The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 5, 2025

FREQUENCY OF SURGICAL SITE INFECTION IN PATIENTS UNDERGOING SURGERY AND ITS ASSOCIATION WITH DURATION OF SURGERY, BLOOD TRANSFUSION, INTRAOPERATIVE BLOOD LOSS AND TYPE OF SURGERY

Dr. Urooj Asad[*1], Dr. Riaz Ahmed Chaudhry[2]

*[*1]Post Graduate Trainee (FCPS General Surgery), DHQ Hospital, Mirpur.*
[2]Professor and Head of Surgery Department (Study Supervisor), DHQ Hospital, Mirpur.

[*1]urooj.asad372@gmail.com

DOI: https://doi.org/10.5281/zenodo.15550912

Keywords
Blood Transfusion, Duration of Surgery, Intraoperative Blood Loss, Surgical Site Infection, Type of Surgery.

Article History
Received on 21 April 2025
Accepted on 21 May 2025
Published on 30 May 2025

Corresponding Author: *
Dr. Urooj Asad

Abstract

Background: *Surgical Site Infection (SSI) leads to adverse outcomes, with its frequency influenced by factors like age, blood loss, transfusion, type and duration of surgery. The controversy in existing literature prompted this study to clarify these associations for improved future practice in SSI management.*

Objectives: *1) To determine the frequency of surgical site infection in patients presenting for surgery at General Surgery Department, Divisional Head Quarter Hospital Mirpur, AJK. 2) To determine frequency of SSI based on duration of surgery, blood transfusion, intra-operative blood loss and type of surgery.*

Duration: *Six months w.e.f 11-11-2023 to 10-05-2023*

Methodology: *After approval from the hospital review committee, 150 adult patients meeting the inclusion criteria were enrolled. Informed consent was obtained, and demographics recorded. Each patient underwent surgery under general anesthesia. Surgery duration, blood loss, and Hb levels were noted. Blood transfusion was administered if necessary. Standard antibiotics were given, and patients were discharged. Follow-up on day 10 assessed SSI, managed by duty staff, with confounding variables controlled by exclusion.*

Results: *The study included 150 participants with a mean age of 41.7 ± 12.24 years. Most were aged 41-60 years (54.7%, n=68), and 51.3% (n=82) were male. Surgical procedures were 58.7% appendectomy (n=88), 24.0% exploratory laparotomy (n=36), and 17.3% hernia repair (n=26). The average surgery duration was 103.8 ± 20.86 minutes, with 28% lasting 2 hours or more. Intraoperative blood loss averaged 128.47 ± 122.25 ml, and 8.7% required blood transfusions. SSI occurred in 32.7% of patients, particularly in longer surgeries, significant blood loss, and emergency cases.*

Conclusion: *In conclusion, this study found that 32.7% (n=49) of patients developed SSI. Factors such as age, gender, procedure type, surgery duration, blood loss, transfusion, and surgery nature influenced SSI incidence, emphasizing the need for targeted preventive measures.*

INTRODUCTION

Surgical site infection (SSI) refers to infections that occur at the incision site within 30 days of surgery.[1] It is a hospital-acquired infection (HAI) linked to surgical procedures. SSI remains a common and significant complication, contributing to increased morbidity, mortality, and healthcare costs.[2] Despite advancements in surgical techniques and the use of antibiotic prophylaxis, SSI persists as a major issue globally, varying in frequency across different hospitals and procedures.[3] Addressing this challenge is crucial for improving patient outcomes and reducing the burden on healthcare systems.[4] Worldwide frequency of SSI has been reported as 10.9% in Rawanada,[1] 21.1% in Ethopia,[5] 24.6% in Ehtopia,[6] 27.5% in Sudan,[7] 12.5% in India[8] and 33.68% in Pakistan.[9]

The causes of SSIs are multi-factorial, recognized risk factors include the duration of surgery, blood transfusion, intra operative blood loss and type of surgery.[10] SSI can be prevented by identifying and mitigating the predisposing factors.[11]

Mukagendaneza et al.[1] reported a significantly higher rate of surgical site infections (SSI) in patients with surgery durations of ≥2 hours compared to those with <2 hours (16.8% vs. 8.3%; p=0.026), in patients receiving blood transfusions compared to those without (39.3% vs. 8.6%; p<0.001), and in patients undergoing emergency surgeries versus elective surgeries (19.7% vs. 2.8%; p<0.001). These findings suggest the importance of closely monitoring patients with longer surgeries, those receiving blood transfusions, and those undergoing emergency procedures. Prophylactic antibiotics may also be crucial for these patients. However, other studies report differing results. Hassan et al.[7] found no significant difference in SSI rates based on surgery duration (58.3% vs. 14.0%; p>0.05) or blood loss (42.9% vs. 19.7%; p>0.05). Similarly, Mezemir et al.[6] observed a higher SSI rate with surgery durations >2 hours, but the difference was not statistically significant (34.3% vs. 25.5%; p>0.05). Misha et al.[5] found a significantly higher SSI rate in surgeries lasting ≥2 hours (45.28% vs. 54.72%; p<0.001), but no significant difference between patients with or without blood transfusions (16.98% vs. 14.65%; p=0.646). Given the limited resources in Pakistan, further local studies are necessary to conclusively assess the impact of these factors on SSI rates and to develop targeted preventive strategies.

METHODOLOGY

This descriptive study was conducted in the Department of General Surgery, Divisional Head Quarter Hospital, Mirpur, AJK, over a period of 6 months following the approval of the synopsis. The sample size of 150 cases was calculated using the WHO calculator, with a 95% confidence level and a 5% margin of error, assuming the expected frequency of SSI in patients to be 10.9%.[1] Non-probability consecutive sampling was used for participant selection. The inclusion criteria included patients aged 18-60 years, of both genders, with ASA status I/II undergoing surgery, while the exclusion criteria included patients who had undergone surgery within a month prior to the study or had a diagnosis of SSI before the surgery. The study defined Surgical Site Infection (SSI) as the presence of at least two out of three clinical signs: redness around the wound, serosanguineous discharge, or fever above 100°F, occurring within 10 days of surgery. Surgery duration was calculated by measuring the time from the first cut to the last stitch, while intraoperative blood loss was measured using a surgical tray and soaked gauze weight. Blood transfusion was considered necessary if the patient's Hb level fell below 8 mg/dl. After obtaining informed consent from all participants, demographic data was collected. Each patient underwent surgery according to their specific needs under general anesthesia, and their intraoperative data was recorded. The patients were administered standard antibiotic therapy and were discharged accordingly. A follow-up visit was scheduled for the 10th postoperative day to check for SSI, with the consultant making the final determination. Data was entered and analyzed using SPSS version 25. Numerical variables such as age, surgery duration, and blood loss were presented as mean ± SD, while categorical variables like gender, surgical procedure, and SSI status were presented as frequencies and percentages. Stratification of SSI frequency by factors such as age, gender, surgical procedure, and blood transfusion was performed, and a chi-square test was applied to assess significance, with a p-value of ≤0.05 considered significant.

RESULTS

The study included 150 participants with a mean age of 41.7 ± 12.24 years. The majority of participants were between 41-60 years old (54.7%), while 45.3% were aged 18-40 years. In terms of gender, 51.3% of the participants were male, and 48.7% were female. Regarding the surgical procedures performed, 58.7% underwent appendectomy, 24.0% had exploratory laparotomy, and 17.3% had hernia repair. The mean duration of surgery was 103.8 ± 20.86 minutes, with 72.0% of surgeries lasting less than 2 hours, and 28.0% lasting 2 hours or more. Intraoperative mean blood loss was 128.47 ± 122.25 ml, with 91.3% of participants experiencing blood loss of less than 500 ml, while 8.7% had blood loss of 500 ml or more. Blood transfusion was required for 8.7% of participants, while 91.3% did not receive a transfusion. Lastly, 44.7% of the surgeries were elective, while 55.3% were emergency procedures. Data is given in Table 1.0. Out of the 150 participants, 49 (32.7%) had Surgical Site Infections (SSI) as given in Table 2.0.

The frequency of Surgical Site Infection (SSI) was higher in patients aged 41-60 years (34.1%) than 18-40 years (30.9%; p=0.671). Males had a higher SSI rate than females (35.1% vs. 30.1%; p=0.520). Among procedures, appendectomy had the highest SSI rate (34.1%) followed by exploratory laparotomy (33.3%) and hernia repair (26.9%; p=0.787). SSI was significantly higher in surgeries lasting ≥2 hours (45.2%) versus <2 hours (27.8%; p=0.041), in patients with blood loss ≥500 ml (61.5%) versus <500 ml (29.9%; p=0.029), those receiving blood transfusions (61.5% vs. 29.9%; p=0.029), and in emergency surgeries (39.8% vs. 23.9%; p=0.039), as shown in Table 3.0.

Table Error! No text of specified style in document.**.1 Demographic Characteristics of Patients included in the Study**

Characteristics	Participants (n=150)
Age (years)	41.70±12.24
• 18-40 years	68 (45.3%)
• 41-60 years	82 (54.7%)
Gender	
• Male	77 (51.3%)
• Female	73 (48.7%)
Surgical Procedure	
• Appendectomy	88 (58.7%)
• Exploratory Laparotomy	36 (24.0%)
• Hernia Repair	26 (17.3%)
Duration of Surgery	103.80±20.86
• <2 hrs	108 (72.0%)
• ≥ hrs	42 (28.0%)
Intraoperative Blood Loss	128.47±122.25
• <500 ml	137 (91.3%)
• ≥ 500 ml	13 (8.7%)
Blood Transfusion	
• Yes	13 (8.7%)
• No	137 (91.3%)
Type of Surgery	
• Elective	67 (44.7%)
• Emergency	83 (55.3%)

Table 2.1 Frequency of SSI in Patients after General Surgery

SI	Frequency (n)	Percent (%)
Yes	49	32.7 %
No	101	67.3 %
Total	150	100.0 %

Table Error! No text of specified style in document.**.2 Stratification of Frequency of SSI on the basis of Subgroups of Demographics**

Subgroups	n	SSI n (%)	P-value
Age (years)			
• 18-40 years	68	21 (30.9%)	0.671
• 41-60 years	82	28 (34.1%)	
Gender			
• Male	77	27 (35.1%)	0.520
• Female	73	22 (30.1%)	
Surgical Procedure			
• Appendectomy	88	30 (34.1%)	0.787
• Exploratory Laparotomy	36	12 (33.3%)	
• Hernia Repair	26	7 (26.9%)	
Duration of Surgery			
• <2 hrs	108	30 (27.8%)	0.041
• ≥ hrs	42	19 (45.2%)	
Intraoperative Blood Loss			
• <500 ml	137	41 (29.9%)	0.029
• ≥ 500 ml	13	8 (61.5%)	
Blood Transfusion			
• Yes	13	8 (61.5%)	
• No	137	41 (29.9%)	0.029
Type of Surgery			
• Elective	67	16 (23.9%)	0.039
• Emergency	83	33 (39.8%)	

Chi-square test/Fisher's Exact test, observed difference was statistically significant where p-value≤0.05.

DISCUSSION

SSI is a critical issue in healthcare.[12] Existing literature on the frequency of SSI remains controversial, with varying findings on its association with multiple factors. Key factors such as age, gender, the type of procedure, intraoperative blood loss, blood transfusion, and the duration of surgery have been explored, but their roles in increasing SSI risk are still debated.[13,14] Some studies suggest that longer surgeries, significant blood loss, and blood transfusion may elevate the likelihood of infection, while others show conflicting results.[1,5-9] So, this study was planned to establish a clearer understanding of these associations and to provide a clear line of action for future practice in preventing and managing SSIs.

The mean age of patients undergoing general surgical procedures in this study was 41.7 ± 12.24 years, with the majority (54.7%) aged between 41-60 years and 45.3% aged 18-40 years. Similar studies have reported comparable findings, with a mean age of 40.14±16.7 years by Mukagendaneza et al., 51±16 years by Hassan et al.,[7] and 39.33±2.74 years by Saeed et al.[15] Misha et

al.[5] found that 85.3% of patients were under 60 years of age, with the remaining 14.7% aged 60 or older. In contrast, Saeed et al.[15] reported 27.08% of patients in the <18 years age group, 37.5% in the 19-50 years group, and 35.41% in the >50 years group. Regarding gender, 51.3% of participants in this study were male, and 48.7% were female. This male predominance is consistent with findings from Mukagendaneza et al. (69.0%),[1] Hassan et al. (50.4%),[7] and Saeed et al. (62.05%).[15] However, studies by Mishra et al.[5] and Mezemire et al.[6] reported a smaller proportion of males, accounting for 49.5% and 40.1% of their study populations, respectively. In this study, 44.7% of the surgeries were elective, while 55.3% were emergency procedures. The frequency of elective procedures in similar studies was reported as 48.3% by Mukagendaneza et al.,[1] 33.5% by Misha et al.,[5] and 58.8% by Hassan et al.[7]

The frequency of SSI in this study was 32.7%, which falls between the SSI rates reported by Hassan et al.[7] in Sudan (27.5%) and Iqbal et al.[16] in Pakistan (38.0%). Other studies have reported varying frequencies of SSI, including 10.9% by Mukagendaneza et al.[1] in Rwanda, 11.0% by Guest et al.[17] in the UK, 9.16% by Saeed et al.[15] in Pakistan, 19.3% by Hassan et al.[7] in Sudan, 21.2% by Misha et al.[5] in Ethiopia, and 24.6% by Mezemir et al.[6] in Ethiopia. Mohan et al.[18] in India reported an overall SSI frequency of 5.6% across various surgical procedures, with higher rates observed after appendectomy (15.6%), hernia repair (18.6%), and cholecystectomy (17.9%). Additionally, Kumar et al. in India reported an SSI frequency of 12.5% after general surgeries.[8]

The frequency of SSI was higher in patients aged 41-60 years (34.1%) than 18-40 years (30.9%; p=0.671). Males had a higher SSI rate than females (35.1% vs. 30.1%; p=0.520). Among procedures, appendectomy had the highest SSI rate (34.1%) followed by exploratory laparotomy (33.3%) and hernia repair (26.9%; p=0.787). SSI was significantly higher in surgeries lasting ≥2 hours (45.2%) versus <2 hours (27.8%; p=0.041), in patients with blood loss ≥500 ml (61.5%) versus <500 ml (29.9%; p=0.029), those receiving blood transfusions (61.5% vs. 29.9%; p=0.029), and in emergency surgeries (39.8% vs. 23.9%; p=0.039).

A comparison of our findings with existing literature reveals some notable similarities and differences. Mukagendaneza et al.[1] reported a significantly higher rate of SSI in patients with surgery duration ≥2 hours compared to those with <2 hours (16.8% vs. 8.3%; p=0.026), in patients receiving blood transfusions compared to those without (39.3% vs. 8.6%; p<0.001), and in emergency surgeries compared to elective ones (19.7% vs. 2.8%; p<0.001). Hassan et al.[7] found that SSI was insignificantly higher in patients with longer surgery durations compared to shorter durations (58.3% vs. 14.0%; p>0.05), and in those with blood loss greater than 500 ml compared to those with less (42.9% vs. 19.7%; p>0.05). Mezemir et al.[6] reported a higher SSI frequency in patients with surgery duration >2 hours compared to those with <2 hours (34.3% vs. 25.5%; p>0.05). Misha et al.[5] found a significantly higher SSI frequency in patients with surgeries lasting ≥2 hours (45.28% vs. 54.72%; p<0.001), but no significant difference in SSI rates between patients with and without blood transfusions (16.98% vs. 14.65%; p=0.646). Saeed et al.[15] demonstrated a significant increase in the rate of SSI with advancing age. Kumar et al.[8] reported a significantly higher 17.7% SSI rate associated with emergency surgeries compared to 12.5% for elective surgeries. Additionally, they found that surgeries lasting longer than 2 hours had higher frequency of SSI but the difference was not significant.

CONCLUSION

In conclusion, this study found that 32.7% of patients developed Surgical Site Infections (SSI). Factors such as age, gender, surgical procedure type, surgery duration, intraoperative blood loss, blood transfusion, and the nature of the surgery were found to influence the incidence of SSI. These findings highlight the need for targeted preventive measures to reduce infection risks, particularly in surgeries with longer durations, significant blood loss, and emergency procedures.

LIMITATIONS & RECOMMENDATIONS

Strengths of this study include its comprehensive analysis of various factors influencing Surgical Site Infections (SSI), such as age, surgery duration, blood transfusion, and the type of procedure. The findings align with those of previous studies, adding to the

body of knowledge on SSI. However, limitations include the relatively small sample size and the lack of long-term follow-up. Future research could focus on larger, multi-center studies to confirm these findings and develop effective strategies for preventing SSI, particularly in high-risk patients.

Conflict of Interest: None
Source of Funding: None

Authors Contribution

Author 1

Substantial contributions to study design, acquisition of data
Analysis & Interpretation of Data, Manuscript writing
Has given final approval of the version to be published
Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Author 2

Substantial contributions to concept, study design
Data Analysis, Manuscript writing, Critical Review
Has given final approval of the version to be published
Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

REFERENCES

1. Mukagendaneza MJ, Munyaneza E, Muhawenayo E, Nyirasebura D, Abahuje E, Nyirigira J, et al. Incidence, root causes, and outcomes of surgical site infections in a tertiary care hospital in Rwanda: a prospective observational cohort study. Patient Saf Surg. 2019;13(1):1-8.
2. Alverdy JC, Hyman N, Gilbert J. Re-examining causes of surgical site infections following elective surgery in the era of asepsis. Lancet Infect Dis 2020; 20(3):38-43.
3. Seidelman JL, Mantyh CR, Anderson DJ. Surgical site infection prevention: a review. J Am Med Assoc 2023; 329(3):244-52.
4. Abukhodair AW, Alqarni MS, Bukhari ZM, Qadi A Sr, Mufti HN, Fernandez JA, et al. Association between post-operative infection and blood transfusion in cardiac surgery. Cureus 2020;12(7):2-11.
5. Misha G, Chelkeba L, Melaku T. Incidence, risk factors and outcomes of surgical site infections among patients admitted to Jimma medical center, South West Ethiopia: prospective cohort study. Ann Med Surg (Lond) 2021; 65(1):1-8.
6. Mezemir R, Seid A, Gishu T, Demas T, Gize A. Prevalence and root causes of surgical site infections at an academic trauma and burn center in Ethiopia: a cross-sectional study. Patient Saf Surg 2020; 14(3):1-7.
7. Hassan RSEE, Osman SOS, Aabdeen MAS, Mohamed WEA, Hassan RSEE, Mohamed SOO. Incidence and root causes of surgical site infections after gastrointestinal surgery at a public teaching hospital in Sudan. Patient Saf Surg 2020; 14(1):1-7.
8. Kumar A, Rai A. Prevalence of surgical site infection in general surgery in a tertiary care centre in India. Int Surg J. 2017;4(9):3101-6.
9. Sattar F, Sattar Z, Zaman M, Akbar S. Frequency of post-operative surgical site infections in a tertiary care hospital in Abbottabad, Pakistan. Cureus 2019;11(3):e4243.
10. Liang Z, Rong K, Gu W, Yu X, Fang R, Deng Y, et al. Surgical site infection following elective orthopaedic surgeries in geriatric patients: incidence and associated risk factors. Int Wound J 2019; 16(3):773-80.
11. Ansari S, Hassan M, Barry HD, Bhatti TA, Hussain SZM, Jabeen S, et al. Risk factors associated with surgical site infections: a retrospective report from a developing country. Cureus 2019; 11(6):1-7.
12. Birhanu A, Amare HH, Girma T, Tadesse M, Assefa DG. Magnitude of surgical site infection and determinant factors among postoperative patients, a cross sectional study. Ann Med Surg. 2022;83:104324.

13. Park SY, Kang T, Jeong WK, Song JE. Prevalence, risk factors, and postoperative infection rates of blood transfusion in lumbar spinal fusion surgery: a nationwide population-based study. J Clin Med. 2024;13(16):4867.
14. Aeschbacher P, Nguyen TL, Dorn P, Kocher GJ, Lutz JA. Surgical site infections are associated with higher blood loss and open access in general thoracic practice. Front Surg. 2021;8:656249.
15. Saeed S, Amin SM, Ahmed I, Nisa ZU, Bashir J, Anwar M. Incidence of surgical site infections and its associated factors: a cross sectional study. Pak J Med Health Sci. 2022;16(02):1028-30.
16. Iqbal S, Iftikhar M, Qureshi HU, Khan AG, Ullah S. Frequency of surgical site infection after appendicectomy. J Peoples Uni Med Health Sci Nawabshah. 2024;14(3):32-7.
17. Guest JF, Fuller GW, Griffiths B. Cohort study to characterise surgical site infections after open surgery in the UK's National Health Service. BMJ Open. 2023;13(12):e076735.
18. Mohan N, Gnanasekar D, Sowmya TK, Ignatious A. Prevalence and risk factors of surgical site infections in a Teaching Medical College in the Trichy District of India. Cureus. 2023;15(5):1-10.