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Study of surgical site infection (SSI) in patients undergoing caesarean section (CS): A retrospective study

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Abstract
Background: Cesarean section (C-section) is one of the most commonly performed surgery in modern obstetrics. Due to this the worldwide continuous rise in the incidence of cesarean sections, the number of women with postpartum infection is expected to increase. Postpartum infections are a major cause of prolonged hospital stay and increase burden to our health care system.
The objective of this study was to determine the incidence and risk factor for the of Surgical site infections (SSI).
Methods: A Retrospective analytical study was conducted at Smt. Kashibai Navale medical college and general hospital, Pune. 1269 Patients undergoing LSCS from January 2017 to December 2017 were included after satisfying inclusion and exclusion criteria were included in the study.
Results: Out of 1269 LSCS patient, 56(4.4%) of them had SSI, which represents the incidence rate of SSI post LSCS in our study. Anemia and previous caesarean were important risk factor for SSI in our study. Prolonged surgery was found to be statistically significant etiological factor in the study. MRSA (37.5%) was the commonest pathogen to produce SSI in our series, followed by sterile culture in 21% cases.
Conclusion: Surgical site infection (SSI) following cesarean delivery was noted in 4.4% patients and it is a major cause of burden of disease both for the patients and the healthcare system in terms of the morbidity, and economic costs. Multidisciplinary team approach has proven effective for decreasing the incidence to minimal level. Reduction in incidence of SSI may be achieved by use of peri operative antibiotics, correction of anemia, use of proper surgical techniques and minimizing the duration of surgery.
Pre-operative and post LSCS antibiotic policy should depend on types of bacteria isolated by culture and there resistance mechanism. This may effectively contribute in decreasing SSI after LSCS.

Keywords: Surgical site infections, antibiotics prophylaxis, Cesarean delivery, antibiotic prophylaxis, wound culture and sensitivity, Post LSCS

1. Introduction
Cesarean section (C-section) is one of the most commonly performed surgery in modern obstetrics. Due to this the worldwide continuous rise in the incidence of cesarean sections, the number of women with postpartum infection is expected to increase [1]. Surgical site infection (SSI) following cesarean delivery is a major cause of morbidity and mortality, increasing both the duration of patient hospitalization and hospital costs lead to increase burden to our health care system [2]. SSI rates after cesarean range from 3% to 5%, varying according to the population being studied, the methods used to monitor and identify cases, and the use of appropriate antibiotic prophylaxis [3].
Among the risk factors described for post-cesarean SSI is prolonged labor, premature rupture of membranes, excess vaginal manipulation, manual extraction of the placenta, and premature birth [4]. Co-morbidities such as HIV, severe anemia and gestational diabetes are also associated with higher rates of puerperal infection, particularly surgical wound infection. The beneficial effect of antibiotic prophylaxis in reducing occurrences of infection associated with elective or emergency cesarean section is already well established [5].
Use of prophylactic antibiotics in women undergoing cesarean section substantially reduced the incidence of episodes of fever, endometritis, wound infection, urinary tract infection and serious infection after cesarean section [6].

2. Objectives of study

- To determine the incidence of Sugical site infections(SSI) in patients undergoing a LSCS
- To identify risk factors responsible for SSI in LSCS patients
- To identify common bacterial pathogen responsible for SSI in LSCS patients.

3. Methods

A Retrospective analytical study was conducted at Smt. Kashibai Navale medical college and general hospital, Pune. Data was collected from patient record sheets, OT register and laboratory records. Patients undergoing LSCS from January 2017 to December 2017 were included in the study.

3. Criteria for considering studies for the review

3.1 Inclusion Criteria

The patients with SSI within 30 days of the operative procedure and meeting the CDC/NHSN criteria as follows:

1. Febrile Morbidity: Fever more than 38¹ C, occurring on two occasions at least 4 hours apart, after the first 24 hours following LSCS.

2. A superficial incisional SSI: at least one of the following criteria:

- Purulent drainage
- Organism isolated
- At least one of the following signs and symptoms of infection- pain or tenderness, localised swelling, redness or heat.

3. Deep incisional SSI: at least one of the following criteria:

- Purulent drainage
- Incision that spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms-fever (>38°), localised pain or tenderness.
- The diagnosis is made by a surgeon or attending physician

4. Organ/space SSI: one or more of the following criteria:

- The patient has an identified organism cultured from endometrial tissue of fluid obtained during the operation.
- The diagnosis is made by a surgeon or attending physician based on at least two of the following: fever (≥ 38 °C) with no other validated causation, purulent drainage from the uterus, abdominal pain or uterine tenderness.

3.2 Exclusion criteria

1. Cases in which the diagnosis of SSI is not based on the CDC/NHSN criteria and where the follow-up extends beyond 42 days.
2. Immuno compromised patients as they would not be generalizable to the entire population and more susceptible to infection.

All patients who underwent lower segment caesarean section received a single dose of prophylactic antibiotic in the form of Inj. Cefotaxime 1 gm half an hour prior to surgery. Preoperative skin preparation was done with germicidal solution (3%) containing chlorhexidine gluconate and cetrimide. Skin was then treated with povidon Iodine (10%) solution.

In postoperative period all patients received injectable cefotaxime 1 gm intravenous 12 hourly for 24 hours and then oral for next 7 days. On 4th postoperative day for every patient wound was examined for any discharge and signs of inflammation. Those with wound discharge were noted, swabs for culture sensitivity were sent on the same day. Those patients were started with another broad spectrum antibiotic, depending on culture sensitivity reports along with daily dressings.

Those wounds with dehiscence were resutured after good granulation tissue observed.

Data collected included details of the wound infections, any organisms grown in the cultures, the drug sensitivity of those organisms as well as the risk factors contributing to infections, like obesity, premature rupture of the membranes (PROM), prolonged labour and comorbid medical conditions like diabetes, hypertension and anemia.

3.3 Statistical analysis

Data analysis was done using SPSS 20.0. p value obtained by Pearson chi-square test were used for data analysis.

4. Result

During the period of study, 4215 deliveries were done in the hospital, out of which 1269 patients delivered by LSCS. A total of 1269 cases of caesarean sections were performed in the study period.

Table 1: Type of LSCS and incidence of SSI

Type of lscs	Total	SSI
Elective	508	18 (3.5%)
Emergency	761	38 (4.9%)
P value	0.274	

In our study, Out of 1269 cases of LSCS, 56(4.4%) had wound infection. Out of 56 patients with SSI, 18 cases were operated electively, while 38 had emergency caesarean sections. SSI is not statistical significant with type of LSCS as p value is coming 0.274.

Table 2: Risk factors for SSI Risk factors associated with SSI were evaluated and are summarized in following table.

S. No	Risk Factor	Number of cases	Percentage
1.	Anaemia	13	23.21%
2.	Post-partum Hemorrhage	04	7%
3.	Blood transfusion	09	16.07%
4.	Haematoma	02	3.5%
5.	Obese	03	5.3%
6.	Previous caesarean section	26	46.42%

Table 3: Duration of surgery and SSI

Sr. No	Duration of surgery	Number
1.	Less than one hour	37
2.	More than one hour	19
P value	0.04	

Average duration of surgery was less than one hour in 1003 LSCS our study. 266 LSCS required more than one hour for the surgery. Prolonged duration of surgery was found to be significant factor responsible for SSI.

Table 4: Clinical Presentation of SSI in LSCS

Clinical Presentation	Frequency	Percent
Fever	3	5.4%
Local pain and induration	12	21.5%
Purulent discharge wound	15	26.7%
Spontaneous superficial dehiscence wound	20	35.7%
Wound deliberately opened	6	10.7%
Pelvic collection in USG	Nil	Nil

SSI was detected on 5±2 days. The commonest clinical manifestation of SSI in our study was purulent discharge in 15 (27%) cases. Fever was present in 3(5.3%) cases. Local pain and induration was observed in 12 (21%) cases. Twenty women (35.7%) had spontaneous superficial dehiscence wound and in 6 women (10%) wound was deliberately opened to facilitate drainage of pus. Rectus sheath dehiscence or pus collection in deeper tissues/ organs was not recorded in any patient.

Table 5: Pus Culture and Sensitivity

Type of Organism	Frequency	Percent
E. coli	6	10.7
MRSA	21	37.5
MRCON	7	12.7
Sterile	12	21.4
OTHERS	10	17.7

Wound swabs were sent for culture and sensitivity for both aerobic and anaerobic microorganisms. In the present study, in 78.6% cases cultures showed bacterial growth and in 21.4% they were sterile. MRSA (Methicillin resistant Staph. Aureus) was the commonest organism cultured from wound discharge. *E. coli*, MERCONS were other commonly isolated organisms. No growth was seen in 12 isolates indicating possibility of faulty suturing technique. (Others includes *Streptococcus*, *Enterococcus*, *Candida albicans*, *Pseudomonas* and *Acinetobacter*).

Table 6: Most common antibiotic sensitivity for the organisms

Type of Organism	Most sensitive antibiotics
E. coli	Amikacin, Ciprofloxacin, Gentamycin
MRSA	Ciprofloxacin, Doxycycline
MRCON	Vancomycin, Teicoplanin

Methicillin resistant *Staphylococcus aureus* was found sensitive to mainly Ciprofloxacin, Doxicycline. *E. coli*, Gram negative organisms were sensitive to Amikacin and Gentamycin.
Daily Dressing with betadine (10%) solution and antibiotic treatment was given as per culture sensitivity report.

Table 7: Management of SSI

Treatment		Percentage
Conservative treatment	39	69.6%
Resuturing	17	30.4%

Complete healing was noted with conservative treatment in 39 patients. Resuturing was needed in 17 cases.

Table 8: Average duration of hospital stay

Patient types	Hospital stay(Days)
Patients without SSI	5
SSI conservatively manage	10
SSI manage with Resuturing	14

Patients without SSI were discharged on postoperative day 4 after check dressing. Patient with SSI needed prolonged hospital stay for daily dressing and /or antibiotics therapy. Patients who needed Resuturing needed hospital stay for average 14 days.

5. 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 overall wound problem of 13.5% and SSI of 8.9%7. K. Bhavani and *et al*. found, in there study of 1000 cases incidence of SSI after LSCS was 13.5% [8].
Anaemia and Previous caesarean section were the most common high risk factors found in our study. Premature Rupture of Membranes and Post Caessarian Pregnancy in labour with Scar tenderness were the risk factors detected in study by K. Bhavani and *et al*. [8].
Adekunle Sobande *et al*. performed a retrospective study of 371 patients undergoing repeat ceasarean section in King Khalid University, Saudi Arabia. Incidence of wound dehiscence in this study was 4.12% [9].
Surgery duration of more than 1 hour had been reported to increase the risk for SSI more than twofold in killian CA *et al*. similar result was noted in our study 10 SSI after cesarean delivery has a distinctive microbial source of pathogens composed of both skin and vaginal origin 11.MRSA (37.5%) was the commonest pathogen to produce SSI in our series, followed by sterile culture in 21% cases. The increase in the presence of MRSA in study group is a serious concern. The other organisms found to be growing together were *E. coli*, MRCONS and pseudomonas. This may alter the pattern of prophylactic antibiotic given preoperatively in the near future if their incidence is on the rise. K. Bhavani and *et al*. found that most common pathogens were *S. aureus*, *Pseudomonas aeruginosa* and *E. coli*, as was also observed in there study8.No organisms were detected on culture in 21.4% patients with SSI, which points towards need for more careful and correct surgical techniques for primary cloure.
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 and *et al*. In our study, SSI was detected on 5±2 days, 35.7% patient had spontaneous superficial dehiscence wound.
The management of post cesarean wound infection includes antibiotic treatment, wound exploration, and debridement 12. In our study 69.6% patients with SSI were managed conservatively and 30.4% patients required Resuturing. Prolonged hospital stay with increase in health care costs was noted with SSI.

6. Conclusion

Surgical site infection (SSI) following cesarean delivery was noted in 4.4% patients and it is a major cause of burden of disease both for the patients and the healthcare system in terms of the morbidity and economic costs. Reduction in incidence of SSI may be achieved by proper peri operative antibiotics and correction of anaemia, use of correct surgical techniques and minimizing the duration of surgery.
Pre-operative and post LSCS antibiotic policy should depend on types of bacteria isolated by culture and their resistance mechanism. This may effectively contribute in decreasing SSI after LSCS.

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