MAK HILL Publications Research Journal of Medical Science

Research Article
doi: 10.59218/makrjms.2023.10.24.29

OPEN ACCESS

Key Words
Surgical site infection, outpatient procedure, inpatient procedure, postoperative complication

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Received: 20 September 2023
Accepted: 7 October 2023
Published: 8 October 2023

Citation: Chetan D. Dhandore, Babu P. Ubale, Mayur M. Mastud and Sanjay R. Gaikwad, 2023. Assessment of Surgical Site Infection Rates in Outpatient vs. Inpatient Procedures. Res. J. Med. Sci., 17: 24-29, doi:10.59218/makrjms.2023.10.24.29

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Assessment of Surgical Site Infection Rates in Outpatient vs. Inpatient Procedures

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ABSTRACT

Surgical site infections (SSIs) are critical complications that can elevate postoperative morbidity, extend hospitalization durations, and increase medical expenses. Given the growing preference for outpatient surgical operations, understanding the differential in SSI rates between outpatient and inpatient settings becomes paramount. This study aimed to evaluate and compare the incidence of SSIs in outpatient versus inpatient surgical procedures. A comprehensive review of 500 surgical cases from a single-center database over three years (2020-2022) was performed. Patients were bifurcated into outpatient (n = 250) and inpatient (n = 250) categories. The primary metric was the emergence of SSIs within a 30-day post-surgical window. Confounding variables, such as demographic information, comorbidity profiles, complexity of the surgery and preoperative antibiotic administration, were balanced using multivariable logistic regression. Within the outpatient cohort, SSIs were noted in 10.0% of cases, whereas the inpatient group exhibited a rate of 22.0%. When accounting for confounding elements, outpatient surgical interventions displayed a distinct odds ratio (OR = 2.48, 95% CI 1.52-4.02, $p<0.01$) for SSIs in comparison to their inpatient counterparts. The data underscore a discernible variance in SSI rates between outpatient and inpatient surgical settings. The insights gathered underscore the importance of procedure-specific infection prevention methodologies based on the surgical environment.

INTRODUCTION

Surgical site infections (SSIs) are among the most common healthcare-associated infections, contributing significantly to postoperative morbidity, increased length of hospital stay and escalating healthcare costs[1]. As medical advancements continue to develop, there has been a substantial rise in the number of surgical procedures conducted in outpatient settings[2]. This shift is primarily attributed to the reduced cost, patient preference for home recovery and advancements in surgical and anesthetic techniques that facilitate quicker recovery[3].

However, with the transition towards outpatient surgeries, there arises a pertinent question regarding the safety and quality of these procedures, especially in terms of postoperative complications like SSIs. While some studies suggest outpatient procedures may carry a reduced risk due to shorter exposure to hospital pathogens others highlight potential concerns related to postoperative care and monitoring in home settings[4,5].

Given the increasing trend and the equivocal evidence available, it is crucial to comprehensively assess the rates of SSIs in outpatient versus inpatient surgical procedures to ensure patient safety and the maintenance of healthcare standards.

Aim: The primary objective of this study is to assess and compare the rates of surgical site infections (SSIs) in patients undergoing outpatient versus inpatient surgical procedures.

Objectives:

- **Delineate the incidence of SSIs:** To systematically quantify the incidence of surgical site infections within a 30-day postoperative period for both outpatient and inpatient surgical cohorts
- **Analyze contributing factors:** To evaluate the potential variables and factors, such as patient demographics, surgical complexity, antibiotic prophylaxis and duration of hospital stay, that may influence the risk of SSIs in both surgical settings
- **Assess the impact on patient outcomes:** To investigate the implications of SSIs on patient outcomes, including readmission rates, postoperative complications, duration of antibiotic treatment and overall recovery time in both outpatient and inpatient environments.

MATERIALS AND METHODS

Study design and setting: A retrospective cohort study was conducted at Ashwini rural Medical College, a tertiary care hospital with comprehensive surgical facilities. The study spanned over three years, from January 2020 to December 2022.

Study population: The study population comprised patients who underwent surgical procedures during the study period. Exclusion criteria included patients under the age of 18, those with missing medical records and surgeries that were neither strictly outpatient nor inpatient (e.g., day surgeries).

Data collection: Medical records were reviewed to extract relevant data, including:

- Patient demographics (age, gender, comorbidities)
- Surgical details (type of surgery, surgical team, duration of surgery)
- Prophylactic antibiotic use
- Postoperative outcomes (occurrence of SSIs, readmissions, other complications)

Definition of outcomes:

- **Primary outcome:** Incidence of SSIs within 30 days post-surgery
- **Secondary outcomes:** Hospital readmission rates, duration of postoperative antibiotic treatment, and length of recovery

Statistical analysis: Data were analyzed using SPSS software (Version 25.0). Descriptive statistics were used to summarize the baseline characteristics of the study population. The incidence of SSIs in both outpatient and inpatient surgeries was compared using chi-square tests. Multivariable logistic regression was employed to adjust for potential confounding variables and to calculate odds ratios (ORs) with 95% confidence intervals (CIs). A p-value of less than 0.05 was considered statistically significant.

Ethical considerations: The study protocol was reviewed and approved by the Institutional Review Board (IRB) of Medical college. Patient data were anonymized to ensure privacy and confidentiality. Since this was a retrospective study, informed consent was waived.

OBSERVATION AND RESULTS

In the study evaluating 500 surgical patients, Table 1 compares the incidence of surgical site infections (SSIs) within a 30-day postoperative period between outpatient and inpatient settings. Out of the outpatient cohort, 10% (n = 25) experienced SSIs, serving as the reference group. Contrastingly, the inpatient group displayed a higher incidence, with 22% (n = 55) developing SSIs. This increased risk in the inpatient setting is quantified with an odds ratio (OR) of 2.48, which is statistically significant with a $p<0.01$. The confidence interval for this OR is between 1.52 and 4.02, suggesting a robust association between the inpatient setting and elevated SSIs within 30 days post-surgery.

Table 1: Incidence of surgical site infections (SSIs) within a 30-day postoperative period in outpatient vs. Inpatient surgical cohorts (N = 500)

Surgical setting	No. of SSIs within 30 days	Percentage	Odds ratio (OR)	95% confidence interval (95% CI)	p-value
Outpatient	25	10.0	Reference	--	--
Inpatient	55	22.0	2.48	1.52-4.02	<0.01

Table 2: Factors influencing the risk of SSIs in outpatient vs. Inpatient surgical cohorts (N = 500)

Factors/variables	Outpatient n (%)	Inpatient n (%)	Odds ratio (OR)	95% confidence interval (95% CI)	p-value
Patient demographics					
Age >60	50 (20.0)	80 (32.0)	1.89	1.32-2.70	<0.010
Gender (male)	120 (48.0)	140 (56.0)	1.36	0.99-1.88	0.060
Surgical complexity					
High complexity	40 (16.0)	90 (36.0)	2.81	1.90-4.15	<0.001
Antibiotic prophylaxis					
Received	220 (88.0)	230 (92.0)	1.47	0.82-2.62	0.190
Duration of hospital stay					
> 5 days	10 (4.0)	70 (28.0)	8.75	4.42-17.40	<0.001

Table 3: Implications of SSIs on patient outcomes in outpatient vs. Inpatient surgical cohorts (N = 500)

Outcomes/factors	Outpatient n (%)	Inpatient n (%)	Odds ratio (or)	95% confidence interval (95% CI)	p-value
Readmission rates					
Readmitted within 30 days	15 (6.0)	35 (14.0)	2.50	1.35-4.60	<0.010
Postoperative complications					
Major Complications	20 (8.0)	60 (24.0)	3.46	2.08-5.78	<0.001
Duration of antibiotic treatment					
>7 days	30 (12.0)	80 (32.0)	3.33	2.15-5.16	<0.001
Overall recovery time					
>14 days	40 (16.0)	95 (38.0)	3.13	2.10-4.68	<0.001

Table 2 elucidates various factors affecting the risk of SSIs across 500 surgical patients, differentiating between outpatient and inpatient cohorts. Within patient demographics, older individuals (age >60) comprised 20% of the outpatient group and 32% of the inpatient group, resulting in a significant odds ratio (OR) of 1.89. Males constituted 48% of outpatient surgeries and 56% of inpatient surgeries with an or of 1.36, though this was marginally insignificant with a p>0.06. Surgical complexity marked a pronounced disparity high complexity surgeries were 16% in outpatients versus 36% in inpatients, yielding a significant or of 2.81. Regarding antibiotic prophylaxis, 88% of outpatients received it compared to 92% of inpatients, with an or of 1.47, albeit not statistically significant. Lastly, extended hospital stays (greater than 5 days) were observed in only 4% of outpatients compared to a substantial 28% in inpatients, highlighting a dramatic o of 8.75, underscoring a statistically profound difference.

Table 3 presents the implications of surgical site infections (SSIs) on various patient outcomes, comparing outpatient and inpatient surgical cohorts from a sample of 500 patients. Notably, the inpatient group showed a higher rate of readmissions within 30 days (14.0% vs. 6.0% in outpatients) with an odds ratio (OR) of 2.50. The incidence of major postoperative complications was also markedly higher in the inpatient cohort at 24.0%, compared to 8.0% for outpatients, yielding an OR of 3.46. The inpatient group exhibited prolonged antibiotic treatments (more than 7 days) at a rate of 32.0%, contrasting with 12.0% in outpatients (OR = 3.33). Lastly, extended overall recovery times exceeding 14 days were reported in 38.0% of inpatient cases, significantly higher than the 16.0% observed in the outpatient group, with an associated OR of 3.13. Each of these differences indicated statistical significance, emphasizing substantial variations in patient outcomes between the two surgical settings.

DISCUSSIONS

Table 1 provides an insightful examination of the incidence of surgical site infections (SSIs) within a 30-day postoperative period, comparing outpatient and inpatient surgical settings. Notably, the inpatient group demonstrates a substantially higher incidence of SSIs (22.0%) compared to the outpatient cohort (10.0%), with an odds ratio of 2.48, indicating that patients undergoing inpatient procedures are nearly 2.5 times more likely to develop an SSI within a month following their operation.

The findings of this study echo those from Zhuang *et al.*[3] who also reported elevated SSI rates among inpatient surgical patients. Their analysis suggested that prolonged hospital stays, often characteristic of inpatient surgeries, might expose patients to hospital-acquired infections, thereby escalating the risk of SSIs.

However, the outcomes presented in Table 1 contrast with those from a study by Edmiston *et al.*[4] which did not find significant differences in SSI rates between the two surgical settings. One possible reason for this discrepancy could be the type of surgeries assessed or differences in post-operative care protocols across different institutions.

Furthermore, the observed heightened risk for SSIs among inpatient surgeries in our study resonates with the findings of Delgado-Miguel *et al.*[5] who

underscored factors like surgical duration, complexity, and patient comorbidities as potential contributors to increased SSIs in inpatient settings.

Despite the observed variations across studies the consensus remains that SSIs represent a significant challenge in postoperative care. Efforts to understand their epidemiology, especially in varying surgical settings, are critical to devising effective preventive strategies.

Table 2 provides a comprehensive analysis of various factors potentially influencing the risk of surgical site infections (SSIs) in outpatient versus inpatient surgical settings.

The heightened risk of SSIs among patients aged over 60 in the inpatient setting, as reflected by an odds ratio (OR) of 1.89, resonates with findings from He *et al.*[6]. They identified older age as a consistent predictor of postoperative complications, including SSIs, which might be attributable to age-associated physiological changes, reduced immune responses, or co-existing comorbidities.

The slight inclination for males to exhibit SSIs in the inpatient setting, though not statistically significant ($p = 0.06$), mirrors the observations by Edmiston *et al.*[7]. They postulated that differences in skin microbiota and health behaviors between genders might account for the variability in SSI risk.

The marked discrepancy in SSIs related to surgical complexity, with an OR of 2.81 for high complexity in the inpatient setting, is consistent with the findings of Hou *et al.*[8]. Complex surgeries often entail prolonged operative durations, thereby increasing exposure to potential contaminants.

Interestingly, while the receipt of antibiotic prophylaxis was high in both groups the difference was not statistically significant. This contrasts with the study by Zhao *et al.*[9] which emphasized the protective effect of timely antibiotic prophylaxis against SSIs, suggesting other factors might be at play in our study's context.

Lastly, the significantly prolonged hospital stay in the inpatient group (OR = 8.75 for stays >5 days) reinforces findings from Sattar *et al.*[10] indicating that extended hospitalization might correlate with higher SSI risk due to prolonged exposure to hospital-acquired pathogens.

Table 3 delineates the profound implications of surgical site infections (SSIs) on patient outcomes, segregating between outpatient and inpatient surgical cohorts.

The inpatient group's elevated readmission rates within 30 days post-surgery (14% compared to the outpatient's 6%) with an odds ratio (OR) of 2.50 find support in the work of Rudic *et al.*[11]. They emphasized that SSIs significantly contribute to hospital readmissions due to their associated complications and the necessity for further interventions.

Furthermore, the distinct discrepancy in major postoperative complications, with an OR of 3.46 favoring the inpatient cohort, echoes the sentiments of Scaggs Huang *et al.*[12]. Their study underscored that inpatient settings, typically catering to more complex cases or patients with multiple comorbidities, invariably experience higher post-surgical complications, SSIs being a primary concern.

The extended duration of antibiotic treatment, observed more predominantly in the inpatient group (OR = 3.33), aligns with the findings from Chopra *et al.* [13]. They posited that SSIs often necessitate prolonged antibiotic regimens, both as a treatment measure and a preventive strategy against potential complications.

Lastly, the augmented recovery time in the inpatient group, with nearly 38% taking more than 14 days compared to 16% in the outpatient setting, resonates with the conclusions of Gillespie *et al.*[14] Their research concluded that SSIs invariably prolong the healing process, impacting overall recovery time, especially in inpatient environments where cases are generally more intricate.

CONCLUSION

The assessment of surgical site infection (SSI) rates between outpatient and inpatient procedures provides valuable insights into the differential risks and implications associated with surgical settings. Our findings underscore a notably higher incidence of SSIs in inpatient surgical procedures compared to outpatient ones. These disparities can be attributed to various factors, including patient demographics, surgical complexity and duration of hospital stay. While outpatient procedures offer the advantage of reduced SSI rates and potentially faster recovery, it's essential to recognize that inpatient surgeries often involve more complex cases and inherently come with increased risks. It is paramount for healthcare professionals to be cognizant of these differences to optimize patient care, implement effective preventive measures, and ensure informed decision-making in surgical planning. Continuous monitoring and research into improving surgical outcomes across both settings remain crucial for advancing patient care and safety.

LIMITATIONS OF STUDY

Single-center data: The study was conducted in a single medical institution, which may limit the generalizability of the findings to broader populations or diverse healthcare settings.

Retrospective design: Given its retrospective nature, the study might have inherent biases associated with data collection. There's potential for missing data or inaccuracies in the historical records, which could affect the results.

Variability in surgical procedures: The study encompassed a range of surgical procedures with varying complexities. Different surgeries have distinct SSI risks, and not accounting for these nuances might affect the overall rates reported.

Lack of patient-level data: Detailed patient-specific factors like comorbidities, nutritional status, or personal habits, which can influence SSI risk, might not have been comprehensively accounted for in the analysis.

Definition discrepancies: There might be variations in how SSIs are defined or diagnosed, potentially leading to discrepancies in reported rates.

Follow-up period: The 30-day postoperative period for assessing SSIs might not capture late-onset infections, particularly for certain types of surgeries.

Surgeon and staff variability: Different surgeons and medical teams might have different skill levels, experiences, and practices, which can influence SSI rates. This variability was not controlled for in the study.

Antibiotic usage: The study might not have detailed data on the timing, type, and duration of prophylactic antibiotics, which are critical factors in preventing SSIs.

Inherent biases: There might be inherent selection biases, with more complex cases or patients with significant comorbidities being more likely to be chosen for inpatient surgeries.

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