

# Analysis of the risk factors and microbial etiology of surgical site infections following Lower Segment Caesarean Section

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## Abstract

### Background

Lower segment caesarean section (LSCS) is a common surgical mode of delivery and surgical site infection is the most common infectious complication in these patients. The main objective of the study was to analyse the risk factors and microbial etiology of surgical site infection (SSI) following LSCS.

### Methods

300 consecutive patients undergoing LSCS, irrespective of indication, were studied. A questionnaire was developed to assess the risk factors associated with development of SSI. All patients were followed up from day one of surgery till discharge and then up till 45 days following LSCS.

## Results

SSI was identified in 78 (22.66%) out of 300 patients. 5.11% of *Staphylococcus aureus* strains were MRSA. The *Acinetobacter* species (32.03%) was the most common organisms isolated followed by *Staphylococcus aureus* (20.41%) and Coagulase negative *staphylococcus* (13%). Premature rupture of membrane (PROM) of more than 4 hours, Emergency LSCS, anaemia and increase in adipose tissues were the commonest risk factors.

## Conclusions

A proper assessment of risk factors that pre-dispose to SSI and their early detection and modification may help in reduction of SSI rates. Also, antimicrobial audit and infection surveillance could give an insight into the current antibiotic prescription practices.

**Key words:** Lower segment caesarean section, risk factors, surgical site infection.

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## Introduction

Cesarean section is the commonest major Obstetrical operation. The incidence of LSCS is rising over the past decade in Nepal. Surgical site infection (SSI) is a common, postoperative complication that causes considerable morbidity. SSI is an important factor and carries 5-10 fold increased risk of postpartum infection compared to vaginal delivery.<sup>1</sup> We have not come across many studies done in Nepal regarding surgical site infection following LSCS. As a result not much data is available on the incidence rates of SSI following lower segment cesarean section in Nepali hospitals. The data is also lacking in the knowledge of common pathogens after LSCS. There exists a need to investigate intra-operative and postoperative risk factors for SSI after LSCS. In spite of the availability of antibiotics, SSI increases the morbidity and also increase the hospital stay and cost. SSIs are still responsible for much morbidity and socioeconomic burden for both patients as well as health care systems.<sup>2</sup> Reduction in surgical site infections while minimizing antibiotic resistance still remains a challenge for many health care institutions.<sup>3</sup> So, the main aim of our study is to analyse the risk factors and microbial etiology of surgical site infection (SSI) following LSCS.

## Materials and Methods

This is a prospective study done in the Department of Obstetrics and Gynaecology, Dhulikhel Hospital, Kathmandu University Hospital, Nepal from 2015 March to January 2017. 300 consecutive patients undergoing emergency/elective LSCS were included in the study irrespective of the indication. During this period 5721 deliveries were conducted. The patients were assessed preoperatively and also postoperatively on 3<sup>rd</sup> post operative day as well as on 45<sup>th</sup> post operative day, which matches with their post natal visit as well as immunization of the baby. Informed consent was taken from every patient enrolled in the study. LSCS wound was inspected at the time of dressing on the third postoperative day and also on the day of discharge of the patient and then all patients were followed up in postnatal clinic till the 45<sup>th</sup> postoperative day. All patients who developed SSI following surgery were included as cases. Data was collected from every patient regarding the various risk factors and demographic details by means of a detailed questionnaire.

Surgical site infection was detected on the basis of the criteria given in the modified CDC (Centres for Disease Control and Prevention) definition.<sup>4</sup> Purulent discharge was collected from the surgical incision site with sterile cotton swabs. Blood sample for blood culture and urine

culture were collected as and when the possibility of septicemia or bacteremia was suspected, as suggested by the presence of fever, shock, or other signs and symptoms of sepsis associated with the surgical wound. The bacterial isolates obtained were identified as per standard identification procedures.<sup>5</sup> Antibiotic susceptibility of the incriminated organism was done using standard disc diffusion method as per Clinical Laboratory Standards Institute guidelines.<sup>6</sup> Data was recorded on a questionnaire and managed on Microsoft excel 2007 software. The data were analysed as frequency and percentage.

## Results

Amongst 300 women, included in the study most of them were in the age group of 21-25 years. The mean age of patients who underwent LSCS was 23±3.6 years. 183 (61%) patients were in the age group of 21-25 years, followed by the age group of 26-30 years (30%). Only 3 (8%) were more than 35 years of age as shown in table 1. No women were less 18 years.

**Table 1. Age distribution of women undergoing LSCS**

Age	Number	Percentage
18-20	22	7.34
21-25	183	61
26-30	90	30
31-35	3	1
>35	2	0.66
Total	300	100

262 (87.3%) out of 300 women underwent emergency LSCS while only 38 (12.6%) women underwent elective surgery. 78 (22.66%) women had surgical site infection following LSCS of them 56 (18.66%) women were found to have infection at the surgical site during their stay in the hospital within 5 days of surgery. 22 (7.3%) women with surgical site infection detected within 45 post operative day, when they came for follow up. A total of 78 bacterial isolates were obtained. 9 (3%) SSIs had a polymicrobial etiology. *Acinetobacter* species was the most common isolate 19 (24.4%) followed by *Staphylococcus aureus* 16 (20.41%) and Coagulase negative *Staphylococcus* 10 (13%) as shown in table 2.

**Table 2. Type of bacterial isolates**

Type of bacterial isolates	Number	Percentage
<i>Acinetobacter</i>	19	24.4
<i>Staphylococcus aureus</i>	16	20.41
Coagulase negative <i>Staphylococcus</i>	10	13
<i>Escherichia coli.</i>	9	11.5
Polymicrobial	9	11.53
<i>Enterococcus</i>	5	6.41
Methicillin resistant <i>Staphylococcus aureus</i> (MRSA)	4	5.11
Klebsiella	3	3.8
<i>Pseudomonas</i>	2	2.56
<i>Proteus</i>	1	1.28
Total	78	100

Amongst 78 women who had SSI, 72 (92.30%) had undergone Emergency LSCS compared to Elective LSCS 6 (7.69%). Other significant risk factors were Premature rupture of membrane (PROM) >6 hours, maternal adiposity, anemia as shown in table 3.

**Table 3. Risk factors for surgical site infection (SSI)**

Risk factors	Number	Percentage
Premature rupture of membrane >6 hours	37	47.43
Maternal adiposity	19	24.35
Maternal anaemia	11	14.13
Preoperative fever	8	10.25
Preclampsia	2	2.56
Overt diabetes	1	1.28
Total	78	100

## Discussion

Surgical site infection is an important outcome indicator after surgery. The situation is worsened by the emergence of polymicrobial resistant strains of nosocomial pathogens and Methicillin resistant *Staphylococcus*.<sup>7</sup> In our study we had 9 patients with polymicrobial infection. This also increases morbidity significantly as it prolongs the hospital stay of patients.

According to a study by ward et al<sup>8</sup> 7-12% of hospitalized patients end up with hospital acquired infections globally with more than 1.4 million people suffering from infectious complications acquired in the hospital. The infection rate in the present study was 22.66% including post discharge surveillance and it is similar to a study by Cardosodel et al<sup>9</sup> who reported a rate of 23.5%.

Emergency LSCS predisposes more to SSI as compared to elective surgery.<sup>10</sup> In the present study, out of 300 patients, 87.3% women underwent emergency LSCS and similar findings of SSI was observed. The reason in our case could be many women who underwent Emergency LSCS were referred cases, who had ruptured membranes at home or in health centers or who had attempted home delivery and this predisposes the women to increased exogenous bacterial contamination as there is lack of use of sterile technique or timely antibiotic prophylaxis. Similar findings have been reported by Martens et al.<sup>11</sup>

Body mass index of more than 25 has been shown to affect the outcome of surgery. The local changes such as increase in adipose tissue, a need for larger incision, decreased circulation to fat tissue, and an increase in local tissue trauma related to retraction contribute to an increased incidence of SSI in these patients.<sup>12</sup> Independent factors related to body homeostatic balance which take place in wound healing and immune function are disturbed in such patients. In the present study an increased BMI was seen to influence the outcome of surgery in terms of an increased rate of infection like other study.<sup>12</sup>

Patients with anaemia were seen to be more prone to SSI. Anaemia diminishes resistance to infection and is frequently associated with puerperal sepsis. Pre-operative anaemia is an important predictor of infection and has been proved by several other studies.<sup>13</sup> In our study also, anaemia was found to be significantly associated with SSI. Premature rupture of membranes is associated with the largest bacterial inoculum and liquor gets infected and infection supervenes.<sup>14</sup> We did not find any association between the type of incision made and surgical site infection. Antibiotic prophylaxis in surgical patients has always been a matter of debate. For prophylactic antibiotic the current recommendation states that the parenteral antibiotic must be given 30 minutes prior to the incision so as to attain high tissue and serum levels during surgery<sup>15</sup>. As per the hospital policy Inj Ceftriaxone was administered, those who received antibiotics before surgery were found to be less prone to SSI as compared to those who did not receive it. Some received it just before the incision as it was an emergency case.

Shapiro et al<sup>16</sup> reported that with each hour of surgery the infection rate almost doubles. The finding relates to the pharmacokinetics of the antibiotic prophylaxis and to the greater bacterial wound contamination that occurs in lengthy clean-contaminated surgeries. In the

present study, 65% of patients with prolonged duration of surgery exceeding 45 minutes got infected. A prolonged preoperative stay in the hospital due to conditions like urinary tract infection, respiratory tract infection or blood pressure management, have been shown to increase the rate of SSI.<sup>3</sup> In our study patients who had >3 sterile vaginal examination did not show increased rate of SSI, it may be because that all such patients had received a timely antibiotic prophylaxis. The postoperative stay was longer in patients who developed SSI as shown in a study by Lilani et al.<sup>17</sup> Patients with preexisting illnesses like overt diabetes mellitus, preclampsia were more prone to infection in the present study. Hyperglycaemia has several deleterious effects upon host immune function, most notably on neutrophil function. Poor control of glucose during surgery and in the perioperative period increases the risk of infection and worsens outcome from sepsis. Hypertension, preexisting or pregnancy induced, HIV, and other comorbid states have been associated with SSI in several studies.<sup>18,19</sup> Studies have shown that common causative organisms leading to post-LSCS SSI include Gram-negative bacteria, anaerobes, and *Staphylococcus aureus*.<sup>20</sup> In our study, predominant micro organism was *Staphylococcus aureus* (38.5%) which included Coagulase negative *Staphylococcus aureus* and MRSA and followed by *Acinetobacter* species (24.4%). Many other studies have reported similar findings of predominance of *Staphylococcus aureus* in wound infections.<sup>21</sup> Polymicrobial etiology was found in 9 out of 78 SSIs identified. Lilani et al. found a polymicrobial etiology in 2 out of 7 SSIs. One of the most prevalent bacteria isolated was *Staphylococcus aureus*. Special interest in *Staphylococcus aureus* SSI is due to its role in hospital infection and MRSA infections are of great concern due to high morbidity and mortality rates. *Staphylococcus aureus* originates from patients' nasal flora and may influence the outcome of surgery.<sup>22</sup> The increased isolation rates of *Staphylococcus aureus* stresses the need to screen and treat subjects for nasal carriage which could possibly influence etiology of SSIs.

### Limitation

It would have been more significant if it had been a multicentre trial involving many tertiary hospitals like ours.

### Conclusion

A proper assessment of risk factors that predispose to SSI and their early detection is important in our context

as it helps in the modification of risk factors and also helps in reduction of SSI rates. Also, antimicrobial audit and infection surveillance could give an insight into the current antibiotic prescription practices.

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