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A PROSPECTIVE OBSERVATIONAL BACTERIOLOGICAL STUDY OF CAESAREAN SECTION WOUND INFECTIONS

Obstetrics & Gynaecology

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ABSTRACT

Introduction Caesarean section (C-section) is one of the most commonly performed obstetric surgeries worldwide, offering a crucial intervention for maternal and fetal safety. However, it carries a 5–20 times higher risk of surgical site infection (SSI) compared to vaginal deliveries. SSIs are a significant cause of maternal morbidity, prolonged hospitalisation, and increased healthcare costs. This study investigates the incidence, risk factors, and microbial spectrum of SSIs in post-caesarean patients at a tertiary care hospital. **Materials and Methods** A prospective observational study was carried out on 350 women undergoing caesarean sections at ASRAM Medical College, Eluru, from January 2021 to June 2022. Participants were monitored for 30 days postoperatively for signs of SSI. Wound swabs from clinically infected sites were cultured, and isolates were subjected to antibiotic sensitivity testing. Patient demographics, obstetric and surgical data were analysed to identify statistically significant risk factors. **Results** The incidence of wound infection was 9.4%. Statistically significant associations were observed with anemia (20%, p=0.002), PROM (32.7%, p=0.001), chorioamnionitis and obstructed labour (both 100%, p=0.001), BMI >30, surgery duration >60 minutes, and prolonged hospitalisation (>15 days). The most commonly isolated organisms were Staphylococcus aureus (3.7%), Escherichia coli (2.3%), and Pseudomonas spp. (1.7%), with high sensitivity to gentamicin, amikacin, and ceftazidime, respectively.**Conclusion** The burden of post-caesarean wound infections remains considerable. Targeting modifiable risk factors such as anemia, obesity, and surgical duration, along with adherence to aseptic protocols and rational antibiotic use, can significantly reduce SSI rates and improve maternal outcomes.

KEYWORDS

INTRODUCTION

Caesarean section (C-section) is a critical operative procedure in modern obstetric practice that plays a pivotal role in ensuring the safety of both mother and fetus in complicated pregnancies and deliveries. While its global utilization has risen dramatically over recent decades, reaching levels as high as 60% in certain regions, it is not without risk. One of the most significant postoperative complications associated with C-section is surgical site infection (SSI), which continues to contribute substantially to maternal morbidity and healthcare burden, particularly in developing countries.

Surgical site infections, as defined by the Centers for Disease Control and Prevention (CDC), are infections that occur within 30 days of an operative procedure at the site of the surgery. These are categorized into three major types: superficial (limited to the skin and subcutaneous tissue), deep incisional (involving muscle and fascia), and organ/space infections (such as endometritis following C-section). SSIs can lead to delayed wound healing, wound dehiscence, prolonged hospitalization, the need for further surgical interventions (such as resuturing), and, in rare cases, sepsis or maternal mortality.

C-sections are considered clean-contaminated procedures because they involve entry into the genitourinary tract. This classification places them at an inherently elevated risk of infection. Moreover, various patient-related (e.g., anemia, obesity, diabetes), procedural (e.g., emergency surgery, prolonged operative time), and postoperative (e.g., poor wound care, delayed mobilization) factors further augment this risk.

The increasing global trend of caesarean deliveries underscores the importance of understanding and addressing SSIs. Although preventive measures such as prophylactic antibiotics, aseptic surgical techniques, and enhanced recovery protocols have been adopted, infection rates remain non-negligible.

Given this context, the present study was undertaken to assess the incidence of post-caesarean wound infections in a tertiary care setting, identify the predominant bacterial pathogens involved, and explore patient and procedural risk factors that contribute to SSIs. By focusing on local bacteriological trends and resistance profiles, this study also aims to provide data that can guide empiric antimicrobial therapy and inform institutional infection control policies.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective, observational study conducted in the Department of Obstetrics and Gynaecology at Alluri Sitarama Raju Academy of Medical Sciences (ASRAM), Eluru, a tertiary care teaching hospital in Andhra Pradesh, India. The study was designed to systematically observe and document the development of surgical site infections in women undergoing caesarean section deliveries over a defined time frame.

Study Period

January 2023 to January 2025.

Sample Size

A total of 350 pregnant women undergoing caesarean section were enrolled consecutively during the study period. This sample size was deemed sufficient based on previous local hospital incidence data and feasibility considerations.

Ethical Approval and Consent

Ethical clearance for the study was obtained from the Institutional Ethics Committee prior to commencement. Written informed consent was obtained from all participants after explaining the study's purpose, procedures, potential risks, and benefits.

METHODOLOGY

All patients undergoing either elective or emergency caesarean sections were included. Preoperative and intraoperative data were collected, including patient demographics, comorbidities (e.g., diabetes, hypertension, anemia), indications for caesarean section, duration of surgery, type of skin and uterine closure, and use of prophylactic antibiotics.

Postoperatively, patients were observed daily for signs and symptoms of surgical site infection. These included local indicators (redness, warmth, tenderness, discharge from the incision site) and systemic signs (fever, malaise, elevated white cell count). Patients were followed for 30 days postoperatively through inpatient stay and outpatient follow-up visits.

If a wound infection was suspected, swab samples were collected from the wound and sent for aerobic culture and sensitivity testing in the microbiology laboratory. Isolates were identified using standard microbiological techniques, and antibiotic susceptibility was assessed using the Kirby-Bauer disc diffusion method.

STATISTICALANALYSIS

Data were entered in Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) software version 20.0. Descriptive statistics were used to summarize categorical variables as frequencies and percentages. Continuous variables were expressed as means with standard deviations. The Chi-square test was used to assess associations between categorical variables and the presence of wound infection. A p-value of <0.05 was considered statistically significant.

INCLUSION AND EXCLUSION CRITERIA

Inclusion Criteria

- All pregnant women who underwent caesarean section, either elective or emergency, at the study hospital during the period of January 2021 to June 2022.
- Patients willing to provide informed consent and comply with postoperative follow-up for 30 days.

Exclusion Criteria

- Women who delivered vaginally during the study period.
- Patients with a known history of pre-existing wound infection or systemic infection prior to surgery.
- Patients who failed to complete postoperative follow-up (lost to follow-up within 30 days).
- Women who underwent caesarean section in another facility and were admitted postoperatively for complications (to exclude confounding variables).

RESULTS AND ANALYSIS

Incidence of Surgical Site Infections

Out of 350 women who underwent caesarean section during the study period, 33 patients developed clinical and microbiologically confirmed surgical site infections. This corresponds to an overall infection rate of 9.4%. Infections were classified based on CDC criteria, with the majority being superficial incisional SSIs. No deep incisional or organ/space infections (e.g., endometritis or pelvic abscess) were reported during the follow-up period.

Age and Socioeconomic Status

The majority of patients belonged to the 21–25-year age group, which also accounted for most infections (25/282, 8.9%). However, the highest proportion of infection was seen in patients aged <21 years (6/37, 16.2%), although this difference was not statistically significant (p=0.29). Socioeconomic status (SES), determined by modified Kuppuswamy's scale, showed a statistically significant association with wound infections (p=0.001), with the majority of cases occurring in patients from lower socioeconomic classes.

Parity and Type of Caesarean Section

Primigravidae were found to have a significantly higher rate of wound infection (13.2%) compared to multigravidae (6.5%) (p=0.03). Emergency caesarean sections were associated with a higher infection rate (10.2%) compared to elective procedures (4.4%), although this difference did not reach statistical significance (p=0.17). This may reflect suboptimal preoperative preparation and increased labor-related contamination in emergency cases.

Impact of Clinical Risk Factors

A statistically significant correlation was observed between wound infections and the presence of anemia (p=0.002), with 20% of anemic women developing infection. PROM was associated with a 32.7% infection rate (p=0.001), chorioamnionitis and obstructed labour showed 100% infection rates (each p=0.001), highlighting the profound impact of infection-prone obstetric conditions.

Comorbidities such as gestational diabetes mellitus (11.4%) and hypertensive disorders (11.9%) were not found to be statistically significant contributors, although they trended toward increased risk.

Key Risk Factors

The following variables showed statistically significant associations with wound infection:

Risk Factor	Infection Present (%)	p-value
Anemia	20.0%	0.002
PROM	32.7%	0.001
Chorioamnionitis	100%	0.001
Obstructed Labour	100%	0.001
BMI >30	83.3%	0.001
Surgery >60 minutes	100%	0.001
Hospital stay >15 days	100%	0.001

Body Mass Index (BMI) and Surgery Duration

Obesity (BMI >30) was a powerful predictor of wound infection, with 83.3% of obese patients developing SSIs (p=0.001). The infection rate progressively increased with rising BMI categories. Similarly, prolonged duration of surgery demonstrated a strong positive correlation with infection: 100% of patients with operative times >60 minutes developed SSIs (p=0.001), while those with surgeries <45 minutes had a much lower rate (5.6%).

Postoperative Hospital Stay and Treatment

Longer hospital stays were significantly associated with wound infection. All patients with hospital stays of 15–21 days or more than 21 days had SSIs, whereas those discharged within 8 days had minimal infections (p=0.001).

Management included daily dressings in 5.7% and resuturing in 4.9% of patients. No patients required re-laparotomy or intensive care, and all cases were eventually managed conservatively with satisfactory outcomes.

Microbial Profile of Infections

Aerobic culture yielded growth in 31 out of 33 infected cases. The most frequently isolated organisms were:

- Staphylococcus aureus: 13 cases (3.7%
- Escherichia coli: 8 cases (2.3%)
- Pseudomonas aeruginosa: 6 cases (1.7%)
- Klebsiellapneumoniae and Enterobacter spp.: 2 cases each (0.6%)

No growth was observed in 91.1% of all wound swabs, possibly due to empirical antibiotic administration prior to sample collection or limitations in anaerobic culture techniques.

Antibiotic Sensitivity Patterns

- Staphylococcus aureus isolates exhibited 100% sensitivity to gentamicin and high sensitivity to amikacin and doxycycline. Moderate resistance was noted to erythromycin and ciprofloxacin.
- E. coli and Klebsiella isolates showed complete sensitivity to amikacin, while Pseudomonas isolates were universally sensitive to ceftazidime and cefepime.
- These results affirm the continued utility of aminoglycosides and third-generation cephalosporins as empiric therapy in this setting.

DISCUSSION

The present study revealed a 9.4% incidence of surgical site infections following caesarean section, which is consistent with previously reported figures in similar low-resource tertiary care settings. Despite standardized preoperative prophylactic antibiotic administration, meticulous surgical techniques, and routine postoperative care, SSIs continue to impose a significant burden on maternal health.

Several patient-related and procedural factors were identified to be significantly associated with the occurrence of SSIs in this study. Notably, anemia emerged as a statistically significant risk factor. Anemia compromises oxygen delivery to tissues, impairing the wound healing process and increasing susceptibility to infections. This finding underscores the need for proactive antenatal screening and correction of hemoglobin levels prior to delivery.

Premature rupture of membranes (PROM), chorioamnionitis, and obstructed labour were also strongly associated with infection, with the latter two showing a 100% infection rate. PROM increases the risk

of ascending bacterial infection, while chorioamnionitis directly introduces infectious agents into the uterine environment, contaminating the surgical field. Obstructed labour often necessitates prolonged instrumentation and emergency operative interventions under less-than-ideal aseptic conditions, elevating infection risk.

Obesity, defined as BMI >30, was another major determinant. Adipose tissue has poor vascularity, which delays wound healing and increases the risk of infection. Surgical duration exceeding 60 minutes also had a direct correlation with SSI incidence. Prolonged surgeries expose the surgical wound to environmental contaminants and increase tissue trauma, both of which facilitate infection.

The microbial analysis revealed Staphylococcus aureus as the most common pathogen, followed by E. coli and Pseudomonas aeruginosa. This aligns with global trends, where S. aureus—particularly methicillin-resistant strains (MRSA)—is frequently isolated in SSIs. The antibiogram demonstrated high sensitivity to gentamicin and amikacin, reinforcing their role in empiric treatment. However, the increasing resistance patterns necessitate culture-based therapy wherever feasible.

Interestingly, 91.1% of wound swabs showed no growth, which could be attributed to prior antibiotic exposure, delayed sample collection, or the inability to isolate anaerobic organisms due to laboratory constraints. This finding emphasizes the need for improved microbiological techniques and protocols in routine clinical practice.

From a policy perspective, the study suggests that simple, cost-effective interventions—such as antenatal anemia correction, avoidance of prolonged surgeries, strict adherence to asepsis, timely antibiotic administration, and rational wound care—can greatly reduce the incidence of SSIs. Furthermore, institutional implementation of SSI surveillance programs and regular audit of antimicrobial sensitivity patterns can enhance infection control practices.

CONCLUSION

Surgical site infections following caesarean section continue to represent a significant cause of maternal morbidity, particularly in low-resource settings. The present study identifies an incidence of 9.4%, with strong associations noted with anemia, PROM, chorioamnionitis, obesity, prolonged surgery, and obstructed labour.

The predominant pathogens identified—Staphylococcus aureus, E. coli, and Pseudomonas spp.—highlight the importance of routine bacteriological surveillance and the need for targeted antibiotic policies based on local sensitivity profiles. Despite routine antibiotic prophylaxis, SSIs remain prevalent, suggesting that prevention requires a multifaceted approach that includes both systemic and local interventions.

Key strategies to reduce post-caesarean wound infections should focus on preoperative patient optimization (especially anemia and glycemic control), intraoperative efficiency and asepsis, and postoperative vigilance. Institutions should prioritize the development of surgical safety protocols, ongoing staff training, and patient education regarding hygiene and wound care.

In conclusion, the findings of this study reinforce the necessity of a comprehensive and sustained approach to SSI prevention—balancing evidence-based medical interventions with practical, resource-conscious solutions to improve maternal outcomes in obstetric surgery.

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