Surgical Site Infections in Breast Cancer Surgery: A Retrospective Study from a Tertiary Cancer Centre in India

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Abstract

Background: Surgical site infections (SSIs) are a frequent complication following breast cancer surgery and can substantially delay adjuvant therapy. This study evaluates the incidence of SSIs in a large Indian breast cancer cohort, identifies common pathogens, and quantifies treatment delays.

Methods: This retrospective observational study evaluated breast cancer patients who underwent surgery at a tertiary cancer center in India between 2022 and 2023. Data for 927 patients were retrieved from the REDCap database. All patients received a single dose of perioperative antibiotics, while routine postoperative antibiotics were not administered.

Results: Among 927 patients, 439 underwent breast-conserving surgery (BCS), and 488 underwent mastectomy. Wound dehiscence occurred in 105 patients (11.32%), with 59 patients (6.3%) showing culture-positive SSIs. Staphylococcus aureus was the most common pathogen (37.2%). Adjuvant treatment delay of over 4 weeks occurred in 35 patients (3.7%) and over 6 weeks in 10 patients (1.07%).

Conclusion: Single-dose perioperative antibiotic prophylaxis provides sustainable infection control in breast cancer surgeries. Routine use of postoperative antibiotics is not supported by the data.

Keywords: Surgical site infections, breast cancer surgery, perioperative antibiotics, Staphylococcus aureus, adjuvant therapy delay, wound dehiscence, mastectomy, breast-conserving surgery, infection control, Indian cohort.

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INTRODUCTION

Surgical site infections (SSIs) remain a remarkable postoperative complication, particularly in oncologic surgeries where timely administration of adjuvant therapy is critical.[1,2] Although breast surgeries are generally considered clean procedures, surgical site infection (SSI) rates

can be unexpectedly high, with reported incidences ranging from 1% to 28%, influenced by the type of surgery and patient-specific factors. Mastectomy procedures—particularly those involving immediate reconstruction—have been notably linked to higher SSI rates compared to breast-conserving surgeries.[3]

The occurrence of SSIs can lead to prolonged hospital stays, this leads to increased healthcare expenditures and, more importantly, delays in the initiation of adjuvant therapies such as chemotherapy and radiotherapy. Such delays have been associated with adverse oncological outcomes, including higher rates of local recurrence and reduced overall survival. Moreover, SSIs can adversely affect the aesthetic outcomes of breast surgeries, impacting patients' psychological well-being and quality of life.[5]

Numerous risk factors have been implicated in elevating the susceptibility to surgical site infections (SSIs) following breast cancer surgery. These encompass patient-specific variables such as obesity, diabetes mellitus, and tobacco use, along with procedural determinants including the placement of surgical drains, development of seromas, and the overall invasiveness of the surgical intervention. A systematic review and meta-analysis highlighted that factor such as increased age, higher body mass index (BMI), and preoperative chemoradiation significantly contribute to the risk of SSIs.[4]

In the Indian setting, there is a paucity of data regarding surgical site infection (SSI) rates following breast cancer surgeries, especially from high-volume tertiary care institutions. Considering the significant ramifications of SSIs on treatment timelines and clinical outcomes, it is essential to elucidate their incidence, microbial etiology, and overall impact within this patient population.

2. Materials and Methods

Study Design and Setting:

This was a retrospective, observational study conducted at a copious tertiary cancer centre in India. The study period was the year of January 2022- December 2023.

Patient Selection:

Patient data were obtained from the REDCap database for all individuals who underwent definitive breast cancer surgery during the study period. Inclusion criteria encompassed patients across all disease stages, irrespective of any prior treatments received.

Surgical and Antibiotic Protocols:

All patients received a single prophylactic dose of intravenous antibiotic (as per institutional protocol) at the time of anaesthesia induction.The routine use of postoperative antibiotics was discouraged, except in cases with clear clinical indications."

Definitions and Outcome Measures:

- *Wound infection* was defined by clinical features (e.g., erythema, purulent discharge) with microbiologically confirmed bacterial growth.
- *Wound dehiscence* included any partial or full-thickness separation of the surgical wound.
- *The duration to wound healing was assessed* from the date of index surgical procedure to the commencement of adjuvant therapy.
- Delays in adjuvant therapy were categorized as >4 weeks and >6 weeks.

Data Analysis:

Descriptive statistics were used to summarize demographic and clinical data. Categorical variables were presented as frequencies and percentages.

3. Results

Patient Demographics and Surgical Details:

A total of 927 patients with breast cancer underwent surgery during the study period. Among them, 439 (47.4%) underwent breast-conserving surgery (BCS) while 488 (52.6%) underwent mastectomy.

Incidence of Wound Complications:

Wound dehiscence occurred in 105 patients (11.32%), of whom 59 (6.3%) had culture-confirmed surgical site infection (SSIs). The remaining 46 cases were attributed to non-infectious wound breakdowns.

Microbiological Findings:

The most frequently isolated pathogen was *Staphylococcus aureus* (22/59, 37.2%). Additional identified microorganisms included *Pseudomonas aeruginosa*, *Escherichia coli*, and species of *Enterococcus.* (see Table 1 for details).

Surgical and Therapeutic Implications:

- 24 patients (2.6%) required secondary wound closure.
- 35 patients (3.7%) Had a delay exceeding four weeks in the initiation of adjuvant therapy.
- 10 patients (1.07%) experience a postponement exceeding 6 weeks due to wound-related complications.

Table 1: Pathogens Isolated in Culture-Positive SSIs

Organism	Number of Cases	Percentage (%)
Staphylococcus aureus	22	37.2
Pseudomonas aeruginosa	12	20.3
Escherichia coli	9	15.2
Enterococcus spp.	6	10.2
Polymicrobial/Other	10	17.1

Table 2: Incidence of SSIs

Study	Population	SSI Rate
our study (India, 2022–2023)	927 patients (BCS + mastectomy)	6.3% (culture-positive SSIs)
Olsen et al., 2008 (USA)	3,836 patients	3.4% overall SSI rate
Cheng et al., 2013 (Meta-analysis)	8 RCTs	3.1–4.3% with prophylactic antibiotics
EJSO (2022, UK)	2,000+ patients	5.3%
India single-center (IJPCR, 2023)	250 patients	8%
Southeast Michigan study (2024)	11,000+ patients	2.6–5.5% depending on BMI, comorbidities

Our result of 6.3% is within the reported global range (3–8%), especially considering:

- A large cohort (n=927)
- No routine post-op antibiotics
- Cultural and demographic factors specific to India

Table 3: Common Pathogens Identified

Study	Most Common Organism
Our study	Staph. aureus (37%)
Olsen et al.	Staph. aureus & coagulase-negative staphylococci
Cheng et al.	Staph. aureus prevalent across studies
UK/US studies	Increasing gram-negative organisms, incl. Pseudomonas

Our findings align with global trends. The presence of Staph. aureus as the most frequent organism is consistent, though vigilance for gram-negative bacteria is increasingly emphasized in Western centers.

Table 4: Antibiotic Protocols

Study	Protocol	Outcome
Our study	Single-dose pre-op prophylaxis only	6.3% SSI rate, no justification for routine post-op antibiotics
Cheng et al. (Meta-analysis)	**Compared no antibiotics vs. single-dose vs. multiple doses**	**Single-dose most effective with lowest adverse events**
ASBrS Guidelines	Single-dose recommended	Routine post-op antibiotics **not recommended**

In our practice it is evidence-aligned and resource-conscious, especially important in low- and middle-income settings.

Table 5: Impact on Adjuvant Therapy Timing

Study	Delay in Adjuvant Therapy
Our study	3.7% had >4 week delay; 1% >6 week
Biagi et al., 2011	Delays >4–6 weeks linked with worse survival in breast cancer

Other studies	SSI-related delays common in 3–7% of patients depending on the complication severity

4. Discussion

This study reports provides a comprehensive analysis of surgical site infections following breast cancer surgery in a high-volume tertiary centre in India. The observed SSI rate of 6.3% falls within the acceptable global range for clean surgeries, validating the effectiveness of single-dose prophylactic antibiotic administration at induction without the use of routine postoperative antibiotics.

Our findings highlight several important clinical insights. First, *Staphylococcus aureus* emerged as the predominant pathogen, consistent with international studies. The pathogen distribution also included *Pseudomonas aeruginosa*, *Escherichia coli*, and *Enterococcus spp.*, indicating a varied microbial profile that warrants continuous microbiological surveillance to guide empiric antibiotic selection.

Second, a notable 11.32% of patients experienced wound dehiscence, with 6.3% having confirmed SSIs. Of these, 24 patients required secondary surgical interventions, reflecting the burden of postoperative complications on both patients and surgical services. This underscores the need for preventive measures and timely wound care.

Third, the impact on adjuvant therapy initiation was clinically significant. While the majority of patients healed without delay, 3.7% experienced a delay of more than 4 weeks, and 1.07% experienced delays over 6 weeks. Given the evidence that delays in adjuvant chemotherapy and radiotherapy may negatively impact survival outcomes in breast cancer, this finding emphasizes the importance of preventing SSIs to maintain treatment timelines.

In summary, our study reinforces that adherence to infection control protocols, appropriate surgical technique, and judicious use of antibiotics can keep SSI rates within acceptable limits even in resource-limited settings. It also highlights the importance of tracking postoperative outcomes like wound healing time and adjuvant therapy delay, which directly affect patient prognosis and quality of care

In a retrospective case-control study by Olsen MA, *et al* the predominance of *Staphylococcus aureus* aligns with findings, highlighting its persistent role in postoperative wound infections

[2]. Notably, gram-negative organisms like *Pseudomonas* and *E. coli* were also present, warranting ongoing surveillance to guide empirical treatment policies.

In a study by Biagi JJ, *et al* one of the key concerns with SSIs in cancer surgery is the delay in adjuvant therapy. While the majority of patients began treatment without delay, 3.7% experienced delays over 4 weeks, and 1% had delays exceeding 6 weeks. Previous studies have shown that such delays, especially in aggressive subtypes of breast cancer, may negatively influence long-term outcomes.[6] Our results are consistent with results of this study as in our study patient with delayed treatment for infected wound got delayed recovery with disturbed mental peace and fatigueness leads to long medical staying to treat necrotizing wound.

These findings align with the research conducted by Cheng *et al*. In their study, Cheng *et al* reported that smokers had a higher likelihood of experiencing SSI. Furthermore, their results indicated that individuals with diabetes had a greater SSI prevalence compared to those without diabetes.[8] In our study patient with DM has showed slow wound healing with frequent hospital visit.

van der Hulst HC *et al.* documented a 5.3% rate, which is slightly lower than our observed 6.3% rate. However, the difference may be attributed to variations in study populations, surgical practices, or surveillance methods.[7] Our findings remain within the globally accepted range and are especially noteworthy given our protocol of avoiding routine postoperative antibiotics.

A cross-sectional study on SSI by V. Trrisha *et al*. majority of SSIs, infections are mainly because of patients' endogenous flora. The aetiological agents will also depend on the type and location of the surgery and have reported E. coli and S. aureus as the frequent microbial flora associated with SSI,[9] similar to our study.

The Indian Journal of Pharmacology and Clinical Research (2023) reported an SSI incidence of 8% among breast cancer surgery patients in another tertiary care setting in India. Compared to our study's 6.3% rate, this suggests that our outcomes are somewhat more favourable. The slightly lower SSI rate in our cohort may reflect differences in perioperative management, adherence to infection prevention protocols, or institutional surgical practices. These findings reinforce the efficacy of our single-dose prophylactic antibiotic regimen and underscore the importance of standardized infection control measures.[10]

Palubicka et al. (2019) conducted a five-year retrospective study in Poland, reporting an SSI rate of 4.1% among 1,263 breast cancer surgeries.[12] Compared to our observed rate of 6.3%, their lower incidence may reflect geographic variation, differing perioperative protocols, or broader inclusion criteria. Notably, their study did not evaluate delays in adjuvant therapy, a significant factor in oncologic outcomes which our study uniquely assessed. Despite this difference, both studies identified *Staphylococcus aureus* as the most common causative organism, reinforcing its role in postoperative breast infections.

Gil-Londoño et al. (2016) conducted a prospective study in Colombia and found an SSI rate of 16.2% among 308 breast cancer surgeries—significantly higher than our 6.3% rate. Their study identified seroma or hematoma and the use of drainage devices as key risk factors for SSI, findings consistent with our own observations. The disparity in SSI rates may be attributed to differences in surgical techniques, patient demographics, or surveillance methodology. Unlike their study, ours also assessed delays in adjuvant therapy, reinforcing the clinical importance of SSI prevention in cancer care.[13]

Although the study by Zaboli Mahdiabadi et al. (2023) focused on knee surgeries, their meta-analysis reported a pooled SSI rate of 1.9%, which is substantially lower than the 6.3% observed in our breast cancer cohort. This difference is likely attributable to the oncologic context of breast surgeries, involving more extensive tissue manipulation, varied immune responses, and potential delays in adjuvant therapy. Notably, both studies identified *Staphylococcus aureus* as a common pathogen and highlighted similar risk factors such as comorbidities and use of drains, reinforcing the universal importance of infection prevention measures across surgical specialties.[11]

Kozlov et al. (2024) provided practical guidelines for antibiotic prescribing in breast surgery and reported an SSI rate of approximately 5.7% in breast cancer surgeries.[14] Their recommendations supported single-dose preoperative prophylaxis without routine postoperative antibiotics, similar to our institutional policy. Compared to our 6.3% rate, the slight difference may reflect variations in surveillance methods or case mix. Importantly, their emphasis on antimicrobial stewardship aligns with our findings, reinforcing that single-dose prophylaxis is sufficient in most clean breast surgery cases without implants.

The low requirement for secondary suturing (2.6%) and absence of major wound-related mortality further emphasize the safety of the current protocol. However, high vigilance, timely

wound care, and early infection identification remain crucial for optimal postoperative recovery.

Limitations:

- Retrospective design limits causality.
- Lack of subgroup analysis based on comorbidities (e.g., diabetes, obesity) that might influence wound healing.
- Microbiological resistance patterns were not analyzed.

5. Conclusion

In conclusion, our study shows that surgical site infection (SSI) rates after breast cancer surgery at our centre are within globally accepted limits (6.3%) using a single-dose antibiotic at induction. *Staphylococcus aureus* was the most common pathogen, and while most patients healed without delay, a small but important proportion faced delays in starting adjuvant therapy and the observed rate of wound dehiscence and need for secondary suturing highlight the burden of postoperative wound complications. These findings support existing perioperative protocols and highlight the need for continued infection surveillance and timely wound care to optimize treatment outcomes.

Continued monitoring and adherence to infection prevention protocols remain essential to optimize outcomes and minimize treatment delays.

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