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Original Research Article

SURGICAL SITE INFECTION AMONG GYNECOLOGICAL GROUP: RISK FACTORS AND POSTOPERATIVE EFFECT

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ABSTRACT

Background: Surgical site infection (SSI) is one of the most common postoperative complications following gynecological surgeries and contributes significantly to patient morbidity, prolonged hospitalization, and increased healthcare costs. Despite advances in surgical techniques and infection prevention strategies, SSIs remain a major concern, particularly in abdominal gynecological procedures. The objective is to determine the incidence of surgical site infection among gynecological surgical patients, identify associated risk factors, and assess the postoperative effects of SSI. **Materials and Methods:** A prospective observational study was conducted over a period of one year in the Department of Surgery in collaboration with the Department of Gynecology at Baba kinaram autonomous state medical College, Chandauli, UP. A total of 570 women undergoing gynecological surgical procedures were included using random sampling. Patients were followed postoperatively, and surgical sites were evaluated for SSI based on CDC/NHSN guidelines. Data were analyzed using Microsoft Excel. **Result:** Out of 570 patients, 104 developed SSI, yielding an overall incidence of 18.2%. Superficial SSI was the most common type (94%), followed by deep SSI (6%); no organ or space SSI was observed. Higher SSI rates were noted among patients aged 36–50 years and those with increased body mass index. Exploratory laparotomy and abdominal hysterectomy were significantly associated with higher SSI incidence, while laparoscopic and vaginal procedures had the lowest rates. SSI occurrence increased with wound contamination, with all dirty wounds developing infection. Midline incisions and mattress sutures were associated with higher SSI rates compared to Pfannenstiel incisions and subcuticular closure. Medical comorbidities, particularly diabetes mellitus and anaemia, showed a strong association with SSI. Patients with SSI experienced prolonged wound care, extended antibiotic therapy, and longer hospital stays. Microbiological cultures were positive in 35% of SSI cases, with Escherichia coli being the most commonly isolated organism. **Conclusion:** Surgical site infection remains a significant postoperative complication in gynecological surgeries, with an incidence of 18.2% in the present study. SSI development is influenced by multiple modifiable patient-related and surgical factors. Identification of high-risk patients, optimization of comorbidities, preference for minimally invasive techniques, and adherence to standardized infection prevention measures are essential to reduce SSI incidence and improve postoperative outcomes.

INTRODUCTION

Surgical site infection (SSI) is one of the most common healthcare-associated infections and remains a significant cause of postoperative morbidity, prolonged hospitalization, readmissions, and increased healthcare costs worldwide.[1,2] According to the World Health Organization, SSIs account for a substantial proportion of infections in surgical patients, particularly in low- and middle-income countries, where resource limitations further amplify their impact on patient outcomes and healthcare systems.[1]

Gynecological surgeries encompass a wide spectrum of procedures, ranging from minimally invasive vaginal and laparoscopic surgeries to major open abdominal and oncological operations. The reported incidence of SSIs following gynecological procedures varies widely, typically ranging from 1% to 15%, depending on the type of surgery, patient characteristics, and surveillance methods used.[3-6] Hysterectomy, one of the most frequently performed gynecologic surgeries, has been consistently associated with a notable risk of SSI, especially when performed via the abdominal route.[4,6]

Multiple patient-related and procedure-related risk factors contribute to the development of SSIs in gynecological patients. Patient-related factors include obesity, diabetes mellitus, anemia, smoking, advanced age, immunosuppression, and poor nutritional status.[3-10] Procedure-related factors such as prolonged duration of surgery, excessive intraoperative blood loss, emergency procedures, contaminated or dirty surgical wounds, inappropriate timing or choice of prophylactic antibiotics, and open surgical approaches significantly increase the risk of postoperative infection.[3-6]

Importantly, many of these risk factors are modifiable. Evidence-based guidelines emphasize the role of preventive strategies such as optimization of comorbid conditions, appropriate antimicrobial prophylaxis, maintenance of perioperative normothermia and glycemic control, proper skin antisepsis, and adherence to standardized surgical protocols.[1,2,8] Implementation of surgical site infection prevention bundles has shown measurable reductions in SSI rates in gynecological practice.[8]

Beyond localized wound complications, SSIs exert a profound effect on postoperative recovery and long-term outcomes. Patients who develop SSIs experience significantly longer hospital stays, higher rates of readmission, increased need for reinterventions, and delayed initiation of adjuvant therapy in gynecologic oncology cases.[7,8] These postoperative effects not only compromise patient quality of life but also impose a considerable economic burden on healthcare systems.

Given the preventable nature of many SSIs and their substantial clinical consequences, continuous surveillance and identification of procedure-specific and patient-specific risk factors are essential. Standardized definitions and surveillance criteria, such as those proposed by the CDC/NHSN, are crucial for accurate diagnosis, reporting, and comparison of SSI rates across studies and institutions.[9] Understanding the risk factors and postoperative effects of SSIs among gynecological patients is therefore vital for developing targeted preventive strategies and improving surgical outcomes.

MATERIALS AND METHODS

Study Area: This study is conducted in the Department of surgery with collaboration of Gynecology Department.

Study duration: Duration of study was over a period of one year at Baba Kinaram Autonomous State Medical College, Chandauli, UP

Study Population: A total of 570 women undergoing gynecological surgical procedures were included in the study.

Data Collection: The study population comprising of 570 women who underwent gynaecology surgeries. Subjects were sampled by random sampling. Postoperative follow up and incision site evaluation for SSI based on CDC guidelines was done for each patient.

Data Analysis: Data was analyzed by using Microsoft Excel.

RESULTS

A total of 570 women undergoing gynecological surgical procedures were included in the study. Surgical site infection (SSI) was identified in 104 patients, resulting in an overall incidence of 18.2%, while 466 patients (81.8%) did not develop SSI.

Among the patients with SSI, superficial surgical site infection was the most common presentation, observed in 98 cases (94%), whereas deep SSI was documented in 6 cases (6%). No organ or space surgical site infection was noted in the study population.

Analysis of demographic factors showed variation in SSI occurrence across age groups. A higher incidence of SSI was observed among women aged 36–50 years, followed by those aged 20–35 years, while patients aged above 50 years also demonstrated susceptibility to SSI. Increasing age was associated with a higher risk of postoperative infection.

With respect to surgical factors, SSI occurred most frequently in patients who underwent exploratory laparotomy, followed by abdominal hysterectomy. In contrast, the incidence of SSI was markedly lower among patients who underwent laparoscopic or vaginal gynecological procedures, and this association was statistically significant.

The occurrence of SSI showed a strong association with the class of surgical wound. No SSI was observed in clean wounds, whereas a progressively increasing incidence was noted in clean-contaminated wounds, and all dirty wounds developed SSI, indicating a higher risk with increasing wound contamination.

Body mass index (BMI) demonstrated a significant relationship with SSI development. Overweight and obese patients showed substantially higher rates of SSI compared to patients with normal BMI, indicating that increasing BMI was an important risk factor for postoperative infection.

Patients with a history of previous surgery exhibited a higher incidence of SSI compared to those without prior surgical intervention. Similarly, the type of incision influenced SSI rates, with midline incisions showing a higher frequency of infection compared to Pfannenstiel incisions and laparoscopic or vaginal approaches.

The method of skin closure also impacted SSI occurrence. The highest incidence of SSI was observed in wounds closed using mattress sutures, whereas subcuticular sutures were associated with the lowest infection rates.

Medical comorbidities played a significant role in SSI development. A higher incidence of SSI was observed among patients with diabetes mellitus, anaemia, and hypertension, with diabetes and anaemia showing a particularly strong association.

The postoperative effect of SSI was evident in terms of wound-related morbidity. Patients who developed SSI required prolonged wound care and antibiotic therapy, leading to an extended duration of hospital stay. Microbiological analysis of wound swabs showed bacterial growth in 35% of SSI cases, with Escherichia coli being the most commonly isolated organism, followed by Klebsiella species, Staphylococcus aureus, Pseudomonas, and Enterococcus faecium, while the remaining cultures were sterile.

Table 1: Overall Burden of Surgical Site Infection among Gynecological Patients (N = 570)

Parameter	Number (n)	Percentage (%)
Patients without SSI	466	81.8
Patients with SSI	104	18.2
Total	570	100

Table 2: Pattern of Surgical Site Infection among Gynecological Patients (N = 104)

Type of SSI	Number (n)	Percentage (%)
Superficial SSI	98	94.0
Deep SSI	6	6.0
Organ/space SSI	0	0.0

Table 3: Demographic Risk Factors Associated with Surgical Site Infection

Risk factor	Category	SSI Present n (%)	SSI Absent n (%)	p value
Age (years)	20–35	18 (17.6)	84 (82.4)	
	36–50	70 (22.7)	238 (77.3)	0.05
	>50	16 (10.0)	144 (90.0)	
BMI	Normal	30 (9.9)	274 (90.1)	
	Overweight	56 (32.2)	118 (67.8)	<0.001
	Obese	16 (40.0)	24 (60.0)	

Table 4: Surgical-Related Risk Factors for Surgical Site Infection

Surgical factor	Category	SSI Present n (%)	SSI Absent n (%)	p value
Type of surgery	Abdominal hysterectomy	60 (21.1)	224 (78.9)	
	Exploratory laparotomy	42 (39.6)	64 (60.4)	<0.001
	Laparoscopic/Vaginal	2 (1.1)	178 (98.9)	
Type of incision	Pfannenstiel	56 (20.3)	220 (79.7)	
	Midline	42 (37.5)	70 (62.5)	<0.001
	Laparoscopic/Vaginal	6 (3.3)	176 (96.7)	

Table 5: Wound and Closure-Related Risk Factors for Surgical Site Infection

Factor	Category	SSI Present n (%)	SSI Absent n (%)	p value
Wound class	Clean	0 (0)	48 (100)	
	Clean-contaminated	102 (19.6)	418 (80.4)	0.003
	Dirty	2 (100)	0 (0)	
Skin closure method	Mattress	88 (27.2)	236 (72.8)	
	Subcuticular	10 (6.3)	148 (93.7)	<0.001
	Staples	4 (18.2)	18 (81.8)	

Table 6: Medical Risk Factors Associated with Surgical Site Infection

Comorbidity	SSI Present n (%)	SSI Absent n (%)	Odds Ratio	p value
Diabetes mellitus	30 (48.4)	32 (51.6)	5.49	<0.001
Anaemia	54 (38.0)	88 (62.0)	4.63	<0.001
Hypertension	16 (33.3)	32 (66.7)	2.46	0.04

Table 7: Postoperative Microbiological Profile in Surgical Site Infection Cases (N = 36)

Organism isolated	Number (n)	Percentage (%)
Escherichia coli	18	50.0
E. coli	3	8.4
Klebsiella	3	8.4
Staphylococcus aureus	4	11.0
Pseudomonas spp.	4	11.0
Enterococcus faecium	4	11.0

DISCUSSION

Surgical site infection (SSI) remains a significant postoperative complication following gynecological surgeries and continues to be a major concern despite advances in surgical techniques and infection prevention strategies. The incidence of SSI varies across institutions depending on patient profile, type of surgery, and perioperative care practices. In the present study, the overall incidence of SSI was 18.2%, which is comparable to the findings reported by Bharatnur et al. and Gupta et al., who documented SSI rates ranging from 18% to 21% in gynecological surgical populations.[11-14] However, this incidence is higher than that reported by Jain et al. and Bhalodia et al., who observed lower SSI rates of approximately 10–11%, reflecting institutional and demographic differences.[12,13]

The predominance of superficial SSI observed in the present study (94%) is consistent with observations across all referenced studies. Bharatnur et al. and Bhalodia et al. similarly reported that superficial SSIs constituted the majority of postoperative wound infections, while deep SSIs were less frequent and organ or space infections were rare.[11,12] This pattern suggests that while wound contamination at the skin and subcutaneous level remains common, effective intraoperative techniques and antibiotic prophylaxis may limit deeper tissue involvement.

Age was identified as an important demographic factor influencing SSI occurrence. In the present study, higher SSI rates were observed among women aged 36–50 years, followed by those aged 20–35 years, with women above 50 years also demonstrating increased susceptibility. Similar trends were reported by Bharatnur et al. and Gupta et al., who observed a higher risk of SSI with increasing age, attributing this to age-related immune compromise and increased prevalence of comorbidities.[11,14]

Surgical factors played a crucial role in SSI development. Exploratory laparotomy was associated with the highest incidence of SSI in the present study, followed by abdominal hysterectomy. Comparable findings were reported by Bharatnur et al. and Bhalodia et al., who noted significantly higher SSI rates following open abdominal procedures compared to minimally invasive techniques.[11,12] In contrast, laparoscopic and vaginal procedures demonstrated markedly lower SSI rates, which may be due to reduced tissue handling, smaller incisions, and shorter operative duration.

A strong association was observed between SSI and the class of surgical wound. In the present study, no SSI was noted in clean wounds, whereas a progressively increasing incidence was observed in clean-contaminated wounds, and all dirty wounds resulted in SSI. This stepwise increase in infection risk with increasing wound contamination has been consistently reported by Bharatnur et al. and Bhalodia et al. and highlights the importance of endogenous microbial flora in gynecologicalsurgeries.[11,12]

Body mass index (BMI) emerged as a significant modifiable risk factor for SSI. Overweight and obese patients demonstrated substantially higher SSI rates compared to those with normal BMI. This finding is in agreement with all reviewed studies, including Bharatnur et al., Jain et al., Gupta et al., and Bhalodia et al., who consistently reported obesity as a major contributor to postoperative wound infections.[11–14] Poor vascularity of adipose tissue, increased dead space, and prolonged operative time likely contribute to this increased risk.

Patients with a history of previous surgery exhibited a higher incidence of SSI in the present study. Bharatnur et al. similarly reported increased SSI rates among patients with prior surgical scars, attributing this to altered anatomy, adhesion formation, and compromised tissue vascularity, which adversely affect wound healing.[11]

The type of incision was found to significantly influence SSI rates, with midline incisions showing a higher frequency of infection compared to Pfannenstiel incisions and minimally invasive approaches. Similar findings were reported by Bharatnur et al. and Gupta et al., who observed better wound healing and lower SSI rates with transverse incisions.[11,14]

The method of skin closure also impacted SSI occurrence. In the present study, wounds closed using mattress sutures demonstrated the highest SSI rates, whereas subcuticular sutures were associated with the lowest infection rates. This observation is consistent with the findings of Bharatnur et al., who emphasized that subcuticular closure minimizes dead space and tissue trauma, thereby reducing the risk of infection.[11]

Medical comorbidities played a significant role in SSI development. A higher incidence of SSI was observed among patients with diabetes mellitus, anaemia, and hypertension, with diabetes and anaemia showing particularly strong associations. Similar observations were reported by Jain et al., Bhalodia et al., and Bharatnur et al., who highlighted impaired immune response, reduced tissue oxygenation, and delayed wound healing as key mechanisms underlying increased SSI risk in these patients.[11–13]

The postoperative impact of SSI was evident in the present study, as affected patients required prolonged wound care, extended antibiotic therapy, and longer hospital stays. This finding aligns with reports by Gupta et al. and Bharatnur et al., who documented increased hospital stay and healthcare burden among patients who developed SSI.[11,14]

Microbiological analysis revealed bacterial growth in 35% of SSI cases, with Escherichia coli being the most commonly isolated organism, followed by Klebsiella species, Staphylococcus aureus, Pseudomonas, and Enterococcus faecium. Similar microbial patterns were reported by Bharatnur et al. and Bhalodia et al., indicating a predominance of gram-negative organisms in gynecological SSIs, likely due to contamination from endogenous genital and gastrointestinal flora.[11,12]

Overall, the findings of the present study are consistent with evidence from the referenced articles, reinforcing the multifactorial nature of SSIs in gynecological surgeries. Identification and optimization of modifiable risk factors such as BMI, glycaemic control, correction of anaemia, appropriate choice of surgical approach, incision type, and wound closure technique are essential to reduce SSI incidence and improve postoperative outcomes.[11–14]

CONCLUSION

Surgical site infection remains a common and significant postoperative complication following gynecological surgical procedures, contributing to increased patient morbidity and prolonged hospital stay. In the present study, the overall incidence of surgical site infection was 18.2%, with superficial surgical site infection being the most common presentation. Deep surgical site infections were infrequent, and no organ or space infections were observed.

The occurrence of surgical site infection was found to be influenced by multiple patient-related and surgical factors. Higher age, increased body mass index, history of previous surgery, presence of medical comorbidities such as diabetes mellitus and anaemia, and the use of open abdominal surgical approaches were associated with a higher risk of infection. Exploratory laparotomy and abdominal hysterectomy showed the highest incidence of surgical site infection, whereas laparoscopic and vaginal procedures were associated with significantly lower infection rates.

Wound-related factors such as wound classification, type of incision, and method of skin closure played a crucial role in the development of surgical site infection. Clean-contaminated and dirty wounds demonstrated a progressively higher risk of infection compared to clean wounds. Midline incisions and mattress sutures were associated with higher infection rates, while Pfannenstiel incisions and subcuticular skin closure were associated with a lower incidence of surgical site infection.

Medical comorbidities significantly increased susceptibility to postoperative infection, highlighting the importance of adequate preoperative optimization. Patients who developed surgical site infection required prolonged wound care, extended antibiotic therapy, and longer duration of hospital stay, emphasizing the substantial clinical and economic burden associated with this complication.

Microbiological analysis revealed Escherichia coli as the most common causative organism, followed by other gram-negative and gram-positive bacteria, underscoring the need for appropriate antibiotic prophylaxis and rational antimicrobial use.

In conclusion, surgical site infections in gynecological surgeries are multifactorial and largely preventable. Identification of high-risk patients, optimization of modifiable risk factors, preference for minimally invasive surgical techniques where feasible, adherence to strict aseptic protocols, and appropriate perioperative antibiotic strategies are essential to reduce the incidence of surgical site infection and improve postoperative outcomes.

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