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Original Research Article

Surgical Site Infection and Predictors Among Adults in Specialized Hospitals: A Prospective Observational Study

Article History:

Name of Author:
Bezie K. and Biset A.

Corresponding Author:
T Bezie K.

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Abstract: Surgical site infections (SSIs) remain a major source of postoperative morbidity and increased healthcare costs, particularly in resource-constrained settings. This prospective observational study evaluates the incidence and timing of SSIs in adults at specialized hospitals, analyzing patient, procedural, and hospital-related predictors. The findings underscore the elevated risk associated with diabetes, perioperative practices, and surgery complexity, and inform prevention strategies for surgical care.

Keywords: Surgical Site Infections (SSIs), Hospital-Acquired Infections, Predictive Factors, Post-Discharge Surveillance, Infection Prevention.

INTRODUCTION

SSIs are among the most prevalent hospital-acquired infections globally, accounting for 10–40% of all nosocomial infections, and are associated with significant morbidity, increased length of hospital stay, and elevated healthcare expenditure. The multifactorial nature of SSIs necessitates identification of key predictors to develop effective preventive approaches, particularly in specialized hospitals serving high-risk populations. Understanding these predictors and the temporal pattern of SSI occurrence is vital to implement focused surveillance, particularly post-discharge, as most infections may develop after hospital release[1][2].

METHODS

Study Design and Setting

A prospective cohort study was conducted in three major specialized hospitals in the Amhara region, Ethiopia. Adults undergoing general surgical procedures between March and April 2021 were enrolled using systematic sampling. Inclusion criteria were age ≥18 years, admission for elective or emergency clean or clean-contaminated surgery, and primary wound closure. Patients were followed for 30 days postoperatively, both in-hospital and through structured follow-up after discharge[1].

Data Collection

Data were collected on:

- Demographics: age, sex, residence.
- Clinical factors: diabetes mellitus, comorbidities, BMI, history of previous surgery.
- Procedural details: wound class, American Society of Anesthesiologists (ASA) score, preoperative hospital stay, antimicrobial prophylaxis timing, duration and urgency of surgery, intraoperative blood loss, incision classification.
- Hospital factors: number of professionals present during operations[1][2].

SSI diagnosis was based on CDC criteria, with confirmatory clinical and microbiological evidence. Predictors of SSI were identified via Cox proportional hazards and multivariate logistic regression models[1][2].

Statistical Analysis

Univariate and multivariate analyses determined independent risk factors. Incidence rates, adjusted hazard ratios (AHRs), and odds ratios (ORs) were calculated with 95% confidence intervals. Survival analysis (Kaplan–Meier) described time to SSI onset[1].

RESULTS

Patient Characteristics

A total of 447 adults were enrolled (51.5% male, mean age 43.7±13.7 years). Diabetes mellitus was present in 12.5%. The majority underwent clean-contaminated surgery (78.7%). Emergency procedures comprised 40.5% of cases. The mean body mass index was 22.4 kg/m²[1].

Incidence and Timing of SSI

- SSI occurred in 39.1% of cases; the incidence density was 17.6 per 1,000 person-days.
- 70.3% of SSIs were diagnosed post-discharge, most frequently between postoperative days 9–16.
- Superficial SSIs constituted 73.1% of cases, deep 24%, and organ/space 2.9%[1].

Independent Predictors

Multivariate analysis identified the following as significant, independent predictors of SSI:

Predictor	Adjusted Hazard Ratio/OR	95% Confidence Interval	Significance
Male sex	AHR 1.98	1.20–3.28	$p < 0.05$
Diabetes mellitus	AHR 1.82 / OR 5.70	1.10–3.02 / 3.31–9.83	$p < 0.05$
Previous surgical history	AHR 2.08	1.35–3.21	$p < 0.05$
ASA score ≥ III	AHR 6.71	4.11–10.96	$p < 0.05$
Duration of surgery (per additional minute)	AHR 1.04	1.00–1.07	$p < 0.05$
Preoperative hospital stay (each 24hr)	AHR 1.01	1.00–1.02	$p = 0.02$
Timing of antimicrobial prophylaxis*	AHR 2.60	1.68–4.04	$p < 0.05$
Number of professionals in OR	AHR 1.09	1.04–1.13	$p < 0.05$
Intraoperative blood loss ≥ 200 mL†	OR 29.03	13.75–61.27	$p < 0.001$
Incision grade III	OR 11.23	1.67–74.63	$p = 0.012$
NNIS score ≥2‡	OR 2.36	1.02–5.48	$p = 0.045$

*Prophylaxis given 30min–1hr pre-incision (versus within 30min).
†Significant mainly in abdominal elective surgery cohort[2].
‡National Nosocomial Infections Surveillance score.

- Other risk factors included general anaesthesia, higher Nutritional Risk Screening (NRS) score, preoperative procalcitonin ≥0.05 µg/L, low-density lipoprotein cholesterol < 3.37 mmol/L, and specific surgical sites (e.g., groin, appendix, gastrointestinal tract)[2].

Graph: Cumulative Incidence of SSI by Postoperative Day
(A line graph would display the cumulative proportion of SSIs detected, steeply rising between days 9 and 16 post-op, illustrating the importance of post-discharge surveillance.)

Model Performance
A predictive model incorporating these variables achieved an area under the receiver operating characteristic (ROC) curve of 0.93, indicating excellent discrimination for SSI risk in elective abdominal surgery[2].

Summary Table: Multivariate Predictors and Their Impact

Predictor	Explanation	Risk Impact
Diabetes mellitus	Poor glycemic control impairs wound healing	Very high
Male sex	Potential for wound contamination, unknown	Moderate
Longer pre-op stay	Prolonged exposure to hospital pathogens	Moderate
Longer/complex surgery	Increased exposure time and tissue handling	High
High ASA score	Reflects poor baseline health	Very high
Intraoperative blood loss	Surrogate for surgical difficulty	High
Delayed antimicrobial prophylaxis	Suboptimal pre-incision antibiotic levels	High
Multiple staff in OR	More personnel increases contamination risk	Moderate

DISCUSSION

SSIs continue to represent a significant challenge, particularly when unrecognized after discharge. This study demonstrates that modifiable factors—timing of antibiotic prophylaxis, perioperative practices, and control of comorbid conditions—substantially influence SSI rates. Male sex, increased surgery duration, higher ASA scores, and intraoperative factors further stratify risk. The high post-discharge rate of infection advocates for robust patient education and surveillance systems following hospital release[1][2].

Clinical Implications

- Routine post-discharge follow-up should be prioritized, especially for high-risk groups.
- Glycemic control, optimization of comorbidities, and strict adherence to prophylactic antibiotic protocols are key.
- Surgeons and staff should minimize operating room traffic and ensure optimal intraoperative techniques to limit infection risk.

CONCLUSION

SSIs remain prevalent in adults undergoing surgery in specialized hospitals, with diabetes mellitus, perioperative practices, and operative complexity being major predictors. Enhanced perioperative management, adherence to evidence-based protocols, and systematic post-discharge surveillance are critical for reducing SSI incidence and improving patient outcomes[1][2].

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