Surgical Site Infection (SSI): Frequency and Risk Factors in Post Caesarean Section Cases in a Tertiary Care Hospital

Shazia Jabbar[1], Shakira Perveen[2], Quratulain Naseer[3]

Abstract

Objective: To determine the frequency of Surgical Site Infections (SSI) and associated risk factors in patients undergoing caesarean section in a tertiary care hospital.

Subject and Methods: A descriptive study conducted from 22nd January 2016 to 21st July 2016 in the department of Obstetrics and Gynaecology, Unit 2, Civil Hospital Karachi. Total 185 post-caesarean section patients, were included in the study, regardless of their booking status. Data on history of patient, demographic information and potential risk factors were noted on a predesigned proforma and patient was followed for 30 days post operatively for occurrence of surgical site infection according to Center for Disease Control (CDC), sample size was calculated by open Epi info and SPSS 17 was used for data analysis. Frequency and percentages were calculated for qualitative variables like parity, Body Mass Index (BMI), diabetes mellitus (DM), chorioamnionitis, education status of patient. Chi-square test was performed to determine the association of SSI with risk factors with p-value taken significant at $p \leq 0.05$.

Results: Total of 185 women aged 18-40 years, who underwent caesarean section in our health facility, were selected. Mean age of women was 25.48 + 4.64 years and gestational age was 35.05 ± 2.517 weeks. Women with parity less than 3 were 121 (65.4%), 108 (58.4%) women had Body Mass Index(BMI) ⩾ 27 and diabetes was found in 85 (45.9%). SSI was seen in 45 (24.3%) post caesarean section patient. Distribution showed that 23 (51.1%) women had superficial incisional infection following caesarean section, 12 (26.6%) women had deep incisional and 10 (22.2%) women had organ/space infection.

Conclusion: The study identified the frequency of surgical site infections as 24.3% following caesarean section and various modifiable risk factors, such as obesity and diabetes in our population were identified.

Keywords: surgical site infection(SSI), caesarean section, body mass index (BMI), parity, risk factors.

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Introduction

In obstetrical practices worldwide, caesarean section is the most commonly performed surgical procedure[1]. Caesarean section (CS) is a major surgical procedure, which carries immediate as well as long term maternal and perinatal risks. Surgical site infections(SSI) indicate the quality of surgical care provided[2] and can range from a minor wound discharge, poor scar, and persistent pain to major life threatening complications like sepsis[3]. The Centre for Disease Control and prevention(CDC)[4] describes three levels of SSI as superficial incision, deep incision and organ or space infection, in addition there may also be microbiological evidence of wound infection from cultures obtained aseptically from wound fluid or tissue.

[1-3] Department of Obstetrics & Gynaecology
Civil Hospital Karachi / Dow Medical College
Dow University of Health Sciences

Correspondence: Shazia Jabbar
Department of Obstetrics and Gynaecology
Civil Hospital Karachi / Dow Medical College
Dow University of Health Sciences
Email: sjkhan@dr.com
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Globally the estimates of SSI vary from 0.5-15%[5] depending on the surveillance method used to identify infections, the patient population, and the prophylactic use of antibiotic and post-operative follow ups[6]. SSI continues to be a major source of morbidity after operative procedure despite application of refined surgical skills, scrubbing up techniques, environmental changes in operating room and the use of preventive antibiotics. Even in developed countries like the United States the reported rate of SSI is 2-5% for all operations[7]. The independent risk factors for post-operative CS wound infection have not been well documented in the literature and have been found to be multifactorial. Studies have identified obesity (BMI >25)[8], diabetes, chorioamnionitis[9] and low socioeconomic status[10] as major risk factors leading to SSI. It seems that overall SSI rates are higher than that reportedand has been identified as a major contributor to health and economic burden[11], hence identification of risk factor will help in the preventive strategy.

In an era of global economic recession in which the cost for surgery is a primary concern for a country like Pakistan, SSI prolongs hospital stay and rate of re-admission which increases burden on health care providers, on patient's pocket and indirectly affect patients' quality of life and productivity. This can be avoided by a vigilant SSI surveillance during and after surgery so as to come up with a standardized protocol.

The study was conducted to find the frequency and associated risk factors resulting in SSI so that early detection can help in reducing maternal morbidity (physical and psychological), hospital stay as well as rate of readmission and medical cost.

Subjects and Methods

Descriptive study was conducted from 22nd January 2016 to 21st July 2016 in the department of Obstetrics and Gynaecology Unit 2 Civil Hospital Karachi (CHK). A non-probability consecutive sampling was used for selection of sample. Sample size was calculated by open epi version 3.03 online sample size calculated by taking prevalence of SSI 12%[9], 95% level of significance, 5% confidence level. The calculated sample size was 163, keeping 5% margin for lost of follow-up patients and 5% for refusal of consent 185 sample size was taken.

The inclusion criteria was age between 18-40 years and any parity women (primiparous, multipara, grand multipara) between gestational age 32-42 weeks (assessed on ultrasound), who had undergone caesarean section regardless of their booking status, were selected.

The exclusion criteria included women with personal history of skin allergy, surgical site skin infection prior to surgery and patients referred from other hospitals with wound infection.

Information about all the women fulfilling the inclusion criteria who had their surgical procedures (caesarean section) in Obstetrics and Gynaecology, Unit 2, (CHK) was collected on a structured proforma which included demographic information, level of education, indication of caesarean section and potential risk factors like BMI, diabetes and were followed up in OPD one week after discharge and then after 15 days for 30 days for SSI (surgical site infection). Patients who had SSI on follow up their pus and/or tissue fluid swab was taken for microbial evidence. Depending on their type of wound infection patients were either readmitted or were advised for dressing and follow up with the report of pus culture and sensitivity.

Outcome surgical site infection was assessed according to the CDC criteria of 30 days following surgical procedure as superficial incision site infection affecting the skin and subcutaneous tissue, indicated by localized (Celsian)[12] signs such as redness, pain, heat or swelling at the site of the incision or by the drainage of pus. Deep incisional infection affecting the fascial and muscle layers. These infections may be indicated by the presence of pus or an abscess, fever with tenderness of the wound, or a separation of the edges of the incision exposing the deeper tissues. Organ or space infection which involves any part of the anatomy other than the incision that is opened or manipulated dur-

ing the surgical procedure, for example joint or peritoneum. In addition, there may also be microbiological evidence of wound infection from cultures obtained aseptically from wound fluid or tissue. However, since skin sites are normally colonized by a variety of organisms, positive wound cultures in the absence of clinical signs are rarely indicative of SSI.

Risk factors responsible for SSI included BMI ≥ 27, diabetes mellitus: (according to WHO criteria for diabetes should be fasting blood sugar (FBS) ≥ 7.0 mmol/l (≥126mg/dl) fasting was defined as no caloric intake for at least 8 hours[13].

Chorioamnionitis (diagnosed as one or more of the following, maternal fever with temperature > 100.4ºF, tachycardia >100/min, fetal tachycardia >160/min, Purulent or foul smelling amniotic fluid or vaginal discharge, uterine tenderness, WBC >17,000[14].

The collected data was analyzed by using SPSS version 17. Mean and standard deviation were computed for quantitative variables like gestational age, age of the patient, frequency and percentage were calculated for qualitative variables like parity, BMI, DM, chorioamnionitis, education status of patient. Chi-square test was performed to determine the association of SSI with risk factors with p-value taken significant at $p \leq 0.05$.

Results

Total of 185 women of age 18-40 years were selected, gestational age 37 to 42 weeks having caesarean section were included in the study. Mean age of women included in our study was 25.4 ± 4.64 in years and gestational age 35.05 ± 2.517 weeks.Women with parity <3 were 121 (65.4%), women having BMI >27 were 108 (58.4%) and 85 (45.9%) women were diabetic (Table 1). Outcomes of the study SSI and its different types showed following results, SSI seen in 45 (24.3%) post caesarean section distribution showed that 23 (51.1%) women had superficial incisional SSI after caesarean section, 12 (26.6%) women had deep incisional SSI and 10 (22.2%) women had organ/space SSI post caesarean section, (Table 2). Most of the patients with superficial and deep incision infections presented around 7th-10th post operative day whereas patients with organ/space infection presented earlier around 3rd-5th day post-operatively.

Age distribution showed that 105 (56.8%) women were of age less than 26 years and 26 or above age women were 80 (43.2%) as shown in (Table 2) and presence of SSI seen in 22 (20.9%) and 23 (28.7%) patients respectively with p-value 0.221, (Table 3). Women with gestational age less than 36 weeks were 115 (62.2%) and SSI was seen in 31 (26.9%) patients and gestational age >36 weeks were 70 (37.8%) and SSI observed was 14 (20.0%), in relation to parity women 3 or less children developed SSI in 28 (23.1%) and >3 children had SSI in 17 (26.5%). Educational status showed that most of the participants of the study were not highly educated. 75 (40.5%), received primary level education and rest of them received secondary, intermediate and graduate level of education.

Out of 45 cases 33 (73.3%) women had emergency caesarean section out of which 24 (53.3%) women had history of repeat caesarean section, and previous number of caesarean section was not found to be significantly associated with rate of infection. Women with diabetes were 26 (57.7%) followed by raised blood pressure in 21 (46.6%) and almost all the women had haemoglobin level <11 gm/dl and varying level of anaemia.

The microbial evidence was found in 23 (51.1%) of women with 7 who had E. Coli isolated on pus swab followed by staph aureus in 5 women, proteus and Methyl resistant Staphylococcus aureus (MRSA) each in 4 patients and 3 had klebsiella positive on culture. These women were treated accordingly and after clearance of infection wounds were resutured in 23 (51.1%) women.

Association of risk factors with SSI was calculated using Chi-Square (x^2) with p-value significant

Table 1. Demographic characteristics of the study population (n=185)

Variables		Frequency	Percentage
Age	Less than 26 years	105	56.8
	⩾26.00 years	80	43.2
Gestational Age	⩾32 ⩽ 36 weeks	115	62.2
	⩾36.00⩽42 weeks	70	37.8
Parity	Less than 3	121	65.4
	⩾3	64	34.6
Education Status	Graduate	26	14.1
	Inter	34	18.4
	Secondary	50	27.0
	Primary	75	40.5
BMI ⩾27	No	77	41.6
	Yes	108	58.4
Chorioamnionitis	No	70	37.8
	Yes	115	62.2
DM	No	100	54.1
	Yes	85	45.9

Table 2. Frequency of SSI in Post Caesarean Section Patients

	N (185)	Percentage (%)
SURGICAL SITE INFECTION	45	24.3
Superficial incision infection	23	51.1
Deep incision infection	12	26.6
Organ/space Infection	10	22.2

Table 3. Association of risk factors with SSI. (n=185)

Variables		SSI No	Yes	Total	p-Value
Age	Less than 26 years	83	22	105	
	⩾26.00 years	57	23	80	0.221
Gestational Age	⩾32 ⩽ 36 weeks	84	31	115	
	⩾36 ⩽ 42 weeks	56	14	70	0.285
Parity	Less than 3	93	28	121	
	⩾3	47	17	64	0.606
Education Status	Graduate	20	06	26	
	Inter	24	10	34	
	Secondary	35	15	50	0.049*
	Primary	61	14	75	
BMI⩾27	No	64	13	77	
	Yes	76	32	108	0.046*
Chorioamnionitis	No	54	16	70	
	Yes	86	29	115	0.717
DM	No	81	19	100	
	Yes	59	26	85	0.049*

Statistical test for significance was calculated using Chi Square (x2)at 5% level of significance.

at ≤0.05 and showed 108 (58.4%) women had BMI ≥ 27 with SSI seen in 32 (29.6%) women while 77 (41.6%) had BMI<27 with significant p-value 0.046. A total of 115 (62.1%) women had chorioamnionitis and 19 (16.5%) developed infection not found to be statistically significant. A total of 85 (45.9%) women were found to be diabetic and 85 (30.5%) had SSI with significant p-value 0.049 (Table 3).

Discussion

Cesarean delivery is considered as a life saving procedure for obstructed labor and other emergency obstetrical conditions; ensuring access to cesarean delivery is an essential strategy for meeting the Sustainable Development Goals for reducing child and maternal mortality[15]. However, as a surgical procedure, there are risks of complications and overuse can be harmful to both mother and newborn. The rising level of caesarean section is becoming a public health concern globally[16]. The World Health Organization (WHO) recommended that national rates not exceed 10 to 15%[17]. The post caesarean section SSI seen in this study was 45 (24.3%) majority of post Caesarean SSIs found in our study were superficial infections followed by deep tissue infections and organ/Space infection. Post caesarean section SSI reported in study by Mpogoro FJ et al[18] was 10.9%, in a study by Jido T et al[19] was 9.1% and Safi FN et al[9] reported SSI as 12%, the difference observed can be attributed to the post discharge follow up. Varying ranges of SSI are observed in different regions.

In our study majority of superficial and deep infections were identified around 7-10 days post operatively with deep/organ infection presented around 3-5 days post-operatively studies by Dhar H[7] showed post-caesarean wound infection was identified around 6-10 days and Wolch C[8] study showed median time of 10 days for all SSI and 8 days for deep and organ/space infections.

In our study, 56.8% of women were aged 26 years or less compared to study by Safi FN[9] where 83% of women belonged to age group 21-40 years and another Wolch C[8] showed median age of 31 years of women who had SSI. Regarding parity 65.4% of women with SSI were of parity 3 or less similarly studies by Mohammad N[17] and Safi FN[9] showed 41.4% and 68% of women were multigravida respectively. 73.3% had emergency LSCS with 53.3% had repeat caesarean section similar to the study by Mohammad N[17] in which 78% of women with SSI had emergency LSCS with 34% having a repeat caesarean section. We had 115 (62.2%) patients who had chorioamnionitis and 29 developed SSI with p-value calculated as 0.717 was not statistically significant whereas study by Dhar H[7] has identified chorioamnionitis as a risk factor in SSI post-caesarean section cases. This could be explained in part as our departmental protocol in initiating combination drug therapy in chorioamnionitis cases with cephalosporin, metronidazole and gentamicin after sending all cultures right away.

The association of educational status with SSI in our study showed 15% and 14% infection in patients with primary and secondary level education with decreasing percentage to 10% and 6% with increased education level that is intermediate and graduation and significant p-value as 0.049, similar study by Amenu D[20] showed 67% of patients who developed infection were illiterate.

The association of obesity and SSI in our study was calculated as p-value 0.046 which was statistically significant study by Myles TD[21] has contributed obesity as an independent risk factor for post-caesarean infectious morbidity similarly other studies by Amenu D[20] and Gould D[22] also labeled obesity and greater BMI as a known risk factor in wound infection. The proposed explanation being the relative avascularity of adipose tissue, technical difficulty in handling adipose tissue and obliterating dead space in the fat-tissue of the abdominal wall, poor penetration of antibiotic as well as improper dosing of antibiotic may all play a role in initiating infection post operatively[18].

Diabetes mellitus as a risk factor for SSI in our study was calculated as p-value 0.049, which is statistically significant similar to study by Nausheen S[11] and Schneid K[23] (Table 1).

Independent risk factors for post-cesarean SSI, as described in the scientific literature included multivariate analysis, are young age, obesity, hypertension or preeclampsia, diabetes mellitus, choroamnionitis, nulliparity, less than seven prenatal visits, extended time from rupture of membranes until cesarean section, emergency cesarean delivery, lack of appropriate antibiotic prophylaxis, increased surgical time, and birth of twins.

The microbial evidence was found in 23 (51.1%) of women with 7 had E. Coli in 30.4% isolated on pus swab followed by S. aureus in 5 (21.7%) women similar to the study by Ansar A[23] with E. Coli in 48% of cases followed by S. aureus whereas studies by Dhar H[7] and Wolch C[8] had S. aureus as the commonest infecting organism found in 31.2% and 40.4% respectively followed by E. Coli in 18.9% and 13.3% respectively

Ours is a tertiary care hospital and the increased in rate of SSI observed in this study could be explained in part by the fact that we dealt with mostly referred, non-booked and complicated patients. There is an increased patients turn over and caesarean section rate especially in emergency operation theatre sometimes not giving ample time for satisfactory theatre preparation. The early discharge of patients on 3rd post operative day and less educational status of the patient have all contributed in the development of post-operative wound infection.

This study has identified modifiable risk factors like diabetes, raised BMI ≥25kg/m^2 and less education status for post-caesarean section surgical site infection. Identification of these risk factors reminds obstetric staff that appropriate targeting of infection reducing strategies to women at high risk is needed. Such strategies include, but are not limited to, antibiotic prophylaxis as routine, antiseptic skin preparation, adequate glycemic control in diabetic patients, and the use of appropriate dressings[24] and targeted counseling in less educated women regarding wound management.

Limitations of the present research include the lack of evaluating the exact time of antimicrobial prophylaxis administration, operating time, outcome of SSI with hospital stay, readmission rate and calculating BMI values at the time of delivery. Further studies with a broader sample size and multicenter studies may give further insight to these limitations.

Prevention of these infections should be a clinical and public health priority. Occurrence of SSI is common and multifactorial. Development and implementation of protocol will help the obstetric staff in early detection of risk factors causing infection, targeting strategies towards high risk women and auditing SSI[25] will help in reducing maternal post-operatively infectious morbidity.

Conclusion

The study identified frequency of surgical site infections following caesarean section in 24.3% women with superficial incision infection constituting 51.1%, deep incision 26.6% and deep organ infections responsible for 22.2% of SSI. Modifiable risk factors like obesity and diabetes were identified in our population. The 24.3% frequency of SSI as explained earlier may be attributed to the increased patient turnover, complicated referred cases, low socioeconomic status with poor general health and less educated patient who fail to comply with the post-discharge advice.

Conflict of Interest

Authors have no conflict of interests and no grant/ funding from any organization for this study.

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