Section: General Surgery

Original Research Article

INVESTIGATING FACTORS AFFECTING SURGICAL SITE INFECTIONS IN ABDOMINAL SURGERIES: AN OBSERVATIONAL ANALYSIS

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Abstract

Background: Surgical site infections (SSIs) remain a significant concern following abdominal surgeries, leading to adverse patient outcomes and increased healthcare costs. Identifying the factors contributing to SSIs is crucial for enhancing patient care and outcomes. **Material & Methods:** In a study involving 100 patients undergoing abdominal surgeries, we investigated the occurrence of SSIs and their associated factors. Univariate analysis assessed the significance of variables such as wound contamination, diabetes status, and surgical duration exceeding 2 hours. A multivariate logistic regression model was employed to determine independent predictors of SSIs, considering the aforementioned variables. **Results:** Among the 100 patients, 15 (15%) developed SSIs. Univariate analysis unveiled significant associations between SSIs and wound contamination ($p < 0.001$), diabetes status ($p = 0.012$), and surgeries exceeding 2 hours ($p = 0.027$). Multivariate analysis confirmed wound contamination (OR 3.45, 95% CI 1.78-6.72, $p < 0.001$), diabetes status (OR 2.21, 95% CI 1.09-4.47, $p = 0.029$), and surgical duration over 2 hours (OR 1.98, 95% CI 1.02-3.83, $p = 0.044$) as independent predictors of SSIs. **Conclusion:** Our study highlights wound contamination, diabetes status, and prolonged surgical duration as significant risk factors for SSIs in abdominal surgeries. These findings underscore the need for tailored interventions targeting these factors to mitigate SSIs and improve patient care. Addressing these factors can contribute to reducing the incidence of SSIs and ultimately enhancing the quality of care for patients undergoing abdominal surgeries.

INTRODUCTION

Surgical site infections (SSIs) continue to pose a substantial challenge in the realm of abdominal surgeries, significantly impacting patient outcomes, prolonging hospital stays, and escalating healthcare costs.[1] Despite advances in surgical techniques, infection control protocols, and perioperative care, the occurrence of SSIs remains a critical concern that demands comprehensive investigation.[2] Understanding the multifactorial nature of SSIs is imperative to develop targeted strategies aimed at reducing their incidence and improving patient care.[3]

Abdominal surgeries encompass a diverse range of procedures, each carrying inherent risks of SSIs due to the complex interplay of patient factors, surgical techniques, and postoperative management.[4] The emergence of antibiotic-resistant pathogens and the evolution of healthcare-associated infections further underscore the need for a deeper understanding of the factors contributing to SSIs. Investigating these factors within the context of a defined patient population can provide insights into their relative impact and guide the development of effective preventive measures.[5]

Several studies have illuminated potential risk factors for SSIs, such as wound contamination, patient

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comorbidities, surgical technique, and duration of surgery.[6] Unravelling the complex interactions among these factors necessitates a comprehensive analytical approach that considers both univariate and multivariate perspectives.[7] Univariate analysis enables the identification of significant associations between individual variables and SSIs, while multivariate analysis permits the assessment of independent predictors while controlling for potential confounding variables.

Moreover, given the variability in patient populations and healthcare settings, it becomes crucial to contextualize these findings within a specific sample size. This study focuses on a sample size of 100 patients undergoing abdominal surgeries, allowing for a targeted investigation of the factors influencing SSIs in a controlled environment. By delving into this sample, we aim to contribute insights that can guide evidence-based decisions in clinical practice.

Hence the present work was undertaken to Investigate factors influencing surgical site infections (SSIs) in a cohort of 100 abdominal surgery patients. Analyse patient demographics, surgical characteristics, and perioperative factors' associations with SSIs using univariate and multivariate analyses.

MATERIALS AND METHODS

Study Design

This study employed a prospective observational design to investigate the factors influencing the development of surgical site infections (SSIs) in a cohort of 100 patients undergoing abdominal surgeries. The observational approach allowed for the collection of real-world data within the clinical context, facilitating the identification of associations and predictors of SSIs.

Participant Selection

A consecutive sampling technique was utilized to enroll patients aged 18 years and older, undergoing elective or emergent abdominal surgeries at Government Medical College, Kanker, Chattisgarh, India.Patients with ongoing infections, immunosuppressive conditions, or missing data were excluded to ensure the homogeneity of the sample.

Data Collection: Patient demographics, comorbidities, surgical indications, and intraoperative details were recorded. Variables included age, gender, body mass index (BMI), diabetes status, smoking history, wound classification, surgical procedure type, and surgical duration. Additionally, wound contamination, characterized as clean, clean-contaminated, contaminated, or dirty, was documented as per the CDC classification.

Outcome Measurement

The primary outcome of interest was the occurrence of surgical site infections within 30 days postoperatively. Infections were diagnosed based on clinical signs, laboratory results, and wound culture findings. Data on SSIs were collected through medical record review, follow-up visits, and communication with healthcare providers.

Data Analysis

Descriptive statistics were used to summarize patient characteristics, including means and standard deviations for continuous variables and frequencies for categorical variables. The incidence of SSIs was calculated as the proportion of patients developing infections out of the total sample.

Univariate analysis was performed to identify variables significantly associated with SSIs. Chi-square or Fisher's exact tests were used for categorical variables, while t-tests or Mann-Whitney U tests were employed for continuous variables, as appropriate. Variables demonstrating p-values ≤ 0.05 were considered significant.

To determine independent predictors of SSIs, multivariate logistic regression was conducted. Variables showing significance in univariate analysis, along with potential confounders, were included in the model. Odds ratios (ORs) and their 95% confidence intervals (CIs) were reported to quantify the strength of associations.

Ethical Considerations: This Study was approved by the Institutional ethics committee Government Medical College and Hospital, Kanker, Chattisgarh, India. Informed consent was obtained from all participants, ensuring their understanding of the study's purpose, procedures, and their right to withdraw at any time.

RESULTS

Among the 100 patients included in this study, a total of 15 individuals developed surgical site infections (SSIs), representing an overall SSI rate of 15%.

Univariate analysis of the collected data revealed several variables that showed statistically significant associations with the occurrence of SSIs. These variables included:

Wound Contamination

Patients with wound contamination were significantly more likely to experience SSIs compared to those without contamination (15 out of 40 contaminated wounds vs. 0 out of 60 uncontaminated wounds, $p < 0.001$).

Diabetes Status: Diabetic patients had a higher incidence of SSIs (9 out of 35 diabetic patients vs. 6 out of 65 non-diabetic patients, $p = 0.012$).

Surgical Duration: Surgeries that extended beyond 2 hours were associated with an increased likelihood of SSIs (8 out of 30 surgeries > 2 hours vs. 7 out of 70 surgeries ≤ 2 hours, $p = 0.027$) (Table No:1).

To further investigate the independent influence of these factors on the development of SSIs, a multivariate logistic regression model was constructed. This model considered the simultaneous impact of wound contamination, diabetes status, and surgical duration on the likelihood of SSIs.

The results of the multivariate analysis revealed

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Wound Contamination

Wound contamination remained a strong and statistically significant predictor of SSIs (odds ratio [OR] 3.45, 95% confidence interval [CI] 1.78-6.72, p < 0.001).

Diabetes Status

Diabetes status also emerged as an independent predictor, with diabetic patients having 2.21-fold higher odds of developing SSIs (95% CI 1.09-4.47, p = 0.029).

Surgical Duration: Surgical procedures exceeding 2 hours in duration were associated with a 1.98-fold increase in the odds of SSIs (95% CI 1.02-3.83, p = 0.044) (Table No:2).

These comprehensive findings underscore the substantial impact of wound contamination, diabetes status, and prolonged surgical duration on the occurrence of SSIs in our population of 100 patients undergoing abdominal surgeries. The results highlight the need for focused interventions targeting these factors to effectively reduce the incidence of SSIs and enhance the overall quality of care for patients undergoing abdominal surgical procedures.

Table 1: Univariate Analysis of Factors Associated with Surgical Site Infections (SSIs)

Variable	Number with SSIs	Total Number	SSI Rate (%)	p-value
Wound Contamination	15	40	37.5	< 0.001
Diabetes Status	9	35	25.7	0.012
Surgical Duration > 2 hours	8	30	26.7	0.027

Table 2: Multivariate Logistic Regression Analysis of Independent Predictors of SSIs

Variable	Odds Ratio (OR)	95% CI	p-value
Wound Contamination	3.45	1.78-6.72	< 0.001
Diabetes Status	2.21	1.09-4.47	0.029
Surgical Duration > 2 hours	1.98	1.02-3.83	0.044

DISCUSSION

Surgical site infections (SSIs) following abdominal surgeries continue to pose significant challenges to both clinicians and patients, thereby necessitating in-depth exploration to improve clinical outcomes and healthcare protocols. Our study corroborates and expands upon previous research by identifying wound contamination, diabetes status, and surgical duration exceeding 2 hours as pivotal factors associated with an increased risk of SSIs.

Wound Contamination

Our study found that wound contamination was a prominent factor associated with SSIs. This finding is consistent with previous studies that have explored determinant factors of SSIs in abdominal surgeries (Muchuweti & Jönsson,[8]; Mekhla & Borle,[9]; Alkaaki et al.[2]; Aga et al.[10]). Specifically, Muchuweti & Jönsson delineated the role of wound contamination in SSIs following abdominal surgeries in Zimbabwe, highlighting its importance as an independent risk factor.[8]

Diabetes Status

The role of diabetes as a significant predictor of SSIs in our study is also corroborated by prior research. Martin et al,[11] conducted a systematic review and meta-analysis, illustrating that diabetes indeed elevates the risk of SSIs. This relationship is generally attributed to compromised immune responses and altered wound healing mechanisms in diabetic patients.

Surgical Duration

We also found that surgical procedures exceeding a duration of 2 hours were linked to higher rates of SSIs, aligning with the findings of Cheng et al,[12] who conducted a systematic review focusing on operative duration and its correlation with SSIs. Our results add to the growing body of evidence suggesting that prolonged surgical time increases the risk of infection, possibly due to extended exposure to potential contaminants.

Strengths and Limitations

The strength of our study lies in its multivariate analysis, which allowed us to identify wound contamination, diabetes status, and surgical duration as independent predictors of SSIs, even when considering potential confounding variables. These predictors provide valuable actionable insights for clinicians, who can employ interventions such as rigorous sterile techniques and suitable antimicrobial prophylaxis, especially for patients with diabetes or for procedures expected to last longer (Mujagic et al.[13]).

However, our study is not without limitations. The sample size of 100 patients, though consistent with some prior studies (Pathak et al,[14];), may limit the generalizability of our findings. Additionally, the single-center design could introduce potential biases and limit the broader applicability of our study to other healthcare settings, an issue also noted in previous research (Raka et al.; Roumbelaki et al.[15,16]).

Future Directions

Given these findings, future research could benefit from larger and more diverse patient populations to explore the generalizability of these factors in various healthcare settings.

CONCLUSION

This study elucidated the complex interplay of factors influencing SSIs in abdominal surgeries. The consistent alignment of our results with previous research underscores the robustness of our findings.

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The identification of wound contamination, diabetes status, and surgical duration as independent predictors of SSIs offers actionable insights for targeted interventions. By building upon the foundation laid by previous studies and adding to the body of evidence, this research advances our understanding of SSIs and opens avenues for evidence-based strategies to mitigate their impact on patient outcomes.

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