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BACTERIOLOGICAL PROFILE AND ANTIBIOGRAM IN SURGICAL SITE INFECTIONS FOLLOWING LOWER SEGMENT CAESAREAN SECTION IN A TERTIARY CARE HOSPITAL

Obstetrics & Gynaecology

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ABSTRACT

Background: Surgical site infections (SSIs) are a major cause of morbidity following lower-segment cesarean section (LSCS), and are associated with rising antimicrobial resistance. **Objectives:** To evaluate the bacteriological profile of SSIs post-LSCS and determine the antibiotic susceptibility patterns of wound isolates in a tertiary care hospital. **Methods:** Prospective observational study in the Departments of Obstetrics & Gynaecology and Microbiology at Niloufer Hospital, Hyderabad. Samples were processed using standard methods; the Antibiogram was interpreted. **Results:** Escherichia coli was the most common bacteria isolated, followed by Klebsiella pneumoniae and Pseudomonas aeruginosa. Gram-positive isolates were resistant to penicillin/cephalosporins but sensitive to Vancomycin/Linezolid. Gram-negatives showed resistance to cephalosporins/fluoroquinolones, but retained susceptibility to carbapenems and piperacillin-tazobactam. **Conclusion:** SSIs after LSCS are increasingly caused by multidrug-resistant organisms. Institutional antibiogram data should guide empirical therapy.

KEYWORDS

Surgical site infection, LSCS, antibiogram, multidrug resistance

INTRODUCTION

A surgical site infection (SSI) is an infection that occurs at or near a surgical incision within 30 days of the operative procedure (or within 90 days if prosthetic material is implanted), and involves either:

1. Superficial Incisional SSI – infection involves only the skin or subcutaneous tissue of the incision.
2. Deep Incisional SSI – infection involves the deeper soft tissues (e.g., fascia and muscle layers) of the incision.
3. Organ/Space SSI – infection involves any part of the anatomy (organs or spaces) other than the incision that was opened or manipulated during the operation.

Diagnostic Criteria (any one of the following):

- Purulent drainage from the incision.
- Organisms isolated from an aseptically obtained culture of fluid/tissue from the incision.
- Signs of infection (pain, tenderness, localised swelling, redness, or heat) with incision deliberately opened by the surgeon.

LSCS rates have increased globally, with the WHO reporting a rise from 12% in 2000 to over 21% in 2021.[1] In India, LSCS rates are also rising, especially in urban hospitals. [2] SSIs are one of the most common complications of LSCS, occurring in 3–15% of cases in developing countries. [3]

Predisposing Factors:

- SSI risk in LSCS is influenced by multiple maternal and peri-operative factors such as obesity, diabetes mellitus, anaemia, prolonged rupture of membranes, multiple vaginal examinations, prolonged labour, emergency surgery, and blood transfusion.[4-6]
- Additional intra-operative factors include type and duration of surgery, blood loss, skill of the surgeon, and aseptic precautions.[7-9]
- Post-operative conditions such as poor wound care, low socioeconomic status, and malnutrition further predispose to SSI.[9]

The bacteriological profile of SSIs varies geographically. Staphylococcus aureus (including MRSA) remains the most frequent isolate, while Gram-negative bacilli such as Escherichia coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa are increasingly reported.[11-13] Emerging multidrug resistance, including ESBL-producing and carbapenem-resistant organisms, complicates treatment[14 15] This study investigates the bacteriological spectrum and antibiotic susceptibility of SSIs following LSCS in a tertiary care hospital.

MATERIALS AND METHODS

Study design: A prospective observational study was conducted at Niloufer Hospital, Hyderabad, a tertiary care teaching hospital, from 1-1-2024 to 31-7-2024. The study was approved by the Institutional Review Board of Niloufer Hospital. Written informed consent was obtained from all participants before their inclusion in the study.

Inclusion criteria:

- Age > 18 years
- Women with clinical features of SSI after LSCS.
- Who has given consent for the study.

Exclusion criteria:

- Age < 18 years
- Women who have not given consent.
- Deep SSI
- Incomplete clinical data

Clinical data were collected from patient medical records and included:

- Demographic details (age, parity, and comorbidities such as diabetes, hypertension, obesity, etc.).
- Type of Cesarean section (elective or emergency).
- Risk factors for infection (e.g., prolonged labor, rupture of membranes, obesity).
- Postoperative follow-up was done to identify patients who developed SSIs. The diagnosis of SSI was based on the presence of signs and symptoms such as redness, warmth, swelling, pain, or discharge at the surgical site, along with positive microbiological confirmation

Sample Collection and Microbiological Processing

Samples were collected from patients who developed clinical signs of surgical site infection, typically between 3 and 7 days postoperatively. Pus or wound swab specimens were obtained either from the wound bed or from the edges of the infected site using sterile cotton-tipped swabs under strict aseptic precautions to minimise contamination. The collected samples were promptly transported to the microbiology laboratory for further processing.

All specimens were subjected to standard bacteriological culture and identification procedures. Gram staining was performed on the isolated colonies, and species identification was confirmed.

Antibiotic susceptibility testing was carried out using a panel of commonly prescribed antibiotics. The isolates were categorised as either susceptible or resistant based on the results obtained.

STATISTICAL ANALYSIS

The collected data were analysed, and descriptive statistics were used to summarise the demographic and clinical characteristics of the study population.

STUDY LIMITATIONS

- The study was conducted at a single centre, for a short period, which may limit the generalizability of the findings to other regions.
- The study did not explore the molecular mechanisms of antibiotic resistance, which could provide additional insights into the resistance patterns observed.

RESULTS

During the period of study from 1-1-2024 to 31-7-2024, 5215 deliveries were done in the hospital, out of which 2641 patients were delivered by LSCS.

Table 1: Type of LSCS and incidence of SSI

TYPE OF LSCS	TOTAL	SSI	PERCENTAGE
ELECTIVE	1056	36	(3.5%)
EMERGENCY	1585	81	(5.1%)
TOTAL	2641	117	(4.4%)

In our study, out of 2641 cases of LSCS, 117 (4.4%) had wound infection. Out of 117 patients with SSI, 36 cases were operated electively, while 81 had emergency caesarean sections.

SSI is more common with emergency LSCS

Table 2: Risk factors associated with SSI

S.NO	RISK FACTOR	NUMBER OF CASES	PERCENTAGE
1	ANAEMIA	27	23.07%
2	POST-PARTUM HEMORRHAGE	11	9.4%
3	HEMATOMA	5	4.27%
4	OBESITY	17	14.52%
5	PREVIOUS CAESAREAN SECTION	48	41.02%

Some common risk factors for SSIs were noted. The commonest factor was previous surgery followed by anaemia.

Table 3: Duration of surgery and SSI

S NO.	DURATION OF SURGERY	TOTAL NUMBER	SSI	PERCENTAGE
1	< 1 hour	1961	67	3.4
2	>1 hour	680	50	7.35
3	TOTAL	2641	117	4.43

The average duration of surgery was less than one hour in 1961 LSCS in our study. 680 LSCS required more than one hour for the surgery. Prolonged duration of surgery was found to be a significant factor responsible for SSI.

Table 4: Clinical Presentation of SSI in LSCS

S NO.	CLINICAL PRESENTATION	FREQUENCY	PERCENTAGE
1	FEVER	22	18.8
2	LOCAL PAIN AND INDURATION	17	14.52
3	PURULENT DISCHARGE WOUND	42	35.90
4	SPONTANEOUS SUPERFICIAL DEHISCENCE OF WOUND	37	31.62
5	WOUND DELIBERATELY OPENED	13	11.11
6	PELVIC COLLECTION IN USG	3	2.56

SSI was detected on 4±2 days. The commonest clinical manifestation of SSI in our study was purulent discharge in 42(35.9%) cases. Fever was present in 22(18.8%) cases. Local pain and induration were observed in 17 (14.52%) cases. 37 women (31.62%) had a spontaneous superficial dehiscence wound, and in 13 women (11.11%), the wound was deliberately opened to facilitate drainage of pus. Rectus sheath dehiscence or pus collection in deeper tissues/ organs was recorded in 3 patients.

Table 5: Pus Culture and Sensitivity

S NO.	TYPE OF ORGANISM	NUMBER	PERCENTAGE
1	E.COLI	22	18.8
2	KLEBSIELLA	16	13.68
3	PSEUDOMONAS	15	12.82
4	MRSA	14	11.97
5	STAPHYLOCOCCUS AUREUS	4	3.42
6	OTHERS	8	6.84
7	STERILE	38	32.48

In the present study, in 67.52% cases cultures showed bacterial growth and in 32.48% they were sterile. E. coli was the commonest organism cultured from wound discharge. Klebsiella, MRSA, Staphylococcus aureus, Pseudomonas were other commonly isolated organisms. No growth was seen in 38 isolates indicating possibility of faulty suturing technique. (Others includes Streptococcus, Enterococcus, Candida albicans).

Table 6: Most common antibiotic sensitivity for the organisms

TYPE OF ORGANISM	MOST SENSITIVE ANTIBIOTICS
E. COLI	Amikacin, Ciprofloxacin, Gentamycin
KLEBSIELLA	Amikacin, Meropenem
PSEUDOMONAS	Piperacillin, Cefipime, Meropenem
MRSA	Doxycycline, Linezolid, Vancomycin, Clindamycin
STAPHYLOCOCCUS AUREUS	Cephelexin, Cefazolin, Linezolid

Methicillin-resistant Staphylococcus aureus was found to be sensitive mainly to clindamycin and doxycycline. E. coli, Gram-negative organisms, were sensitive to Amikacin and Gentamycin.

Table 7: Management of SSI

S NO.	TYPE OF TREATMENT	NUMBER	PERCENTAGE
1	CONSERVATIVE	38	32.48
2	SECONDARY SUTURING	79	67.52

Complete healing was noted with conservative treatment in 38 patients. Daily Dressing with betadine (10%) solution and antibiotic treatment was given as per the culture and sensitivity report. Resuturing was needed in 79 cases.

Table 8: Average Duration Of Hospital Stay

PATIENT TYPE	AVERAGE HOSPITAL STAY (DAYS)
PATIENTS WITHOUT SSI	5
SSI CONSERVATIVELY MANAGED	9
SSI MANAGED WITH RESUTURING	15

Patients without SSI were discharged on postoperative day 4 after a check dressing. Patient with SSI needed a prolonged hospital stay for daily dressing and /or antibiotic therapy. Patients who needed Resuturing needed a hospital stay for an average 15 days

DISCUSSION

The rate of SSI after caesarean section in our study was 4.4%, which is comparable to 4.2% as detected by Al Jama FE. A study of SSI following CS in Nigeria reported an overall wound problem of 13.5% and SSI of 8.9% [19]. K. Bhavani et al. found, in their study of 1000 cases, the incidence of SSI after LSCS was 13.5% [22].

Anaemia, Previous caesarean section and obesity were the most common high-risk factors found in our study. Premature Rupture of Membranes and Post Caesarean Pregnancy in labour with Scar tenderness were the risk factors detected in the study by K. Bhavani et al. [22]. Adekunle Sobande et al. performed a retrospective study of 371 patients undergoing repeat caesarean section in King Khalid University, Saudi Arabia. Incidence of wound dehiscence in this study was 31.62% [24]. Surgery duration of more than 1 hour has been reported to increase the risk for SSI more than twofold in Killian CA et al. A similar result was noted in our study [23].

SSI after cesarean delivery has a distinctive microbial source of pathogens composed of both skin and vaginal origin [24]. E. coli (18.8%) was the commonest pathogen to produce SSI in our series, followed by Klebsiella, MRSA and Pseudomonas. This may alter the pattern of prophylactic antibiotics given preoperatively in the near future if their

incidence is on the rise. K. Bhavani et al. found that the most common pathogens were S. aureus, Pseudomonas aeruginosa and E. coli, as was also observed in their study [22]. No organisms were detected on culture in 32.48% patients with SSI, which points towards the need for more careful and correct surgical techniques for primary closure.

Most of the women developing wound infections following discharge returned 6–10 days later, with complaints of fever, pain, and wound discharge and redness in K Bhavani et al. In our study, SSI was detected on 4±2 days, 31.62% patient had a spontaneous superficial dehiscence wound.

The management of post-cesarean wound infection includes antibiotic treatment, wound exploration, and debridement [31]. In our study, 32.48% patients with SSI were managed conservatively, and 67.52% patients required resuturing. Prolonged hospital stay with an increase in health care costs was noted with SSI. [21]

CONCLUSION

Surgical site infections following LSCS (4.4% incidence) remain a significant cause of maternal morbidity and increased healthcare costs, worsened by rising multidrug resistance among both Gram-positive and Gram-negative organisms. Prevention requires a targeted approach focusing on risk factor identification and correction, adherence to aseptic techniques, and minimising operative duration.

Empirical antibiotic therapy should be guided by an institution-specific antibiogram, with continuous surveillance of microbial patterns to optimise treatment strategies.

A protocol-driven, evidence-based approach integrating prevention and rational antibiotic use is essential to reduce SSI burden and improve maternal outcomes.

FUTURE DIRECTIONS AND KNOWLEDGE GAPS

Future research should prioritise multicentre studies with larger sample sizes to generate more generalizable data on SSIs following caesarean sections. Exploration of molecular mechanisms underlying antimicrobial resistance and evaluation of clinical outcomes with different treatment strategies are needed to refine management protocols.

Significant variability in bacterial profiles and antibiograms across institutions highlights an important knowledge gap. Continuous local surveillance of microbial patterns and resistance trends is essential to guide empirical therapy, strengthen antimicrobial stewardship, and ensure rational antibiotic use in obstetric care.

Sustained surveillance combined with robust, multicentre evidence will be key to optimising SSI prevention and management strategies.

CONFLICT OF INTEREST

None declared.

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ABBREVIATIONS

SSI: surgical site infection; LSCS: Lower segment caesarean section; E. coli: Escherichia coli

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