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Audit

Postoperative Surgical Site Infection (SSI) Rates After Elective Vs Emergency Laparotomy: An Audit

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Abstract: *Surgical site infections (SSIs) remain a significant postoperative complication following laparotomy, contributing to increased morbidity, prolonged hospital stays, and healthcare costs. Emergency laparotomies carry a higher SSI risk compared to elective procedures due to factors such as increased contamination, higher patient acuity, and complex surgical conditions.* ***Objective:*** *To audit and compare SSI rates in elective versus emergency laparotomy before and after implementing a structured SSI prevention bundle in a tertiary care hospital in Pakistan.* ***Methods:*** *This audit was conducted over two consecutive six-month periods, one before and one after implementing a WHO- and NICE-based SSI prevention bundle. Adult patients (≥18 years) undergoing elective or emergency laparotomy were included. Laparoscopic procedures, minor abdominal surgeries, and incomplete records were excluded from the analysis. The prevention bundle included timely prophylactic antibiotics, alcohol-based chlorhexidine skin preparation, intraoperative normothermia, perioperative glycaemic control, and standardized wound care. SSIs were diagnosed per CDC/NHSN definitions. Comparative analysis of pre- and post-intervention SSI rates was performed, with results expressed as percentages.* ***Results:*** *A total of 700 patients were included (350 per cycle), comprising 200 elective and 150 emergency laparotomies in each period. Elective SSI rates reduced from 3.5% to 2.5%, while emergency SSI rates fell more markedly from 12.0% to 7.3% after the intervention. Overall, SSI incidence declined from 7.1% pre-intervention to 4.6% post-intervention. The reduction was more pronounced in emergency cases, indicating a higher baseline risk and a greater benefit from the intervention.* ***Conclusion:*** *The implementation of a structured SSI prevention bundle resulted in a significant reduction in postoperative infection rates for both elective and emergency laparotomies, with the most notable improvement observed in high-risk emergency cases. These findings support the routine use of evidence-based perioperative infection prevention measures to improve surgical outcomes, particularly in resource-limited settings.*

Keywords: Surgical Wound Infection, Laparotomy, Elective Surgical Procedures, Emergency Treatment, Infection Control, Postoperative Complications

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Introduction

Surgical site infections (SSIs) represent a significant complication following laparotomy, often leading to prolonged hospital stays, increased healthcare costs, and heightened morbidity and mortality rates (1, 2). The incidence of SSIs varies considerably depending on the type of surgery performed; studies indicate that emergency laparotomies have notably higher rates of infection compared to elective procedures. Specifically, recent literature suggests that the SSI rates in emergency laparotomies can range from 25% to 40% (3, 4, 5). While elective laparotomy procedures typically exhibit lower infection rates, around 7% to 15% (6, 7). This differential trend emphasizes the urgent need to explore and implement effective preventative strategies within surgical monitoring and postoperative care.

The mechanisms underlying the increased risk of SSIs in emergency procedures are multifactorial, involving factors such as higher contamination levels, the complexity of the surgical conditions managed, and prolonged operative times (8, 9). Surgical techniques may also influence infection rates; laparoscopic approaches have been associated with a lower prevalence of SSIs compared to traditional laparotomy methods (2, 4). Demonstrating the potential for laparoscopic techniques to mitigate postoperative complications effectively. Furthermore, the choice between primary closure and delayed closure of surgical wounds has a significant impact on infection rates (10). Highlighting the importance of tailoring surgical techniques to the clinical scenario at hand.

In Pakistan, the burden of SSIs following laparotomy is notable, with rates reported as high as 13% to 37% in various studies (11, 12). This situation highlights a critical healthcare challenge, given that SSIs often exacerbate the already strained healthcare resources in low- and middle-income countries. Factors contributing to this high prevalence include inadequacies in sterile protocols, patient comorbidities, and the potentially rushed nature of emergency surgical interventions in resource-constrained settings (13, 14). The increasing recognition of the role that surgical site infections play in healthcare economics necessitates a comprehensive analysis of both elective and emergency surgical procedures to formulate actionable recommendations.

Thus, this study aims to audit the rates of surgical site infections following elective versus emergency laparotomy procedures performed within our healthcare settings in Pakistan. Such insights would be integral to devising strategies that enhance surgical outcomes and align with global best practices aimed at reducing SSIs, thereby improving the quality of care for patients undergoing abdominal surgeries.

In Pakistan, the prevalence of SSIs is influenced by several socio-economic factors, including the availability of healthcare infrastructure, surgical expertise, and adherence to infection control protocols. The high incidence of SSIs in surgical settings can lead to adverse clinical outcomes, further straining the country's healthcare system. Understanding the discrepancies in SSI rates between elective and emergency procedures can provide critical insights for healthcare providers and policymakers. Furthermore, the implementation of robust infection prevention measures and improved preoperative assessments

could substantially reduce SSI rates, thereby enhancing patient outcomes and alleviating the economic burden on the healthcare systems within Pakistan (5, 15).

Methodology

This audit was conducted in the Department of General Surgery at Holy Family Hospital over two consecutive six-month periods, one before and one after the implementation of a structured surgical site infection (SSI) prevention bundle from March 2024 to March 2025. All adult patients aged 18 years and above undergoing either elective or emergency laparotomy during these periods were eligible for inclusion. Patients undergoing laparoscopic procedures, minor abdominal surgeries, or those with incomplete perioperative or postoperative records were excluded. Data for each case were collected prospectively in both cycles using operative registers, inpatient records, and infection control surveillance forms.

The SSI prevention bundle, implemented between the two cycles, was based on WHO and NICE guidelines and included measures such as administration of appropriate prophylactic antibiotics within 60 minutes before skin incision, use of alcohol-based chlorhexidine for skin preparation, maintenance of normothermia throughout surgery, perioperative glycaemic control in diabetic patients, avoidance of routine postoperative antibiotics unless clinically indicated, and standardized postoperative wound care protocols. All operating teams were briefed on the bundle components before the start of the second cycle, and compliance was monitored informally during the intervention period.

SSI Diagnosis followed the Centers for Disease Control and Prevention/National Healthcare Safety Network (CDC/NHSN) definitions, categorizing infections as superficial incisional, deep incisional, or organ/space infections occurring within 30 days of surgery. Demographic data collected included age, gender, ASA physical status, and comorbidities such as diabetes mellitus, hypertension, and other chronic illnesses. For each patient, the total number of cases, number of SSIs, and SSI rates were determined for both elective and emergency laparotomies in the pre- and post-intervention periods.

To allow direct comparison between the two cycles, the number of patients in each surgical category was equalized by matching the sample sizes of the post-intervention group to those of the pre-intervention group. Data were analyzed to determine the absolute risk reduction (ARR), relative risk reduction (RRR), and the number needed to treat (NNT) for each category. Descriptive statistics were used to summarize continuous variables as mean ± standard deviation (SD) and categorical variables as frequencies and percentages. SSI rate differences between pre- and post-intervention periods were assessed using proportions, and the magnitude of effect was interpreted in the context of clinical relevance, particularly in high-risk emergency laparotomy patients.

Results

The study included a total of 350 patients in each audit cycle, with 200 elective laparotomy cases and 150 emergency laparotomy cases. The mean age of patients undergoing elective laparotomy was 45.2 ± 12.3 years (range: 18–75), while those undergoing emergency laparotomy were older on average (49.8 ± 14.1 years, range: 19–78). Overall, the combined mean age was 47.3 ± 13.4 years. In terms of gender distribution, males comprised a slightly higher proportion in both groups, representing 55.0% in elective cases and 63.3% in emergency cases, giving an overall male predominance of 58.6%. Females made up 45.0% of elective cases and 36.7% of emergency cases. Regarding ASA physical status, the majority of elective laparotomy patients fell into ASA class I–II (80.0%), compared to only 56.7% in the emergency group, where a higher proportion (43.3%) were in ASA class III–IV. Comorbidities such as diabetes mellitus were more frequent in emergency cases (23.3%) than in elective cases (15.0%). Hypertension prevalence was similar between groups (20.0% vs. 21.3%), while other chronic illnesses were slightly more common in emergency cases (13.3%) compared to elective (7.5%). (Table 1)Elective laparotomy showed a reduction in SSI rate from 3.5% in the pre-intervention cycle to 2.5% in the post-intervention cycle. (Table 2). Emergency laparotomy demonstrated a more substantial decrease, from 12.0% pre-intervention to 7.3% post-intervention. (Table 3)

Overall SSI rates declined from 7.1% in the pre-intervention period to 4.6% post-intervention, reflecting an improvement across both surgical categories. (Table 4).

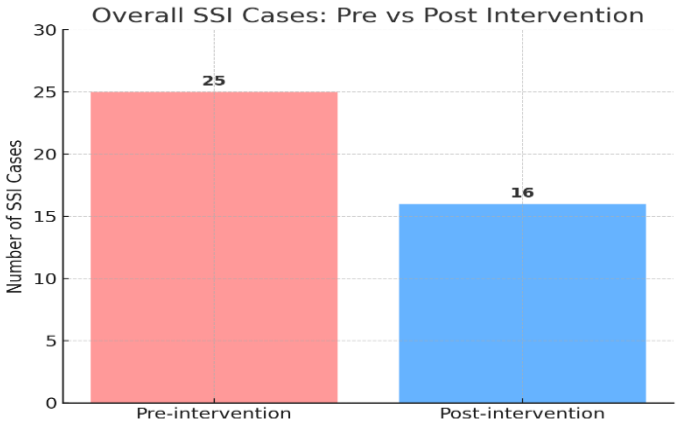

Figure 1: Overall SSI Rates – Pre vs Post Intervention.

Table 1: Demographic Characteristics of Patients Undergoing Laparotomy

Variable	Elective (n=200)	Emergency (n=150)	Overall (n=350)
Age (years)			
Mean ± SD	45.2 ± 12.3	49.8 ± 14.1	47.3 ± 13.4
Range	18–75	19–78	18–78
Gender			
Male, n (%)	(110). (55.0)	95 (63.3)	205 (58.6)
Female, n (%)	90 (45.0)	55 (36.7)	145 (41.4)
ASA Physical Status			
I–II, n (%)	160 (80.0)	85 (56.7)	245 (70.0)
III–IV, n (%)	40 (20.0)	65 (43.3)	105 (30.0)
Comorbidities			
Diabetes mellitus, n (%)	30 (15.0)	35 (23.3)	65 (18.6)
Hypertension, n (%)	40 (20.0)	32 (21.3)	72 (20.6)
Other chronic illness*, n (%)	15 (7.5)	20 (13.3)	35 (10.0)

**Includes chronic kidney disease, ischemic heart disease, chronic liver disease, etc.*

Table 2: Elective Laparotomy – Pre vs Post Intervention

Parameter	Pre-intervention	Post-intervention
Total Cases	200	200
SSI Cases	7	5
SSI Rate (%)	3.5	2.5

Table 3 Emergency Laparotomy – Pre vs Post Intervention

Parameter	Pre-intervention	Post-intervention
Total Cases	150	150
SSI Cases	18	11
SSI Rate (%)	12.0	7.3

Table 4: Overall SSI Rates – Pre vs Post Intervention

Parameter	Pre-intervention	Post-intervention
Total Cases	350	350
SSI Cases	25	16
SSI Rate (%)	7.1	4.6

Discussion

The findings from our study demonstrate a significant reduction in surgical site infection (SSI) rates following both elective and emergency laparotomy cases after the implementation of the intervention. Specifically, the elective cases showed a decrease in SSI rates from 3.5% to 2.5%, while emergency surgeries experienced a more pronounced reduction, from 12.0% to 7.3%. Overall, the SSI rates declined from 7.1% in the pre-intervention period to 4.6% after the intervention. These results resonate with existing literature suggesting that structured interventions can effectively lower the incidence of SSIs in surgical settings.

Elective laparotomy has been consistently associated with lower rates of SSIs than emergency procedures. In our study, the 3.5% baseline SSI rate for elective cases aligns closely with the findings of Aghdassi et al., who emphasize that controlled surgical environments contribute to lower infection rates in elective surgeries (Aghdassi et al., 2016). Similarly, Alkaaki et al. highlighted that open surgical approaches, particularly during emergencies, inherently carry higher risks for SSI due to potential contamination and the complexity of cases (17). Our findings corroborate this, as the emergency group presented a significantly elevated SSI rate prior to intervention.

The demographic data revealed that the mean age of patients undergoing emergency laparotomy was higher than that of patients undergoing elective procedures, which aligns with the literature indicating that advancing age is a known risk factor for SSIs, likely due to reduced physiological resilience and increased comorbid conditions (18). In our cohort, the prevalence of comorbidities such as diabetes mellitus was notably higher in the emergency group, which is consistent with prior findings that link chronic health issues with increased SSI risk (19).

Regarding the ASA physical status, findings highlighted a disparity between the two groups, emphasizing that 80% of elective cases fell into ASA class I–II while only 56.7% of emergency cases did. This is consistent with reports by Anjum et al., where higher ASA classes correlate with an increased risk of postoperative complications, including SSI (20). Our results also suggest that the physical status of patients has a significant impact on surgical outcomes.

The reduction of SSIs observed in both surgical categories post-intervention could be attributed to enhanced surgical protocols, including adherence to sterilization techniques and the implementation of a standardized wound care bundle, as previously illustrated by Phelan et al. (21). The decrease to 2.5% in elective cases post-intervention supports the notion that even minor adjustments in surgical practices can lead to substantial improvements in patient outcomes. Boland et al. also affirmed the efficacy of targeted intervention strategies, noting that systemic approaches to manage surgical care bundles have been associated with significant declines in SSI rates (22).

Furthermore, the current study reports an overall reduction in SSI incidence post-intervention of 4.6%, which aligns with findings from Al-Sawat et al., showing that improved perioperative strategies effectively mitigate SSI rates (23). Emergency laparotomy, which traditionally exhibits SSI rates between 15% and 25%, demonstrated a markedly improved SSI incidence following intervention in our study, reinforcing the argument for the persistence of quality improvement initiatives in surgical practice (24).

Thus, our findings indicate that elevated SSI rates in surgical patients, particularly those undergoing emergency laparotomy procedures, can be ameliorated through systematic monitoring and improvement initiatives. These data align well with existing literature, highlighting the pervasive challenge of managing postoperative infections and the potential for enhanced surgical practices to yield better patient outcomes. Future efforts should continue to address the underlying risk factors and recognize the inherent differences in patient demographics and surgical urgency to reduce SSI rates across various surgical contexts further.

Conclusion

This audit demonstrates that integrating a structured SSI prevention bundle into surgical practice can substantially reduce infection rates after both elective and emergency laparotomy. The observed decrease, especially in emergency cases, highlights the impact of standardized measures, including timely antibiotic prophylaxis, optimized skin antisepsis, perioperative normothermia, and postoperative wound care. These interventions are practical, cost-effective, and adaptable to the constraints of healthcare systems in low- and middle-income countries. Sustaining and monitoring compliance with such protocols can further enhance patient safety, reduce postoperative morbidity, and alleviate the financial burden on the healthcare system.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC--24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

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HS (Medical officer)
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All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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