



Risk Factors Associated with Wound Infection Following Caesarean Section - A Hospital Based Study

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Authors' contributions

This work was carried out in collaboration between both authors. Author AA designed and supervised the study and wrote the first draft of the manuscript. Author SN helped in literature searches and editing of manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Aim: To find out the risk factors associated with wound infection following caesarean section.

Design: Prospective cohort study.

Place and Duration of Study: This study was carried out in the Department of Obstetrics and Gynaecology, Lalla-Ded Hospital, Government Medical College, Srinagar from October 2014 to September 2015.

Methodology: Total of 1560 women who had undergone CS for delivery during study period were considered as eligible. Wound was observed for the development of infection on the third, fifth and seventh postoperative day. Patients who developed wound infection constituted the cases (116) and those with healthy wound constituted the controls (1444).

Results: Incidence of wound infection following caesarean section was found to be 7.4% in this

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study. Wound infection was found to be common in women who had BMI of ≥ 25 , who had absent membranes before surgery, who were diabetic, who underwent emergency surgery and the woman who had vertical skin incision.

Conclusion: The risk of developing wound infection after caesarean section depends on multiple factors. Therefore, increased awareness on these risk factors and prevention of these infections should be a clinical and public health priority.

Keywords: Caesarean section; wound infection.

ABBREVIATIONS

BMI = *Body Mass Index*;
CS = *Caesarean Section*;
LSCS = *Lower Segment Caesarean Section*;
PROM = *Premature Rupture of Membranes*.

1. INTRODUCTION

Caesarean section is a surgical procedure in which incision is made on the mother's abdomen and uterus to deliver the baby. It is often performed when a vaginal delivery would put the baby's or mother's life or health at risk. Some are also performed upon request without a medical reason to do so [1]. Caesarean section is one of the most commonly performed surgical procedures in obstetrical and gynaecological department. Post-LSCS wound infection increases maternal morbidity, prolongs hospital stay and increases medical costs [2].

Given that one in four women deliver their baby by CS, these infections represent a substantial burden. They will impact not only directly on the mother and her family but also are a significant cost in terms of antibiotic use, GP time midwife care and every effort should be made to avoid them [3].

Prevention of these infections should be a clinical and public health priority. Post LSCS wound infection can seriously affect a woman's quality of life at a critical time when she is recovering from an operation and has a new born baby to look after. More needs to be done to look into this and address ways of reducing infection.

A wound infection is defined by the US Centre for Disease Control and Prevention (CDC) as surgical site infection (SSI). The CDC definition [4] describes three levels of wound infection:

- Superficial incisional, affecting the skin and subcutaneous tissue. These infections may be indicated by localised (Celsian) signs such as redness, pain, heat or swelling at

the site of the incision or by the drainage of pus.

- Deep incisional, affecting the fascial and muscle layers. These infections may be indicated by the presence of pus or an abscess, fever with tenderness of the wound, or a separation of the edges of the incision exposing the deeper tissues.
- Organ or space infection, which involves any part of the anatomy other than the incision that is opened or manipulated during the surgical procedure, for example joint or peritoneum. These infections may be indicated by the drainage of pus or the formation of an abscess detected by histopathological or radiological examination or during re-operation.

The risk factors for wound infection after CS include age of the patient, BMI, elective versus emergency CS, status of membranes (intact/ruptured), duration of labour, associated medical disorders like anaemia, diabetes etc. There is also evidence to indicate that any foreign body in the surgical site may increase the probability of infection. In general, monofilament sutures appear to be associated with a decreased risk compared with other sutures [5]. Subcuticular absorbable sutures that are buried in the wound are associated with a decreased risk of infection [6,7].

This study was done to identify the risk factors associated with post LSCS wound infection. The knowledge of associated risk factors of wound infection after CS will help to increase the awareness among the healthcare professionals for the prevention of this problem in the hospital.

2. MATERIALS AND METHODS

This study was carried out in the Department of Obstetrics and Gynaecology, Lalla-Ded Hospital, Government Medical College, Srinagar from October 2014 to September 2015. This is a prospective cohort study. Total of 1560 women who had undergone CS for delivery during study

period were considered as eligible. Patients, who were discharged on fourth postoperative day or before, were excluded from the study.

The research protocol was approved by the institutional ethical committee. All participants received a detailed explanation of the study before providing their signed consent.

Data was collected from patients by observing the wound for the development of infection (in the form of cellulitis, discharge of pus, hematoma, wound dehiscence) on the third, fifth and seventh postoperative day. Patients who developed infection after discharge were not included in the study. Patients with subcuticular stitches were also excluded.

Patients who developed wound infection constituted the cases (116) and those with healthy wound constituted the controls (1444). The characteristics of cases and controls were compared by using descriptive statistics. Comparative evaluation was done by using Chi-Square test. All p-values of < 0.05 were taken as significant.

3. RESULTS

A prospective study was carried out on 1560 women who underwent LSCS. Women who developed post-LSCS wound infection constituted the cases (116) and those with healthy wound constituted the controls (1444). Majority of the patients (78.1%) were in the age group of 20-34 years. Mean age was found to be 27.5 years. Most of the patients (37.3%) had a BMI of 23-24 kg/m². Mean BMI was found to be 26.3 kg/m². 73.5% women were booked with the hospital antenatally whereas 26.5% were unbooked. Of all the study subjects, 7.6% had PROM whereas 92.4% had intact membranes. 37.8% of the patients were anaemic and 62.2% were having a normal haemoglobin (9.5-15 g/dl was taken as normal in third trimester of pregnancy [8]). 6.5% of the patients were known diabetics. Out of 1560 LSCS operations, 1195 were emergency caesareans and 365 were done electively. 40% subjects were given vertical skin incision whereas 60% had a transverse skin incision (Table 1).

Majority of the patients belonged to age group of 20-34 years. Among cases, 10.3%, 80.2% and 9.5% patients belonged to the age group of <20 years, 20-34 years and ≥35 years respectively.

Among controls, 11.9%, 77.9% and 10.2% belonged to age group of <20 years, 20-34 years and ≥35 years respectively. Mean age was found to be 27.6 years in cases and 27.4 years in controls. There was no statistical significance of age between the cases and controls in our study (Table 2).

Table 1. Demographic and obstetric characteristics of the studied subjects

		N=1560	%
Age (years)	<20	185	11.9
	20-34	1219	78.1
	≥35	156	10.0
	Mean	27.5	
BMI (kg/m ²)	<23	429	27.5
	23-24	582	37.3
	≥25	549	35.2
	Mean	26.3	
Booking status	Yes	1147	73.5
	No	413	26.5
PROM	Yes	119	7.6
	No	1441	92.4
Anaemia	Yes	590	37.8
	No	970	62.2
Diabetes	Yes	101	6.5
	No	1459	93.5
Type of surgery	Emergency	1195	76.6
	Elective	365	23.4
Skin incision	Vertical	624	40.0
	Transverse	936	60.0

BMI= Body Mass Index, PROM= Premature Rupture of Membranes

Mean BMI was found to be 28.4 kg/m² in cases and 24.2 kg/m² in controls. The difference in BMI was found to be statistically significant (Table 2).

Cases and controls were compared with respect to the status of amniotic membranes and the difference was found to be statistically significant (Table 2).

No significance of anaemia was seen with respect to cases and controls in our study. Among cases, 15.5% were diabetic whereas among controls 5.7% were diabetic. The difference was found to be statistically significant (Table 2).

Emergency LSCS and vertical skin incision was found to be more commonly associated with wound infection when compared with elective LSCS and transverse skin incision (Table 2).

Table 2. Comparison between cases and controls with respect to different variables

Variable		Cases (N=116)	Controls (N=1444)	p-value
Age (years)	<20	12(10.3%)	173(11.9%)	0.9
	20-34	93(80.2%)	1126(77.9%)	
	≥35	11(9.5%)	145(10.2%)	
	Mean	27.6	27.4	
BMI (kg/m ²)	<23	23(19.8%)	406(28.1%)	0.0112
	23-24	33(28.4%)	549(38.0%)	
	≥25	60(51.8%)	489(33.9%)	
	Mean	28.4	24.2	
PROM	Yes	18(15.5%)	101(6.9%)	0.02
	No	98(84.5%)	1343(93.1%)	
Anaemia	Yes	48(41.3%)	542(37.5%)	0.7
	No	68(58.7%)	902(62.5%)	
Diabetes	Yes	18(15.5%)	83(5.7%)	0.002
	No	98(84.5%)	1361(94.3%)	
Type of surgery	Emergency	97(83.6%)	1098(76.1%)	0.03
	Elective	19(16.4%)	346(23.9%)	
Skin incision	Vertical	71(61.2%)	553(38.3%)	<0.0001
	Horizontal	45(38.8%)	891(61.7%)	

BMI= Body Mass Index, PROM= Premature Rupture of Membranes; P value < 0.05 statistically significant

4. DISCUSSION

The incidence of wound infection after CS ranges widely due to a variety of risk factors present in different patient populations. CS surgery has a 5-20 times higher risk of postpartum infection as compared to vaginal deliveries, mainly with regards to wound infections, endometritis, pelvic peritonitis or pelvic abscesses [9]. Wound infections are still regarded as the most common nosocomial infections in patients undergoing surgery.

Wound infection after CS was seen in 7.4% patients in our study. Comparing to other studies conducted in different parts of the world, the wound infection after CS was found to be 8.3% in Norway study [10], 9.6% in UK study [11] and 5% in US study [2].

The risk of developing wound infection after caesarean section is multi-factorial and has been found to be influenced by the following factors in this study: overweight/obesity, membrane rupture before LSCS, diabetes, emergency LSCS and vertical skin incision.

The relationship of maternal BMI was studied with respect to cases and controls. Mean BMI among cases was 28.4kg/m² and among controls was 24.2kg/m². The difference in BMI between cases and controls was found to be statistically significant. Our study was comparable to the

study done by Moir-Bussy B et al. [12] and Pelle H et al. [13] who also found increased rate of wound infection in overweight/obese patients than normal weight patients. It can be because of relatively poor perfusion of adipose tissue, which can impair wound healing, decrease the local immune response and facilitate infection becoming established [14,15,16]. The incision for obese women may also need to be longer and therefore involve more tissue becoming exposed to contamination [17].

In the present study, the cases and controls were compared on the basis of PROM and intact membranes at the time of CS. Higher rates of wound infection were found in patients with absent membranes as compared to patients with intact membranes. The difference was statistically significant. Our study was comparable to the study done by Dhar H et al. who also found similar results. Once the amniotic membranes rupture, the amniotic fluid has increased chance to get infected by multiple vaginal examinations. The non-sterile amniotic fluid may act as a transport medium by which bacteria come into contact with the uterine and skin incision leading to chorioamnionitis and its sequelae. These findings were supported in other studies [11,18,19,20].

In our study, increased rate of wound infection was observed in diabetic patients as compared to non-diabetic patients (15.5% vs 5.7%). Our

study was comparable to the study done by C Wloch et al. [11] who also found similar results (15.6% vs 9.6%). Diabetic patients have impaired leukocyte function, and the metabolic abnormalities of diabetes lead to inadequate migration of neutrophils and macrophages to the wound, along with reduced chemotaxis [21,22].

Increased rate of wound infection was observed in those patients who had underwent emergency CS compared to elective CS and was statistically significant. The Indian study also revealed that emergency CS predisposes more to wound infection as compared to elective CS [23]. Amenu D et al. [24] found in their study that emergency CS had two times increased risk of wound infection (11.9% vs 5.4%) than elective cases. It can be attributed to the fact that in emergency cases multiple vaginal examinations are frequent. There is also increased risk of bacterial contamination or break in sterile technique or lack of timely antibiotic prophylaxis. These findings have been reported in studies of India [23], Ethiopia [24] and MG martens [19].

In this study, increased rate of wound infection was observed in patients who were given vertical skin incision as compared to those who had transverse skin incision. The difference was statistically significant. Our study was comparable to the studies done in India [23] and New York [25] who also found similar results.

5. CONCLUSION

Wound infection after caesarean section is a common problem in many of the hospitals. The risk of developing wound infection after caesarean section depends on multiple factors, and has been found to be commonly influenced by the following factors in this study: obesity, membrane rupture before LSCS, diabetes, emergency LSCS and vertical skin incision.

Therefore, increased awareness on these risk factors and prevention of these infections should be a clinical and public health priority.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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