

# Study of Incidence and Risk Factors for Surgical Site Infection after Cesarean Section at First Referral Unit

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## ABSTRACT

**Introduction:** Infection is the most common cause of mortality and morbidity in pregnant women during cesarean section. Hence this study was undertaken to study the incidence of SSI after cesarean section at first referral units and identify micro-organisms as well as risk factors leading to it.

**Material and Methods:** This prospective observational study was conducted over 300 pregnant women undergoing emergency (group1) and elective cesarean section (group2) irrespective of the indication. Pregnant women with pre-existing skin infection at surgical site were excluded from study. Patient history, general physical and systemic examination, investigations and other details were taken into consideration. Antimicrobial prophylaxis included injection Ceftriaxone one gram I.V., 30 minutes before making skin incision. Preoperative skin preparation was done with chlorhexidene gluconate, five percent povidone iodine. Post operatively injectable antibiotics were given for three days followed by oral medication, check dressing done on fourth post operative day. Diagnosis of SSI was made on basis of signs and symptoms. The women who developed these were taken as case and who did not develop SSI after 30 days were treated as control. The qualitative variables were expressed in terms of frequency and percentages. Chi-square test / Fischer exact test were used.

**Results:** The incidence of SSI in our study was 9%. Incidence of SSI was high in low socio-economic class, unbooked status, irregular visits and with leaking per vaginum of more than 24 hours, duration of surgery more than one hour, prolonged labor, pre-operative antibiotic prophylaxis ( before two hours of surgery). Most of the organisms were gram negative (56.53%) and were found sensitive to Aminoglycosides and resistant to Cephalosporins.

**Conclusion:** SSI rates need to be lower down especially in lower socio-economic class. Prophylactic antibiotics should be chosen principally on basis of efficacy against the usual exogenous and endogenous microorganisms known to cause infectious complication in each clinical setting, as well as their safety profile and cost.

**Keywords:** Antimicrobial prophylaxis, Cesarean section, Infection, Surgical site.

from 3-15%.<sup>2</sup> It delays the recovery, prolongs hospitalization, necessitate readmission, adds to hospital bills and other morbidities as well as mortalities.

This study was undertaken to study the incidence of SSI after cesarean section at first referral units and identify micro-organisms as well as risk factors leading to it.

## MATERIAL AND METHODS

After approval from the institutional ethics and scientific committee, this prospective observational study was conducted over 300 pregnant women undergoing emergency and elective cesarean section irrespective of the indication. Pregnant women with pre-existing skin infection at surgical site were excluded from study. All 300 women were randomized into two groups of 150 each, those planned for elective cesarean (Group 1) and those requiring emergency cesarean section (Group 2) for four days. Daily vitals charting was done, self retaining urinary catheter removed on second day and detailed history, general physical and systemic examination, indication for cesarean, investigations, any history of local site hair removal, intrapartum details/dai handling, surgical details were taken into consideration. Antimicrobial prophylaxis included injection Ceftriaxone one gram I.V., 30 minutes before making skin incision. Preoperative skin preparation was done with chlorhexidene gluconate, five percent povidone iodine and alcohol containing product. Post operatively inj. Ceftriaxone was given I.V. and second dose after 12 hours, inj. Metronidazole 100 ml I.V. eight hourly for three days followed by oral medication check dressing done on fourth post operative day. Diagnosis of SSI was made on basis of signs and symptoms which included pain, fever, localized swelling, induration, dehiscence, overlying skin changes and exudative purulent discharge. The women who developed these were taken as case and who did not develop SSI after 30 days were treated as control.

Those having SSIs were readmitted, daily dressings and broad spectrum antibiotics were started. Before initiating any treatment, the discharge (serous, blood mixed or purulent) from the surgical incision site were collected with sterile cotton swab and sent to our hospital's microbiology department for culture and drug sensitivity. Blood and urine

## INTRODUCTION

A surgical site infection is defined as an infection which occurs at the incision/operative site (including drains) within 30 days after surgical procedure if no implant is left in place/within one year if an implant is left in place. The infection must appear related to the surgical procedure. According to CDC's National Nosocomial Infection Surveillance system 38% of all nosocomial infections in surgical patients are SSI. Cesarean section falls in clean-contaminated wounds category.<sup>1</sup> SSI is the second most common infectious complication following cesarean section after UTI. It's incidence ranges

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samples were collected for culture as and when possibility of septicaemia was noted as per standard method.

Indian authors have obtained a prevalence of around 24.2% of SSI after cesarean section.<sup>3</sup> Detailed record analysis of our hospital substantiates this number of infection rate. Hence, taking the prevalence rate to be 24.2% and assuming error of ±5%, the minimal sample size required was 282. The level of significance was assumed to be 5%. However, we rounded it of to 300. The statistical formula used for sample size collection is:

$N = (1.96)^2 * pq / d^2$  where, 1.96 is tabulated standard normal distribution value at 5%, 'p' is prevalence rate (0.242), 'q' = 1-p = 0.758 and 'd' is margin of error (0.05). To evaluate the correlation of quantitative variables affecting the infection they were expressed in terms of mean ± S.D. and unpaired 't' test / Mann-Whitney test were used. The qualitative variables were expressed in terms of frequency and percentages and chi-square test / Fischer exact test were used. A p-value < 0.05 were considered statistically significant. Statistical package for social science (SPSS) version 15.0 software were used for statistical analysis.

**RESULTS**

The incidence of SSI in our study was 9%. 96.2% SSIs were superficial and 3.7% were deep SSI. Majority of the infection (62.96%) were in low socio-economic class. We found women with unbooked status, irregular visits and with leaking per vaginum of more than 24 hours, duration of surgery more than one hour (n=92.59%, p=0.001) more prone to SSIs. Among other risk factors pregnancy induced hypertension, anemia, pre-term delivery, prolonged labor (≥12 hours), multiple vaginal examinations (more than three), pre-operative antibiotic prophylaxis (before two hours of surgery) were strongly associated with SSI. While studying microbiological and drug susceptibility, we found most of the organisms were gram negative (56.53%) most common organism isolated was *E.coli* (25.93%) followed by coagulase negative *Staphylococcus epidermidis* (22.2%). Most Gram negative organisms were found sensitive to Aminoglycosides and resistant to Cephalosporins, Clavulanic acid and fluoroquinolones. Gram positive were mostly sensitive to Clavulanic acid, cephalothin and levofloxacin, and resist-

ant to ampicillin, gentamycin and erythromycin.

**DISCUSSION**

In India, the incidence of postoperative infectin in various hospitals ranges from 10 to 25%.

In our study, majority of women were in the age group 21 to 25 years(EL-50%, EM-53.33%). There was no significant variation in age group. The p-value was 0.412, although Devjani et al found increasing age as a risk factor significantly associated with SSI.<sup>3</sup>

In our study majority of women in both the groups(EL 64%, EM 68.67%) were in lower middle class and so was SSI(62.96%), but p-value (0.001) was only significant for lower socio-economic class, supported even by Oslen et al.<sup>4</sup> This may be linked to poor hygiene and nutrition.

Our study supports the notion that Emergency CS is an important predictor of SSI as compared to Elective surgery.<sup>5,6</sup> 16.67% women developed SSI in elective group and only 1.33% in emergency group (p<0.001). This might be the outcome of already ruptured membranes in emergency CS or multiple attempts of home delivery by a local mid-wife, increased exogenous bacterial contamination, lack of timely antibiotic prophylaxis

Pregnancy induced hypertension has positive association with increased risk of SSIs as it is associated with low vitality and thus predisposes to infection. In our study 29.63% of infected and 4.03% of uninfected women had PIH (p <0.001), it is further supported by Kirby et al and Kofman.<sup>7,6</sup> Anemic women are more prone to SSI (p<0.001) due to frequent association with other co-morbidities and irregular follow up. Preoperative anemia as an important predictor of infection has been proved by several other studies as well.<sup>8-10</sup> It diminishes resistance to infection and is also associated with puerperal sepsis.

While correlating uninfected women, SSI women and type of labor, spontaneous and induced labor had more risk of SSI (p-value was 0.001,0.003,0.001 respectively) as is reported by other authors also. Prolonging labor and multiple per vaginum examinations also predisposes to SSI.<sup>11</sup>

Antibiotic prophylaxis in surgical patients has always been a matter of debate. For prophylactic antibiotic the current recommendation states that antibiotic must be given before two hours of skin incision, so as to attain high tissue levels during surgery.<sup>12</sup> However at many centers the antibiotics have been withheld until after the clamping of umbilical cord. Our study supports the current concept (p=0.001) in accordance with two other studies.<sup>13</sup>

Several studies have supported the use of blood products and development of postoperative SSI.<sup>3</sup> Allogenic blood prod-

	n	%
Case (infected)	27	9.0%
Control (uninfected)	273	91.0%
Total	300	100

**Table-1:** Distribution of women with infection and without infection.

Systemic factors		Uninfected		Infected		p- value
		N	%	n	%	
UTI		0	0.00	0	0.00	-
Fever		0	0.00	1	3.70	0.001
PIH		11	4.03	8	29.63	0.001
Past history	GDM	1	0.37	0	0.00	0.376
	Hypothyroidism	2	0.73	0	0.00	0.328
	T.B.	1	0.37	0	0.00	0.376

**Table-2:** Distribution of women with systemic association in uninfected and infected groups.

Hb (gm/dl)	Uninfected		Infected		P - value
	n	%	N	%	
<11	129	47.25	18	66.67	0.027
>11	144	52.75	9	33.33	
Total	273	100	27	100	
Mean ± S.D.	10.88 ± 1.67		10.17 ± 1.86		
P - value	0.018				

**Table-3:** Distribution of women with anemia in infected and uninfected group.

Interval of prophylactic antibiotic	Uninfected		Infected		P - value
	n	%	N	%	
<2 hours	154	56.41	6	22.22	0.001
>2 hours	119	43.59	21	77.78	0.001
Total	273	100	27	100	
Mean±S.D.	2.01± 1.21		3.19 ± 2.06		
P - value	0.001				

**Table-4:** Distribution of women with interval of prophylactic antibiotic in uninfected and infected groups.

ucts have immunomodulatory effects that may increase the risk of nosocomial infections.<sup>14</sup> It is also possible that the transfusion of blood products acts as a marker of a number of co-morbidities and other SSI risk factors, which independently places them at inherently greater risk of infections. With each hour of surgery, the infection rate almost doubles. The finding relates to pharmacokinetics of antibiotic prophylaxis and to the greater bacterial wound contamination that occurs in lengthy clean-contaminated surgeries. In our study, 92.59% of patients with prolonged duration of surgery exceeding an hour got infected which was statistically significant ( $p=0.001$ ). Devjani et al found 53.3% of patients with prolonged duration of surgery exceeding 45 minutes got infected. Lilani et al reported a rate of 38.46% for surgeries that lasted more than two hours. Johnson et al classified duration of LSCS into  $\leq 30$  minutes and 31-60 minutes and found increased SSI in lated group.<sup>15</sup>

We also studied other factors like pre-operative WBC count, blood group, methods of preoperative preparation, obesity but none of them had significant p-value.

Most of the organisms isolated were Gram negative (56.52%) comparable with other literatures available.<sup>16,3</sup> Most common organism in our study was *E.coli* (25.93%) which is in contrast to NNSI survey (1997-2001) that reported *Staph. aureus* (47%) including MRSA and *Staph. epidermidis* as most common organisms causing SSI.

## CONCLUSION

A proper assessment of risk factors that predispose to SSI and their modification may help reduce SSI rates. Employing strict infection control policies by a functional infection control committee would bring the level of SSI to an acceptable level. This committee should be able to monitor surveillance studies with a view to issuing guidelines to circumvent established risk factors. Operation theatre discipline should be strictly followed. Frequent antimicrobial audit and qualitative research could give an insight into the current antibiotic

prescription practices and the factors governing the same.

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