Volume - 15 | Issue - 08 | August - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

CLINICAL STUDY OF SURGICAL SITE INFECTION FOLLOWING LOWER SEGMENT CAESAREAN SECTION AT A TERTIARY CARE CENTRE

Obstetrics & Gynaecology

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ABSTRACT

Background: Surgical site infection (SSI) following lower segment caesarean section (LSCS) remains an important contributor to post-caesarean maternal morbidity, prolonged hospitalisation and increased treatment burden. Identification of frequently observed clinical, obstetric and operative factors is essential for improving prevention, early diagnosis and management. The present study aimed to evaluate the incidence, clinical profile, microbiological pattern, treatment modalities and maternal morbidity associated with SSI following LSCS at a tertiary care centre. **Methods:** This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Government Medical College, Chhatrapati Sambhajinagar, from April 2024 to March 2026. During the study period, 5,952 LSCS were performed, of which 280 women developed SSI and were included for descriptive analysis. SSI was diagnosed clinically and classified according to CDC depth-based criteria. **Results:** The overall incidence of SSI following LSCS was 4.7%. SSI incidence was 4.92% after emergency LSCS and 2.86% after elective LSCS. Emergency LSCS was observed in 93.5% of SSI cases. Other frequently observed factors were ≥3 vaginal examinations (68.0%), operative duration >38 minutes (67.1%), anaemia (55.5%), PROM (54.0%) and previous uterine surgery (53.6%). Wound discharge was the most frequent presentation (78.6%). Superficial incisional SSI was the most frequent type (74.6%). MRSA was the most frequent isolate (33.9%). Conservative management was successful in 78.6%, while secondary suturing was required in 19.6%. Exploratory laparotomy and burst abdomen were each observed in 0.7%. Hospital stay of 10–20 days was required in 49.6%. **Conclusion:** Post-caesarean SSI occurred in 4.7% of LSCS cases and was observed more often after emergency procedures. Most infections were superficial and responded to conservative management. The findings support risk identification, rational antibiotic use, aseptic operative practice and structured postoperative wound surveillance.

KEYWORDS

Caesarean Section; Lower Segment Caesarean Section; Surgical Site Infection; Postoperative Wound Infection; Maternal Morbidity; Methicillin-Resistant Staphylococcus Aureus; Wound Sepsis

INTRODUCTION

Caesarean section is among the most frequently performed obstetric operations worldwide and has a vital role in reducing maternal and perinatal morbidity when performed for appropriate indications. However, increasing caesarean delivery rates have also expanded the population of women exposed to postoperative complications. Surgical site infection is one of the most clinically relevant complications after caesarean delivery because it delays postoperative recovery, increases antimicrobial use, prolongs hospital stay and adds to the emotional and financial burden on the mother and health-care system.[1,2]

Surgical site infection is conventionally diagnosed when infection occurs at or near the surgical incision or operative site within the defined surveillance period and is related to the operative procedure. CDC/NHSN classification categorises SSI as superficial incisional, deep incisional or organ/space infection according to the depth and anatomical extent of involvement.[2] Post-caesarean SSI is multifactorial. Host-related factors such as anaemia, obesity, diabetes and poor nutritional status; intrapartum factors such as prolonged labour, premature rupture of membranes and repeated vaginal examinations; and procedure-related factors such as emergency surgery, prolonged operative duration, suboptimal antibiotic timing and tissue handling have all been described in the literature.[3,4,5]

Evidence-based preventive strategies include appropriate antibiotic prophylaxis, adequate skin preparation, aseptic operative technique, avoidance of unnecessary hair removal, optimisation of modifiable maternal conditions and systematic postoperative surveillance.[1,3,6,7] In tertiary care obstetric units, many women undergoing LSCS have referral-related delays, advanced labour, PROM, anaemia or prior uterine surgery. These factors make local data important for planning preventive bundles, rational antibiotic policies and early wound-care protocols. The present study was conducted to evaluate the incidence, clinical presentation, microbiological profile, treatment modalities and maternal morbidity associated with SSI following LSCS at a tertiary care centre.

MATERIALS AND METHODS

This was a prospective observational study conducted in the Department of Obstetrics and Gynaecology at Government Medical College, Chhatrapati Sambhajinagar. The study evaluated surgical site infection following lower segment caesarean section. The study was conducted over two years, from April 2024 to March 2026. Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was obtained from all participants, and confidentiality of patient information was maintained.

Inclusion Criteria

- Pregnant women who underwent emergency or elective LSCS at the tertiary care centre.
- Patients diagnosed with surgical site infection following LSCS.
- Patients willing to participate and provide informed consent.

Exclusion Criteria

- LSCS performed at another hospital and referred for complications.
- Patients with pre-existing skin infection at the surgical incision site.
- Patients unwilling to participate in the study.

After written informed consent, data were collected using a structured case proforma. Demographic variables included age, residence and body mass index. Obstetric and intrapartum variables included type of LSCS, PROM, duration of PROM, duration of labour, number of vaginal examinations, anaemia and history of previous uterine surgery. Operative variables included type of skin incision, duration of surgery and skin closure technique. Postoperative variables included clinical presentation, depth of SSI, wound swab culture, treatment modality, need for re-surgery, wound complications and hospital stay.

Postoperative wound assessment was performed according to departmental protocol. Check dressing was done on postoperative day 5 for low-risk patients and day 7 for high-risk patients. Earlier wound examination was performed when fever, dressing soakage, erythema, tenderness, discharge or induration was present. SSI was diagnosed on the basis of clinical features, wound findings and culture results and was classified according to clinical presentation and CDC depth-based criteria as superficial incisional, deep incisional or organ/space SSI.[2]

Patients with superficial wound infection were managed conservatively with culture-guided antibiotics, daily wound dressing, release of sutures for drainage and open wound care where required. Women with wound gape underwent secondary suturing when indicated. Severe complications such as burst abdomen required exploratory laparotomy. Patients were followed up for 6 weeks after discharge to assess wound healing, morbidity and readmission where applicable.

Data were entered in Microsoft Excel and analysed descriptively. Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean and standard deviation where available.

RESULTS

During the study period, the overall incidence of surgical site infection following LSCS was 4.7%. The incidence was higher after emergency LSCS (4.92%) than after elective LSCS (2.86%).

Table 1. Incidence of Surgical Site Infection Following LSCS

Category	Total LSCS, n	SSI cases, n	Incidence (%)
All LSCS	5,952	280	4.70
Emergency LSCS	5,323	262	4.92
Elective LSCS	629	18	2.86

The largest age group was 26–30 years (42.5%), followed by 21–25 years (35.0%). Rural residence was more frequent than urban residence (65.7% versus 34.3%). Increased BMI was commonly observed, with overweight and obesity together accounting for 64.0% of SSI cases.

Table 2. Demographic Profile of Women with SSI After LSCS

Variable	Category	n	%
Age group	<20 years	11	3.9
	21–25 years	98	35.0
	26–30 years	119	42.5
	31–35 years	46	16.4
	>35 years	6	2.2
Residence	Rural	184	65.7
	Urban	96	34.3
BMI category	Underweight	9	3.2
	Normal weight	92	32.8
	Overweight	113	40.4
	Obese	66	23.6

Emergency LSCS was the most frequently observed obstetric factor (93.5%). Repeated vaginal examinations were documented in 68.0%, while labour duration >12 hours was present in 62.1%. PROM was present in 54.0%, and among those with PROM, duration >12 hours was observed in 66.9%. Anaemia was present in 55.5%, and previous uterine surgery was recorded in 53.6%. Overweight and obesity were recorded in 40.4% and 23.6%, respectively.

Table 3. Obstetric, Intrapartum and Host-related Factors Observed Among SSI Cases

Factor	Denominator	n	%
Emergency LSCS	280	262	93.5
≥3 vaginal examinations	280	190	68.0
PROM	280	151	54.0
PROM >12 hours*	151	101	66.9
Labour duration >12 hours	280	174	62.1
Anaemia, Hb <11 g/dL	280	155	55.5
Previous uterine surgery	280	150	53.6
Overweight	280	113	40.4
Obesity	280	66	23.6

(*PROM >12 hours was calculated among women with PROM)

Operative duration >38 minutes was documented in 67.1%. Pfannenstiel incision was used in 96.8%, while vertical incision was used in 3.2%. Mattress suturing was the most frequently used skin closure technique (81.4%), followed by subcuticular suturing (17.5%) and stapler closure (1.1%).

Table 4. Operative Factors Among Women with SSI After LSCS

Variable	Category	n	%
Duration of surgery	<38 minutes	92	32.9
	>38 minutes	188	67.1
Skin incision	Pfannenstiel	271	96.8
	Vertical	9	3.2
Skin closure technique	Mattress suturing	228	81.4
	Subcuticular suturing	49	17.5
	Stapler	3	1.1

Wound discharge was the most frequent clinical presentation (78.6%). Full-length wound gape was observed in 15.0%, partial wound gape in 5.7%, and burst abdomen in 0.7%. Superficial incisional SSI was the predominant type (74.6%), followed by deep incisional SSI (24.5%) and organ/space SSI (0.9%).

Table 5. Clinical Presentation and Depth of SSI

Variable	Category	n	%
Clinical presentation	Wound discharge	220	78.6
	Partial wound gape	16	5.7
	Full-length wound gape	42	15.0
	Burst abdomen	2	0.7
Depth of infection	Superficial incisional SSI	209	74.6
	Deep incisional SSI	69	24.5
	Organ/space SSI	2	0.9

MRSA was the most frequent isolate (33.9%), followed by Staphylococcus aureus (17.9%), Escherichia coli (11.1%), Klebsiella species (8.9%) and Pseudomonas species (8.9%). Other organisms accounted for 19.3%. This microbiological pattern supports the importance of wound culture and local antimicrobial surveillance.

Table 6. Microbiological Profile of Wound Infection

Organism isolated	n	%
MRSA (methicillin-resistant Staphylococcus aureus)	95	33.9
Staphylococcus aureus	50	17.9
Escherichia coli	31	11.1
Klebsiella species	25	8.9
Pseudomonas species	25	8.9
Others	54	19.3
Total	280	100.0

Conservative management with antibiotics and wound care was successful in 78.6%. Secondary suturing was required in 19.6%, while exploratory laparotomy was required in 0.7%. Secondary healing was documented in 1.1%.

Table 7. Treatment Procedures/Interventions used for SSI

Treatment procedures/interventions used	n	%
Medical/conservative management	220	78.6
Secondary suturing	55	19.6
Exploratory laparotomy	2	0.7
Secondary healing	3	1.1
Total	280	100.0

Severe wound morbidity was uncommon; with burst abdomen and exploratory laparotomy each recorded in 0.7%. However, SSI was associated with prolonged hospitalisation. Hospital stay of 10–20 days was required in 49.6%, while stay >20 days was required in 6.4%. Hospital stay <10 days was recorded in 43.9%.

Table 8. Maternal Morbidity and Hospital Stay

Outcome	Category	n	%
Severe wound complication	Burst abdomen	2	0.7
Re-surgery	Exploratory laparotomy	2	0.7
Duration of hospital stay	<10 days	123	43.9
	10–20 days	139	49.6
	>20 days	18	6.4

DISCUSSION

The present prospective observational study evaluated SSI following LSCS at a tertiary care centre over two years. Among 5,952 LSCS performed during the study period, 280 women developed SSI, giving an overall incidence of 4.7%. SSI incidence was higher after emergency LSCS than elective LSCS, with an incidence of 4.92%, compared with 2.86% after elective LSCS. Most infections were superficial incisional infections and were managed conservatively. Severe complications such as burst abdomen and need for exploratory laparotomy were uncommon.

The observed SSI incidence of 4.7% lies within the range reported in several post-caesarean SSI studies and reviews. Kawakita and Landy[4] reported that wound infection complicates approximately 2–7% of caesarean deliveries, while Zuarez-Easton et al.,[5] described a wider range of 3–15%, particularly reflecting differences in setting, surveillance methods and post-discharge follow-up. Wloch et al.,[8] in a multicentre cohort study from England, reported an SSI frequency of 9.6% after caesarean section, while Opøien et al.,[9] observed a rate of 8.9% using CDC standards. Moulton et al.,[10] reported an SSI rate of 5.5% at a US academic institution, which is close to the present observation. The difference from other reports may reflect variation in study setting, SSI definition, surveillance duration and completeness of post-discharge follow-up.

Emergency LSCS was observed in 93.5% of women who developed SSI. Emergency procedures are often performed in the setting of labour, ruptured membranes, repeated vaginal examinations, urgency of delivery and limited time for preoperative optimisation. These factors may increase microbial exposure and reduce the opportunity for ideal preparation. Previous studies have consistently identified emergency caesarean delivery and labour-associated caesarean section as important factors associated with SSI.[8-11] In the present study, the higher incidence after emergency LSCS compared with elective LSCS supports the need for targeted intrapartum infection-prevention protocols for emergency obstetric surgery.

Repeated vaginal examinations were observed in 68.0% of women with SSI, and labour duration exceeded 12 hours in 62.1%. PROM was present in 54.0%, and among women with PROM, duration exceeded 12 hours in 66.9%. These findings are clinically relevant because repeated examinations, prolonged labour and prolonged rupture of membranes increase ascending microbial colonisation and may contribute to postoperative wound contamination. Similar observations have been reported in Indian and international studies.[12-15] The findings support careful labour monitoring, avoidance of unnecessary vaginal examinations, timely decision-making for LSCS and strict aseptic precautions during intrapartum care.

Anaemia was observed in 55.5% of women in the present study. Anaemia may impair tissue oxygenation and wound healing and has been identified as an important modifiable maternal factor in post-caesarean SSI literature.[13,14] Increased BMI was also common, with 40.4% overweight and 23.6% obese women. Obesity may be associated with thicker subcutaneous tissue, reduced tissue vascularity, increased seroma formation, technical difficulty and prolonged operative time. Olsen et al.,[11] reported higher BMI as an independent risk factor for SSI after low transverse caesarean section. Li and Cui[12] also identified BMI and duration of surgery as important factors in SSI after caesarean section. The present findings highlight the need for antenatal optimisation, correction of anaemia and careful postoperative wound care in women with increased BMI.

Operative duration exceeded 38 minutes in 67.1% of affected women. Prolonged operative duration may reflect adhesions, prior uterine surgery, difficult extraction, haemostasis-related issues or technical complexity. Previous uterine surgery was present in 53.6% of women in the present study, suggesting that repeat surgery and scar-related adhesions may contribute to longer operations and increased tissue handling. Wloch et al.,[8] Moulton et al.,[10] and Li and Cui[12] have described operative or procedure-related factors as important determinants of SSI. Pfannenstiel incision was used in 96.8% of cases, while mattress suturing was the most frequent skin closure method. As the present study included only women with SSI and did not include a non-SSI comparison group for operative variables, these findings should be interpreted descriptively rather than causally.

Wound discharge was the commonest clinical presentation, observed in 78.6% of women. This is consistent with clinical practice, where discharge, erythema, local tenderness, induration and wound gape often prompt early wound assessment. Superficial incisional SSI accounted for 74.6% of cases, while deep incisional SSI accounted for 24.5% and organ/space SSI for 0.9%. This predominance of superficial infection is similar to reports from other post-caesarean SSI studies and suggests that most infections were detected before progression to severe wound morbidity.[4,5,15] Burst abdomen occurred in only two women, indicating that severe fascial dehiscence was uncommon.

MRSA was the most common organism isolated, accounting for 33.9% of cases, followed by Staphylococcus aureus, E. coli, Klebsiella and Pseudomonas. The predominance of MRSA is important for institutional infection-control policy because it may reflect hospital flora, antimicrobial selection pressure, colonisation patterns and wound-care practices. Jain et al.,[14] in a western Indian study, highlighted the importance of identifying bacterial profile and antimicrobial susceptibility patterns in post-caesarean SSI. Culture-guided antibiotic therapy, antimicrobial stewardship and periodic review of local antibiograms are therefore essential, particularly in tertiary care units with high surgical load.

Most women in the present study were successfully managed with conservative treatment, including antibiotics and wound dressing. Secondary suturing was required in 19.6%, while exploratory laparotomy was required in 0.7%. Conservative success in most cases is clinically encouraging and is likely related to the predominance of superficial incisional SSI. Nevertheless, SSI prolonged hospital stay; hospital stay of 10–20 days was required in 49.6%, and stay >20 days in 6.4%. These findings are consistent with the established burden of SSI in terms of delayed recovery, prolonged admission, increased cost and maternal distress.[5,19]

The findings support a bundle-based approach to prevention. Evidence-based strategies include timely antibiotic prophylaxis, adjunctive antibiotics where indicated, appropriate skin preparation, minimising unnecessary vaginal examinations, careful PROM and labour management, correction of anaemia, glycaemic control, meticulous haemostasis, gentle tissue handling, rational skin closure and structured postoperative surveillance.[6,7,16–19] In high-volume tertiary care centres, routine audit of SSI incidence, microbiological profile and compliance with preventive measures can help improve quality of obstetric surgical care.

This study has certain limitations. It was a single-centre observational study and included only women who developed SSI. Some potentially relevant variables such as detailed antibiotic sensitivity pattern, diabetes control, subcutaneous fat thickness, surgeon level, postoperative glycaemic status and complete post-discharge microbiological follow-up were either not fully available or not analysed in detail. However, the study also has important strengths, including its prospective design, large LSCS denominator of 5,952 procedures, clinically relevant sample of 280 SSI cases, use of structured data collection, CDC-based depth classification, inclusion of microbiological profile, treatment modalities and hospital-stay outcomes, and practical relevance for tertiary-care obstetric infection-prevention protocols.

CONCLUSION

The overall incidence of surgical site infection following lower segment caesarean section in the present study was 4.7%, with higher incidence after emergency LSCS than elective LSCS. Emergency LSCS, repeated vaginal examinations, prolonged operative duration, anaemia, PROM, prolonged labour, increased BMI and previous uterine surgery were frequently observed among women who developed SSI. Wound discharge was the most frequent clinical presentation, superficial incisional SSI was the predominant type, and MRSA was the most common organism isolated.

Most women responded to conservative management, while secondary suturing, exploratory laparotomy and burst abdomen were required only in a small proportion of cases. These findings emphasise the need for early identification of high-risk women, correction of anaemia, careful management of PROM and labour, reduction of unnecessary vaginal examinations, timely antibiotic prophylaxis, strict aseptic technique, meticulous surgical practice, rational antibiotic use based on culture sensitivity and structured postoperative wound surveillance. Routine SSI audit and local antibiogram review may help strengthen post-caesarean infection-prevention practices in tertiary obstetric units.

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