IJSN
Volume 3, Number 3

A Study to Assess the Incidence and Risk factors of Surgical Site Infection following Caesarean Section in a Selected Hospital of Odisha.

Dharitri Swain

Abstract

Title: A Study to Assess the Incidence and Risk factors of Surgical Site Infection following Caesarean Section in a Selected Hospital of Odisha. **Background** : Surgical site infection (SSI) is a common postoperative complication, constituting a major public health problem in terms of mortality; morbidity, prolonged hospital stays, and increased antimicrobial resistance due to the inappropriate use of broad spectrum antibiotics. Factors which affect post-caesarean section SSI rate include the maternal pre-operative medical and obstetric conditions, the type of surgical procedure, and the absence of antibiotic prophylaxis. **Objective:** The aim of this study was to find out the incidence and associated risk factors of surgical site infection among caesarean section cases. **Method :** A prospective, descriptive study was undertaken in a tertiary teaching hospital (SUM hospital), Odisha, India. Total 546 Women were included in the study, who underwent surgical procedure for delivery during study period. Wound was evaluated for the development of SSI on third day, and fifth post-operative day, and on the day of discharge. **Results** :The mean age of the women was 26±3.08. Among the studied cases 87.17% were literate and 12.82% were illiterate. Maximum (77.10%) women were housewife and primpara (59.70). Antenatal clinic was attended by 78.02%. The most common indications for caesarean delivery observed were cephalopelvic disproportion (25.82%), malpresentation (18.86%) and fetal distress (16.84%). The incidence rate of surgical site infection (SSI) was 62 (11.35%). SSI was found to be common in women who underwent emergency surgery, rupture of membrane before surgery, who had frequent vaginal examination and prolonged labour, statistically significant ($p<0.05$). Also women who had vertical skin incision and interrupted skin suturing ($p<0.01$) during surgery had develop more SSI. **Conclusion:** SSI is found to be multi-factorial and various modifiable risk factors were observed in this study. Formation of hospital protocol and its strict implementation by all the health care professionals could be effective to minimize and prevent the infection rate after caesarean section.

Key Words: Caesarean section, SSI, modifiable risk factors, maternal infection,

Introduction

Caesarean section (CS) is a surgical procedure where a baby is delivered by cutting through the front wall of the abdomen to open the uterus. Surgical site infection (SSI) after a caesarean section increases maternal morbidity prolongs hospital stay and medical costs. [3]

In the literature, the rates of SSI after caesarean section reported 3% to 15%, depending on the surveillance methods used to identify infections, the patient population, and the use of antibiotic prophylaxis. Maternal infectious morbidity has been shown to be eight-fold higher after caesarean delivery than after vaginal delivery. Due to the worldwide continuous rise in the incidence of caesarean deliveries, it is expected to increase the number of postpartum infection. The SSI after caesarean section causes physical, psychological and economical burden to woman, her family and to the community. [15]

The knowledge of incidence and associated risk factors of SSI after CS will help to increase the awareness among the health care professionals for the prevention of this problem in the hospital.

Author Affiliation: *Assistant Professor, M.Sc Nursing (Obstetrics and Gynaecology), College Of Nursing, All India Institute of Medical Sciences (AIIMS), Bhubaneswar

Correspondance: Dharitri Swain, Assistant Professor, M.Sc Nursing (Obstetrics and Gynaecology), College Of Nursing, All India Institute of Medical Sciences (AIIMS), Bhubaneswar, Sijua, P.O: Dumduma, Dist: Khurda, Odisha-751019

E-mail: dhari79@yahoo.co.in, dharitriswain79@gmail.com

Objectives

1. To find out the common indications of Caesarean Section.
2. To find out the incidence of Surgical Site Infection following Caesarean Section.
3. To find out the risk factors related to Surgical Site Infection following Cesarean Section.
4. To find out the association between Surgical Site Infection following Cesarean Section and selected demographic variables.

Methods

(i) Study population

The study was conducted in the maternity ward of SUM hospital, Bhubaneswar, Odisha, a tertiary care teaching hospital during ten months period (May 2012 – February 2013).The population consists of women who had undergone Caesareans Section and were admitted in the selected SUM hospital at BBSR during the study period.

(ii) Study design and sampling procedure

The study was a descriptive and prospective study. A sample size of 546 was obtained using the hypothesis testing method and based on the following assumptions: 95% confidence level, findings from a previous study and a 5% margin of error. Non-Probability convenience sampling technique was used to select patients.

Inclusion criteria

Total of 546 women who had undergone caesarean section for delivery during study period were considered as eligible.

Exclusion criteria

- Patients who were discharged on 3rd day.
- Who underwent exploratory laparotomy following caesarean section.
- Who developed infection after discharge. (Post discharge infection cases)

(iii) Instrument Description and Data Collection

Structured proforma and observational check list, patient records were used to collect the data. The structured interview schedule and patient record was used for assessing the risk factors and incidence proforma used to find the incidence. The tool was constructed in two parts and the constructed tool was validated by seven experts in the field of Nursing and medicine based on their experience clinical expertise. The suggestion and recommendations given by the experts were accepted and necessary corrections were done for modifying the tool. The tool was pretested among five samples for simplification and then the reliability was done. The tool was found reliable (r=0.89).

Part I: Includes items of demographic variables such as age, education, occupation, parity, antenatal check up and place of antenatal check up, co-morbidities, weight and BMI.

Part II: Consists of items related to indications of Caesarean Section

Part III: Includes items related to incidence and risk factors of surgical Site Infection following Caesareans Section

Section A: observational checklist for assessment of CS wound infection

Section B: Consists of statements related to risk factors of SSI following Caesarean Section

Ethical consideration was obtained by taking written permission from the authority of the hospital. Self-introduction and the purpose of the study to the participants were explained. Informed consent was obtained from the study samples and Interviewed patients to get the information. Surgical Site Infection following Caesarean Section was collected by observation and from Patient records. Wound observation was done for the development of SSI on third, fifth post operative day and on the day of discharge. All the suspected surgical sites were evaluated irrespective of the day of operation until complete recovery.

(iv) Data Analysis plan

Data was recorded and were checked for completeness, entered into the computer and analyzed using SPSS version 16. Collected data was compared in terms of presence of surgical site infection and study variables. Result of data was calculated in descriptive statistics like mean, frequency and percentage for numerical data and Chi-square' test was used for comparing descriptive variables and for finding association. P value of 0.05 was taken as statistically significant.

Results

(i) Patient characteristics

This study has included 546 cases, among which, age 19 and below were 1.04%, age 35 and above were 22.16% and remaining maximum (76.73%) were between 20 to 34 years. Maximum no of women (87.17%) were literate and 12.82% never attended any formal and informal education. Seventy seven percent were engaged in their house hold activities. Out of 546 cases, 59.7% were primpara, 40.29% were multipara and 56.41% had a gestational age less than 37 weeks and 80% were found to be obese. Total of 78.02 percent did regular ANC check up; 21.97% of women had not attended ANC clinic regularly throughout pregnancy. Among ANC attended cases, 76.52% had attended ANC at government Hospital. On admission, 4.21% were febrile, only two presented with hypertensive, six were gestational diabetes and had complained anaemia **(Table-1)**.

Table 1: Demographic Characteristics of women underwent CS

Variables	Frequency	Percent	Variables	Frequency	Percent
Age in years			**Educational background**		
= 19	06	1.1	Illiterate	70	12.82
20-34	419	76.73	Literate	476	87.18
= 35	121	22.17			
Occupation			**Parity**		
Housewife	421	77.10	Primpara	326	59.70
Service	13	2.38	Multipara	220	40.29
Labourer/Agriculture	78	14.29	**BMI**		
Business	27	4.95	=18.5	30	5.49
Others	07	1.28	18.5-24.9	79	14.47
Antenatal regular check-up			=25	437	80.04
Yes	426	78.02	**Gestational age**		
No	120	21.97	**<37 weeks**	308	56.41
Place of ANC			**=37 weeks**	238	43.59
Government hospital	326	59.7	**Co morbidities**		
Private hospital	184	33.7	Gestational diabetes	06	1.09
Primary health centre	18	3.3	Hypertensive disorder	02	0.36
Private clinics	18	3.3	Anaemia	03	0.54
Any other			Febrile	23	4.21

(ii) Common indications of caesarean section delivery

The most frequent indication for caesarean section delivery was cephalopelvic disproportion (25.82%) followed by malpresentation (18.86%) and fetal distress (16.84%), presented in **Table-2**.

(iii) Analysis of risk factors

(a) Incidence of surgical site infection and associated demographic factors

During the study period, out of 546 caesarean cases, total of 62 women was found to have SSI: (2 deep and 60 superficial) infections. The overall infection rate was 11.35%. **(Table-3)**

Twenty four women out of 285 respondents under the age of 30 years (38.7%) developed surgical site infection compared to 38 (61.29%) 30 years or older. This difference was statistically not significant. Women who had formal education (n=27, 87.17%) were less likely to develop SSI, compared to (n=35, 12.82%) those with non-formal education (P=NS). Similarly, a significantly higher proportion (n=41, %) of women less than 37 weeks gestation develop SSI compared to 21 (%) women more than 37 weeks gestation (P=NS). Furthermore, a higher proportion

Table 2: Indications for caesarean section

Table3: Incidence of Surgical site infection.

Variables	Number (%)
Infected cases	62 (11.35)
Non infected	484(88.65)
casesTotal	546 (100.0)

(n=326, 83.87%) of primpara women had SSI compared to multipara (n=220, 16.12%). Also obese women had a higher proportion (n=437, 67.74%, P<0.01) SSI compared to non obese (n=109, 32.25%, P<0.01). No significant association was found between the patients demographic characteristics except BMI of women **(Table-4).**

Table 4: Incidence of surgical site infection (SSI) and associated demographic factors.

Table 5: Incidence of surgical site infection (SSI) and associated risk factors.
N= 546

Variables	SSI cases (n= 62)	no SSI (n= 484)	Total (N= 546)	P value
Obstetric factors				
ANC attended				
Yes	39 (62.9%)	248(51.24%)	426(78.02%)	NS
No	23 (37.1%)	235(48.56%)	120(21.97%)	
Previous C. section				
No	18 (29.03%)	393 (81.19%)	411 (75.27%)	NS
Yes	44 (70.97%)	91 (18.81%)	135(24.73%)	
Types of surgery				
Elective	09 (14.51%)	95(19.62%)	204(37.36%)	p<0.05
Emergency	53 (85.49%)	389 (80.37%)	342(62.64%)	
Rupture of membrane				
Yes	36 (58.06%)	222(45.87%)	258(47.25%)	p<0.05
No	26 (41.94%)	262 (54.13%)	288(52.75%)	
Per- vaginal examination				
2- 6 times	38 (61.29%)	263 (54.33%)	301(55.13%)	p<0.05
<2 times	24 (38.71 %)	221 (40.47%)	245(44.87%)	
Prolonged labour				
Yes	36 (58.07%)	190 (39.25%)	226(41.39%)	p<0.001
No	26 (41.93%)	294(60.74%)	320(58.61%)	
Surgical factors				
Types of incision (skin)				
Vertical	38(61.29%)	224(46.28%)	262(47.98%)	p<0.01
Horizontal	24 (38.71%)	260(53.71%)	284 (52.02%)	
Types of suturing (skin)				
Interrupted	41 (66.13%)	287(59.3%)	328(60.07%)	p<0.01
Continuous	21 (33.87%)	197 (40.7%)	218(39.93%)	
Long duration of surgery				
Yes	39 (62.90%)	145(29.95%)	184(33.70%)	NS
No	23 (37.10%)	339(70.05%)	362(66.30%)	
Medical factors				
Gestational diabetes				
Yes	03(4.83%)	03(0.62%)	06(1.10%)	NS
No	59 (95.17%)	481 (99.38%)	540(98.90%)	
Hypertensive disorder				
Yes	00(0 %)	02(0.41%)	02(0.37%)	NS
No	62(100 %)	482(99.59%)	544(99.63%)	
Anaemia				
Yes	02(3.22%)	01 (0.2 %)	03(0.55%)	NS
No	60(96.78 %)	483(99.8%)	543(99.45%)	
Febrile				
Yes	06(9.68%)	17(3.51%)	23(4.21%)	NS

(b) Incidence of surgical site infection and associated other risk factors

However Surgical site infection were found to be higher and statistically significant in women who underwent emergency CS (n=342, 85.49%, p<0.05); who had per vaginal examination more than two to six (n=301, 61.29%, P<0.05). SSI was found to be higher in those who had membrane ruptured status before going to surgery and statistically significant (n=258, 58.06%, p<0.05); who had vertical skin incision (n=262, 61.29%, p<0.0001) and had interrupted skin suturing (n=328, 66.13%, p<0.01) during surgery **(Table-5).**

Discussion

In present study overall surgical site infection following caesarean section found was 11.35%, whereas a lower rate infection was found in other studies conducted in different parts of the world: UK 9.6% [18], Norway 8.3 % [7] , US 5% [6] and Oman study 2.66% [6]. However a higher rate of infection was observed in a study conducted at Nepal, which comprises 12.6% [15] and also 16%, was found in studies conducted in US and India (24.2%) before intervention. [11, 1] Similar rates were found in other studies conducted in UK 11.2% and Ethiopia 11.4%.[2,4] The SSI rate was found to be only 2.7% in a retrospective study done in Patan hospital in Nepal which is lower compared to this study. [5] However, a randomized trial conducted in Chitwan showed that; overall wound complications rate was found 15.2%. [12]

The risk of developing SSI after C-section is multi-factorial and has been found to be influenced by the demographic factors, obstetric factors, surgical and medical factors in this study: No significant association was found between the patients demographic and medical conditions except BMI of patient. However emergency surgery, membrane rupture before surgery, prolonged labour, vertical skin incision and interrupted skin suturing which were found statistically significant.

In this study, women who were obese developed more SSI compared to non-obese (n=437, 67.74%) and was statistically significant (p<0.05). Similar type of finding was observed in a study conducted at Tartu University Hospital, Estonia. [13] Women who had undergone emergency LSCS (n=342, 85.49%) developed more SSI compared to elective LSCS (n=204, 14.51%) and was statistically significant (p<0.05). Similar finding was observed in a study conducted in Nepal revealed that Emergency caesarean section predisposes more to SSI as compared to elective (80.16%). [15] Similar findings were identified in a study conducted in Ethiopia where emergency surgery had two times increased risk of surgical site infection (11.9% vs. 5.4%) than elective cases. [4] This finding could be attributable to the fact that in emergency cases membrane rupture and multiple vaginal examinations are frequent. There is also increased risk of bacterial contamination or breaks in sterile technique or lack of timely antibiotic prophylaxis.

The length of time between rupture of the membranes and surgery also showed statistically significant (P<0.05) risk for surgical site infection (n=258, 58.06%). Study conducted in Oman revealed four-fold increased risk in the rate of PROM among the case group compared to the controls. They found association between PROM and wound infections highly significant (P <0.001). [6] A study done in Tanzania, rupture of membranes prior to surgery lasting 8 hours or longer, (HR = 2.7; 95% CI = 1.3-5.8; p = 0.011) and 3 or more vaginal examinations (HR = 3.3; 95% CI = 1.7-6.5; p = 0.001) were found to be significant risks for SSI development. [14] Once the membrane is ruptured the amniotic fluid has increased chance to get infected induced by multiple vaginal examinations. It is thought that 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 complications. These findings were supported in other studies. [6, 18, 14, 10] Also present study shows women who had prolonged labour developed increase rate of SSI which was statistically significant (n=226, 58.07%, p<0.001). Similar type of finding was observed in a study conducted at Tartu University Hospital, Estonia. [13]In this study, increased rate of SSI was observed in vertical incision cases which was statistically significant (n=262, 61.29, p<0.01). A study conducted in India (Nepal), type of skin incision had been found to be a risk factor for developing SSI. [15] Vertical incision was significantly found to predict SSI; women with vertical skin incisions had a 3.6 fold risk of developing a SSI compared to those with transverse skin incision. [14] Study conducted in New York based hospital found a significantly greater incidence of wound complications (35% compared with 9%) in women with vertical skin incisions. The difference was significant (p <0.05). [16] In this study, the SSI was also found to be significantly higher (P <0.01) in those with interrupted suturing (n=328, 66.13%) whereas, women who had continuous suture had less SSI (n=218, 33.87%). Study conducted in UK revealed

the lowest SSI rate in patients where a continuous suture had been used; 1.3% in 2009, to 6.7% in 2010 and 10.7% in 2011. [17, 9] The choice of subcuticular suture rather than interrupted site is associated with a significantly lower incidence of infection. [8, 15, 2]

Conclusion

SSI after caesarean section is a common problem in most of the tertiary care hospitals. The risk of developing SSI after C-section is multi-factorial and has been found to be most commonly influenced by the following factors in this study: emergency surgery, frequent vaginal examination, prolonged labour, membrane rupture before surgery, vertical skin incision and interrupted skin suturing.

Therefore, increased awareness on these risk factors, implementation of hospital policy and protocol should be done by all the health care professionals in order to minimize and prevent the infection rate after caesarean section.

Limitation

Present study has some limitations. Some of the cases during the study period were not followed up which could likely influence the calculated rate of surgical site infection. The various other potential risk factors that can cause SSI could not be assessed in this study, such as: wound contamination grade, ASA grade, amount of blood loss, post discharge cases.

Implications

From the findings of the study the following implication are stated.

-Present study would help nurses and other healthcare personnel to understand the risk factors of SSI following CS so that risk factors can be modified and infection rate can be prevented.

- The findings would help the health policy maker to develop and strictly implement the policy and hospital protocol for control and prevention of SSI which will help to reduce the maternal morbidity and mortality.

-The nurse administrator would further recommend practicing the hospital protocol for better quality care for reducing incidence of SSI following caesarean case.

Recommendations

- ☞ This type of study may be conducted in different region of India to know the incidence of SSI following caesarean delivery.
- ☞ Training strategy for health professional may be implemented to prevent the rate of SSI following caesarean delivery.
- ☞ This type of study may be conducted in large no of sample to know other risk factors of SSI following caesarean delivery

References

1. A Johnson, D young, J Reilly. Caesarean section surgical site infection Surveillance. Journal of hospital infection 2006; 64:30-35.
2. Amenu D, Belachew T and Araya F. Surgical site infection rate and risk factors among obstetric cases of Jimma University specialized hospital, Southwest Ethiopia. Ethiop Journal of Health Science 2011 July; 21(2).
3. Caesarean section surgical site infection surveillance. Wexford general hospital.2009 to 2011 comparative report.
4. Cocoran S, Jackson V, Smith C S, Loughrey J. Kenna MC, Cafferkey M. Surgical site infection after cesarean section: Implementing 3 changes to improve the quality of patient care. Dublin, Ireland. American Journal of Infection Control 2013; 41:1258-63.
5. De D, saxena S, Mehata G, Yadav R, and Dutta R. Risk factor analysis and microbial etiology of surgical site infections following lower segment caesarean section. International Journal of Antibiotics 2013; Volume 2013.
6. Dhar H, Busaidi AI, Rathi B, Nimre A E, Sachdeva V and Hamdi I. A Study of Post-Caesarean Section Wound Infections in a Regional Referral Hospital, Oman. Sultan Qaboos University Med J 2014 May; (14)2:e211-21.
7. Eriksen HM, Sæther AR, Løwer HL, Vangen S, Hjetland R, Lundmark H, Aavitsland P. Infections after caesarean sections. Journal of Norwegian Medical Association. Tidsskr Nor Legeforen 2009; 129:618–22.
8. Gould D. Caesarean section, surgical site infection and wound management. Nursing Standard 2006 Nov; 21(32):57-66.

9. Killian CA, Graffunder EM, Vinciguerra TJ, Venezia RA. Risk factors for surgical-site infections following cesarean section. Infect Control Hosp Epidemiol 2001; 22:613-17.

10. Martens M G, Kolrud B L, Faro S, Maccato M, and Hammill H. Developmwnt of wound infection or separation after cesarean delivery: prospective evaluation of 2431 cases. Journal for reproductive medicine for obstetrician and gynaecologist 1995;40(3):171-5.

11. Olsen MA, Butler AM, Willers DM, Devkota P, Gross GA and Fraser VJ. Risk factors for surgical site infection after low transverse cesareansection. Infect Control Hosp Epidemiol 2008; 9:477-84.

12. Pandit A. Sharma P and Yangzom K. Incidence of caesarean wound infection in Patan hospital, Nepal. Journal of Nepal Medical Association 2003; 42:280-3.

13. Piret Mitt, Katrin Lang. surgical-site infections following cesarean section in an Estonian university hospital: post discharge surveillance and analysis of risk factors. Journal of Infect Control Hosp Epidemiol.2005;5(6):449-454.

14. Shrestha A, Napit J, Neupane B and Sedhain LB. A randomized trial comparing skin closure in cesarean section: Interrupted suture with nylon vs subcutucular suture with No 1 polyfilament. JNHRC 2013 Sept;11(3)

15. Shrestha S, Shrestha R, Shrestha B, Dongol A. Incidence and Risk Factors of Surgical Site Infection Following Cesarean Section at Dhulikhel Hospital. Kathmandu Univ Med J 2014; 46(2):113-6.

16. Wall DP, Deucy E E, Glantz and Pressman E K. Vertical Skin Incisions and Wound Complications in the Obese Parturient, The American College of Obstetricians and Gynecologists 2003 Nov;102(5), Part1.

17. Webster J. Post caesarean wound infection: A review of the risk factors. Aust NZ Journal of Obstetrics and gynaecology 1988:201.

18. Wloch C, Wilson J, Lamagni T, Harrington P, Chalett A, Sheridan E. Risk factors for surgical site infection following caesarean section in England: result from a multicentre cohort study; BJOG An international Journal of Obstetrics and gynaecology 2012; 119:1324–1333.