

FACTOR INVOLVED IN POST-OPERATIVE WOUND INFECTIONS IN A POTENTIALLY CLEAN CASE IN GENERAL SURGERY WARD

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Abstract

Background: Post-operative wound infections represent a prevalent complication in surgical procedures, leading to heightened morbidity and mortality rates. A variety of patient-related factors, including diabetes and obesity, as well as procedural elements, significantly affect infection rates. This study seeks to elucidate the primary risk factors associated with post-operative wound infections in clean surgical cases at Ghurki Trust Teaching Hospital, Lahore.

Objective: The objective of this study was to identify the factors contributing to post-operative wound infections in potentially clean surgical cases within a general surgery ward, with particular emphasis on local patient demographics and surgical practices.

Methods: A cross-sectional study was conducted over a six-month period in the Department of Surgery at Ghurki Trust Teaching Hospital, Lahore. A total of 110 patients who developed post-operative wound infections were selected through non-probability consecutive sampling. Data regarding demographic characteristics, surgical procedures, and risk factors—including age over 50 years, diabetes, smoking, anemia, obesity, hospital stay exceeding three days, ASA score greater than 2, and prolonged operative time—were collected using a structured proforma. Data analysis was performed utilizing SPSS version 26, employing both descriptive and inferential statistics, including chi-square tests to assess associations. $p < 0.05$

Conclusion: The study identified diabetes, obesity, prolonged hospital stays, and an ASA score greater than 2 as significant contributors to post-operative wound infections. These results underscore the necessity for targeted preoperative management and infection prevention strategies,

particularly for patients at high risk. Further research is warranted to validate these findings and to inform enhancements in surgical practices and patient care.

INTRODUCTION

Surgery is responsible for the majority of hospital infections, injuries, accidents, disabilities, and fatalities within the worldwide healthcare system. The annual number of patients undergoing surgical treatment is significant and on the rise.¹ Post-surgical wound infections are a prevalent issue in healthcare. The development of these infections is intricate and involves various biological pathways at the molecular level. Such infections contribute significantly to both illness and death rates.² The occurrence of postoperative wound infections varies based on the type of surgery and can happen in 5–20% of cases. These infections can lead to an additional 7–11 days in the hospital and increase the risk of death by 2–11 times compared to similar patients without infections. It is estimated that up to 60% of these infections can be avoided. To prevent postoperative wound infections, it is essential to maintain proper hygiene, ensure surgical sterility, and implement effective measures to prevent the spread of infections before, during, and after the procedure.¹

Of course, relative disregard for postoperative factors may be justified if implementation of the current “best practice” measures alone were sufficient in eliminating postoperative infection in the 21st century. Unfortunately, as many surgeons and professionals in infection prevention are painfully aware, the war is far from being won, with many patients continuing to develop such surgical complications despite implementation of best practice measures, including compliance with standard antibiotic prophylaxis.^{3,5} There is a growing focus on distinguishing between superficial, deep incisional, and organ space infections in research on risk associations. This aims to enhance the identification and comparison of risk factors across different studies and healthcare facilities. In clinical practice, deep and organ space infections tend to result in longer hospital stays, increased readmission rates, and greater overall morbidity compared to superficial incisional infections.^{6,7}

Risk factors can be categorized into those related to the patient and those related to the procedure. Patient-related risk factors for wound infection encompass advanced age, malnutrition, low blood volume, obesity, steroid use, diabetes, the use of immunosuppressive drugs, smoking, and existing infections in other areas of the body. On the other hand, procedure-related risk factors include the development of a hematoma, the use of foreign materials like drains, the presence of dead space, previous infections, the length of the surgical scrub, preoperative shaving, inadequate skin preparation, lengthy surgeries, poor surgical techniques, hypothermia, contamination from the operating room, and extended hospital stays during the perioperative period.⁸

A meta-analysis indicated that factors such as an operative time exceeding 60 minutes (AOR = 1.78; 95% CI: 1.08–2.94), the presence of diabetes (AOR = 3.25; 95% CI: 1.51–6.99), an ASA score greater than 1 (AOR = 2.51; 95% CI: 1.07–5.91), and a hospital stay longer than 7 days (AOR = 5.76; 95% CI: 1.15–28.86) were significantly linked to post-operative wound infections.¹⁰

The purpose of this study is to identify the factors contributing to post-operative wound infections in potentially clean cases within the general surgery ward. Previous literature has indicated that certain factors can increase the likelihood of these infections. Although there has been one local study on this topic, there is still a need for updated data specific to the local population. Thus, we aim to conduct this research to enable the application of our findings in the local context in the future. This will enhance our practices and knowledge, allowing us to address risk factors before or after surgery to prevent post-operative wound infections.

MATERIALS AND METHOD:

This cross-sectional study took place at the Department of Surgery, Ghurki Trust Teaching Hospital in Lahore, over a period of six months after

receiving ethical approval. A total of 110 patients with post-operative wound infections were selected through non-probability consecutive sampling. Information regarding demographic characteristics, surgical procedures, and risk factors (such as age over 50, diabetes, smoking, anemia, obesity, hospital stays longer than 3 days, ASA score greater than 2, and extended operative time) was gathered using a structured form. All surgeries were conducted by the same surgical team under general or local anesthesia. The inclusion criteria included patients aged 20 to 70 of any gender who were diagnosed with post-operative wound infections according to the

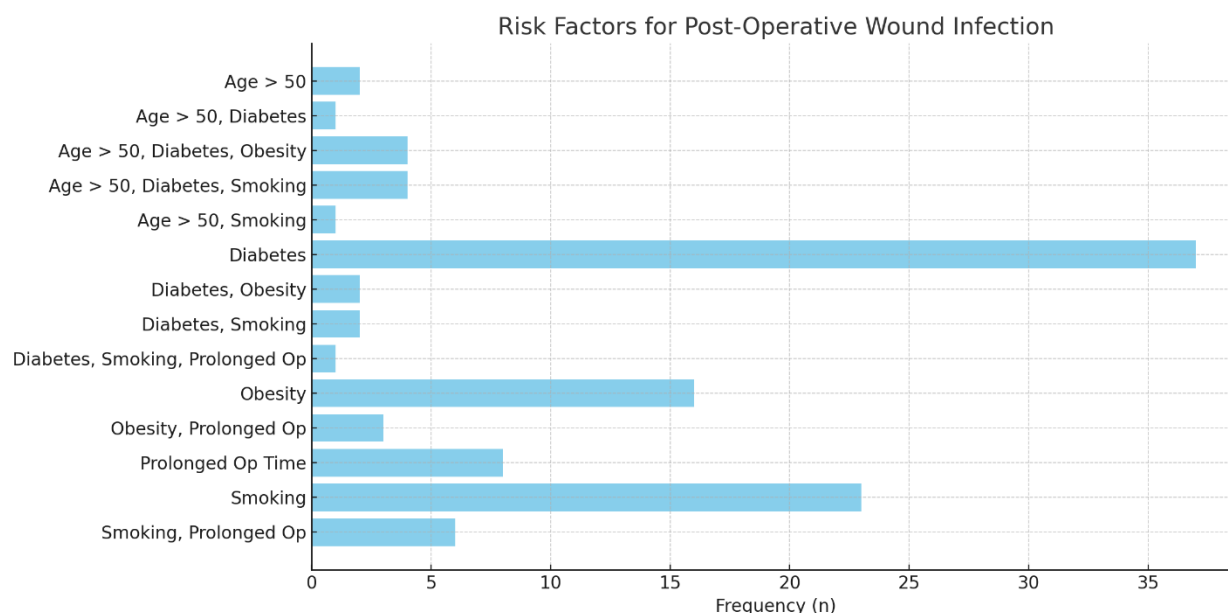
operational definition. Patients who had emergency surgeries or were undergoing re-operations after the initial surgery were excluded, as were those lost to follow-up for at least 30 days post-surgery. Data analysis was performed using SPSS version 26, with quantitative variables reported as mean $\pm$ SD and qualitative variables as frequencies and percentages. Stratified analyses were conducted based on gender, type of surgical procedure, and the duration between surgery and infection, with a chi-square test used to evaluate associations. A p-value of ≤ 0.05 was deemed significant.

RESULTS:

Table 1: Summary of Post-Operative Wound Infection Factors

Factor	Frequency (n)	Percentage (%)
Total Cases	110	100%
Gender		
Male	52	47.27%
Female	58	52.73%
Age Group (years)		
25-30	17	15.45%
30-35	9	8.18%
35-40	16	14.55%
40-50	25	22.73%
50-55	24	21.82%
55-60	10	9.09%
60-65	6	5.45%
65-70	3	2.73%
BMI Category		
Normal	43	39.09%
Overweight	36	32.73%
Obese	28	25.45%
Very Obese	3	2.73%
Infection Developed Within		
1 Week	91	82.73%
2 Weeks	19	17.27%
Risk Factors		
Age > 50	2	1.82%
Age > 50, Diabetes	1	0.91%
Age > 50, Diabetes, Obesity	4	3.64%
Age > 50, Diabetes, Smoking	4	3.64%
Age > 50, Smoking	1	0.91%
Diabetes	37	33.64%
Diabetes, Obesity	2	1.82%

Diabetes, Smoking	2	1.82%
Diabetes, Smoking, Prolonged Operation	1	0.91%
Obesity	16	14.55%
Obesity, Prolonged Operation	3	2.73%
Prolonged Operation Time	8	7.27%
Smoking	23	20.91%
Smoking, Prolonged Operation	6	5.45%
ASA Score		
<2	89	80.91%
>2	21	19.09%
Hospital Stay > 3 Days		
Yes	36	32.73%
No	74	67.27%



The study evaluated post-operative wound infections among 110 patients, with a slight female predominance (52.73%). Most patients were between 40–55 years of age (44.55%). Regarding body mass index (BMI), a significant proportion were overweight (32.73%) or obese (25.45%), both recognized risk factors for wound infections. A majority of infections (82.73%) developed within the first week post-surgery, while 17.27% occurred within the second week. Among the risk factors

identified, diabetes was the most common (33.64%), followed by smoking (20.91%), obesity (14.55%), and prolonged operation time (7.27%). Combined risk factors such as diabetes with obesity or smoking were also observed but were less frequent.

Additionally, 19.09% of patients had an ASA score greater than 2, indicating higher surgical risk, and 32.73% had a hospital stay longer than three days.

INTERPRETATION:

Table 2: Distribution of Risk Factors by Demographic and Clinical Characteristics

Gender	Female	Male	p-value
Age> 50	1	1	
Age> 50, Diabetes	1	0	
Age> 50, Diabetes, Obesity	3	1	
Age> 50, Diabetes, Smoking	0	4	
Age> 50, Smoking	0	1	
Diabetes	27	10	
Diabetes, Obesity	2	0	<.001
Diabetes, Smoking	1	1	
Diabetes, Smoking, Prolonged operation	0	1	
Obesity	14	2	
Obesity, Prolonged operation	3	0	
Prolonged operation time	5	3	
Smoking	1	22	
Smoking, Prolonged operation	0	6	

Age	25-30	30-35	35-40	45-50	50-55	55-60	60-65	65-70	p-value
Age> 50	0	0	0	0	0	0	1	1	
Age> 50, Diabetes	0	0	0	0	1	0	0	0	
Age> 50, Diabetes, Obesity	0	0	0	1	1	2	0	0	
Age> 50, Diabetes, Smoking	0	0	0	0	2	0	2	0	
Age> 50, Smoking	0	0	0	0	0	1	0	0	.001
Diabetes	2	1	6	8	12	4	2	2	

Diabetes, Obesity	0	2	0	0	0	0	0	0
Diabetes, Smoking	0	0	1	1	0	0	0	0
Diabetes, Smoking, Prolonged operation	0	0	1	0	0	0	0	0
Obesity	3	0	2	5	4	2	0	0
Obesity, Prolonged operation	1	0	0	0	2	0	0	0
Prolonged operation time	2	2	0	1	2	0	1	0
Smoking	8	3	4	7	0	1	0	0
Smoking, Prolonged operation	1	1	2	2	0	0	0	0

BMI	Normal	Obese	Overweight	Very obese	p-value
Age> 50	1	0	1	0	
Age> 50, Diabetes	1	0	0	0	
Age> 50, Diabetes, Obesity		3	1		
Age> 50, Diabetes, Smoking	1	2	1	0	
Age> 50, Smoking	0	0	1	0	
Diabetes	11	10	16		
Diabetes, Obesity	0	2	0	0	.002
Diabetes, Smoking	2				
Diabetes, Smoking, Prolonged operation	1	0	0	0	
Obesity	0	7	6	3	
Obesity, Prolonged operation		2	1	0	
Prolonged operation time	6	0	2	0	
Smoking	15	2	6	0	

Smoking, operation	Prolonged	5	0	1	0
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infection developed	1 week	2 week	p-value
Age> 50	2		
Age> 50, Diabetes	1		
Age> 50, Diabetes, Obesity	4		
Age> 50, Diabetes, Smoking	2	2	
Age> 50, Smoking	1		
Diabetes	28	9	
Diabetes, Obesity	2		
Diabetes, Smoking	2		.809
Diabetes, Smoking, Prolonged operation	1		
Obesity	14	2	
Obesity, Prolonged operation	3		
Prolonged operation time	6	2	
Smoking	20	3	
Smoking, Prolonged operation	5	1	

ASA Score	Less than 2	More than 2	p-value
Age> 50	1	1	
Age> 50, Diabetes	1		
Age> 50, Diabetes, Obesity	1	3	
Age> 50, Diabetes, Smoking	1	3	
Age> 50, Smoking		1	
Diabetes	28	9	
Diabetes, Obesity	2		
Diabetes, Smoking	2		
Diabetes, Smoking, Prolonged operation	1		.001
Obesity	12	4	
Obesity, Prolonged operation	3		
Prolonged operation time	8		
Smoking	23		
Smoking, Prolonged operation	6		

Hospital stay > 3 days	No	Yes	p-value
Age> 50	1	1	
Age> 50, Diabetes	1		
Age> 50, Diabetes, Obesity	1	3	
Age> 50, Diabetes, Smoking	1	3	
Age> 50, Smoking	1		
Diabetes	18	19	
Diabetes, Obesity	2		.001
Diabetes, Smoking	2		
Diabetes, Smoking, Prolonged operation	1		
Obesity	11	5	
Obesity, Prolonged operation	3		
Prolonged operation time	3	5	
Smoking	23		
Smoking, Prolonged operation	6		

The key findings from the table highlight several important trends in the distribution of risk factors across different age groups. The 45-50 and 50-55 age groups are most commonly associated with a combination of risk factors, such as diabetes, obesity, and prolonged operation times, suggesting that these age groups are at higher risk for multiple health complications. Diabetes is particularly prevalent in the 50-55 age group, followed by the 45-50 group, indicating that the likelihood of developing diabetes increases with age. Obesity is also commonly observed in individuals aged 45-50, with a notable occurrence in the 25-30 age group as well, pointing to a significant risk factor for middle-aged individuals. Smoking is more prevalent in the younger 25-30 age group, though it continues to be a concern in individuals up to age 50, often in combination with diabetes and prolonged operation time. Prolonged operation times are seen more frequently in individuals aged 25-35 and 45-50, suggesting that these individuals may require more invasive medical procedures due to their health conditions. Overall, older adults, particularly those aged 45-55, tend to have multiple risk factors, which could imply a need for more comprehensive healthcare management and interventions. In contrast, younger individuals, especially those in the 25-30 age group, are more likely to have isolated risk

factors, with smoking being more common in this group. Significant associations observed between risk factors and demographic profile of patients as $p < .05$.

Discussion:

The research highlighted several important risk factors linked to post-operative wound infections, aligning with earlier studies. It has been shown that diabetes mellitus weakens immune function and reduces the body's ability to fight infections, resulting in a higher incidence of wound infections in diabetic patients. Studies consistently show that individuals with diabetes face a greater risk of wound infections compared to those without diabetes, with a particularly high prevalence among female patients. In our study, 33.64% of post-operative patients with infections were diabetic, supporting previous findings that recognize diabetes as a major risk factor and a frequent cause of surgical site infections. ¹¹⁻¹²

The current study has identified obesity as a major risk factor. There is substantial evidence linking obesity to poor wound healing, which is attributed to factors like increased body fat, weakened immune response, and the added mechanical stress on surgical sites. Furthermore, individuals with obesity often have additional health issues, such as diabetes and hypertension, which increase the likelihood of complications after surgery. In this research, 14.55%

of the participants were found to be obese, with a particularly high rate among those undergoing incisional hernia repair. This was also noted in the study as a factor contributing to a higher risk of mesh infection in ventral incisional hernia repair¹³.

A study found that patients who were obese or morbidly obese had notably higher rates of surgical site infections (SSIs) in both clean and clean-contaminated surgeries, but this trend was not seen in contaminated or dirty/infected surgeries¹⁴. The research confirmed that obesity is a significant risk factor for infections at surgical sites, with the likelihood of infection being 1.1 to 4.4 times higher, depending on the specific type of surgery conducted¹⁵.

Our study shows that of those who contracted an infection, 82.73% developed a surgical site infection (SSI) within the first week after surgery, whereas 17.27% had infections that appeared after the second week. These findings are at odds with another study that suggested the average onset of SSI usually happens within three weeks following surgery¹⁶. Initial infections, like those observed in our study, could be linked to inadequate prophylactic measures during surgery or contamination during the procedure. In contrast, infections that occur later may stem from problems in postoperative care, including poor wound management or slow healing¹⁶. This difference can also be attributed to various systemic risk factors that may worsen the infection process, along with extended hospital stays, which were noted in 32.73% of cases in our study and could act as an extra risk factor¹⁷⁻¹⁸.

The study found that smoking, a known risk factor for wound infections, was more common among male participants. In particular, 20.91% of the subjects suffered from infections and delayed healing of their wounds. Smoking negatively impacts blood circulation and the delivery of oxygen to tissues, which impedes the healing process and increases the likelihood of infections. This observation is consistent with earlier studies that show a negative relationship between smoking and wound healing results. Additionally, those who quit smoking or who never smoked experienced considerably fewer postoperative complications related to wound

healing and a lower rate of surgical site infections compared to those who continued to smoke^{19,20}.

In this study, the ASA (American Society of Anesthesiologists) score proved to be an important factor. A higher ASA score (above 2) indicates a greater level of preoperative comorbidities and is associated with a higher risk of postoperative complications, including wound infections, which occurred in 19.09% of the cases we examined. This finding is consistent with previous studies that show patients with higher ASA scores are more likely to experience infections, longer recovery times, and increased mortality rates²¹⁻²².

While this study provides valuable insights into the factors associated with post-operative wound infections, it is not without its limitations. The study's cross-sectional design limits the ability to establish causal relationships between the identified risk factors and wound infections. Additionally, the study was conducted in a single hospital, and the findings may not be generalizable to other settings. Further prospective studies with larger sample sizes across multiple centers are needed to confirm these findings and assess the impact of specific interventions aimed at reducing post-operative wound infections. Moreover, the role of microbiological factors, which was not explored in this study, warrants further investigation as these play a critical role in the development of wound infections.

Conclusion:

In conclusion, this study highlights several key risk factors for post-operative wound infections in a general surgery ward, including diabetes, obesity, prolonged hospital stays, and certain surgical procedures. Addressing these factors through preoperative optimization, improved surgical technique, and enhanced postoperative care could significantly reduce the incidence of wound infections. Future research should focus on larger, multicenter studies to further explore these factors and identify effective preventive measures tailored to the local population.

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