Section: Obstetrics and Gynaecology

Original Research Article

STUDY OF SURGICAL SITE INFECTION, MICROBIOLOGICAL PROFILE & RISK FACTORS FOLLOWING CAESAREAN SECTION IN TERTIARY CARE HOSPITAL

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Abstract

Background: To estimate the incidence, independent risk factors and organisms causing surgical site infections following caesarean section. **Materials and Methods:** The conducted study is prospective observational cohort study involving 277 females who underwent caesarean section. Out of 277, we lost follow-up of 27 patients. A total of 250 patients were included for analysis who underwent labor and scheduled C-sections from January 2021 to September 2022 at Department of Microbiology and Department of Gynaecology, Government Medical College & Dr. Susheela Tiwari Government Hospital, Haldwani, Nainital. Each woman was followed for 30 postoperative days. Culture-based microbiological methods were used to identify causative agents in postoperative wounds. Data analysis included descriptive statistics, and univariate logistic regression analysis. **Result:** Overall, the SSI rate was found to be 18.0% and the median time was the 5th - 6th postoperative day. The mean age of the patients was 20-31years. The average length of stay was 6 to 7 days. We found a statistically significant association between SSI and co-morbidity, preoperative antibiotic use, duration of operation, age, and history of previous cesarean section. Univariate logistic regression analysis confirmed that one or more co-morbidity, previous cesarean section, preoperative antibiotics, and duration of the surgery < 1 h are predictors of SSI. **Conclusion:** Knowing the associated risk factors with SSI can assist clinicians in identifying women with specific risk factor profiles. Careful assessment of membrane status, identifying and properly managing patients with morbidity can further decrease the SSI rate.

INTRODUCTION

Surgical site infections (SSI) are defined as infections occurring up to 30 days after surgery and affecting either the incision or deep tissue at the operation site. Cesarean section is the commonest obstetric surgical procedure, its global rates (including both emergency and elective) are ranging from 5 to 20% and the rates continue to rise in both developed and developing countries.[1]

SSIs in obstetrics is the second most common cause of maternal mortality next to postpartum hemorrhage.[2] Women undergoing cesarean deliveries have a 5 to 20-fold greater chance of getting an infection compared with women who give birth vaginally. Several risk factors for developing post cesarean section SSI, and identification of these factors are important for reducing SSI rate, Hence this study was conducted to estimate the incidence, independent risk factors and organisms causing surgical site infections following caesarean section.

MATERIALS AND METHODS

The conducted study is prospective observational cohort study involving 277 females who underwent caesarean section. Out of 277, we lost follow-up of 27 patients. A total of 250 patients were included for analysis that underwent labor and scheduled C-sections from January 2021 to September 2022 at Department of Microbiology and Department of Gynaecology, Government Medical College & Dr. Susheela Tiwari Government Hospital, Haldwani, Nainital.

An official letter was obtained from the institutional ethical committee to conduct this research and get

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consent from each patient. The patients were told about the objectives and benefits of the study and after having verbal consent from the patient with SSI.

All information regarding patient specific demography, surgical class wound, peri-operative process measures, potential risk factors, post-operative antibiotics etc. were recorded in WHO peri-operative data collection form taken from WHO surveillance & infection control protocol.[3] Obstetrics and Gynecology residents were trained on how to detect SSI with demonstration on few cases using the CDC's criteria.[4]

After the surgical operation has taken place, the second phase of data in 'WHO post-operative period data collection form were recorded.[3] Data collection was done for each patient on the day of surgery and followed up on the weekly basis. and on the day of discharge, the surgical wound was inspected and classified according to CDC definitions. All women were meticulously instructed about signs and symptoms of SSI, and were asked to contact the hospital if they suspected an infection, within 30 days after the operation. All patients after discharge were followed up telephonically for 30days.[4] Specimens from SSI were collected in sterile pre packed swab. Two swabs were taken for each case, one for gram staining and another for aerobic bacterial culture. Specimen was properly labelled and delivered to the laboratory as soon as possible with a completed requisition form. In case of delay, samples were stored in the refrigerator.

Sample was plated on blood agar & MacConkey agar [Himedia Laboratories Pvt Ltd., Mumbai]. All culture plates were incubated at 37˚C for 24-48 hours in an incubator. Plates were examined for growth if no growth was detected; plates were re incubated for an additional 48 hours before being declared negative. Identification was done on basis of bacterial colony morphology, cell morphology and reaction on gram stain and by standard biochemical tests. Antimicrobial susceptibility test by Kirby- Bauer disk diffusion method according to CLSI guidelines 2022.[5]

RESULTS

Out of 250 patient 12 patients underwent elective LSCS and 238 for emergency procedure.

Out of 250 patient 45 patents developed surgical site infections. Among 250 patient 235 were developed clean wound and 15 patients developed clean contaminated wound. In 179 cases duration of surgery is less than 60 min but in 71 patient duration is more than 60min. All patients found in between 20- 31 years of age group. Maternal risk factors and association with SSI are shown in [Table 1].

Table 1: Maternal risk factors and association with SSI

Risk Factor		Post Cesarean SSI						P Value
		Yes (No.=45)		No (No.=205)		Total (Np=250)		
		No.	%	No.	%	No.	%	
Age	≤30 Years	39	86.7%	186	90.7%	225	90.0%	0.4104
	>30 Years	6	13.3%	19	9.26%	25	10.0%	
Residence	Rural	29	64.4%	127	61.9%	156	62.4%	0.7545
	Urban	16	35.6%	78	38.1%	94	37.6%	
Anemia	Yes	24	53.3%	101	49.2%	125	50.0%	0.6214
	No	21	46.7%	104	50.8%	125	50.0%	
Diabetes Mellitus	Yes	19	42.2%	8	3.9%	27	10.8%	0.00001
	No	26	57.8%	197	96.1%	223	89.2%	
Hypertension	Yes	17	37.8%	12	5.86%	29	11.6%	0.00001
	No	28	62.2%	193	94.14%	221	88.4%	
Gravida	Multi	37	82.2%	132	64.3%	169	67.6%	0.0206
	Primi	8	17.8%	73	35.6%	81	32.4%	
Gestational Age	<37	26	57.8%	118	57.5%	144	57.6%	0.9633
	≥37	19	42.2%	87	42.5%	106	42.4%	
History Of Previous LSCS	YES	25	55.6%	11	5.3%	36	14.4%	0.00001
	NO	20	44.4%	194	94.6%	214	85.6%	
No. Of Pelvic Examination	≤2	26	57.8%	106	51.7%	132	52.8%	0.4686
	≥3	19	42.2%	99	48.3%	118	47.2%	
Membrane Status	Ruptured	42	93.3%	157	76.5%	199	79.6%	0.0115
	Intact	3	6.7%	48	23.4%	46	20.4%	
Type Of Surgical Procedure	Elective	5	11.1%	17	8.29%	22	8.8%	0.0287
	Emergency	40	88.9%	188	91.7%	228	91.2%	
Surgical Wound Class	Clean	40	88.9%	195	95.1%	235	94.0%	0.3955
	Clean Contaminated	5	11.1%	10	4.9%	15	6.0%	
Duration Of Surgery	<60 MIN	29	64.4%	150	73.2%	179	71.6%	0.2397
	≥60 MIN	16	35.6%	55	26.8%	71	28.4%	

Distributions of organisms are depicted in [Table 2].

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Table 2: Distribution of Isolates According to the Type of Organism Obtained On Culture

Micro-Organism	Number	Percentage
Gram-Positive		
MRCONS (Methicillin-resistant coagulase-negative staphylococci)	11	24.4%
MRSA (Methicillin-resistant Staphylococcus aureus)	10	22.2%
MSSA (Methicillin-sensitive Staphylococcus aureus)	7	15.6%
Gram-Negative		
Klebsiella pneumoniae	6	13.3%
E. coli	5	11.1%
Acinetobacter spp.	3	6.8%
Pseudomonas spp.	2	4.4%
Mixed- E. coli and K. pneumoniae	1	2.2%
Total	45	100%

Gram positive organisms were sensitive to Linezolid and Cotrimoxazole. Gram negative microorganisms (Enterobacteriaceae) were sensitive to Imipenem and Colistin. Non fermenters were highly sensitive to Piperacillin-tazobactam, Ceftazidime and Colistin.

DISCUSSION

The rate of surgical site infection following caesarean delivery varies, with reported values ranging from 0.5% to 25%. In present study, the rate of surgical site infection was found 18.0% which is high when compared to the rates of the developed countries (which is 4.5%,9.6%7%,11%).[6,7,8,9] In India the incidence of post LSCS SSI in various hospital setting varies from 3.5% to 28% (Shilpa Gupta et al).

Higher prevalence rates of SSIs in developing countries may be due to limited hygienic practice unlike developed countries, difference in population sampling, study design, and ethnicity contribute to the variation in the prevalence rates in the other studies as compared to the present study.[10] Worldwide, SSIs have been responsible for the growing cost; morbidity and mortality correlated with surgeries, and continue to be difficult to address.[11,12]

In present study, diabetes mellitus, hypertension, gravida, history of previous LSCS, membrane status and type of surgical procedure were observed to be statistically significant risk factors for surgical site infection ($p<0.05$). History of previous LSCS found to be significant due to increased risk of surgical site infection due to poor healing of previous scarred tissue in which incision is repeated.

Emergency surgical procedure was observed to be statistically significant risk factor for surgical site infection in our study. Emergency procedures, where the surgery was unplanned, were more likely to develop SSI as seen in study by Chhetry M et al.[13] Emergency CS rate was also significantly higher in SSI group (81.2% vs. 64.3%; $p < 0.001$) in study done by Gomaa K et al,[14] and Jain AK et al,[15] they observed that emergency CS develop SSI may be due to inadequate preoperative preparation time.

Bacteriological studies have shown that SSIs are universal and the etiological agents involved may vary with geographical location, between various procedures, between surgeons, from hospital to hospital. In developing countries, due to poor infection control practices, overcrowded hospitals and inappropriate use of antimicrobials, risk of surgical site infections has been increased.[16]

Greater number of Gram-positive organisms were isolated in the present study, which is consistent with findings of other published studies.[17,18,19,20,21] We also observed that Gram-positive micro-organisms including Methicillin-resistant Coagulase-negative Staphylococci (24%) Methicillin-resistant Staphylococcus aureus (22.2%) and Methicillin-sensitive Staphylococcus aureus (15.6%) were the major contributors for the development of SSI as compared to Gram negative microorganisms.

Gram-negative micro-organisms including Klebsiella pneumoniae, E. coli, Pseudomonas spp, Acinetobacter spp. and mixed growth (E. coli and K. pneumoniae) were isolated in 13.3%, 11.1%, 4.4%, 6.8% and 2.2% cases, respectively.

Antimicrobial susceptibility pattern of Gram-positive organisms were sensitive to Linezolid and Cotrimoxazole. Gram negative microorganisms (Enterobacteriaceae) were sensitive to Imipenem and Colistin. But non fermenters were highly sensitive to Piperacillin tazobactam, Ceftazidime and Colistin.

CONCLUSION

The present study shows an 18% rate of surgical site infection in our tertiary care centre. The commonest pathogens causing SSI were Staphylococci.

Diabetes mellitus, hypertension, multigravida, history of previous LSCS, rupture of membrane and type of surgical procedure (emergency LSCS) were observed to be significant risk factors for surgical site infection in this study.

Knowing the associated risk factors with SSI can assist clinicians in identifying women with specific risk factor profiles. Careful assessment of membrane status and identifying and properly managing patients with morbidity can further decrease the SSI rate. Further studies with a larger sample size are required to validate the findings of the present study.

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