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FREQUENCY OF SURGICAL SITE INFECTION POST DECORTICATION

Original Research

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ABSTRACT

Background: Surgical site infections (SSIs) are among the most frequent and preventable postoperative complications, accounting for significant morbidity, prolonged hospitalization, and financial burden. Although SSIs have been extensively studied in various surgical fields, limited data are available on their incidence, causative organisms, and contributing factors following open lung decortication for empyema, especially in low-resource healthcare settings. Addressing this knowledge gap is crucial for tailoring effective infection prevention and management protocols.

Objective: To determine the frequency, microbial etiology, and associated risk factors of surgical site infections in patients undergoing open lung decortication for empyema.

Methods: A descriptive study was carried out over six months in the Department of Thoracic Surgery, Lady Reading Hospital, Peshawar. A total of 139 patients aged ≥18 years who underwent open decortication were included using non-probability consecutive sampling. Patients with immunosuppression, diabetes, chronic kidney disease, pre-existing skin infections, or re-do procedures were excluded. Data were collected through a pretested structured proforma, and SSI was diagnosed during 2–3 week postoperative follow-up based on clinical signs, wound culture reports, and surgeon's assessment. Microbial isolates were identified using standard culture and sensitivity techniques. Data were analyzed using SPSS version 29, with $p \leq 0.05$ considered statistically significant.

Results: Of the 139 patients, 80 (57.5%) were male and 59 (42.5%) were female, with a mean age of 34.6 ± 4.2 years. The mean hospital stay was 8.2 ± 2.4 days. SSIs were identified in 15 patients (10.79%); 8 (53.3%) were superficial, 5 (33.3%) deep, and 2 (13.3%) organ-space infections. Microorganisms were isolated in 13 (86.6%) cases, with *Pseudomonas aeruginosa* being the most common (30.7%), followed by *Acinetobacter spp.* and *Staphylococcus aureus* (each 15.38%). Univariate analysis showed no significant association between SSI and age, gender, or hospital stay ($p > 0.05$).

Conclusion: The incidence of SSIs after open lung decortication was moderately high, with a predominance of superficial infections and delayed presentation after discharge. The high prevalence of nosocomial organisms emphasizes the need for improved infection control, targeted empirical antibiotic therapy, and enhanced post-discharge follow-up.

Keywords: Acinetobacter infections, Empyema, Lung decortication, Nosocomial infections, Pseudomonas aeruginosa, Surgical site infection, Thoracic surgery.

INTRODUCTION

Surgical site infections (SSIs) remain a significant challenge in postoperative care and are among the most prevalent healthcare-associated infections worldwide. These infections typically arise within 30 days following a surgical procedure and can profoundly affect patient outcomes by delaying wound healing, increasing morbidity, and prolonging hospital stays (1,2). For patients, SSIs often result in pain, reduced quality of life, and economic repercussions, including lost productivity and extended recovery periods. The burden is not only clinical but also economic, as these infections substantially raise the cost of treatment due to additional interventions and prolonged care requirements. Reported SSI rates vary depending on the type and classification of the surgical wound, with prevalence ranging from 1.5% to 20% across different settings (3,4). SSIs are broadly categorized into superficial incisional, deep incisional, and organ-space infections, each with varying implications for patient management and prognosis (5). Numerous risk factors predispose individuals to SSIs, including advanced age, diabetes, obesity, smoking, malnutrition, immunosuppression, malignancy, blood transfusions, prolonged hospitalization, and lengthy operative times (3,6). Importantly, the global incidence of SSIs reflects considerable disparities in healthcare systems. For instance, reported rates are 0.9% in the United States, 2.6% in Italy, 2.8% in Australia, 2.1% in South Korea, 6.1% in low- and middle-income countries, and up to 7.8% in South and Southeast Asia (7,8). In a large Turkish cohort of 3,066 surgeries, the SSI incidence was 5.2%, with superficial infections accounting for the majority (62.3%), followed by organ-space (22.7%) and deep incisional infections (14.9%) (9).

Microbiologically, Staphylococcus aureus is the most frequently implicated pathogen in SSIs, although a wide spectrum of organisms may be involved. The World Health Organization (WHO) has classified certain pathogens based on their antibiotic resistance profiles into critical, high, and average priority categories, underscoring the urgent need for enhanced infection control strategies. Notably, carbapenem-resistant *Acinetobacter baumannii* and third-generation cephalosporin-resistant *Pseudomonas aeruginosa* are listed among the critical pathogens due to their multidrug resistance and associated treatment difficulties (10). Effective management of SSIs includes prompt initiation of systemic antibiotics based on microbial sensitivity patterns, meticulous wound care, surgical debridement where necessary, and comprehensive supportive care measures such as pain control and nutritional optimization. In severe cases, surgical re-intervention may be required to control infection and prevent further complications (11,12). Despite substantial literature addressing SSIs in general surgical and obstetric populations, there remains a paucity of data concerning SSIs following thoracic surgical interventions such as decortication. Decortication, a procedure primarily performed to remove the fibrous peel restricting lung expansion in cases of chronic empyema, is commonly carried out at Lady Reading Hospital in Peshawar. However, local data on the incidence, microbiological spectrum, and risk factors for SSIs in this context are limited. Understanding these aspects is crucial to tailoring preventive strategies, guiding empirical antibiotic therapy, and ultimately improving patient outcomes while minimizing healthcare costs. This study aims to determine the frequency of surgical site infections following decortication, identify the most common causative pathogens through culture and sensitivity reports, and evaluate associated risk factors to support evidence-based clinical practices.

METHODS

This descriptive study was conducted at the Department of Thoracic Surgery, Lady Reading Hospital (LRH), Peshawar, over a period of six months following the approval of the research synopsis. A total of 139 patients were included, with the sample size calculated using a 95% confidence level, 5% margin of error, and an anticipated population proportion of 10% for surgical site infections (SSIs) following thoracic surgery (1). The sampling strategy employed was non-probability consecutive sampling, ensuring the enrollment of all eligible patients undergoing decortication during the study period. Patients aged 18 years and older of either gender undergoing decortication were included. Exclusion criteria encompassed patients with comorbidities such as diabetes mellitus, immunosuppressive conditions, or chronic kidney disease; those with pre-existing skin infections; patients with chest tubes in situ at the time of surgery; and individuals undergoing re-do decortication procedures. The rationale for excluding these populations was to minimize potential confounders that could independently elevate SSI risk and affect outcome reliability. Data were collected using a structured, pretested questionnaire following informed written consent from all participants. Ethical approval was obtained from the Institutional Review Board (IRB) of LRH Peshawar. Demographic and clinical information, including age, sex, antibiotic usage, and length of preoperative hospital stay, were documented. Surgical sites were monitored for signs of infection during follow-up visits in the outpatient department.

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For patients who exhibited clinical evidence of SSI—such as purulent discharge, redness, swelling, or localized pain—wound swabs or pus aspirates were collected using standard aseptic techniques and transported to the hospital's microbiology laboratory for culture and sensitivity testing. The results were recorded systematically for subsequent analysis. Data were analyzed using SPSS version 29 for Windows. Quantitative variables such as age and duration of hospital stay prior to surgery were expressed as mean ± standard deviation, while categorical variables including gender and presence of SSI were presented as frequencies and percentages. To assess associations, SSI rates were stratified by age, gender, and preoperative hospital stay, and the Chi-square test was applied post-stratification. A p-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 139 patients who underwent open decortication for empyema during the study period were included. The study population consisted of 57.5% males (n=80) and 42.5% females (n=59), with a mean age of 34.6 ± 4.2 years. The average length of hospital stay was 8.2 ± 2.4 days. Surgical site infections were documented in 15 patients, yielding an overall incidence rate of 10.79%. All cases of SSI were detected during follow-up visits conducted between the second and third postoperative week. Among these, superficial infections were the most common, observed in 8 patients (53.3%), followed by deep infections in 5 patients (33.3%), and organ-space infections involving the pleural cavity in 2 patients (13.3%). Six of the patients who developed SSI (40%) required hospital readmission due to infection-related complications. Among these, four patients (66.6%) underwent wound debridement and dressing, while two patients (33.3%) required re-do decortication procedures Microbiological cultures confirmed the presence of pathogenic organisms in 13 out of the 15 infected cases (86.6%). Among these, 3 infections (23.07%) were polymicrobial. *Pseudomonas aeruginosa* was the most frequently isolated pathogen, responsible for 4 cases (30.7%), followed by *Acinetobacter* species and *Staphylococcus aureus*, each isolated in 2 cases (15.38%). Additionally, *Corynebacterium* species and *Escherichia coli* were identified in one case each, accounting for 7.69% of culture-positive SSIs respectively. Univariate analysis revealed no statistically significant association between the occurrence of SSI and variables such as patient age, gender, or duration of preoperative hospital stay (p > 0.05 in all cases).

Table 1: Demographic and Clinical Characteristics of Study Participants

Characteristic	Value
Total number of patients	139
Gender	
Male	80 (57.5%)
Female	59 (42.5%)
Mean age (years)	34.6 ± 4.2
Mean hospital stay (days)	8.2 ± 2.4

Table 2: Incidence and Type of Surgical Site Infections (SSI)

Parameter	Value
Patients with SSI	15 (10.79%)
Timing of SSI detection	After 2–3 weeks follow-up
Type of SSI	
– Superficial SSI	8 (53.3%)
– Deep SSI	5 (33.3%)
– Organ-space SSI (Pleural empyema)	2 (13.3%)

Table 3: Readmission and Management of SSI Patients

Parameter	Value
Patients requiring readmission	6 (40% of SSI patients)
Management of readmitted patients	
– Wound debridement and dressing	4 (66.6%)
– Re-do decortication	2 (33.3%)

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Table 4: Univariate Analysis of SSI Association

Variable	Association with SSI
Age	Not significant
Gender	Not significant
Duration of hospital stay	Not significant

Table 5: Micro-organisms separated from SSI

Microorganism	Number of Cases	Percentage of Laboratory Confirmed SSI (%)
Total SSI with positive culture	13	86.6% of total SSI (15)
Polymicrobial infections	3	23.07%
Pseudomonas aeruginosa	4	30.7%
Acinetobacter spp.	2	15.38%
Staphylococcus aureus	2	15.38%
Corynebacterium spp.	1	7.69%
E. coli	1	7.69%

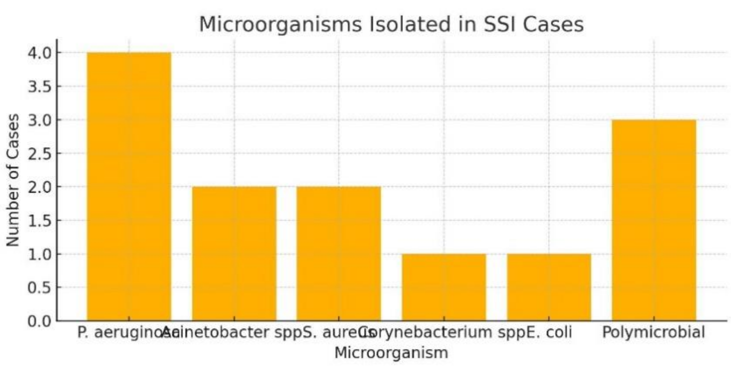

Figure 1 Microorganism Isolated in SSI Cases

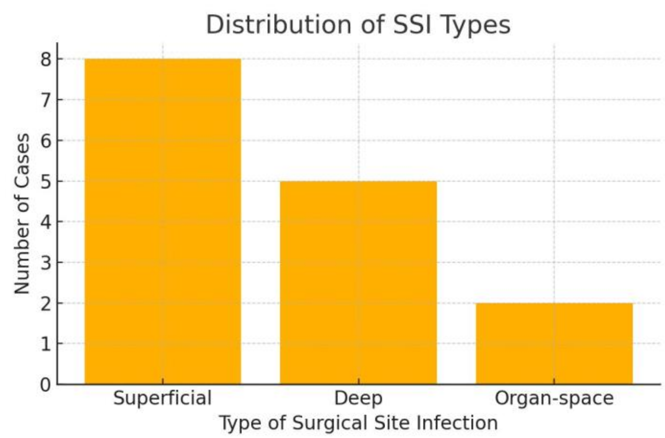

Figure 2 Distribution of SSI Types

DISCUSSION

This study investigated the incidence, microbial etiology, and associated risk factors of surgical site infections in patients undergoing open decortication for empyema. The overall SSI rate observed was 10.79%, which is somewhat higher than the 6.1% reported in broader thoracic surgical cohorts that included both open and thoracoscopic procedures, and moderately higher than the 8.5% specifically observed in decortication cases. Such variation may be attributed to differences in case selection, postoperative care standards, and institutional infection control practices. Notably, the majority of SSIs in this study were superficial (53.3%), with deep and organ-space infections being comparatively less frequent (13-15). This distribution differs from previously reported cohorts in which organ-space infections, particularly pleural empyema, constituted the predominant SSI type. Importantly, all infections in the present cohort were detected post-discharge during the second to third week of follow-up, unlike other studies that reported a majority of infections occurring during hospitalization. This delayed presentation could point to potential deficiencies in outpatient follow-up strategies or wound care education provided at discharge. The microbiological spectrum in this study revealed *Pseudomonas aeruginosa* as the most frequently isolated pathogen, followed by *Acinetobacter* species and *Staphylococcus aureus*. A significant proportion of infections (23.07%) were polymicrobial (16,17). These findings contrast with earlier studies where *S. aureus* was the dominant organism, and *P. aeruginosa* featured less prominently. The higher frequency of *P. aeruginosa* in this setting may reflect local environmental factors, institutional antibiotic use policies, or lapses in sterile surgical protocols. The detection of polymicrobial infections underscores the need for empirical broad-spectrum antibiotic coverage while awaiting culture sensitivity results, especially in post-decortication patients who are often debilitated or immunocompromised (18,19). The presence of nosocomial organisms such as *Acinetobacter* and *P. aeruginosa* also raises concerns regarding environmental contamination and infection control vigilance within surgical units.

The univariate analysis did not demonstrate significant associations between SSI occurrence and patient age, gender, or duration of hospital stay. These results are consistent with previous literature, which found no correlation between these demographic or perioperative variables and infection rates (20,21). However, evidence from other cohorts indicates that intraoperative variables such as surgical duration, open versus thoracoscopic approach, estimated blood loss, and patient-related factors such as ASA score and nutritional status may be more strongly associated with postoperative infections. The absence of such intraoperative data and comorbidity-related factors in this study limits the ability to identify more predictive clinical markers of SSI risk. Despite its contributions, this study had several limitations. It was conducted at a single tertiary care institution, which may constrain the applicability of findings to broader surgical populations with different practices. The number of SSI events was relatively small (n=15), reducing the statistical power to detect subtle associations or perform meaningful multivariate regression. Moreover, critical variables such as perioperative antibiotic protocols, glycemic control, smoking status, nutritional indices, and wound classification were not captured, although they are well-established influencers of SSI outcomes. Future studies should adopt a prospective multicenter design with larger sample sizes and incorporate these variables to build predictive models for SSI following thoracic procedures. Nonetheless, this study provides valuable insight into the local burden of surgical site infections post-decortication and highlights the predominance of Gram-negative and polymicrobial etiologies in this setting. These findings have practical implications for empirical antibiotic choices and suggest an urgent need to reinforce postoperative surveillance, discharge counseling, and infection prevention protocols.

CONCLUSION

Surgical site infections following open lung decortication for empyema continue to pose a substantial clinical challenge, contributing to patient morbidity, hospital readmissions, and increased healthcare costs. This study highlights the predominance of superficial infections diagnosed after discharge, with a significant presence of nosocomial and polymicrobial pathogens, emphasizing the critical need for robust infection control and targeted antimicrobial strategies. Although no clear associations were identified with baseline demographic or clinical factors, these findings underscore the importance of vigilant postoperative monitoring and the potential benefit of reinforcing wound care education. The insights gained serve as a foundation for enhancing surgical outcomes through improved preventive measures and pave the way for more comprehensive future research.

AUTHOR CONTRIBUTION

Author	Contribution
Tahir Raza*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Zia ur Rehman	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Jamil ur Rehman	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Anwar Iqbal	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Zeeshan Ehsan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mohammad Abid Khan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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