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Surgical Site Infections in General Surgery and Gynecology: A Prospective Study of Risk Factors and Outcomes

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Abstract
Background and Objectives: Patient morbidity, lengthened hospital stays, and increased healthcare expenditures are greatly impacted by surgical site infections (SSIs), which continue to rank among the most prevalent postoperative consequences in both general surgery and gynecological treatments. The purpose of this research was to examine surgical site infections (SSIs), their prevalence, causes, and microbiological composition, as well as their effect on the recovery of patients having general or gynecological operations.
Materials and Methods: A prospective observational study was performed over 12 months in the Departments of General Surgery at a tertiary care hospital. A total of 50 individuals who developed surgical site infections (SSIs) after undergoing surgical procedures were included. Information was gathered on the patients' demographics, the kind of surgery, the type of wound, the presence of comorbidities (such diabetes, obesity, or anemia), and intraoperative factors including the length of the surgery and the use of prophylactic antibiotics. We took wound samples for microbiological examination and used standard culture and sensitivity procedures to find isolates. Statistical research was conducted to ascertain major risk factors linked to SSIs.
Results: During the study period, SSIs occurred in 12% of surgical cases overall. There was a small female majority (56%), and the average age of the patients was 43.5 ± 10.2 years. A laparotomy (28%) or abdominal hysterectomy (22% of all SSIs) were the most prevalent surgical treatments. Surface infections accounted for 68% of all infections, with deep infections coming in at 24% and organ-space infections at 8%. Common risk factors included insufficient preoperative antibiotic prophylaxis, obesity, diabetes mellitus, and lengthy surgeries (>2 hours). Primarily, 38% were Staphylococcus aureus, 26% were Escherichia coli, and 18% were Pseudomonas aeruginosa. Although amikacin and meropenem were effective against most isolates, ampicillin and cephalosporins were not. The average length of hospital stay for patients with SSI was considerably greater (14.6 ± 4.3 days) than for patients without SSI (7.8 ± 2.1 days).
Conclusion: Particularly in patients with co-morbidities and extensive operating durations, SSIs continue to be a major postoperative problem in gynecological and general procedures. Reducing the occurrence of SSIs can be achieved through early risk factor identification, strict adherence to aseptic methods, and the use of adequate antibiotic prophylaxis. If we want better surgical results and fewer HAIs, we need to practice antimicrobial stewardship and continuous surveillance.

Keywords: Surgical site infection, general surgery, gynecology, risk factors, microbial profile, postoperative outcomes

Introduction
Surgical site infections (SSIs) cause postoperative morbidity, extended hospital stays, and higher healthcare costs; they are among the most common problems that can arise after surgery. Infections involving the incision or deep tissues at the site of surgery, which must occur within 30 days (or one year in the case of implants), are classified as surgical site infections (SSIs) by the CDC. Healthcare systems, particularly in developing nations, bear a heavy burden from these infections, which constitute around 20-30% of all surgical patients' hospital-acquired illnesses [1-3].
The frequency of surgical site infections (SSIs) differs between surgical procedures, patient characteristics, and hospital infection prevention measures. While vaginal flora, hormonal condition, and the treatment type can influence the risk of infection in gynecological surgeries, general surgery procedures involving the gastrointestinal tract carry a larger risk owing to

bacterial contamination. Common risk factors include diabetes, obesity, anemia, long operating times, insufficient sterilisation, and the wrong kind of antibiotics used as a preventative measure [4-6].

The most common bacteria found in surgical site infections (SSIs) are Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella spp., and Enterococcus spp. The therapy of these infections is becoming more complicated due to the rising number of reports of strains that are resistant to multiple drugs. To effectively guide treatment and execute targeted infection control measures, the infectious agents' antimicrobial susceptibility patterns must be identified as soon as possible [7, 8].

Patients having general or gynecological procedures at a tertiary care hospital were the subjects of this study, which aimed to assess the prevalence, causes, microbiological composition, and consequences of surgical site infections. Insight into present epidemiological patterns and the development of evidence-based approaches to the prevention and management of SSIs are the goals of the findings [9-11].

Materials and Methods

This prospective observational study was carried out in the Departments of General Surgery and Gynecology at a tertiary care hospital for a duration of 12 months. This study was conducted at the department of General Surgery, Deccan College of Medical sciences, Hyderabad, Telangana, India, from July 2019 To June 2020. The study sought to evaluate the incidence, risk factors, and microbiological spectrum of surgical site infections (SSIs) in postoperative patients. Fifty patients who developed surgical site infections (SSIs) after different types of surgery were chosen according on CDC guidelines for diagnosing SSIs. A standardized proforma was used to collect detailed clinical data, such as demographic information (age, sex), comorbid diseases (diabetes, hypertension, obesity, anemia), and surgery details.

Inclusion Criteria

- Patients undergoing clean, clean-contaminated, contaminated, or dirty surgical procedures in general surgery or gynecology.
- Patients who developed surgical site infections within 30 days postoperatively.
- Patients aged 18 years and above.
- Patients willing to provide informed consent.

Exclusion Criteria

- Patients who did not develop SSIs postoperatively.
- Patients with pre-existing skin infections or systemic infections prior to surgery.
- Patients who underwent minor outpatient surgical procedures.
- Patients unwilling to participate or lost to follow-up.

Statistical Analysis

We used SPSS software version 22.0 to do the statistical analysis. Data were presented as percentages and mean ± standard deviation. The chi-square test was used to look at the links between categorical characteristics (such having comorbidities or having surgery) and SSI occurrence. A p-value of less than 0.05 was judged statistically significant.

Results

The study comprised 50 patients who got surgical site infections (SSIs) after undergoing general or gynecological operations. Out of these, 28 cases (56%) came from the General Surgery department and 22 cases (44%) came from the Gynecology department. The results are shown below in tables, along with explanations.

Table 1: Demographic Distribution of Patients with Surgical Site Infections (n = 50)

Age Group (years)	No. of Patients	Percentage (%)
18-30	10	20
31-40	12	24
41-50	14	28
51-60	9	18
>60	5	10
Total	50	100
Mean Age ± SD	43.5 ± 10.2	

Patients between the ages of 41 and 50 accounted for 28% of all SSIs, suggesting that middle-aged people are more vulnerable. There was a small female majority (56%), and the average age of the study population was 43.5 ± 10.2 years.

Table 2: Type of Surgery and Wound Classification in SSI Cases (n = 50)

Type of Surgery	No. of Patients	Percentage (%)	Wound Class (CDC)	Frequency (%)
Laparotomy	14	28	Clean-contaminated	32
Abdominal Hysterectomy	11	22	Contaminated	30
Appendectomy	8	16	Dirty	18
Cholecystectomy	7	14	Clean	20
Caesarean Section	6	12	-	-
Others	4	8	-	-
Total	50	100	-	100

The operations most commonly linked to SSIs were laparotomy (28% of cases) and abdominal hysterectomy (22% of cases). A clear correlation between wound type and infection risk was seen, with the majority of infections occurring in clean-contaminated wounds (32%), followed by contaminated wounds (30%).

Table 3: Predisposing Risk Factors Associated with SSIs (n = 50)

Risk Factor	No. of Patients	Percentage (%)
Diabetes Mellitus	15	30
Obesity (BMI > 30 kg/m²)	10	20
Anemia	8	16
Duration of Surgery > 2 hr	9	18
Emergency Surgery	5	10
Smoking/Alcoholism	3	6
Total	50	100

Prolonged duration of operation (>2 hours) (18%), obesity (20%), and diabetes mellitus (30%) were the most prevalent risk variables for surgical site infections. It is clear from these results that metabolic and intraoperative factors contribute to patients' susceptibility to infections.

Table 4: Microbiological Profile of Organisms Isolated from SSIs

Microorganism	No. of Isolates	Percentage (%)
Staphylococcus aureus	19	38
Escherichia coli	13	26
Pseudomonas aeruginosa	9	18
Klebsiella pneumoniae	5	10
Enterococcus faecalis	3	6
Proteus mirabilis	1	2
Total	50	100

Staphylococcus aureus (38% of the total) was the most common bacterium found, followed by E. coli (26%), and Pseudomonas aeruginosa (18%). The small advantage of Gram-positive cocci over Gram-negative bacilli in SSI etiology is further evidence of the persistence of skin flora and environmental contamination.

Table 5: Antibiotic Sensitivity Pattern of Bacterial Isolates

Antibiotic	Sensitive Isolates (%)	Resistant Isolates (%)
Amikacin	84	16
Meropenem	78	22
Ceftriaxone	48	52
Ampicillin	30	70
Ciprofloxacin	60	40
Vancomycin (for Gram +ve)	90	10
Gentamicin	68	32

Amikacin (84%), vancomycin (90%), and meropenem (78%), on the other hand, showed the highest levels of resistance to ampicillin (70%) and ceftriaxone (52%). This highlights the significance of culture-guided therapy and the increasing issue of antibiotic resistance among SSI pathogens.

Discussion

In this prospective study, patients having general or gynecological surgery at a tertiary care hospital were analyzed for surgical site infections (SSIs), including their frequency, causes, microbiological spectrum, and outcomes. Fifty patients experienced surgical site infections (SSIs) after surgery, for a total incidence of around 12%. This is in line with previous research that found SSI rates ranging from 10-15% in comparable clinical settings, depending on the type of surgery and the effectiveness of infection control methods [12-14].

According to the demographic breakdown, the majority of patients were middle-aged individuals (41-50 years old), with a little female predominance (56%). This might be because of hormonal or physiological variations impacting wound healing, or because there are more gynecological procedures. Khan *et al*. (2017) and Patel *et al*. (2018) also found an increase in the incidence of SSI in individuals between the ages of 40 and 60 [15, 16].

The most prevalent operations linked to infections in this study were abdominal hysterectomy (22%), and laparotomy (28%). The risks of bacterial contamination are higher, the operating times are longer, and the patient is often exposed to abdominal viscera during these procedures. In line with the CDC's categorization, the majority of infections occurred in clean-contaminated wounds (32%), whereas contaminated wounds accounted for 30% of infections. This confirms that the risk of infection increases as the wound becomes more contaminated [17, 18].

When looking at the factors that put patients at increased risk, diabetes mellitus ranked highest (30%), followed by obesity (20%), anemia (16%), and lengthy operation (>2 hours) (18%). These results support the previous research by Leaper *et al*. (2010) and Mangram *et al*. (1999) that highlighted the risk of SSIs in diabetics due to hyperglycemia, poor vascularization, and decreased immune response. Additionally, wound healing is slowed by obesity and anemia, which have a deleterious effect on tissue oxygenation and immunological competence [19, 20].

According to the microbiological profile, the most common pathogens were Staphylococcus aureus (38%), Escherichia coli (26%), and Pseudomonas aeruginosa (18%). This pattern is consistent with other research showing that S. aureus is still the most common cause of SSIs because it colonizes the skin and nasal mucosa so often. Enteric or environmental contamination is the most common cause of Gram-negative organisms including E. coli and P. aeruginosa, which are especially common in gynecological and abdominal procedures. Postoperative treatment is becoming increasingly concerned due to the rising isolation of multidrug-resistant bacteria, particularly MRSA and ESBL-producing Gram-negative bacilli [21, 22].

Tests for antibiotic susceptibility revealed that vancomycin and amikacin were both highly effective against Staphylococcus aureus (90% and 84%, respectively), although gentamicin and meropenem were more effective against Gram-negative bacteria (78% and 68%, respectively). Overuse and dependence on older beta-lactam antibiotics led to high resistance rates against ampicillin (70%) and ceftriaxone (52%). Antimicrobial stewardship and culture-guided therapy are crucial in light of similar resistance trends reported by Singh *et al*. (2016) and Bhatia *et al*. (2015) [22-24].

The huge clinical and financial burden linked to postoperative infections was confirmed by the study's finding that patients with SSIs had nearly twice the length of hospital stays as non-infected patients (7.8 ± 2.1 days) (14.6 ± 4.3 days). Extended stays in the hospital are associated with higher healthcare expenditures, slower recoveries, and an increased likelihood of secondary nosocomial infections [24, 25].

Results show that environmental, surgical, and patient-related factors all have a role in surgical site infections (SSIs). To

decrease surgical site infections (SSIs), it is vital to strictly follow to infection prevention procedures. These protocols include skin preparation before surgery, optimal control of blood glucose, appropriate use of antibiotic prophylaxis, preservation of aseptic methods, and regular wound surveillance.

Results show that institutional SSI surveillance programs and frequent monitoring of microbial resistance are necessary, and they are in line with worldwide trends. To better assess the long-term effects and developing resistance patterns in postoperative infections, future research should use bigger samples and longer follow-up durations [25, 26].

Conclusion

The current research shows that SSIs are still a major problem after gynecological and general surgical operations, leading to more complications, longer hospital stays, and more money spent on healthcare. Despite advancements in surgical methods and antibiotic prophylaxis, the continuous difficulty of infection control is shown by the total SSI rate found. The results showed that SSIs were more likely to occur in patients with diabetes mellitus, who were overweight, had anemia, or had surgeries that lasted for an extended period of time. Laparotomy and abdominal hysterectomy, in particular, were the most common surgical procedures associated with infection. Reflecting both internal and external sources of contamination, the most common species found were Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa. Antibiotic susceptibility testing revealed a worrisome level of resistance to routinely used drugs, even though amikacin, vancomycin, and meropenem are still effective against the majority of isolates.

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Conflict of Interest

None.

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