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Research Article

CLINICAL PROFILE AND MORBIDITY IN SURGICAL SITE INFECTION FOLLOWING CESAREAN SECTION IN A TERTIARY CARE CENTER IN NORTH KERALA, INDIA

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ABSTRACT

Objectives: The objectives of this of this study were as follows: (1) To analyse the clinical presentation of surgical site infection (SSI) and to identify the causative organism (2) the maternal morbidities of post-cesarean SSI.

Methods: This study was conducted in the Department of Obstetrics and Gynecology, KMCT Medical college, Kozhikode, from April 1, to August 31, 2021, after clearance from the Ethical Committee, in which 153 cases of SSI Post cesarean were included in the study.

Results: All the patients with SSI had wound discharge, followed by pain and induration (94.4%). Fever was present in 44.4%. About 44.4% of the wound discharge were detected between days 6 and 10. Mean day of detection of wound discharge among patients with SSI was 8.78 days. Superficial incisional SSI (94.4%) had the highest incidence followed by deep incisional (5.6%). *Staphylococcus aureus* (50%) was the most common organism isolated followed by *Escherichia coli* (11.1%). MRSA (11.1%) was isolated from only two cases. Intraoperative adhesions and prolonged operative time were a predictor of SSI (p=0.001). Mean days of hospital stay with and without SSI were 5 and 8.22, respectively, highlighting the extended length of hospital stay among patients with SSI.

Conclusion: Prompt and early identification of SSI with appropriate treatment can reduce the maternal morbidity and improve reproductive health of women.

Keywords: Surgical site infection, Cesarean, Risk factors, Incidence, Labor-related.

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INTRODUCTION

In both developed and developing countries, cesarean section (CS) is the most commonly performed major abdominal operation among women and amounts to 15% globally. Center for Disease Control and Preventions (CDCs) define SSI as an infection occurring within 30 days after a surgical procedure due to the proliferation of pathogenic micro-organisms. This develops in an incision site either within the skin and subcutaneous fat (superficial), musculofascial layers (deep), or in an organ or cavity, if opened during surgery. Due to better hygienic conditions, the use of prophylactic antibiotics and clinging to standard infection control protocols, SSI have significantly come down in the past three decades. This post-operative condition causes significant morbidity and mortality. Pregnancy related and procedure related factors amount to the development of post CS surgical site infection (SSI) [1].

The objectives were as follows: (1) To analyse the day of SSI presentation and clinical symptoms following CS, (2) to study the maternal morbidities, and (3) to the organisms isolated and length of hospital stay post-CS SSI.

METHODS

Study design

This was a prospective study to determine clinical features and morbidities associated with SSI.

Patients with SSI were identified as per the following criteria: (1) Infection occurring in the 1st post-operative week during hospital stay, (2) discharge from surgical site, (3) at least one sign of inflammation (indurations, erythema, and local rise of temperature), (4) wound deliberately opened by the surgeon for drainage, and (5) surgeon declares that the wound is infected.

Study setting

This study was conducted in the Department of Obstetrics and Gynaecology, KMCT Medical College, Kozhikode.

Study duration

The study was April 1, 2021–August 31, 2021.

Sample size N = Z2 $\alpha/2$ × p×(1-p) × D E2 Z $\alpha/2$ = Normal deviate for two tailed hypothesis = 1.96 P = proportion from the previous studies = 56.7% (superficial incisional SSI; Ref Article: SSI following cesarean delivery: patient provider and procedure specific risk factors) (3) D = Design effect = 1 E = Margin of error =10% N (sample size is) = 153 [2].

Selection criteria

Inclusion criteria

The following criteria were included in the study:

- All patients underwent CS and attended outpatient department for follow-up within 30 day following cesarean delivery
- Who had given consent to participate in the study.

Exclusion criteria

The following criteria were excluded from the study:

- Women with wound infection after 30 days following surgery, using the criteria for CDC5 (The center for disease control and prevention) [3]
- Cases operated outside this hospital
- Patients requiring obstetric hysterectomy/any other surgical complication.

KMCT Medical College and Hospital is a tertiary care center with precise catchmentdifficult to delineate and patients virtually come from all over Kozhikode, Malappuram, and Wayanad. About 85–90% of these women are booked in antenatal clinic of KMCT, while 5–10% are booked

Table 1: Indication for cesarean section

Indication for CS	Without SSI (n=135), n (%)	With SSI (n=18), n (%)	Total, n (%)
Previous cesarean	80 (59.3)	8 (44.4)	88 (57.5)
Fetal distress	13 (9.6)	2 (11.1)	15 (9.8)
Hypertensive disorder of pregnancy	2 (1.5)	-	2 (1.3)
PROM	3 (2.2)	-	3 (2.0)
Failed induction	21 (15.6)	3 (16.7)	24 (15.7)
Arrestof descent	5 (3.7)	1 (5.6)	6 (3.9)
Others	11 (8.1)	4 (22.2)	15 (9.8)

CS: Cesarean section, SSI: Surgical site infection, PROM: Premature rupture of membtranes

Table 2: Class of antibiotics received preoperatively

Pre-operative antibiotics	Without SSI (n=135), n (%)	With SSI (n=18), n (%)	Total, n (%)	p
Cefotaxim	92 (68.1)	11 (61.1)	103 (67.3)	0.550
Ampicillin + cefotaxime	43 (31.9)	7 (38.9)	50 (32.7)	

Table 3: Post-operative hemoglobin of patients with and without surgical site infection

Hemoglobin (g) (post-operative)	Without SSI (n=135), n (%)	With SSI (n=18), n (%)	Total
>11	103 (76.3)	18 (100)	121 (79.1)
9–10.9	32 (23.7)	0	32 (20.9)

SSI: Surgical site infection

Table 4: Mean day of detection of wound discharge

Variable	n	Minimum	Maximum	Mean
Day of wound discharge	18	4	15	8.78

Table 5: Time of detection of surgical site infection

Time of detection of SSI	Frequency (n=18), n (%)
During hospital stay	6 (33.3)
After discharge from hospital	12 (66.7)

Table 6: Mode of treatment of surgical site infection

Mode of treatment	Frequency (n=18), n (%)
Treated on OPD basis	12 (66.7)
Readmitted	6 (33.3)

OPD: Outpatient department

Table 7: Distribution of duration of hospital stay

Stay in days	Without SSI (n=135), n (%)	With SSI (n=18), n (%)	Total, n (%)	p
5	135 (100)	8 (44.4)	143 (93.5)	0.001**
6–10	0	5 (27.8)	5 (3.3)	
11–15	0	5 (27.8)	5 (3.3)	

**<0.001 is statistically highly significant. SSI: Surgical site infection

Table 8: Mean days of hospital stay

SSI Days of hospital stay	n	Minimum	Maximum	Mean
Without SSI	135	5	5	5.00
With SSI	18	5	15	8.22

SSI: Surgical site infection

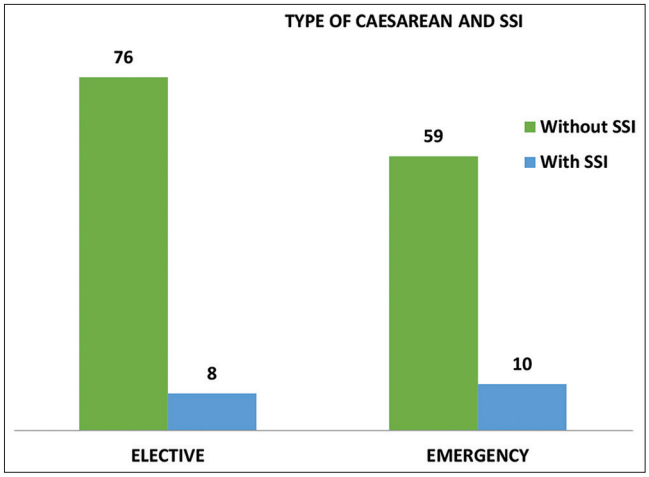

Fig. 1: Distribution of type CS among study population

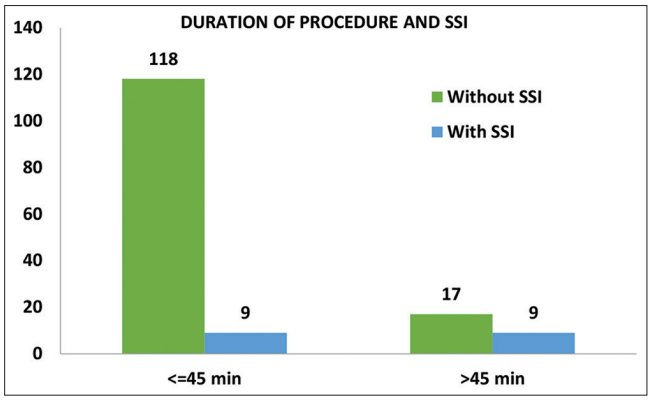

Fig. 2: Duration of procedure among those with and without surgical site infection

outside and <3% seek un-booked "emergency delivery." Relatively small percentage of affluent women come to our hospital. It mainly caters the need of mainly lower and lower middle and mid-middle classes of the population. In addition, many private hospitals also refer complicated cases to the hospital. Majority (90%) are with secondary or higher level education and are aware of their rights to health.

Method of data collection

Data were collected using a standardized questionnaire. Data collected included indication for cesarean, whether performed as an emergency or elective procedure [4] (Tables 1 and 2). Intraoperative data collected include duration of procedure and intraoperative complications (Table 3). All women who underwent cesarean were actively monitored for signs and symptoms of SSI during hospital admission and after discharge (during follow-up in the outpatient clinic) for 30 days (surveillance period) and the relevant information was recorded using a prepared pro forma meeting the objective of the study after taking informed consent. Detection of SSI during hospital stay or post-discharge (with or without readmission), days to SSI development, and culture results were all recorded. Emergency CS was defined as an operation done for the compelling reason that had not been planned, and an elective cesarean was defined as an operation planned and done when scheduled (Fig. 1). Duration of surgery was defined as the time elapsed between skin incision and skin closure (Fig. 2). As pre-operative prophylaxis, antibiotic cefotaxim was given to all patients undergoing cesarean and continued until post-operative day [5]. To assess, the morbidity, (Fig. 3) fever, wound discharge (Table 4) and day of presentation, wound gaping, class of SSI, organism isolated after pus culture and drug sensitivity, and mode of treatment whether treated as outpatient or required readmission or re-suturing of wound were taken

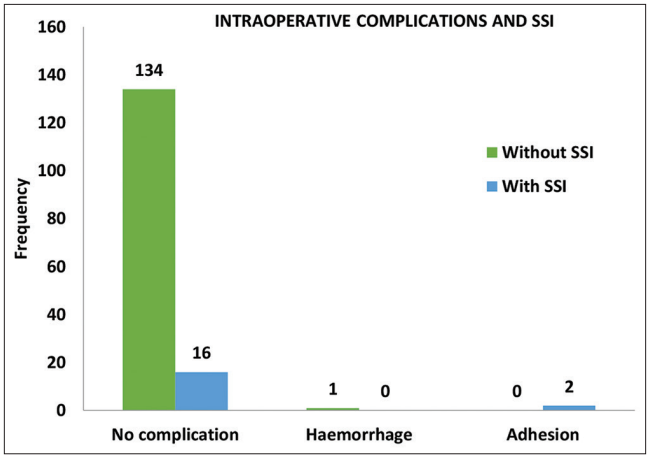

Fig. 3: Distribution of intraoperative complication among patients with and without surgical site infection

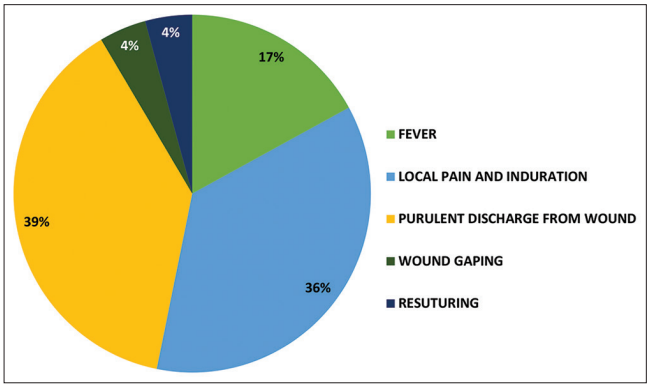

Fig. 4: Distribution of clinical presentation of patients with surgical site infection

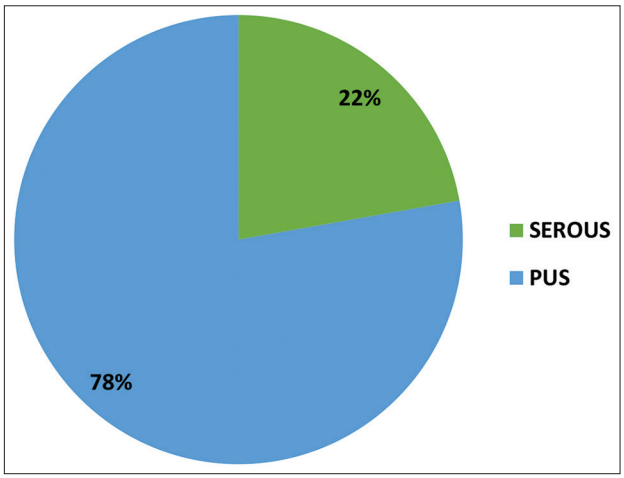

Fig. 5: Type of wound discharge among patients with surgical site infection

into consideration. Extended length of hospital stay was measured as a morbidity indicator. Prolonged hospital stay defined as hospital admission lasting more than 6 days.

Specimen collection and laboratory procedures

Specimens were taken from all patients who clinically were suspected to have SSIs. Before sample collection surrounding skin was cleaned with antiseptic solution. Exudates were obtained from the open

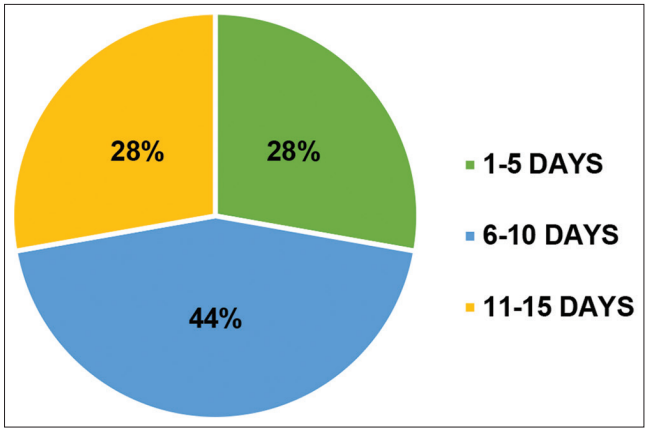

Fig. 6: Day of appearance of wound discharge among patients with ssi

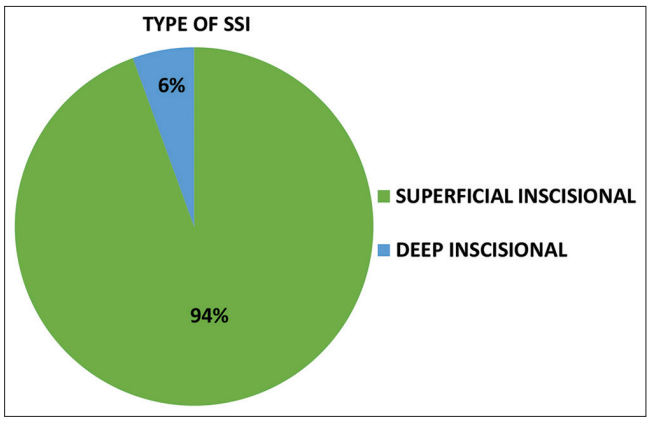

Fig. 7: Distribution of type of surgical site infection

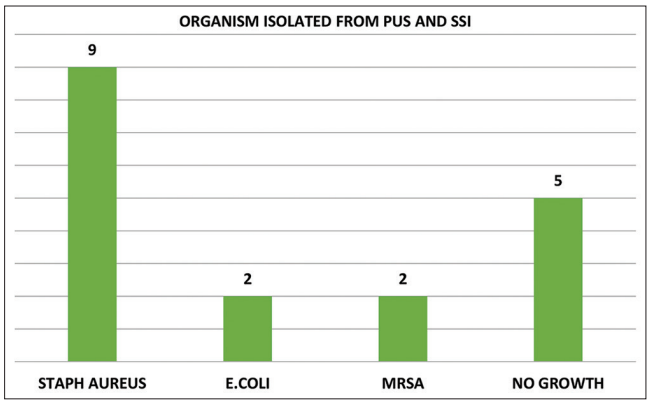

Fig. 8: Organism isolated from the wound

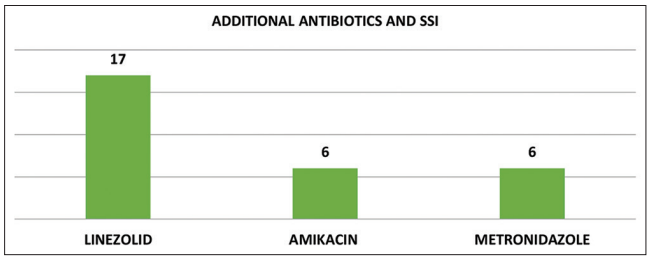

Fig. 9: Distribution of the additional antibiotics among patients with surgical site infection

discharging wounds with a sterile cotton swab. Swabs are transported to the laboratory for processing immediately once obtained. Briefly, specimens were inoculated on blood agar and MacConkey agar and incubated aerobically for 24–48 h. Identification of bacteria was done using conventional physiological and biochemical methods. Biochemical and physiological methods were done using standard protocols [5,6]. Antimicrobial susceptibility of isolates was determined using disk diffusion method according to Clinical Laboratory standard Institute.

Statistical methods

All statistical procedures were performed using the Statistical Package for the Social Sciences (SPSS) 16.0. All quantitative variables are expressed in mean. Qualitative variables expressed in percentages. Associations of selected variables are statistically tested using appropriate statistical test. Chi-square test and independent sample t-test were used to find the statistical significance. $p<0.05$ was considered clinically significant.

However, the type of CS was not recognised as a significant risk factor for the development post-CS SSI, p=0.343.

Ampicillin was given immediately after rupture of membrane. Preoperatively, all patients receive cefotaxim. Type of pre-operative antibiotic is statistically not significant, p=0.550.

Superficial incisional SSI (94.4%) has the highest incidence followed by deep inscisional (5.6%). No case of oragan/space SSI was detected.

DISCUSSION

Clinical presentation of patient with surgical site infection

During the study period, 18 patients developed SSIs which included only superficial and deep SSI. The most common clinical manifestation of SSI was wound discharge in 18 cases. This was followed by local pain and induration in 17 cases and fever in eight cases and two had spontaneous superficial wound dehiscence (Figs. 4 and 5). Re-suturing was done in these two while, in remaining 16 cases, daily aseptic dressings and secondary intention improved wound healing that 14 patients had purulent discharge, while four had serous discharge. In the present study, the time to SSI development varied from 4 to 15 days, with the mean day being 8th day (Fig. 6).

Authors (Reference)	Time to SSI development
Mpogoro *et al*. [7]	3rd–22nd day
Alfouzan *et al*. [2]	2–30 days
Present study 2021	4–15 days

SSI: Surgical site infection

Here, 17 (94.4%) had superficial incisional SSI and only 1 (5.6%) developed deep incisional SSI (Fig. 7).

Authors	Superficial (%)	Deep (%)	Organ space (%)
Alfouzan *et al*. [2]	98	0.7	1.3
Kondakasseril *et al*. [5]	72	24	4
Shree *et al*. [3]	56.7	4.5	38.8
Thakur and Kujur [8]	61.3	29.8	8.7
Opøien *et al*. [6]	100 (29)	0	0
Mpogoro *et al*. [7]	61.8	14.7	23.5
Present study 2021	94.4	5.6	0

Time of detection of surgical site infection (Tables 6-8)

Authors	During hospital stay (%)	Postdischarge (%)
Alfouzan *et al*. [2]	0.7	99.3
Opøien *et al*. [6]	20.7	79.3
Present study-2021	33.3	66.7

Mode of treatment

Majority of the patients with SSI, 12 (66.7%) were treated on OP basis with empirical antibiotics, 6 (33.3%) patients required readmission and were treated with i.v antibiotics and daily aseptic dressing to promote wound healing, out of which four of the wound healed with secondary intention and two of them underwent re-suturing. In Mpogoro *et al*. study [7], majority of patients with SSIs (n = 23/67.6%) were readmitted and one patient with an organ/space SSI died 2 days post re-laparotomy due to septicemia.

Authors	Resuturing (%)
Devi and Durga [1]	63
Kondakasseril *et al*. [5]	54
Present study-2021	11.1

Organism isolated

The microbial etiology of post CS SSIs is found to be diverse and include *Staphylococcus aureus* (Fig. 8), Gram-negative bacteria, and anaerobes. In our study, the most frequently isolated organism was *S. aureus* (61.1%), of which 81.8% were methicillin sensitive and 18.1% of the isolate were resistant to methicillin (MRSA) which was responsible for the development of deep SSI. Followed by *Escherichia coli* which was found in 11.1% cases and no growth was obtained from 27.8% cases (Fig. 9).

Al Shukkur *et al*. [9] repoted that, out of 38 cases with microbial growth, 52% cultured *S. aureus* with 60% displaying methicillin resistance, followed by diphtherioids (22%) and pseudomonas (10.5%).

However, in contrary to the above finding, study by De *et al*. [10] found *Acinetobacter* species (32.03%) as the most frequently isolated organism, it could possibly due to outbreak which happened during the study period and *Acinetobacter* species were frequently isolated from operation theater which would have contaminated the wound.

Author	*Staphylococcus aureus* (%)	*Escherichia coli* (%)	MRSA (%)	Sterile (%)
Thakur and Kujur [8]	32.4	-	11.6	-
Mpogoro *et al*. [7]	27.3	13.6	16.7	-
Kondakasseril *et al*. [5]	56	12	20	12
Present study-2021	50	11.1	11.1	27.8

Hospital stay

Patients with a SSI had statistically significant longer hospital stay. Extended stay was supported by Mpogoro *et al*. [7], De *et al*. [10], Kondakasseril *et al*. [5] (Tables 7 and 8), and Ketema *et al*. [12].

Authors	Mean post-operative day (without SSI)	Mean post-operative day (with SSI)
Mpogoro *et al*. [7]	4±1.7	12.7±6.9
Lilani *et al*. [11]	7.2	24.82
De *et al*. [10]	7.5±2.08	13.08±4.7
Ketema *et al*. [12]	4±1.7	12.7±6.9
Kondakasseril *et al*. [5]	6.72±1.48	22.78±10.2
Present study-2021	5	8.22

SSI: Surgical site infection

CONCLUSION

Post-cesarean SSI is a complex clinical situationwith significant linear association found between number of prior cesarean and longeroperating times with risk of development of SSI. Intraoperative adhesion was a predictor of SSI and significantly extended hospital stay. Prompt and early identification of SSI with appropriate treatment can

reduce the maternal morbidity and thereby improve the reproductive health and quality of life of women.

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AUTHOR' CONTRIBUTIONS

Dr. Hiba has finalized the draft and guarantor, Dr. Heera and Dr Chellamma has prepared the conceptual framework, designing of draft, and data analysis, Dr. Hiba was involved in data collection and analysis, and Dr Heera has done manuscript writing and final editing. Dr Hiba and Dr Abhilash have done data collection.

CONFLICTS OF INTEREST

None declared.

AUTHOR'S FUNDING

None.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee and Institutional Research Committee of KMCT Medical College, Kozhikode.

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