous surveillance to develop more effective prevention strategies.

**Conclusions**

This study highlights critical gaps in surgical care practices within the Bhopal region, particularly concerning lifestyle-related risk factors, antimicrobial prophylaxis, and the persistent challenge of surgical site infections. Despite a relatively healthier patient population in terms of co-morbidities, the alarmingly high incidence of SSIs signals an urgent need for reinforced infection control measures and more judicious use of antimicrobials. Furthermore, the significant rates of smoking, alcohol use, and sedentary behavior among surgical patients underscore the importance of integrating preventive health counseling into preoperative care. Tailoring antimicrobial strategies based on local infection patterns and fostering a culture of active patient engagement could substantially improve postoperative outcomes. Continued surveillance, research, and multidisciplinary collaboration are essential to bridging these gaps and achieving safer surgical practices.

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**Conflicts of interest**

There are no conflicts of interest.

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