

## ORIGINAL ARTICLE

**Risk Factors for Surgical Site Infection Following Cesarean Delivery**SYEDA RABIA BUKHARI<sup>1</sup>, MOMY GUL<sup>2</sup>, UMBER ASAD<sup>3</sup>, LAMIA YUSUF<sup>4</sup>, SURRAYA ISRAR<sup>5</sup>, ABIHA KHURRUM<sup>6</sup><sup>1</sup>MBBS, FCPS (Obs & Gynae), MPH, Medical Officer, Moulvi Ameer Shah Memorial Hospital, Peshawar<sup>2</sup>Assistant Professor Gynae Unit 4, Bolan Medical Complex Hospital, Quetta<sup>3</sup>Senior Registrar Gynae Unit 2, Sir Ganga Ram Hospital, Lahore<sup>4</sup>Associate Professor Obs & Gynae, Khawaja Muhammad Safdar Medical College, Sialkot<sup>5</sup>Associate Professor Obs & Gynae, GKMC/BKMC, Swabi<sup>6</sup>Medical Student, Dow University of Health Sciences, KarachiCorresponding author: Umber Asad, Email: [umb786@yahoo.com](mailto:umb786@yahoo.com)**ABSTRACT****Background and Aim:** Obstetrics' most common surgery is the cesarean section. The most common cause of hospitalization is surgical site infection, which increases morbidity and mortality. Postpartum infection is most commonly caused by cesarean section. The present study aimed to determine the several risk factors for surgical site infections after caesarean birth.**Patients and Methods:** This case-control study was conducted on 874 women underwent cesarean section in the department of Obstetrics and Gynecology at Moulvi Ameer Shah Memorial Hospital, Peshawar from January 2022 to September 2022. Patients were categorized into study group and control. A case is a patient who developed surgical site infections (SSI) after undergoing cesarean section surgery, while a control is a patient who had the procedure before or after SSI wasn't developed. Using the bivariate and multivariate logistic regression methods, infections on the patients were detected based on physical examination, laboratory reports, and post-operative follow-ups. Data analysis was done in SPSS version 28.**Results:** Of the total 874 cesarean cases, the prevalence of surgical site infection after cesarean section was 84 (9.6%). The age wise distribution of cases with SSI were as follows: 12 (14.3%) in 15-25 years, 62 (73.8%) in 26-35 years, and 7 (8.3%) in >35 years. Among 84 cases, the incidence of superficial type and deep incisional type was 80 (95.2%) and 4 (4.8%) respectively. The incidence of SSI diagnosis within 10 and after 10 postoperative days were 57 (67.9%) and 27 (32.1%) respectively. Among SSI diagnosed cases, the prevalence of normal, overweight, and obese patients were 16 (19%), 40 (47.7%), and 28 (33.3%) respectively. The prevalence of primipara was 72% (n=60) in SSI group. Out of total SSI cases, the incidence of primary and repeated CS was 74 (88.1%) and 10 (11.9%) respectively. In the SSI group, 45.2% (n = 38) out of total cases had medical complications like hypertension, diabetes, anemia, hypothyroidism, autoimmune diseases like scleroderma and SLE, and fever.**Conclusion:** The present study concluded that the prevalence of surgical site infection after cesarean section was 9.6%. The chances of surgical site infection after cesarean section increase as one gets older, obese, suffers medical complications while pregnant, goes into labor during a cesarean section, and has more than five PV examinations. Obstetricians should take precautions to avoid preventable risk factors.**Keywords:** Surgical site infection, Risk factors, Cesarean section**INTRODUCTION**

There is no doubt that cesarean sections are the most frequently performed major surgery in obstetrics. They can provide positive outcomes for the mother and the fetus when properly indicated and can be life-saving. Infectious complications are 10 times more common after caesarean births than after vaginal deliveries [1, 2]. Nonetheless, at a time when the worldwide caesarean birth rate is increasing, there is rising worry about maternal death risk and morbidity. Hemorrhage, thromboembolic diseases, postpartum endometritis, anesthesia-related problems, pelvic organ damage, and wound complications are all major complications related with caesarean birth [3, 4]. The postpartum infection major risk factor for is CS, which has a 20-fold increase relative to vaginal birth [5]. As CS rates rise globally, we should predict increased patterns in infectious morbidity [6].

The SSI is an infection developed that includes superficial incisional (incision subcutaneous tissue) and deep soft tissue within 30 days of surgery [7]. SSI is the leading cause of maternal morbidity and prevalent infection in surgical patients [8]. The reported rate of surgical-site infections (SSIs) after caesarean sections varies greatly. The prevalence of postpartum endometritis ranges between 3% and 85% [9, 10], and the risk of wound infection increased from 2% to 10% [11, 12]. Women with extremes maternal weight, limited prenatal care, poor nutrition, lengthy duration of surgery, extended labour or rupture of membranes, general anesthesia, young maternal age, and several operations were more likely to have SSIs [13]. There are various established SSI risk factors following CS [14]; still, investigations on impartial risk variables are uncommon, and there is paucity of data regarding association of CS and incidence of SSI has not formerly been explored in Pakistan. Therefore, the present study's goal was to identify independent risk variables for SSI after cesarean section.

**METHODOLOGY**

This case-control study was carried out on 874 women underwent cesarean section in the Department of Obstetrics and Gynecology at Moulvi Ameer Shah Memorial Hospital, Peshawar from January 2022 to September 2022. Patients were categorized into study group and control. A case is a patient who developed surgical site infections (SSI) after undergoing cesarean section surgery, while a control is a patient who had the procedure before or after SSI wasn't developed. Using the bivariate and multivariate logistic regression methods, infections on the patients were detected based on physical examination, laboratory reports, and post-operative follow-ups. The individual medical data were assessed in order to get information regarding medical issues prior and during pregnancy and labour and surgical outcomes and complications. Pregnancy-related parameters included smoking habits, maternal age, parity, preexisting psychiatric morbidity, weight gain, gestational diabetes, preexisting diabetes mellitus, prior intra-abdominal surgery (mostly previous CS), hypertension and preeclampsia-like obstetric complications, and urinary tract infections. Prelab or premature rupture of membranes (PPROM), oligohydramnios, and fetal problems such as intrauterine growth restriction were also included. Labor factors included membrane rupture, spontaneous or induction labour, induction technique, hours before delivery, symptoms of infection during labour, the number of vaginal exams, and vaginal delivery attempts by pushing or tool. Procedure type (elective vs. emergency), expected blood loss during surgery, operation time in minutes, and blood transfusion were all factors in surgery.

SPSS 26 was used to analyze the data. For categorical variables, frequency and percentage were calculated. The independent T-test was used for comparing mean values. Binary logistic regression was used in bivariate analysis to determine the

link between outcome variables and predictors. A p value of 0.05 was deemed statistically significant.

**RESULTS**

Of the total 874 cesarean cases, the prevalence of surgical site infection after cesarean section was 84 (9.6%). The age wise distribution of cases with SSI were as follows: 12 (14.3%) in 15-25 years, 62 (73.8%) in 26-35 years, and 7 (8.3%) in >35 years. Among 84 cases, the incidence of superficial type and deep incisional type was 80 (95.2%) and 4 (4.8%) respectively. The incidence of SSI diagnosis within 10 and after 10 postoperative days were 57 (67.9%) and 27 (32.1%) respectively. Among SSI diagnosed cases, the prevalence of normal, overweight, and obese patients were 16 (19%), 40 (47.7%), and 28 (33.3%) respectively. The prevalence of primipara was 72% (n=60) in SSI group. Out of total SSI cases, the incidence of primary and repeated CS was 74 (88.1%) and 10 (11.9%) respectively. In the SSI group, 45.2% (n = 38) out of total cases had medical complications like hypertension, diabetes, anemia, hypothyroidism, autoimmune diseases like scleroderma and SLE, and fever. Figure-1 illustrate the age-wise distribution of SSI diagnosed cases. The incidence of superficial type and deep incisional type is depicted in Figure-2. Figure-3 demonstrate the incidence of SSI diagnosis within 10 and after 10 postoperative days. Table-1 represent the details of patients with SSI after caesarean surgery have different features than the control group. Table-II displays the Procedure-associated features of individuals with SSI after caesarean section vs. control group. For procedure-related risk factors, a bivariate logistic regression model was developed as shown in Table-III.

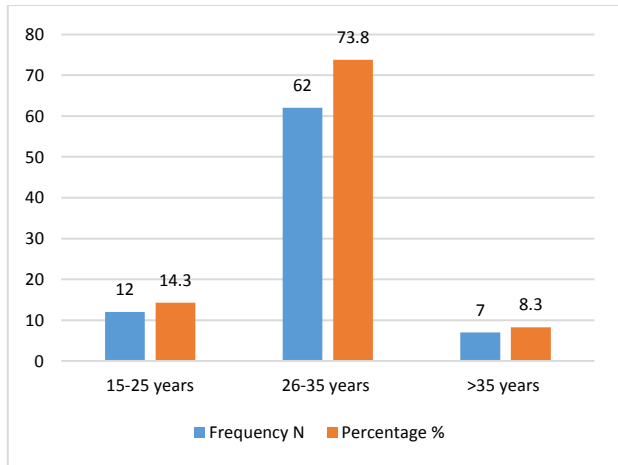


Figure-1: Age-wise distribution of SSI diagnosed cases after cesarean section (n=84)

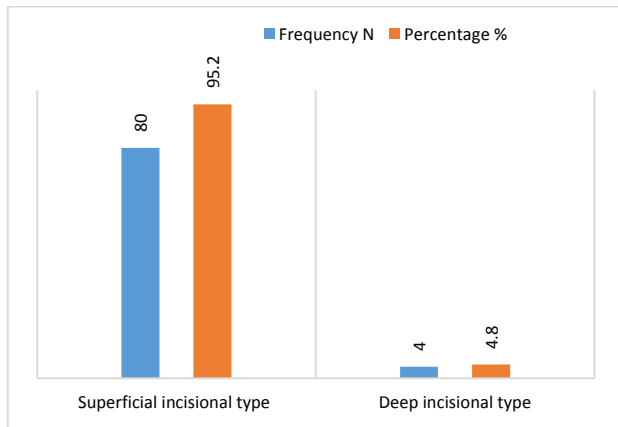


Figure-2: incidence of superficial type and deep incisional type (n=84)

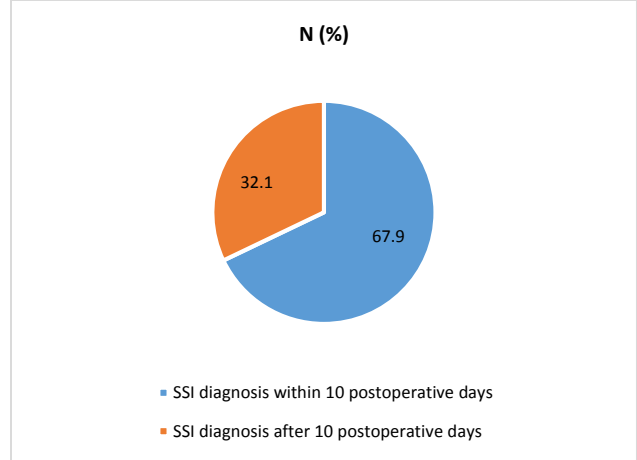


Figure-3: Incidence of SSI diagnosis within 10 and after 10 postoperative days

Table-1: details of patients with SSI after caesarean surgery have different features than the control group

Parameters	SSI group N=84 N (%)	Non-SSI group N=84 N (%)	P-value
Age (yrs.)			0.0132
15-25	12 (14.3)	14 (16.7)	
26-35	62 (73.8)	64 (76.2)	
>35	7 (8.3)	6 (7.1)	
BMI (kg/m2)			<0.001
Normal	16 (19)	41 (48.8)	
Overweight	40 (47.7)	31 (36.9)	
Obese	28 (33.3)	12 (14.3)	
Parity			0.072
Primipara	60 (72)	50 (60)	
Multipara	24 (28)	34 (40)	
ANC visits			0.069
<4	18 (21.4)	28 (33.3)	
>4	66 (78.6)	56 (66.7)	
Cesarean section			0.052
Primary	74 (88.1)	69 (82.1)	
Previous	10 (11.9)	15 (17.9)	
Complications	38 (45.2)	12 (14.3)	<0.001

Table-2: displays of the procedure-associated features of individuals with SSI after caesarean section vs. control group.

Parameters	SSI group N (%)	Non-SSI group N (%)	P-value
CS types			0.012
Emergency	79 (94.2)	68 (81)	
Elective	5 (5.8)	16 (19)	
Membrane rupture			0.311
Artificial	50 (60)	39 (47)	
Spontaneous	34 (40)	45 (53)	
Membrane rupture duration			0.005
≤18 hrs.	67 (80)	80 (95.6)	
>18 hrs.	17 (20)	20 (4.4)	
Frequency of PV examination			0.042
≤5 times	38 (46)	53 (63.1)	
>5 times	46 (54)	31 (36.9)	
Duration of surgery			0.032
≤60 minutes	33 (39.3)	47 (56)	
>60 minutes	51 (60.7)	37 (44)	
Blood loss (ml)			<0.035
100-200	69 (82.1)	74 (88.1)	
250-400	15 (17.9)	10 (12.9)	

Table-3: For procedure-related risk factors, a bivariate logistic regression model was developed

Parameters	Bivariate analysis 95% CI	Multivariate analysis 95% CI	P-value
CS types	4.29 (1.41-12.68)	-	0.012
Membrane rupture	1.38 (0.69-2.92)	-	0.311
Membrane rupture duration	7.01 (1.48-30.46)	8.29 (1.37-46.25)	0.005
Frequency of PV examination	1.89 (1.01-3.72)	2.48 (1.02-6.28)	0.042
Duration of surgery	2.02 (1.06-3.85)	2.09 (0.89-3.84)	0.032
Blood loss (ml)	2.42 (1.01-5.78)	2.29 (0.69-7.52)	<0.035

## DISCUSSION

The present study mainly focused on the surgical site infection related risk factors in patients going through cesarean section and found that after a cesarean section, the incidence of surgical site infection was 9.6%. The likelihood of surgical site infection during a cesarean section increases with age, obesity, medical difficulties while pregnant, going into labour during a cesarean section, and having more than five PV exams. Pre-gestational obesity, and blood transfusion, and prior mental disorder were different independent risk factors for SSI developed after CS. When compared to other studies, our low CS rates appear to have little effect on SSI rates [15, 16]. In our study, the prevalence of normal, overweight, and obese individuals among SSI diagnosed cases was 16 (19%), 40 (47.7%), and 28 (33.3%), respectively. In the SSI group, the prevalence of primipara was 72% (n=60). Primary and recurring CS occurred in 74 (88.1%) and 10 (11.9%) of all SSI cases, respectively. According to the previous study, the incidence of emergency and elective cesarean section was 75% and 25%, with a 2% general risk of SSI after CS [17, 18]. Emergency type cesarean section was the SSI-related independent risk factor [19].

Wound-related complications such as SSI after cesarean section, are a main cause of morbidity and death, increasing inpatient time and expenses during hospitalization [20]. SSI is the predominant infection among patients going through surgical procedures, accounting for 15% of all nosocomial infections [21]. With the increased tendency of cesarean births worldwide, SSI is rising as well. It is also one of the most often seen postoperative problems at the institute where the study was conducted. The majority of surgical site infections are caused by germs present in the patient's body during operation [22].

The majority of surgical site infections are avoidable [23]. To limit the risk of infection, precautions can be taken throughout the preoperative, intraoperative, and postoperative stages of treatment [24]. The frequency and consequences of wound infection are reduced when patients with risk factors are properly monitored postoperatively [25].

The risk of SSI following CS ranges between 3% and 15%, depending on the investigated population, detection and monitoring cases, and the antibiotic prophylaxis proper usage [26]. The incidence of SSI was 8.54% in the present study. K. Chu et al. [27] reported a 9.1% SSI rate after cesarean section. Bradley et al. [28] previously reported a 12.6% incidence rate of SSI in Nepal in 2014. R.G. Sawyer et al. [29] discovered that the overall rate of SSI was 8.9% during a 30-day postoperative monitoring period, compared to 1.8% upon hospital discharge. L.J Moulton et al. [30] observed a 2.76% incidence of wound infection among cesarean section patients. This reduced incidence rate might be attributed to their only considering SSI that occurred during the hospital stay.

The risk of medical issues during pregnancy increases with age [31]. Obesity has been significantly associated with SSI prediction via a variety of variables, including adipose tissue vascularity [32]. This study also discovered that women who are obese are more likely to get SSI than women who are normal weight or underweight. The earlier study shown that primipara women had a higher chance of getting SSI than multipara women. Women having a history of CS are thought to be at a higher risk of SSI due to past scarred tissue poor healing, a vascularity, greater loss of blood, and a lengthier operation period [33]. Women with medical issues such as DM/HTN and other medical complications were substantially related with SSI in this study. These complications includes anemia, fever with respiratory tract infections, hypothyroidism, and heart disease.

## CONCLUSION

The present study concluded that the prevalence of surgical site infection after cesarean section was 9.6%. The chances of surgical site infection after cesarean section increase as one gets older, obese, suffers medical complications while pregnant, goes into labor during a cesarean section, and has more than five PV

examinations. Obstetricians should take precautions to avoid preventable risk factors.

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