

STUDY OF VARIOUS BASELINE FACTORS AND PRE-OPERATIVE FACTORS AFFECTING SURGICAL SITE INFECTION IN CAESAREAN SECTION

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Abstract

Introduction: Caesarean section is one of the most commonly performed surgical procedure in hospitals. But it carries 5-20 fold increase risk of infection compared to vaginal delivery. Analysis of various baseline, intrinsic and extrinsic risk factors predisposing to surgical site infection is necessary to detect common links. obtained information is important to plan a strategy to reduce post caesarean wound infections and its complications.

Material and Method: This is a prospective observational study enrolling 1500 sequential consenting subjects who had undergone caesarean section, on surgical site infection following caesarean section.

Results: The cesarean section rate was found to be 41.2%. Subjects over 35 years of age had highest SSI rates of 16.7% and difference in SSI in subjects more than 35 years was statistically significant (p value = 0.04)

(88.6%) of the total enrolled subjects undergoing LSCS were antenatally registered amongst which 3.3% developed SSI compared to 11.4% of the total subjects were antenatally unregistered amongst which 5.8% developed SSI (p value=0.04)

1% of the total enrolled subjects undergoing LSCS had a history of gestational diabetes mellitus amongst which 33.3% had SSI, while 99% of the subjects did not have history of gestational diabetes amongst whom SSI incidence was 3.3% (p value <0.01) which is significant.

7.6% of the total enrolled subjects undergoing LSCS had a history of hypertension amongst which 8.8% developed SSI compared to 92.4% of the subjects without hypertension had 3.2% SSI. (p value <0.01) there is a significant association of body mass index with SSI. (p value <0.01).

There is significant association found between preterm rupture of membrane and SSI (p value <0.01).

Conclusion: Strategies for the prevention of post operative SSI must aim to control mother's pre-conceptual weight, their antenatal registration, follow standard intranatal management guidelines, timely administration of prophylactic antibiotic if decision to perform LSCS is to be taken.

Keywords: Surgical site infection, caesarean section.

Introduction

Caesarean section is one of the most commonly performed surgical procedure in hospitals. According to WHO on global survey on maternal and perinatal health (2004-2005) the median rate of Caesarean delivery has been estimated to be 33%, with rates as high as 51% in private hospitals. The data from various resources show that the overall rate of Caesarean section in India as a whole is 30% of all delivery. In 2018-2019 India conducted 20% of the total institutional deliveries through Caesarean against 18.7% in previous year Caesarean delivery is the most important factor associated with postpartum infection and carries 5-20 fold increase risk of infection compared to vaginal delivery. Risk factors for Caesarean related morbidity and mortality include un-booked status, emergency compared to elective procedure, use of general anesthesia, anemia and dehydration, prolonged labour etc.

Surgical site infection (SSI) is defined as infection that occurs at/or near surgical incision within 30 days of operation or after 1 year if an implant is placed¹. Surgical site infection is also defined as an infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue of the incision and/or the deep soft tissues of the incision and/or any part of the anatomy other than the incision that was open or manipulated during and operation.

Antimicrobial prophylaxis reduces the risk of endometritis and incisional SSI when administered correctly, has been discussed about its real impact due to less number of studies and their limitations the rates of SSI after Caesarean delivery reported in literature ranges from 3-15% depending on the surveillance used to identify infections, the patient population and the use of antibiotic prophylaxis.²

Analysis of the combined effects of the intrinsic and extrinsic risk factors predisposing patients to SSI is necessary to detect the common links. The intrinsic factors are patient related, and extrinsic factors are related to management and care. A better understanding of predictors might improve infection control by reducing the clinical effects of post Caesarean infections.

Therefore this study aims to study the preoperative, intraoperative and postoperative risk factors associated with SSI after Caesarean section. Information obtained hopefully will be used to plan a strategy to reduce post Caesarean wound infections and its complications.³

Aims and Objectives

- To study the incidence of Surgical Site Infection following caesarean section.
- To study the pre-operative and intra-operative risk factors associated with Surgical Site Infection following caesarean section.
- To find out the type of Surgical Site Infection and its outcome.

Materials and Methods

1. This is a prospective observational study enrolling 1500 sequential consenting subjects who had undergone Caesarean Section, on Surgical Site Infection following Caesarean Section. We conducted a prospective observational cohort study to evaluate the rate, risk factors and microbiological profile at the Department of Obstetrics and Gynecology in our tertiary referral center⁴. From 1st July 2019 to 31st January 2020 all pregnant women who underwent elective and emergency Caesarean Sections were enrolled in the study and followed for 30 days post-operatively.

2. Inclusion criteria:

1500 sequential subjects undergoing Caesarean Section consenting for inclusion in study.

3. Exclusion criteria:

- 1) Subjects undergoing Caesarean Section who do not consent for inclusion in study
- 2) Subjects delivering vaginally.

Table 1: PROPORTION OF TYPE OF WOUND COMPLICATION

WOUND COMPLICATION	No. of SSI(n=54)	%
Seroma	27	50%
Hematoma	3	5.6%
Peritonitis	6	11.1%
Dehiscence	18	33.3%

In our study, the distribution of SSI (n=54) as per type of wound complications were studied.

Table 2: DISTRIBUTION OF SSI ACCORDING TO THE ORGANISM ISOLATED

ORGANISM ISOLATED	No. Of subjects with SSI (n=22) (%)	Superficial incisional	Deep incisional	Organ/Space
Staphylococcus Aureus	10 (45.5%)	6	3	1
E-coli	8 (36.4%)	1	0	0
Coagulase Negative Staphylococcus	1 (4.5%)	0	1	0
Pseudomonas Aeruginosa	1 (4.5%)	0	6	2
Acinetobacter Baumannii	1 (4.5%)	0	1	0
Enterococcus Faecalis	1 (4.5%)	1	0	0

Among various organisms isolated, 45.5% infections were caused by staphylococcus which includes all types of SSI (superficial, deep and organ/space involved)

Table 3: DISTRIBUTION OF SSI AS PER BASELINE FACTORS

SR. NO.	VARIABLE		SSI PRESENT(n=54)	SSI ABSENT(n=1446)	CHI SQUARE VALUE	P VALUE
BASELINE FACTORS						
1	AGE (in completed years)	<35	53	1441	2.9	0.04
		≥35	1	5		
2	AREA OF RESIDENCE	RURAL	28	627	1.5	0.1
		URBAN	26	819		
3	REGISTRATION STATUS	REGISTERED	44	1285	2.8	0.04
		UNREGISTERED	10	161		

In our study, subjects according to age, area of residence and antenatal registration status were studied.

Table 4: DISTRIBUTION OF SSI AS PER BASELINE FACTORS

SR. NO.	VARIABLE		SSI PRESENT(n=54)	SSI ABSENT(n=1446)	CHI SQUARE VALUE	P VALUE
BASELINE FACTORS						
1	HISTORY OF PREVIOUS LSCS	YES	20	612	0.6	0.2
		NO	34	834		
2	MEDICAL DISORDERS	GESTATIONAL DIABETES MELLITUS	5	10	38.6	<0.01
		NO HISTORY OF GESTATIONAL DIABETES MELLITUS	49	1436		
		HYPERTENSION	10	104	9.5	<0.01
		NO HISTORY OF HYPERTENSION	44	1342		
3	BODY MASS INDEX(kg/sq m)	<18.5	2	52	18.3	<0.01
		18.5-24.9	40	1296		
		>=25.0	12	98		

Table 5: DISTRIBUTION AS PER PRE-OPERATIVE FACTORS

SR. NO.	VARIABLE		SSI PRESENT(n=54)	SSI ABSENT(n=1446)	CHI SQUARE VALUE	P VALUE
PRE-OPERATIVE FACTORS						
1	PREOPERATIVE HEMOGLOBIN (gm%)	≤8	1	36	5.5	0.14
		8.1-9	9	115		
		9.1-10	22	595		
		>10	22	700		
2	PREOPERATIVE PLT(lac per cu. mm)	<1	1	29	9.9	0.02
		1 to 2	2	293		
		2 to 3	35	832		
		>3	16	292		
3	HISTORY OF LEAKING PER VAGINUM	YES	17	186	15.4	<0.01
		NO	37	1260		
4	STAGE OF LABOUR	1st	49	1227	0.17	0.3
		2nd	2	37		

Discussion:**1. Details of Wound Complication:**

Different wound complications like haematoma, peritonitis, seroma and dehiscence may be seen in post-operative period.

- Wound hematoma and seroma are collections of blood and serum respectively.
- Hematomas occur due to failure of primary hemostasis or bleeding diathesis.
- Dehiscence is separation tissues at incision site.
- Peritonitis is the inflammation and infection of the peritoneal lining of the abdominal wall and abdominal organs.

➤ In our study, 50% of the SSI had serous discharge from wound and were superficial SSI.

➤ 33.3% of the SSI had a separation of wound margins which needed resuturing later on.

➤ 5.6% of the subjects with SSI had hematoma whereas 11.1% of the subjects with SSI had peritonitis all of which ended up in post LSCS laprotomy.

2. Association of Organism Isolated With Ssi

➤ Among various organisms isolated, 45.5% infections were caused by staphylococcus which includes all types of SSI (superficial, deep and organ/space involved), 36.4% infections were caused by E-coli, Coagulase Negative Staphylococcus, Pseudomonas Aeruginosa,

Acinetobacter Baumannii and Enterococcus Faecalis were the other organisms equally causing SSI (4.5%).

➤ Maximum superficial incisional(6/8) SSI were caused by Staphylococcus Aureus while maximum of the deep incisional(6/11) and organ/space involving SSI (2/3) were caused by Pseudomonas aeruginosa.

3. Age Groupwise Proportion of SSI

Maternal age is considered as a significant factor which is associated with development of SSI.

➤ Subjects over 35 years had highest SSI rates of 16.7% and difference in SSI in subjects more than 35years was statistically significant (p value = 0.04) as compared to subjects under 35 years of age.

➤ Though women between 19-25 years accounted for 74% SSI, SSI was seen in 3.8% subjects undergoing LSCS in this age group.

4. Association of Area of Residence with SSI

➤ In our study, we have assessed the association of area of residence with SSI. In our study, out of the total subjects enrolled for the study, 43.7% of the subjects belonged to rural area amongst which 4.3% subjects developed SSI compared to 56.3% of the total subjects belonged to urban area amongst which 3.1% developed SSI.

➤ This is probably because most of the rural subjects were referred to us as a high risk pregnancy with medical disorder or some obstetric complication.

➤ The difference in association with area of residence was not found to be statistically significant (p value = 0.1).

5. Association of Antenatal Registration Status of Mother with SSI

Antenatal registration means booking a pregnant lady in a health care center for antenatal care. WHO recommends atleast 4 ANC visits for a non-high risk mother.

1st- Before 12 weeks

2nd- At 24-26 weeks

3rd - At 30-32 weeks

4th - At 36-38 weeks

➤ 5.8% SSI is seen in unregistered mothers compared to only 3.3% in registered mothers. (p value=0.04) which is significant.

➤ In our study, (88.6%) of the total enrolled subjects undergoing LSCS were antenatally registered amongst which 3.3% developed SSI compared to 11.4% of the total subjects were antenatally unregistered amongst which 5.8% developed SSI. The number of antenatally registered subjects was higher because most of the subjects belonged to city of Surat where health care facilities are freely available.

6. Association of History of LSCS in Previous Pregnancy with SSI:

➤ In our study, the risk factor of history of previous LSCS was identified, studied and analysed. In this study, compared to history of previous 1 LSCS (2.8%), more SSI are found in mothers having history of previous 2LSCS (5.2%).

➤ It is also found that no SSI was found with history of previous ≥ 3 LSCS(0%). The reason might be that those high risk LSCS were performed by senior obstetricians with

utmost care and scrutiny which led to no SSI in the subjects included in our study.

➤ 3.9% SSI were seen when there was no history of previous LSCS.

7. Association of Medical Disorders of Pregnancy with SSI

Medical disorders like gestational diabetes mellitus, hypertension, hypothyroidism, retro viral infection, jaundice etc affect the occurrence of SSI after LSCS.

In our study no SSI was found in subjects with hypothyroidism, reactive HIV status(n=19) and jaundice (n=1).

➤ In our study, 1% of the total enrolled subjects undergoing LSCS had a history of gestational diabetes mellitus amongst which 33.3% had SSI, while 99% of the subjects did not have history of gestational diabetes amongst whom SSI incidence was 3.3%

➤ In our study 7.6% of the total enrolled subjects undergoing LSCS had a history of hypertension amongst which 8.8% developed SSI compared to 92.4% of the subjects without hypertension had 3.2% SSI.

➤ In our study, a significant association has been found between medical disorder of gestational diabetes mellitus (p value= <0.01) and hypertension (p value= <0.01) in pregnancy with SSI.

8. Association of Body Mass Index with SSI:

BMI is body mass index is a measure of body fat based on body weight expressed in kg/sq metre.

In our study, we have classified our subjects as per WHO Classification of BMI

Underweight - <18.5kg/m²

Normal- 18.5-24.9kg/m²

Overweight- 25-29.9kg/m²

Preobese- 30-34.9kg/m²

Obese- ≥ 35 kg/m²

➤ In our study, 74.07% SSI were seen in subjects with normal BMI, 20.37% in subjects in overweight category, 3.7% in underweight and 1.85% in obese.

➤ In our study, 3.6% of the total enrolled subjects undergoing LSCS were underweight amongst which 3.7% had SSI.

➤ 89% of the enrolled subjects had normal BMI amongst which only 3% had SSI while 6.9% of the total enrolled subjects undergoing LSCS were overweight amongst which 10.6% developed SSI.

➤ 0.33% of the subjects were preobese in which no SSI developed.

➤ 0.07% of the total enrolled subjects were obese and all of them developed SSI.

➤ In our study, there is a significant association of body mass index with SSI. (p value <0.01).

9. Association of Preoperative Haemogram with SSI:

Pre operative haemogram with haemoglobin, total leucocyte count and platelet count gives an idea of the nourishment, ongoing infection in body, coagulation, anemia status and immunity status of the patient. Their association with SSI is studied and analysed in our study

- In our study, maximum subjects had preoperative Hb $\geq 10\text{gm\%}$ amongst which 3% developed SSI.
- Subjects with Hb between 8.1-9gm% had maximum SSI of 7.3% .
- 5.2% subjects with platelet count more than 3 lac per cu mm had SSI while 4% with platelet count 2 lac- 3lac per cu mm and 3.4% when the platelet count was less than 1lac per cu mm and only 0.7% when platelet count was between 1lac -2lac per cu mm had SSI.
- In our study, there is significant association found with development of SSI with pre operative platelet count (p value = 0.02).
- No significant association was found with preoperative Hb value (p value = 0.14), this might be due to confounding factors like preoperative correction of anemia , duration of surgery, type of procedure, type of wound, medical risk factors, small sample size etc.

10. Association of History of Leaking Per Vaginum with SSI:

Leaking per vaginum / premature rupture of membranes is associated with development of post operative surgical site infection in case of LSCS. Rupture of membranes predisposes to infection of liquor leading to chorioamnionitis and can be a risk factor for development of SSI

- In our study 13.5% of the subjects undergoing LSCS enrolled in our study had a history of leaking per vaginum, out of which 8.4% of subjects developed SSI compared to amongst 86.5% of the subjects who had intact membranes at the time of LSCS only 2.9% developed SSI.
- In our study, 31.5% SSI (17/54) was seen in subjects with leaking per vaginum. There is significant association found between preterm rupture of membrane and SSI (p value <0.01).

11. Association of Stage of Labour with SSI:

In our study, the association of stage of labour in which LSCS was performed with SSI was studied and analysed. When LSCS is performed in 2nd stage stage of labour compared to 1st stage of labour there is increased risk of development of SSI.

In our study, 2.6% of LSCS were performed in 2nd stage of labour where 5.1% incidence of SSI was seen compared to 85% of LSCS performed in 1st stage of labour where 3.8% incidence of SSI was seen.

Conclusion

The rate of SSI is increasing worldwide. This study has been conducted to identify various risk factors associated with development of SSI following LSCS during the initial 30 post operative days.

SSI is more prevalent among emergency procedures, obese mothers and women who were unbooked. It is important for antenatal women to be more particular about their prenatal BMI and to have regular antenatal visits so that medical disorders can be identified and modifiable risk factors like anemia are corrected before term.

Strategies for the prevention of post operative BMI must aim to control mother's pre-conceptual weight, their antenatal registration, follow standard intranatal management guidelines, timely administration of prophylactic antibiotic if decision to perform LSCS is to be taken and reduce intraoperative blood loss.

Is likely to incur prolonged hospital stay and substantial additional health care costs. Efforts should be made to rationalize LSCS rate to avoid unnecessary LSCS and that would reduce this morbidity and other sequelae.

Hospitals could audit their SSI infection rate regularly and take appropriate measures to optimize their clinical service.

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