Original Article

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Surgical Site Infection Following Cesarean Section in a Teaching Hospital

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Abstract

Introduction: Over the last 20 years, the increase in cesarean section (CS) delivery has been substantial in many states in the country. Morbidity after a CS is increased considerably once there is a surgical site infection (SSI) and it may lead on to mortality. Medical science is able to reduce this problem of SSI by adhering to strict aseptic and antiseptic measures. How much we could achieve? What is the current burden of this problem? How we can further reduce it?

Objective: To identify the incidence of SSI after CS and to identify the risk factors of SSI after CS.

Design: Descriptive study.

Setting: Department of Obstetrics and Gynaecology Government MCH Kottayam, Kerala, South India. It is a tertiary care center and a teaching hospital.

Study Subjects: Women who had undergone CS.

Results: 4.1% of subjects had SSI. The significant factors in the final model included were a high body mass index (BMI) (above 25), prolonged pre-operative hospital stay, and hypertensive disorders.

Conclusions: By trying to reduce BMI, limiting the pre-operative hospital stay, and taking stringent measures against HDP (hypertensive disorders of pregnancy), we may be able to reduce SSI further.

Key words: Body mass index, Cesarean section, Hospital Stay, Hypertension, Surgical site infection

INTRODUCTION

A consistent increase has been observed in the rate of cesarean deliveries in most of the developed countries and many developing countries including India over the last few decades and is a matter of concern among the social scientists. In recent years, it is often argued that obstetricians also increasingly prefer for surgical birth than a normal birth. In addition, there is also some evidence from certain countries on increasing preference from women who want to deliver their child through the cesarean section (CS). There is an argument that medico-legal issues force an institution to go for cesarean at the slightest indication. Interestingly, all the southern states in India recorded CS delivery as high as that of recorded in countries with the highest level of CS in the world.[1-5] The rates recorded in Kerala, Andhra Pradesh, and Goa are alarming. The data indicate that states with marked demographic transition also records high incidence of CS rate, although, the real cause of such increase would be different. Morbidity after a CS is increased considerably once there is a surgical site infection (SSI) and it may lead on to mortality. Sepsis has become a major cause for maternal mortality in Kerala.[27] SSI is a major cause for sepsis after CS. Hence, identifying risk factors of SSI helps to formulate an ideal environment to reduce SSI and thereby sepsis and maternal mortality. This study aimed to determine the incidence of SSI after the CS and to identify risk factors associated with the development of SSI. Medical science is able to reduce this problem of SSI by adhering to strict aseptic and antiseptic

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measures. How much we could achieve? What is the current burden of this problem? How we can further reduce it?[6,7]

MATERIALS AND METHODS

The Institutional Ethical Committee evaluated the project and granted consent for the same on 23/02/2012. The study period was from March 2012 to May 2013. The data were collected from the post-operative lower segment CS (LSCS) ward on a day-to-day basis. Risk factor profile was analyzed for those who had SSI. Patients with SSI were identified as per the following criteria.

1. Infection occurring in the first post-operative week
2. Involving skin and subcutaneous tissue at surgical site with any one of the following:
    a. Purulent discharge
    b. Organisms isolated from fluid/tissues of superficial incision
    c. At least one sign of inflammation (indurations, erythema, local rise of temperature)
    d. Wound deliberately opened by the surgeon for drainage
    e. Surgeon declares that the wound is infected.

Exclusion Criteria

1. Patients requiring obstetric hysterectomy/any other surgical complication
2. Cases operated outside
3. Patients referred from outside centers in active labor and operated later
4. Patients with HIV, hepatitis B, syphilis, or infective hepatitis/leptospirosis/dengue/documented urinary tract infection.

Variables studied:

1. Body mass index (BMI)
2. Socioeconomic status
3. Hemoglobin level
4. Co-morbidities hypertension/diabetes mellitus/renal disease/bronchial asthma/Thyroid dysfunctions
5. Antibiotic prophylaxis given
6. Presurgery hospital stay
7. Ward used by the patient (general ward/pay ward)
8. Parity
9. Previous surgery
10. Incision transverse/vertical
11. Elective/emergency
12. Anesthesia used (general/spinal/epidural)
13. Surgeon-resident/faculty
14. Soap and water bath before surgery by the subject.

The investigators collected the data from the post-operative ward on the day-to-day basis. BMI was calculated by third post partum day weight and height. Socioeconomic status was assessed by Kuppuswamy's socioeconomic status scale. Emergency CS was defined as an operation for the compelling reason that had not been planned, and an elective cesarean was defined as an operation planned and done when scheduled.

Sample Size

A total of 1500 subjects were required as per calculation.

Calculated with alpha and beta errors, respectively, as follows.

Alpha (α) error = 0.05

Beta (β) error = 20

Statistical Method

Statistical analysis was performed using SPSS software (version 10.0, SPSS Inc., Chicago, IL). Chi-square test and Fishers exact tests were done where ever necessary. ($P < 0.05$ was considered significant) The significant variables ($P < 0.05$) were entered into a multivariate logistic regression for getting a final model.

RESULTS

About 1500 post LSCS subjects were studied. 62 had post-operative SSI in the first post-operative week. This gave an incidence of 4.1%. After doing Chi-squire and Fishers exact tests, 11 variables were found significantly associated with SSI. They are BMI, Socioeconomic status of the patient, anemia, hypertension, diabetes mellitus, renal disease, use of perioperative antibiotics, type of surgery (emergency or elective), pre-operative hospital stay, place of stay in the hospital and the surgeon who did the surgery (Tables 1 and 2) .

DISCUSSION

Reported rates of post-cesarean SSI vary greatly, from 0.3% in Turkey[4] and 11.6% in Brazil[5] to 18.3% in Saudi Arabia.[6] The present study included 1500 CS patients, and 62 had infection which accounts for 4.1% and is comparable with rates of different studies.[3] A study by Jido *et al.*, in Kano Nigeria, the prevalence of SSI following CS was 9.1%. In India, the infection rate was 24.2% including post discharge surveillance in a study conducted at Lady Hardinge Medical College, New Delhi. Post discharge surveillance was not done and it may have contributed to the low rate of SSI in the present study. Stringent exclusion criteria also might have contributed for a low rate.

Table 1: Risk factor analysis of SSIs following LSCS

Variable	Chi-square	*P* value	Significance
BMI	11.962	0.008	Yes
Socioeconomic status	11.4782	0.000706	Yes
Anemia	4.115	0.043	Yes
Hypertension	25.695	0.0007	Yes
Diabetes mellitus	21.076	0.00006	Yes
Renal disease	10.6	0.001	Yes
Bronchial asthma	2.276	0.131	No
Hypothyroidism	0.782	0.377	No
Antibiotic use	30.522	0.0001	Yes
Prolonged hospital stay	4.049	0.044	Yes
Place of stay	16.896	0.0005	Yes
Parity	0.1678	0.68	No
Previous surgery	0.1384	0.070	No
Type of incision	0.032	0.858	No
Emergency/elective	4.945	0.026	Yes
Type of anesthesia	0.359	0.549	No
Surgeon (cons/res)	5.482	0.019	Yes
Soap and water bath	0.519	0.475	No

SSI: Surgical site infection, LSCS: Lower segment cesarean section, BMI: Body mass index

Table 2: Multivariate analysis of significant variables

Variable	95% confidence interval for Exp (B)			
	Odds ratio	Lower bound	Upper bound	Significance
BMI >25	1.5047	1.5047	1.5047	0.0008
Anemia	2.287	0.905	5.780	0.080
Hypertension	3.971	2.179	7.237	0.000001
Hospital stay >5	1.977	1.128	3.464	0.017
Emergency surgery	1.905	0.961	3.778	0.065

*: p< 0.05, Hypertension, BMI above 25, and prolonged hospital stay (more than 5 days) are most significant in the given model. BMI: Body mass index

Around 83.3% of study subjects had normal BMI. 13.8% had overweight. This factor needs special attention as obesity is a booming epidemic, especially in the reproductive age group. In the present study, an increased BMI was seen to influence the outcome of surgery in terms of an increased rate of infection. Similar results were found in other studies.[7-11]

Socioeconomic status of the majority of the patients was in lower middle class as the setting is a government hospital which caters to the poor and needy section of the society. Compared with patients belonging to upper socioeconomic status, patients of low socioeconomic status had a relatively higher number of high-risk characteristics, increasing their underlying risk for SSI; It was found that there is significantly increased risk of SSI in the low socioeconomic status group. Indian studies analyzing the influence of socioeconomic status of the obstetrics population affecting their surgical outcome are limited.[12-21]

Patients with anemia were seen to be more prone to SSI. It is generally agreed that anemia diminishes resistance to infection and is frequently associated with puerperal sepsis. Pre-operative anemia is an important predictor of infection and has been proved by several other studies.[22,23] In the present study also, anemia was found to be significantly associated with SSI. A study by Awan *et al.*, did not identify anemia as a risk factor of SSI.[13]

Hypertensive disorders were present in 10% of the study population. There is increased surgical intervention for patients with pre-eclampsia. The disease state, inductions, hypoalbuminemia, edema all contribute to the development of SSI. In this study also, patients with hypertensive disorders had significantly increased incidence of SSI.

Patients with pre-existing illnesses, such as diabetes mellitus, renal disease, and hypertensive disorders (pregnancy induced or pre-existing), were seen to be more prone to infection in the present study. Hyperglycemia has several deleterious effects on 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, pre-existing or pregnancy induced, and related co-morbid states have been associated with SSI in several studies.[24-26] They were all seen to be significant in the present study. Asthma and hypothyroidism predispose to wound infection in general but has shown no significant relation in the present study.

Use of perioperative antibiotics significantly reduces SSI in this study. It may not be corresponding to all published data.

Pre-operative hospital stay has a significant relationship with wound infection. Overcrowding in the wards is a precursor of infection and is also supported by the results that infection was significantly low among patients in pay wards.

Cases done by faculty had more infection as compared to residents. The expertise of the surgeon usually protects against wound infection. Observation was on the contrary. The explanation may be as follows. High risk cases with BMI nearing 30, cases with severe pre-eclampsia, prolonged labor, second stage LSCS are all done by faculty; hence, these factors would have contributed to high rate of infection in these cases. (Cases done by the faculty: Obese cases, cases with anemia or corrected anemia, diabetes mellitus, pre-eclampsia, and renal disease. The majority of emergency cases are being done by one Assistant Professor on duty and not by residents. Cases of prolonged labor and all second stage LSCS are done by the Assistant Professor on duty. Residents are doing cases posted on an elective basis and uncomplicated cases with a faculty assisting them).

Nulliparous women are more prone for infection according to literature.[16] In the present study, no significant relationship was found between SSI and parity. Previous surgery also did not show a significant relationship with SSI.

Type of incision also had no significant relation with the rate of SSI in this study.

Emergency surgery predisposes to infection. Hospitals with a strict policy on reducing primary sections may go for a decision on section after a trial of labor. As a result, emergency surgeries may increase in number. These emergency surgeries have a high chance of SSI.[1] Similar results were obtained in this study also.

Anesthesia also did not show a major difference, although literature shows evidence of general anesthesia being a risk factor for SSI.[16-20]

Soap and water bath before surgery did not show a significant influence. However, improving personal hygiene helps to prevent SSI. Hence, recommended before all elective surgeries.

Pre-operative hospital stay significantly increased SSI in this study. The stay in the hospital premises increases patient's susceptibility to hospital acquired infections. These infections increase the chances of sepsis and wound infection in these patients. Patients staying in the general ward had more infection than those in pay wards and it was statistically significant. Overcrowding in the general wards may contribute to increased evidence of sepsis (Reasons for prolonged hospital stay in this series were mainly: Diabetes mellitus, pre-eclampsia, anemia, residence is far away and financially not well to spend on taxi fare in case of emergency. Confounding factors are there between high rates of SSI and prolonged hospital stay. However, the SSI rates are low among those who stayed in private rooms. Again relatively better socioeconomic status and better personnel cleanliness of those who are staying in private rooms may be a confounder in the other direction).

CONCLUSION

Three independent risk factors are significantly increasing the chance for SSIs after CS. All the three of them are modifiable to a certain extent. Reduction of BMI should be addressed from the early childhood onwards and unnecessary pre-operative hospital stay, and overcrowding should be discouraged. In public sector Hospitals, this may be a challenge for the caregivers. Another factor worth mentioning is the relationship between hypertensive disorders and prolonged hospital stay (Confounder). Proper guidelines to avoid prolonged stay and proper management of HDP are the need of the era. Even though the statistical significance was not achieved in the final model, all the modifiable factors attained significance at the individual level also are to be addressed properly to reduce the SSI rates.

Limitation

Follow-up of cases after discharging from the hospital was not done and this might have contributed for a low rate for SSI.

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