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ORIGINAL ARTICLE

Comparison of SSI Rates between Cesarean Sections and General Surgical Procedures

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ABSTRACT

Background: Surgical site infection is one of the most frequently occurring post-operative complications that is associated with increased treatment cost, delayed patient recovery, morbidity and increased hospital stay. Post-operative wound infection is a risk for both cesarean sections and general surgery, but the incidence or risk factors for these infections may vary based on patient factors, wound contamination, emergency surgery, and procedure length.

Objective: To compare the frequency of surgical site infections between cesarean sections and general surgical procedures.

Material and Methods: This comparative observational study was carried out at Saidu Teaching Hospital, Saidu Sharif, Swat and HBS Medical and Dental College during the period May 2023 to August 2023. The total number of patients included was 82 (41 cesarean section and 41 general surgical procedures). Demographic, clinical, operative, and postoperative data were collected. Surgical site infection was clinically evaluated and defined as superficial incisional, deep incisional or organ/space infection. Clinically indicated wound cultures were performed. Analysis of data was conducted using SPSS and a p-value of <0.05 was deemed as statistically significant.

Results: The overall surgical site infection rate was 17.1%. SSI was observed in 5 patients in the cesarean section group and 9 patients in the general surgery group, giving infection rates of 12.2% and 22.0%, respectively. Although SSI was more frequent among general surgical patients, the difference was not statistically significant. Superficial incisional SSI was the most common type of infection. Emergency surgery, operative duration of more than 60 minutes, contaminated or dirty wound class, delayed antibiotic prophylaxis, and hospital stay of more than five days were significantly associated with SSI development. The most frequently isolated organisms were Staphylococcus aureus, Escherichia coli, and Klebsiella species.

Conclusion: Surgical site infection was more common after general surgical procedures than cesarean sections, although the difference was not statistically significant. Strengthening infection control practices, timely antibiotic prophylaxis, careful operative technique, and regular postoperative wound surveillance may help reduce SSI rates in both surgical groups.

Keywords: Surgical site infection, cesarean section, general surgery, wound infection, antibiotic prophylaxis, postoperative complications

INTRODUCTION

Post-operative surgical site infection remains a serious complication that remains a significant problem and compromises patient outcome in obstetric and general surgical practice. It is a condition that occurs at or close to an operative site and involves the skin, subcutaneous tissues, deeper soft tissue or organ spaces. Many surgical procedures are carried out under the principle of asepsis, however, SSI is a common source of postoperative morbidity, prolonged healing, prolonged hospital stay, re-admission, need for more antibiotics and extra cost to the patient and healthcare systems[1-3].

Cesarean section is among the most widely used obstetric surgeries in the globe. When medically indicated, it is a life-saving procedure, but when performed, it also brings the risk of postoperative complications of the wound. Emergency surgery, prolonged labor, pre-pregnancy weight, diabetes, delayed administration of prophylactic antibiotic, anemia, and repeated vaginal examination are factors that may contribute to an increased risk of SSI following cesarean section. Caesarean section carries both surgical and obstetric risk factors necessitating careful preoperative preparation, appropriate antibiotic prophylaxis, good aseptic technique and postoperative care of the wound to prevent infection[4-6].

General surgery encompasses a variety of different surgical procedures, ranging from clean elective surgeries to emergency abdominal surgery procedures involving contaminated or infected tissues. SSI rates in the general surgery setting are dependent on the surgical procedure, the type of wound, the length of surgery, extent of tissue manipulation, patient risk factors, and perioperative infection control. Operations involving the gastrointestinal tract or emergency contaminated wounds may have increased infection risk, versus clean elective operations. Hence, the general surgical patient population are a diverse group of patients with varying risks of SSI[7-9].

Comparisons of SSI rates between cesarean section and general surgical procedures are relevant because both types of procedures are frequently performed in hospital surgical environments, but they can have different risks. Cesarean sections are also more standardized, whereas general surgical procedures could have different degrees of complexity and contamination. Knowing if there are differences in SSI rates and risk factors can help the healthcare provider enhance infection-prevention practices, use antibiotics more effectively and boost postoperative monitoring[10, 11].

Given the limited resources of health care, preventing SSI is particularly critical because of the added cost of treatment, extended hospital stays and the extra burden on already stretched surgical services. Local data is essential to fully understand the burden of infection and to make informed infection control decisions. Examining SSI patterns amongst patients undergoing cesarean and general surgical procedures can also inform targeted interventions including optimizing timing of prophylactic antibiotic administration, wound classification, patient identification for high-risk surgery, and regular postoperative infection audit.

The present study was conducted to compare the frequency of surgical site infections between cesarean sections and general surgical procedures. It also aimed to assess the types of SSI, clinical presentation, microbiological profile, and factors associated with SSI development among patients undergoing these surgical procedures.

MATERIAL AND METHODS

This comparative observational study was conducted to compare the frequency of surgical site infections between patients

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undergoing cesarean sections and those undergoing general surgical procedures. The study was carried out at Saidu Teaching Hospital, Saidu Sharif, Swat, and HBS Medical and Dental College. The duration of the study was six months, from May 2023 to August 2023. A total of 82 patients were included in the study, with 41 patients in the cesarean section group and 41 patients in the general surgery group.

Patients were selected using a non-probability consecutive sampling technique. All patients who underwent cesarean section or selected general surgical procedures during the study period and fulfilled the inclusion criteria were enrolled. Patients of all eligible age groups undergoing either elective or emergency surgery were considered for inclusion. Patients with pre-existing wound infection, active systemic infection before surgery, incomplete clinical records, or those lost to follow-up before assessment of surgical site infection were excluded from the study.

After obtaining informed consent, demographic and clinical information was recorded on a structured proforma. The age, gender, residence, socioeconomic status, BMI, diabetes mellitus, hypertension, anemia, smoking history, previous surgical history, and relevant obstetric information were recorded in the cesarean section group. Other procedure-related factors, including the type of procedure, emergency or elective surgery, length of surgery, wound class, type of anesthesia, antibiotic prophylaxis use and timing, and hospital stay length were also recorded.

The main outcome variable was the development of surgical site infection. Postoperative surgical site infection was evaluated clinically, based on the clinical parameters, namely, wound discharge, pain or tenderness, redness, swelling, fever, wound dehiscence, readmission and wound drainage. Based on the depth and extent of the involvement of the wound, SSI was further classified into superficial incisional, deep incisional, and organ/space infection. Delayed postoperative wound infections were seen during hospital stay and after discharge (where applicable) and evaluated.

In patients with clinical symptoms of surgical site infection, samples of the wound and/or discharge were obtained aseptically and submitted for culture and sensitivity. Culture positive or culture negative was recorded for microbiological finding. Isolated organisms were recorded, such as Staphylococcus aureus, Escherichia coli, Klebsiella species, Pseudomonas aeruginosa and other relevant organisms, as well as the antibiotic sensitivity pattern of these, where available.

All collected data were entered and analysed in SPSS. The quantitative variables age, BMI, surgery time and hospital stay were expressed as mean and SD. Categorical variables (type of surgery, emergency surgery, diabetes mellitus, wound class, antibiotic prophylaxis or presence of SSI) were reported in absolute numbers and percentages. The rate and risk factors of SSI were compared between the cesarean section and general surgery groups. Appropriate tests included the chi-square test or Fisher's exact test for categorical variables and the independent sample t-test for continuous variables. A p value<0.05 was set as statistically significant.

RESULTS

The total number of patients who were included in the study was 82. Of these, 41 patients had cesarean section performed, and 41 patients had general surgical procedures. The mean age of the participants was 34.8 ± 10.6 years overall. Overall SSI frequency was 17.1% (14 patients), with no significant differences between the two groups.The overall surgical site infection (SSI) frequency for the two groups was not significantly different, with 17.1% (14 patients) of all patients experiencing SSI. Demographic comparison revealed that average age of the patients in the general surgery group was older than the cesarean section group. There were more patients in both groups from urban areas. There was no significant difference between the mean BMI of the two groups, though it was slightly higher in the cesarean section group.

More emergency surgery was performed in the cesarean section group and contaminated and dirty wounds were more common in general surgery. Patients undergoing general surgery were also more likely to have diabetes mellitus. Surgery time was longer in the general surgery group.

The rate of surgical site infection was higher among patients undergoing general surgical procedures than among those undergoing cesarean sections. Surgical site infection occurred in 5 of 41 patients (12.2%) in the cesarean-section group and 9 of 41 patients (22.0%) in the general-surgery group. However, the difference between the two groups was not statistically significant (p = 0.237).

Superficial incisional SSI was the most common type of infection in both groups. Organ/space infection and deep incisional SSI were more likely to be present in the general surgical patients.

Among patients that developed SSI, the most common clinical sign was discharge from the wound, followed by pain, redness and fever. A small number of patients had wound dehiscence, which occurred more frequently in the general surgery group.

In 11 of 14 cases of SSI, wound culture was positive. Staphylococcus aureus was the most frequently isolated bacteria, followed by Escherichia coli and Klebsiella species. There were more gram minus organisms in general surgery.

There was a significant correlation between SSI and emergency surgery, duration of operation, contaminated/dirty wound class, delayed antibiotic prophylaxis and hospital stay. The frequency of diabetes was higher among the SSI patients and was not significant.

The overall rate of SSI was 17.1% in this study that included 82 patients. The incidence of SSI was found to be higher for patients undergoing general surgical procedures than for those who had cesarean sections: 22.0% versus 12.2%, respectively. While this difference proved clinically significant, it was not statistically significant. The superficial incisional SSI was most prevalent type of infection. Factors that significantly influenced the development of SSI were emergency surgery, operative duration, contaminated wound class, delayed antibiotic prophylaxis, and hospital stay.

Table 1: Baseline demographic characteristics of study participants

Variable	Cesarean Section n=41	General Surgery n=41	p-value
Mean age, years	29.6 ± 5.8	40.1 ± 11.4	<0.001
Male	0	23 (56.1%)	<0.001
Female	41 (100%)	18 (43.9%)	<0.001
Urban residence	25 (61.0%)	23 (56.1%)	0.653
Rural residence	16 (39.0%)	18 (43.9%)	0.653
Mean BMI, kg/m²	27.1 ± 3.9	25.8 ± 4.2	0.149
Low socioeconomic status	15 (36.6%)	17 (41.5%)	0.648

Table 2: Clinical and procedure-related characteristics

Variable	Cesarean Section n=41	General Surgery n=41	p-value
Diabetes mellitus	5 (12.2%)	11 (26.8%)	0.096
Hypertension	6 (14.6%)	9 (22.0%)	0.389
Anemia	14 (34.1%)	10 (24.4%)	0.331
Smoking history	0	12 (29.3%)	<0.001
Emergency surgery	28 (68.3%)	21 (51.2%)	0.116
Elective surgery	13 (31.7%)	20 (48.8%)	0.116
Mean duration of surgery, minutes	52.4 ± 13.6	76.8 ± 24.5	<0.001
Antibiotic prophylaxis within 60 minutes	34 (82.9%)	29 (70.7%)	0.189
Mean hospital stay, days	3.9 ± 1.5	5.6 ± 2.4	<0.001

Table 3: Comparison of surgical site infection rates

SSI Status	Cesarean Section n=41	General Surgery n=41	Total n=82	p-value
SSI present	5 (12.2%)	9 (22.0%)	14 (17.1%)	0.237
SSI absent	36 (87.8%)	32 (78.0%)	68 (82.9%)	0.237

Table 4: Types of surgical site infection

Type of SSI	Cesarean SSI n=5	General Surgery SSI n=9	Total SSI n=14
Superficial incisional SSI	4 (80.0%)	5 (55.6%)	9 (64.3%)
Deep incisional SSI	1 (20.0%)	3 (33.3%)	4 (28.6%)
Organ/space SSI	0	1 (11.1%)	1 (7.1%)

Table 5: Clinical presentation among SSI cases

Clinical Feature	Cesarean SSI n=5	General Surgery SSI n=9	Total n=14
Wound discharge	4 (80.0%)	8 (88.9%)	12 (85.7%)
Redness/swelling	3 (60.0%)	6 (66.7%)	9 (64.3%)
Fever	2 (40.0%)	5 (55.6%)	7 (50.0%)
Pain/tenderness	4 (80.0%)	7 (77.8%)	11 (78.6%)
Wound dehiscence	1 (20.0%)	3 (33.3%)	4 (28.6%)
Readmission due to SSI	0	2 (22.2%)	2 (14.3%)

Table 6: Microbiological profile of SSI cases

Organism Isolated	Cesarean SSI n=5	General Surgery SSI n=9	Total n=14
Culture positive	4 (80.0%)	7 (77.8%)	11 (78.6%)
Culture negative	1 (20.0%)	2 (22.2%)	3 (21.4%)
Staphylococcus aureus	2 (40.0%)	2 (22.2%)	4 (28.6%)
Escherichia coli	1 (20.0%)	2 (22.2%)	3 (21.4%)
Klebsiella species	1 (20.0%)	2 (22.2%)	3 (21.4%)
Pseudomonas aeruginosa	0	1 (11.1%)	1 (7.1%)
No growth	1 (20.0%)	2 (22.2%)	3 (21.4%)

Table 7: Factors associated with surgical site infection

Variable	SSI Present n=14	SSI Absent n=68	p-value
Diabetes mellitus	5 (35.7%)	11 (16.2%)	0.094
Emergency surgery	11 (78.6%)	38 (55.9%)	0.047
Duration of surgery >60 minutes	10 (71.4%)	25 (36.8%)	0.018
Contaminated/dirty wound	8 (57.1%)	14 (20.6%)	0.006
Delayed antibiotic prophylaxis	6 (42.9%)	13 (19.1%)	0.041
Hospital stay >5 days	9 (64.3%)	20 (29.4%)	0.012

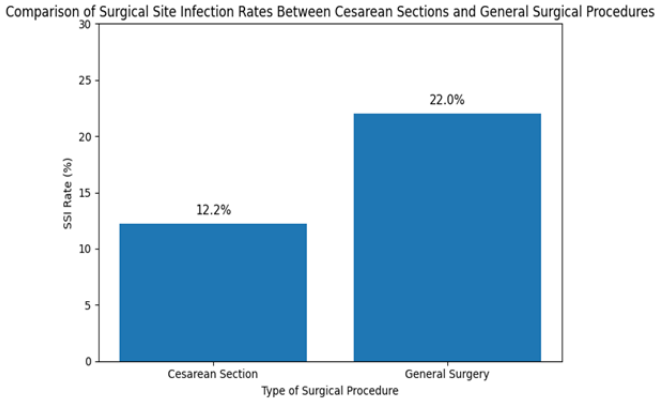

Figure 1: Comparison of surgical site infection rates between cesarean sections and general surgical procedures. SSI rate was higher in the general surgery group 22.0% compared with the cesarean section group 12.2%.

DISCUSSION

The present study compared surgical site infection rates between cesarean sections and general surgical procedures among 82 patients. The overall SSI rate was 17.1%**,** showing that postoperative wound infection remained an important complication in both obstetric and general surgical settings. In this study, SSI was observed in 12.2% of cesarean section patients and 22.0% of general surgery patients. Although the infection rate was higher in the general surgery group, the difference was not statistically significant. This finding suggests that both types of surgery carry a measurable risk of SSI, but the higher rate in general surgical procedures may be related to greater wound contamination, longer operative time, and a more diverse range of surgical conditions[12, 13].

The relatively standardized surgical procedures, routine use of prophylactic antibiotics and reduced surgical time could account for the lower SSI rate in cesarean sections. Yet, caesarean section continues to be one key factor in post-surgical infection of the wound, particularly during emergency situations. Increased risk of infection after cesarean delivery can result from factors like prolonged labor, multiple vaginal examinations, premature rupture of membranes, anemia and late antibiotic use. The majority of cesarean deliveries performed were emergency cesareans, which could be a contributing factor to the SSI rate observed among this population[14-16].

The frequency of SSI was higher for general surgical procedures than for cesarean sections. This could be explained by the presence of procedures that have different categories of wound, such as clean-contaminated, contaminated, and dirty wounds. Additionally, the mean operative duration and hospital stay were greater for the patients who underwent general surgery, which could also increase the likelihood of exposure to hospital-acquired pathogens. The gastrointestinal tract is specifically related to a high risk of postoperative infection due to the presence of bacteria and the increased surgical manipulation of the tissues encountered with gastrointestinal surgery and emergency surgery on the abdomen[17, 18].

In this study, SSI was significantly related to emergency surgery, long surgery time, contaminated/dirty wound class, delayed antibiotic use, and longer hospital stay. The results of this study emphasize the significance of pre-operative preparation, asepsia, antibiotic prophylaxis, and wound surveillance. Failure to give prophylactic antibiotics at the time of incision reduces the protective effect of the antibiotic and longer surgery leads to more exposure of the tissues to contamination risk from bacteria. Likewise, patients admitted to the hospital for longer periods might be more likely to be exposed to resistant hospital organisms[19, 20].

Both study groups had superficial incisional SSI as the most common type of infection. This is clinically significant because superficial infections tend to be identified early and can typically be treated with wound care, antibiotics and further follow-up. Deep incisional and organ/space infections, which are less common, are more serious and may require drainage, reoperation or admission to hospital. The general surgery group had more deep and organ/space infections than the other groups in this study, which could be due to the more complex and contaminated nature of some general surgical procedures.

Microbiological analysis revealed that the majority of the SSI were culture positive. The most common organisms were Staphylococcus aureus, Escherichia coli and Klebsiella species. This pattern suggests that skin flora and gram-negative flora both played a role in the postoperative wound infection. The gram-negative organisms were more common in the general surgery group, probably because of abdominal and gastrointestinal surgeries performed. The findings reinforce the necessity of local AMS and AP, based on culture and sensitivity patterns of the hospital.

There are some limitations to this study. The number of participants was relatively small, and the study was carried out for 6 months; this means that the results might not be generalized. The general surgery group consisted of various surgical procedures, and the risk of infection could have varied based on the type and complexity of surgery. Additionally, follow-up post-discharge could have influenced case detection for delayed SSI. Nevertheless, the research offers valuable local data on the incidence of SSI and on the risk factors in regards to cesarean patients and general surgical patients.

CONCLUSION

The study concluded that surgical site infection was more frequent among patients undergoing general surgical procedures compared with cesarean sections, with SSI rates of 22.0% and 12.2%, respectively. However, the difference between the two groups was not statistically significant. The overall SSI rate was 17.1%, indicating that postoperative wound infection remains an important concern in both surgical categories.

Emergency surgery, prolonged operative duration, contaminated or dirty wound class, delayed antibiotic prophylaxis, and longer hospital stay were important factors associated with SSI development. Superficial incisional infection was the most common type of SSI, while Staphylococcus aureus, Escherichia coli, and Klebsiella species were the main organisms isolated from infected wounds.

Strict infection control measures, timely antibiotic prophylaxis, proper surgical technique, careful wound care, and regular postoperative surveillance are recommended to reduce SSI rates in both cesarean and general surgical procedures. Future studies with larger sample sizes and procedure-specific subgroup analysis are needed to better identify high-risk patients and improve prevention strategies.

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