Clinical and Experimental Health Sciences

Determinants of wound infection in primigravidas in People Medical College Nawab Shah (PUMHS)

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ABSTRACT

OBJECTIVES: To investigate the determinants of post cesarean surgical cite infections (SSI) in primigravidas subjects.

Methodology: This descriptive cross-sectional study was conducted by using non-probability purposive sampling technique from July 2023, to January 2024 in the Department of Obstetrics and Gynecology, PUMHS Nawabshah. Pregnant women were included after qualifying recruitment criteria along with their informed consent in the Obstetrics & Gynecology OPD and Emergency Department at PUMHS. Data was collected by using a detailed questionnaire that captured demographics, gestational age, dietary habits, and pre-operative antibiotic prophylaxis. The study focused on women with post-cesarean SSI, disregarding age, ethnicity and residence. A 30-day post-surgery assessment was conducted to assess the details of post cesarean SSI in the study subjects.

RESULTS: Out of 150 patients with mean age 21.3 (SD=±4.0), 21 (14%) had developed post-cesarean SSI. In these 21 subjects with SSI, 95.2% had experienced membrane rapture, 19% were found with pre-operative antibiotic prophylaxes 52.4% were obese and 57.1% had anemia. Statistical analyses showed a significant association ($p<0.05$) of post-cesarean SSI with, preoperative antibiotic prophylaxis, membrane rupture, labor pain, body mass index, co-morbidities and operation type.

CONCLUSION: The onset of post-cesarean SSI in primigravidas is positively associated with membrane rupture and negatively associated with pre-operative antibiotic prophylaxis along with other risk factors. It necessitates timely measures such as antibiotics prophylaxis and careful pre and post-surgery management to prevent post cesarean SSI in primigravidas.

INTRODUCTION

Post-cesarean surgical site infections (SSIs) are one of the common complications, depending on factors such as co-morbidities, socio-economic status, availability of health care facilities, and the onset of emergency conditions with varying incidence rates around the globe including Pakistan. [1,2,3]

Post cesarean section SSIs integrate a considerable load on the subject's well-being, therefore the preventive measures of such conditions are the prime considerations in this emerging world.[2,4] Many factors play an important role in the onset and complexity of SSI after cesarean section. [1,3] The SSI after a cesarean section increases hospital stay, thereby escalating expenditures and burdens for the mother and her family.[5] Comparing vaginal births to cesarean deliveries, the incidence of infectious complications is ten times higher.[6]

Primigravidas undergoing C-sections are particularly vulnerable to wound infections due to various physiological and obstetric factors.[7] The surgical incision made during a C-section creates an entry point for pathogens, increasing the risk of infection compared to vaginal deliveries.[8] Moreover, the primigravidas status may influence wound healing processes that further exacerbate the risk of post-cesarean SSI.[7]

Wound infections in primigravidas not only jeopardize maternal health but also have broader implications due to societal and cultural norms in developing countries.[9] In a society where childbirth is deeply intertwined with family dynamics, social support networks, and cultural practices, the burden of postpartum complications (including wound infections), extends beyond individual health outcomes.[10] Moreover, other risk factors such as obesity, diabetes, anemia, and availability of healthcare facilities play crucial roles in the onset of SSI after cesarean interventions. [11,12,13,15]

Several studies in the Pakistani population have highlighted a concerning trend of increased C-section rates among primigravidas women, alongside a parallel rise in postoperative complications, including wound infections.[5]

The effectiveness of interventions to lessen the occurrence of wound infections after cesarean section is an area of ongoing research. Different studies have suggested the potential benefits of preoperative skin preparation, choice of incision, and antibiotic prophylaxis to overcome the incidence of SSI.[14]

Developing countries, including Pakistan, face unique challenges in managing wound infection due to varying healthcare infrastructure, accessibility, and quality, which may affect the incidence and management outcomes of SSI after cesarean section.[16,17,18] Despite the expanding recognition of this issue, there remains a significant gap in research focusing on the determinants of wound infection in primigravidas women in Pakistan.[19] Unfortunately, Pakistan misses the mark on the standard reconnaissance framework for postoperative infections, which thus assumes a critical role in morbidity and mortality among mothers.[20]

This study aims to add knowledge to understand the factors associated with SSI in this field of research. The findings could be useful in conveying information for better management with essential mediations to address SSIs after Cesarean section in primigravidas in our population.

Methodology:

This descriptive cross-sectional study was conducted at the Department of Obstetrics and Gynecology, PUMHS NAWABSHAH from July 2023 to January 2024. Non-probability purposive sampling technique was adopted for this study. Before the commencement of the study, written consent was obtained from each participant after describing the main features of this research. Formal approval was obtained from the ethical review board (Ref. No. PUMHSW /SBA/PVC/ERC/2023/325). The sample size was calculated using an online sample size calculator for proportion available www.openepi.com version 3.01, after inserting 1.5%

anticipated prevalence of wound infection at 2.0% margin of error and 95% confidence interval**.** Primigravidas (18 years and above) undergoing C-sections were included while women with pre-existing chronic infections, and immuno-compromised conditions were excluded from this study. The final examination was performed after 30 days following surgery.

Data were stored and analyzed using IBM-SPSS version 23.0; counts with percentages were reported on baseline and operative characteristics of studied patients. The association of wound infection was tested with all studied parameters using Fisher's exact test. Binary logistic regression was also used to study the effect of wound infection on baseline and operative characteristics of patients. Odds ratio with 95% confidence interval were given using univariate and multivariate logistic regression models. P-values less than 0.05 were considered statistically significant.

RESULTS:

The baseline characteristics of the studied samples are presented in table 1. In this study there were 150 total subjects with a mean age was 21.3 (SD=±4.0) years. Among these 21(14%) were found with post cesarean SSI. These wound infection-bearing subjects had more than 37 weeks of gestational age and all these 21 subjects were brought to the hospital on an emergency basis. Only 19% of subjects were found with pre-operative antibiotic prophylaxis, 95.2% suffered from membrane rapture, 57.1% were found with anemia, 4.8% were found with labor pain before operation and 52.4% were found with high BMI. Independent sample t-test showed a significant mean difference of mean age between infected and non-infected subjects, whereas membrane rupture, labor pain prior to operation, body mass index, co-morbidities, and operation type showed a positive association and preoperative antibiotic prophylaxis was negatively associated with SSI in this study (p<0.05).

Table 1: Baseline Characteristics of Studied Patients (N=150)

Characteristics		***Wound Infection***	
		No (n=129)	
		n	***%***
Gestational age	<37 weeks	15	11.6
	>37 weeks	114	88.4
Labour pains prior to operation	No	56	43.4
	Yes	73	56.6
Age (years)¥	Mean (±SD)	23.3	±4.1
BMI (kg/m^2)	<18 kg/m^2	28	21.7
	18 – 24.9kg/m^2	60	46.5
	25 – 29.9 kg/m^2	23	17.8
	>30kg/m^2	18	14.0
Membrane rupture	Intact	72	55.8
	Ruptured	57	44.2
Co-morbid present	None	8	6.2
	Diabetes	11	8.5
	Hypertension	9	7.0
	Viral infections	1	0.8
	Anemia	78	60.5
	Others	22	17.1
Operation type	Emergency	104	80.6
	Elective	25	19.4
Pre operative antibiotic prophylaxis	Yes	64	49.6
	No	65	50.4

*P<0.05 was considered statistically significant Fisher's Exact test
¥: Independent sample t-test

The association of operative parameters with post cesarean SSIs is presented in Table-2. All were found with transverse abdominal incision and less than four postoperative stay in hospital, 81% were found with regional Anesthesia, 42.9% surgeries were done by R4-resident, 57.1% surgeries were more than one hour of duration. Fisher's exact test did give

significant association of abdominal incision, postoperative stay in hospital and surgeon level with wound infection (p<0.05).

Table 2: Association of Operative Parameters with Wound Infection

Variables		***Wound Infection***			
		No (n=129)	***Yes (n=21)***		***p-value***
		N	***%***	***N***	***%***	
Abdominal incision type	Vertical	36	27.9	0	0.0	0.004*
	Transverse	93	72.1	21	100.0	
Post operative stay in hospital	<4 days	74	57.4	21	100.0	<0.01*
	4-7 days	44	34.1	0	0.0	
	>7 days	11	8.5	0	0.0	
Anesthesia type	General	25	19.4	4	19.0	0.99
	Regional	104	80.6	17	81.0	
Surgeon level	Gynecologist	14	10.9	0	0.0	<0.01*
	Resident R4	10	7.8	9	42.9	
	Resident R3	55	42.6	12	57.1	
	Resident ≤R2	50	38.8	0	0.0	
Duration of surgery	<1hour	63	48.8	9	42.9	0.64
	≥1hour	66	51.2	12	57.1	

*P<0.05 was considered statistically significant Fishers Exact test

The risk of wound infection using binary logistic regression analysis, in univariate model age, labor pain prior to operation and pre-operative antibiotics gives negative association with wound infection and membrane rapture gives positive association with wound infection (Table-3). In multivariate model, a significant negative association of labor pain prior to operation and pre operative antibiotic was found with wound infection (p<0.05).

Table 3: Risk Estimation of Wound Infection using Binary Logistic Regression

Parameters	***Univariate Model Odds ratio (95% C.I)***	***p-value***
Age (years)	0.86* (0.75-0.99)	
BMI (kg/m^2)	1.40 (0.85-2.31)	
Labor pains prior to operation	0.03* (0.001-0.29)	
Membrane rupture	25.2* (3.2 – 193.9)	
Regional Anesthesia	1.02 (0.31-3.30)	
Duration of surgery ≥1hour	0.78 (0.30-1.99)	
Pre operative antibiotic prophylaxis	0.23* (0.07 – 0.74)	

Dependent Variable: Wound Infection

*odds ratio considered significant with p<0.05

Discussion

In this study, subjects were enrolled according to the sample size calculations as described in result section. The anticipated 1.5% prevalence was determined by a pilot study in this hospital and found that at 2.0% margin of error and 95% confidence interval, it required at least N=144 samples for this study. Therefore, 150 subjects were selected by strict inclusion/exclusion criteria as mentioned in the methodology section.

The results presented in table 1 shows that all of the 21 subjects (100%) who developed post-cesarean SSI had more than 37 weeks gestational age but this was not found significantly different from those subjects who did not suffer from post-cesarean SSI and had less than 37 weeks of gestational age. However, a retrospective study conducted in the Egyptian population showed a positive association of less than 37 weeks gestational age with post-cesarean

SSI. [11] This discrepancy in the results as compared with the previous study may be due to a low sample size of our study.

In table 1 we have found a significant difference (P<0.04) in age between the subjects with post cesarean SSI (21.3±4.0 years) and normal subjects (23.3±4.1 years). The higher prevalence of post-cesarean SSI in younger age subjects could be due to the lesser level of maturity and awareness as compared with older age subjects in this study.

The increase in cesarean deliveries has been linked to a rise in overweight and obese women, leading to an increase in severe maternal morbidities. [15] Multiple studies highlighted that women with abnormal BMI have a significantly increased risk of postpartum infectious morbidity compared with women with a low BMI.[13,15] In this study, 51% of subjects who experienced post cesarean SSI had BMI (25 – 29.9 kg/m^2) and 49% had BMI (18 – 24.9kg/m2). This showed that high BMI values are significantly associated (P<0.01) with post-cesarean SSI in this study (Table 1).

The most important findings in table 1 show that among 21(14%) subjects with post-cesarean SSI, 95% of subjects experienced membrane rupture, and it was found positively associated with SSI (P<0.01) as compared with 44% of subjects who also experienced membrane rupture but did not develop post cesarean SSI. Similarly, the pre-operative antibiotic prophylaxis was found negatively associated with the onset of post-cesarean SSI (P<0.01) that in 21 subjects who suffered by post cesarean SSI, 81% of subjects were not on pre-operative antibiotic prophylaxis. If we combine the results of membrane rupture and pre-operative antibiotic prophylaxis then we can infer that the membrane rupture had played negative and antibiotic prophylaxis had played a positive role in the onset of post cesarean SSI in the subjects of this study. Furthermore, the univariate and multivariate models of analyses were also carried out to elaborate an association of post-cesarean SSI with different factors as mentioned in table 3. The results showed that membrane rupture is positively associated (P<0.05) with an odd ratio 25.2 (3.2 – 193.9), while pre-operative antibiotic prophylaxis is negatively associated (P<0.05) with an odd ratio (0.23* (0.07 – 0.74) by using univariate model. Similarly, the results of the multivariate model also showed a negative association (P<0.05) with pre-operative antibiotic prophylaxis with an odd ratio of 0.17* (0.04-0.73) only. These findings are according to the previous studies in which membrane rupture and lack of antibiotic prophylaxis before delivery are the main reasons SSI after cesarean interventions.[1,5,8,11,12]

It is also worth noted that all 21(95%) subjects (suffered by post cesarean SSI) were brought to the emergency department for labor. In addition, the 129 (86%) subjects who did not suffer post-cesarean SSI were also brought to the emergency department. These findings could rule out the improper management of these subjects in the emergency department and indicate proper post-cesarean management.

The co-morbidities such as diabetes, hypertension, viral infections, and anemia had shown a positive association with post-cesarean SSI in previous studies.[4,5,7] We also studied the association of these factors in this study and only anemia was found to be significantly associated (P<0.01) with post-cesarean SSI. This finding is in agreement with the result of another study that also showed a positive association of anemia with post-cesarean SSI.

We also considered the association of different types of modalities during cesarean surgery such as abdominal incision type, post-operative hospital stay, anesthesia type, surgeon level, and duration of surgery with the onset of post-cesarean SSI (Table 2). The results showed a positive significant association with abdominal incision (P<0.004) while a negative association with post-operative stay in the hospital (P<0.01). Similarly, the results of surgeon levels showed that the subjects who underwent surgery by

resident R4 had more SSI than resident R3. By combining all these three parameters, it can be inferred that abdominal incisions with less post-operative stay, and surgery by less competent surgeons could be reasons of post cesarean SSI in this study. These findings are also in agreement with previous studies in which these above-mentioned factors were also found to be associated with post-cesarean SSI.[11,21]

The results obtained after comprehensive statistical analyses which are according to the previous studies are the strength of this study however; the low sample size could be the limitation of this study. It is highly recommended to design a multi-center study with a large sample size to obtain more valuable results and a comprehensive analysis of the data in this population.

Conclusion

Significant association of post-cesarean SSI in primigravidas with membrane rupture and lack of antibiotic prophylaxis showed the importance of pre and post-surgery management to prevent these morbidities. In addition, the proper management of all of the above-mentioned factors could decrease the chances of the onset of post-cesarean SSI thereby could decrease the rates of morbidity and even mortality in our populations.

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