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Obstetrics and Gynaecology

"Risk Factors and Bacteriological Study of Postoperative Wound Infection Following Caesarean Section"

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Abstract **Original Research Article**

Background: Post Caesarean wound infection is not only a leading cause of prolonged hospital stay but a major cause of the widespread avoid to Caesarean delivery in developing countries. In order to control and prevent post Caesarean wound infection in our environment there is the need to know the relative contribution of each aetiologic factor, the causative organism and sensitivity of the organisms to different antibiotics. ***Objective:*** To identify the risk factors and bacteriological study of postoperative wound infection following Caesarean section. ***Methods:*** A case control study was conducted in the department of Obstetrics and Gynaecology of Shaheed Tazuddin Ahmad Medical College & Hospital, Gazipur, Bangladesh from November 2019 to March 2020 to find out the risk factors and bacteriological study of postoperative wound infection following Caesarean section. Fifty patients with post Caesarean wound infection were selected as cases. Fifty cases of Caesarean section during the study period without any infection during the study period and Caesarean section done in the same day of the cases were selected as control. Informed consent was taken from each patient. Data was collected by using a preferred set of questionnaire by analyzing the patient profile and management pattern of wound infection patients with caesarean section. ***Results:*** Most frequently isolated organism was *E.coli* 15(30.00%) followed by *Staph. aureus* 7(14.0%). *Pseudomonas* 6(12.0%). *Citobacter* 1(2.0%) *and klebsiella* 1(2.0%) while 20(40.0%) were sterile. Body max index >25(kg/m^2), anaemia (p=0.001), prolonged rupture of membrane (p=0.005), prolonged operation time (p=0.019), were found to be the risk factors for post Caesarean wound infection. ***Conclusions:*** Common indentified risk factors were increased body weight, diabetes, anaemia, irregular antenatal check-up, prolonged rupture of membrane. Effort should be given towards the prevention of prolonged rupture of fetal membrane, reduction of prolonged operation time by training of surgeons to improve their skill; use of potent antibiotics; early intervention, use of good surgical technique and to reduce intra-operative blood loss.

Keywords: Key words: Surgical site infection, Caesarean section, Bacteriological; Risk factors.

INTRODUCTION

Caesarean section is a common operation in obstetric practice. The incidence is rising worldwide and the reported incidence ranges from 5 to 25% depending on the nature and area of practice [1-3]. Caesarean section has a number of complications. Caesarean wound infection is a major cause of prolonged hospital stay, high hospital bills, as well as other morbidities and mortality [4, 5]. Recovery from Caesarean section is more difficult for women who develop postoperative wound infection [6]. Though the causes of Caesarean wound infection are similar globally with slight regional variations, the relative contribution differ from regions to region and even from centre to centre [7]. The main determinant of infection are the virulence of microorganisms, the host defense mechanism and the environment and their continuous interaction between these three factor. Wound infection result from bacterial contamination of the wound. Infection rate is proportionate to number of bacteria, type of bacteria, incision involving mucous surface and the site of existing infection in the body. In Caesarean section the source of infecting organism may be endogenous from patient's viscera, skin contamination from air in the operation theatre and direct from punctured gloves [8]. Risk factors for infection after Caesarean delivery including body mass index more than 25, prolonged preoperative hospital stay, prolonged total duration of surgery, vertical skin incision, development of subcutaneous haematoma after operation, premature or prolonged rupture of membranes, failure of timely antibiotic prophylaxis, increasing age, emergency procedure, preexisting medical illness, intra-operative blood transfusion [9]. Body mass index of more than 25 has been shown to affect the outcome of surgery [10-12]. Patients with anaemia are prone to develop wound infection. Anaemia diminishes resistance to infection and is frequently associated with puerperal sepsis. Preoperative anaemia is an important predictor of infection and has been proved by several studies [13, 14]. Premature rupture of membrane is associated with the largest bacterial inoculums and liquor gets infected and infection supervenes [15]. Transverse, modified Pfannenstiel incision is made 3 cm above the symphysis pubis. A transverse incision has less chance of wound dehiscence [16]. Parenteral antibiotic must be given within 2 hours of incision so as to attain high tissue and serum levels during surgery [17]. Patients who received antibiotics 2 hours before surgery were found to be less prone to wound infection as compared to those who did not receive it in a timely fashsion [16, 17]. Johnson et al. classified duration of LUCS into ≤ 30 minutes and 31-60 minutes and found an increased rate of wound infection in the latter group [18]. Kowli et al. found an infection rate of 17.4% when preoperative stay was 0-7 days and an infection rate of 71.4% with preoperative stay of more than 21 days [19]. Patients with preexisting illness like Diabetes mellitus, Hypertension, Asthma and Immunocompromised status have been associated with infection. Allogenic blood products have immunocirculatory effects that may increase the risk of nosocomial infection [20]. Usually post-operative wound infection appears between 5th to 8th post-operative days but it may appear as early as in 3rd day of operation and even when the patient left the hospital. Classically the presence of postoperative wound infection has been confirmed by documenting the typical clinical signs of inflammation along with discharge of purulent material or culture positive organism from the wound [21]. The organism responsible for wound infection in post Caesarean section originates on the patients skin. Staphylococcus aureus is most commonly isolated bacteria in wound infection following Caesarean section. Streptococcus species, E. coli and other gram– negative organisms eg, proteus mirabilis, psedumonas and klebsiella that may have originally have colonized in the amniotic cavity are also seen. Occasionally Bacteriods which comes only from the genital tract is isolated from material taken from serious wound infection [21, 22]. Shaheed Tazuddin Ahmad Medical College & Hospital, Gazipur, Bangladesh is one of the referral hospitals in government sector of Bangladesh, where Caesarean section operations are frequently performed. But no known bacteriological study on post-operative wound infection following caesarean section has been undertaken up to now. The purpose of carrying out this study is to find out risk factors of postoperative wound infection following Caesarean section by clinical features and isolation of organisms from wound by culture and use of appropriate antibiotics, so that the mortality and morbidity can be reduced. It will also help to develop an antibiotic regimen to be practiced.

AIMS AND OBJECTIVES

General objective

1. To identify the risk factors and bacteriological study of postoperative wound infection following Caesarean section.

Specific objectives

1. To determine the background characteristics and the risk factors of patients with wound infection.
2. To find out the organism responsible for wound infection.
3. To assess the use of appropriate antibiotic by culture and sensitivity test of the wound swab.

MATERIALS AND METHODS

A case control study was conducted in the department of Obstetrics and Gynaecology of Shaheed Tazuddin Ahmad Medical College & Hospital, Gazipur, Bangladesh from November 2019 to March 2020 to find out the risk factors and bacteriological study of postoperative wound infection following Caesarean section. Fifty patients with post Caesarean wound infection were selected as cases. Fifty cases of Caesarean section during the study period without any infection during the study period and Caesarean section done in the same day of the cases were selected as control. Informed consent was taken from each patient. Data was collected by using a preferred set of questionnaire by analyzing the patient profile and management pattern of wound infection patients with caesarean section.

Inclusion criteria

1. Patient's undergone Caesarean section.

Exclusion criteria

1. Patients underwent Caesarean section through a midline sub-umbilical vertical incision.

Outcome Variables

Patient-related variables: Age, body mass index (BMI) at admission, anaemia, diabetes mellitus, sexually transmitted diseases (STD), hypertension, corticosteroids.

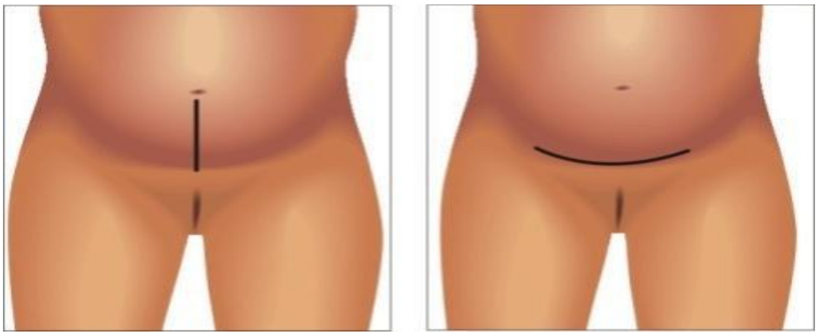
Obstetrics-related variables: Gestational age, number of pregnancies, presence of cervical incompetence, vaginal discharge, antenatal checkup, presence of preaclamsia, spontaneous rupture of membranes, chorioamnionitis, presence of meconium.

Operation–related variables: Urgency of operation, type of skin and uterine incision, manual removal of placenta, presence of drain tube, receipts of shave with razor, duration of time between hospital admission and operation, duration of operation, intra-operative blood transfusion, volume of blood loss, receipt of antibiotic therapy. Type of organisms and type of antibiotics according to C/S.

Procedures of collecting data: Pregnant women admitted in Obstetrics and Gynaecology Department in Shaheed Tazuddin Ahmad Medical College & Hospital, Gazipur, Bangladesh for Caesarean section delivery was selected on the basis of above mention inclusion and exclusion criteria as cases and control. Written informed consent was taken from the patient. Detail history and physical examination was done to find out the risk factors. Necessary investigations eg, Hb%, OGTT, Urine R/M/E, wound swab C/S were done. Information was recorded on the structured data collection sheet. Analysis and compilation of result by comparing cases and control.

Procedures of data analysis: After collection of information, data was checked, verified for consistency and was entered for finalized result. After editing and coding, the coded data was directly entered into the computer by using the SPSS/PC software. Data cleaning validation and analysis was performed using the SPSS/PC software and graph and chart by MS Excel. The result was presented in tables in mean, standard deviation and percentage.

SSI In ACOG Literature: Wound Focus



Pic-1: Vertical skin worse than low transverse for infection [31]

Pic-2: Surgical Site Infections

RESULTS

Table-1: Distribution of the study patients by age

Age (years)	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
<19	8	16.0	4	8.0	
20-24	7	14.0	11	22.0	
25-29	20	40.0	15	30.0	
30-34	8	16.0	12	24.0	
>35	7	14.0	8	16.0	
Mean±SD	26.5	±6.9	25.15	±3.69	0.225^{ns}
Range (min, max)	(18	-39)	(18	-35)	
Case-With infection, Control-Without infection, ns=not significant, * Student's t-test					

Table-1 shows that age distribution of the patients. It was observed that majority of patients belonged to age 25-29 years in both groups. The mean age was 26.5±6.9 years in case group and 25.15±3.69 years in control group. The difference of age was not statistically significant (p=0.225).

Table-2: Distribution of the study patients by Body Mass Index (BMI)

BMI (kg/m^2)	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
19-24	12	24.0	19	38.0	
25-29	27	54.0	21	42.0	
30-40	11	22.0	10	20.0	
Mean±SD	34.3	±2.72	31.2	±3.5	0.001^s
Range (min, max)	19	- 40	(19	-38)	
s= significant, * Student's t-test					

Table-2 shows that body mass index (BMI) of the patients. It was observed that majority 27(54.0%) of patients had BMI 25-30 (kg/m^2) in case group and 21(42.0%) of patients BMI 25-30 (kg/m^2) in control group. The mean BMI was found 34.3±2.72 (kg/m^2) in case group and 31.2±3.5 (kg/m^2) in control group. The difference of mean BMI was statistically significant (p>0.001).

Table-3: Distribution of the study patients by anaemia and diabetes mellitus

Anaemia and diabetes mellitus	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
Anaemia					
Yes	37	74.0	21	42.0	0.001^s
No	13	26.0	29	58.0	
Diabetes mellitus					
Yes	6	12.0	5	10.0	0.749^{ns}
No	44	88.0	45	90.0	
ns=not significant, * Chi-square test (X^2- test)					

Table 3 shows that anaemia and diabetes mellitus status. It was observed that anaemia was found 37(74.0%) in case group and 21(42.0%) in control group. Diabetes mellitus was found 6(12.0%) in case group and 5(10.0%) in control group and the difference was not statistically significant (p>0.05). Anaemia was statistically significant (p=0.001) between two groups.

Table-4: Distribution of the study patients by gravida

Number of pregnancies	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
Primi	37	74.0	41	82.0	0.334^{ns}
Multi	13	26.0	9	18.0	
ns=not significant, * X^2- test					

Table 4 shows that number of pregnancy. It was observed that primi was found 37(74.0%) in case group and 41(82.0%) in control group. Multi para was found 13(26.0%) in case group and 9(18.0%) in control group. The difference was not statistically significant (p=0.334) between two groups.

Table-5: Distribution of the study patients by the status of antenatal check up

Antenatal check up	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
Regular	9	18.0	7	14.0	
Irregular	26	52.0	26	52.0	0.829^{ns}
None	15	30.0	17	34.0	
ns=not significant, * X^2- test					

Table 5 shows that antenatal check up of the patients. It was observed that 9(18.0%) of patients in case group and 7(14.0%) in control group received regular antenatal check up. More than half 26(52.0%) of patients in case group and 26(52.0%) in control group received irregular antenatal checkup. The difference was not statistically significant (p=0.829) between two groups.

Table-6: Distribution of the study patients by obstetrics-related variables

Obstetrics-related variables	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
Prolonged rupture of membrane	13	26.0	8	16.0	0.005[s]
Presence of preeclampsia	10	20.0	3	6.0	0.037[s]
Presence of meconium in liquor amnii	3	6.0	2	4.0	0.338[ns]
s= significant; ns=not significant, * X^2- test					

Table 6 shows that obstetric-related variables of the patients. It was observed that presence of prolonged rupture of membrane was found 13(26.0%) in case group and 8(16.0%) in control group. The difference was statistically significant (p=0.005). Preeclampsia was 10(20.0%) and 3(6.0%) in case and control group respectively. The difference was statistically significant (p=0.037). Presence of meconium was 3(6.0%) in case group and 2(4.0%) in control group. The difference was not statistically significant (p=0.338).

Table-7: Distribution of the study patients by urgency of operation

Urgency of operation	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
Emergency Caesarean section Routine Caesarean section	40 10	80.0 20	30 20	60.0 40	0.005[s]
s= significant, * X^2- test					

Table 7 shows that emergency Caesarean section was done 40(80.0%) of patients in case group and 38(76.0%) in control group. Routine Caesarean section was done 10(20.0%) of patients in case group and 12(24.0%) in control group. The difference was statistically significant (p=0.005).

Table-8: Distribution of the study patients by duration of time between hospital admission and operation.

Duration of time between hospital admission and operation	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
<6 hrs	13	26.0	25	50.0	
6-12 hrs	22	44.0	21	42.0	
> 12 hrs	15	30.0	4	8.0	
Mean±SD	10.3	±6.5	7.10	±3.7	0.003[s]
s=significant, * Student's t- test					

Table 8 shows that duration of time between hospital admission and operation. It was observed that majority 22(44.0%) of patients in case group underwent Caesarean section within 6-12 hrs after admission but in case of control group 25(50.0%), <6 hrs after hospitalization. The mean duration of time between hospital admission and operation was found 10.3±6.5 hrs in case group and 7.10±3.7 hrs in control group. The difference was statistically significant (p=0.003).

Table-9: Distribution of the study patients by duration of operation

Duration of operation (hr)	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
<1 hr	28	56.0	39	78.0	0.019[s]
>1 hr	22	44.0	11	22.0	
s= significant, * X^2- test					

Table 9 shows that duration of operation of the patients. It was observed that 28(56%) of patients in case group and 39 (78.0%) in control group required <1 hr whereas 22(44%) of patients in case group and 11(22%) of patients in control group required >1 hr. The difference was statistically significant (p=0.019).

Table-10: Distribution of the study patients by intra-operative blood transfusion

Intra-operative blood transfusion	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
Needed	24	48.0	10	20.0	0.003^{s}
Not needed	26	52.0	40	80.0	
s=significant, * X^2- test					

Table 10 shows that blood transfusion of the patients. It was observed that 24(48.0%) of patients in case group and 10(20.0%) of patients in control group required intra-operative blood transfusion. The difference was statistically significant (p=0.003).

Table-11: Distribution of the study patients according to risk factors of wound infection.

Risk factors	Case (n=50)	Control (n=50)	OR	95% CI		* P value
				Lower	Upper	
BMI > 25 (kg/m^2)	27	21	1.62	0.68	3.8	0.229^{ns}
BMI > 30 (kg/m^2)	11	10	0.19	0.07	0.49	0.001^{s}
Anaemia						
Hb% <7 (gm/dl)	10	5	2.25	0.63	8.36	0.161^{ns}
Hb% 7-8 (gm/dl)	27	16	2.49	1.02	6.13	0.026^{s}
Irregular antenatal check- up (ANC)	26	20	1.63	0.68	3.88	0.228^{ns}
Prolonged rupture of membrane	13	8	1.84	0.62	5.54	0.219^{ns}
Presence of preeclampsia	5	3	1.74	0.33	9.87	0.460^{ns}
Emergency C/S	40	30	2.67	1.00	7.21	0.029^{s}
Duration of operation >1 hr	22	11	2.79	1.07	7.33	0.019^{s}
Intra operative blood transfusion	24	10	3.69	1.40	9.92	0.003^{s}
S=significant, * X^2–test						

Table 11 shows that BMI >30 (kg/m^2) of 11 patients were found in case group and 10 patients in control group. Significant ($p<0.05$) difference was found between two groups. Patients had 0.19 times chance to develop wound infection. Anaemia (Hb%, 7-8 gm/dl) of 27 patients was found in case group and 16 patients in control group. Significant ($p<0.05$) difference was found between two groups .Patients had 2.49 times chance to develop wound infection. Emergency Cesarean section of 40 patients was found in case group and 30 patients in control group. Significant ($p<0.05$) difference was found between two groups. Patients had 2.67 times chance to develop wound infection. Duration of operation >1 hr, 22 patients were found in case group and 11 patients in control group. Significant ($p<0.05$) difference was found between two groups. Patients had 2.79 times chance to develop wound infection. Intra operative blood transfusion, 24 patients were found in case group and 10 patients in control group. Significant ($p<0.05$) difference was found between two groups. Patients had 3.69 times chance to develop wound infection. Other risk factors such as irregular antenatal check-up (ANC), prolonged rupture of membrane, presence of preeclampsia were not statistically significant ($p>0.05$).

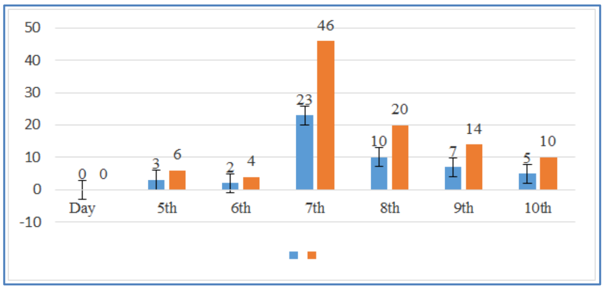


Fig-1: Distribution of the study patients by day of wound infection

Figure-1 shows that majority 23(46.0%) of patients developed infection on 7th POD, 10(20%) on 8th POD, 7(14%) on 9th POD, 5(10%) on 10th POD, 3(6%) on 5th POD and 2(4%) on 6th POD.

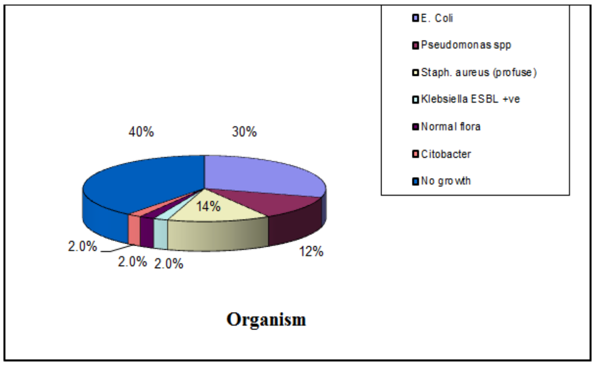


Fig-2: Pie chart

Pie chart shows that the percentage of isolated organisms from cultured wound E. coli 15(30.00%) followed by Staph. aureus 7(14.0%), pseudomonas 6(12.0%). Citobacter and klebsiella 1(2.0%). No growth.20 (40.0%) of cultured wound.

Table-12: Distribution of the study patients by antibiotics sensitivity

Organism isolated	Name of sensitive antibiotics with percentage													
Name	No	Imipenem		Amikacin		Cloxacillin		Ciprofloxacin		Gentamicin		Chloramphenicol	
		No	%	No	%	No	%	No	%	No	%	No	%
E. coli	15	7	46	2	13.33	-		1	6.66	2	13.33	4	26.66
Staph. aureus	7	4	57.14			1	14.28	1	14.28	2	28.56	2	28.56
Pseudomonas	6	4	66.66	2	33.33	-		1	16.66	2	33.33	3	50
Klebsiella	1	1	100	-		-		-		-		1	100
Citobacter	1	1	100	1	100	-		-		-		-	
No growth	20												

Table 12 shows that antibiotics sensitivity of the study patients, it was observed that majority of patients were imipenem sensitive. E.coli was found mostly sensitive to Imipenem (46%) followed by chloramphenicol (26.66%), (13.33%) in both amikacin and gentamicin. Staph. aureus was more sensitive to Imipenem (57.14%), chloramphenicol and gentamicin (28.56%) and cloxacillin (14.28%). In case of pseudomonas infection most of the sensitive antibiotic was Imipenem (66.66%), chloramphenicol (50%), gentamicin (33.33%). Klebsiella and Citobacter both were (100%) sensitive to Imipenem.

Table-13: Distribution of the study patients by antibiotic resistance

Resistance	Total	Pseudomonas spp		E.coli		Klebsiella ESBL +ve		Citobacter		Staph. Aureus (profuse)	
		n	%	n	%	n	%	n	%	n	%
Amoxyclav	11	5	45.5	4	36.4	1	9.09	1	9.09	1	9.09
Aztreonam	5	4	80	1	20	1	20	0	0	0	0
Ceftriaxone	14	6	42.9	5	35.7	1	7.14	1	7.14	2	14.3
Cefixime	19	6	31.6	9	47.4	1	5.26	0	0	4	21.1
Cephradine	14	5	35.7	8	57.1	1	7.14	0	0	1	7.14
Ceftazidime	14	4	28.6	8	57.1	1	7.14	1	7.14	1	7.14
Imipenem	4	2	50	2	50	0	0	0	0	0	0
Levofloxain	5	3	60	3	60	0	0	0	0	0	0
Cotrimoxazol	10	5	50	5	50	0	0	1	10	0	0
Cefotaxim	11	3	27.3	5	45.5	1	9.09	1	9.09	1	9.09
Amikacin	6	0	0	6	100	0	0	0	0	0	0
Ciprofloxacin	8	0	0	6	75	1	12.5	1	12.5	0	0
Doxycycline	10	1	10	6	60	1	10	1	10	2	20
Gentamicin	7	0	0	4	57.1	1	14.3	1	14.3	1	14.3
Nalidixic acid	9	1	11.1	8	88.9	0	0	0	0	0	0
Chloramphenicol	6	3	50	2	33.3	0	0	1	16.7	0	0
Nitrofurantoin	4	1	25	2	50	0	0	0	0	1	25
Cloxacillin	1	0	0	0	0	0	0	0	0	1	100
Azithromycin	6	2	33.3	1	16.7	0	0	0	0	3	50
Cefuroxime	5	0	0	2	40	0	0	0	0	3	60
Erythromycin	1	0	0	0	0	0	0	0	0	1	100
Penicillin	1	0	0	0	0	0	0	0	0	1	100
Amoxicillin	3	1	33.3	1	33.3	0	0	0	0	1	33.3
Ciprofloxacin	7	2	28.6	4	57.1	0	0	0	0	2	28.6
Cefutaxim	1	0	0	0	0	0	0	0	0	1	100
Meclicillin	1	0	0	0	0	0	0	0	0	1	100
Sulphamethoxazole	1	0	0	0	0	0	0	0	0	1	100
Cloxacillin	1	0	0	1	100	0	0	0	0	0	0
Ampicillin	1	0	0	0	0	0	0	0	0	1	100
		6		15		1		1		5	

Table-14: Duration of hospital stay of the study patients

Hospital stay (days)	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
1-5	3	6.0	31	62.0	
6-10	22	44.0	17	34.0	
11-15	14	28.0	2	4.0	
>15	11	22.0	0	0.0	
Mean±SD	14.6	±5.5	6.3	±1.5	0.001^{s}
s=significant, * Student's t-test					

Table 14 shows the length of hospital stay 22(44.0%) patients were stayed in hospital for 6-10 days in case group and 17(34%) patients of control group. 3(6%) patients of study group and 31(62.0%) patients of control group stayed in hospital for 1-5 days. The mean duration of hospital stay was statistically significant (p=0.001).

Table-15: Hospital cost of the study patients

Hospital cost (Tk)	Case (n=50)		Control (n=50)		* P value
	No	%	No	%	
<10,000	17	34.0	35	70.0	
10,000-15,000	30	60.0	15	30.	0.001^{s}
>15,000	3	6.0	0	0.0	
s=significant, * X^2 -test					

Table 15 shows hospital cost of the patients. It was observed that in case group 30(60.0%) patients hospital cost was 10,000-15,000 Taka and in control group 35(70.0%) patients hospital cost was <10,000 TK. The difference was statistically significant (p=0.001).

DISCUSSION

Wound infection has always been a challenge to surgeon. It is a major complication of surgery and trauma. Besides increase in morbidity and mortality, nosocomial infections prolong the hospital stay of patients and increase bed occupancy rate. Also, 7–12% of hospitalized patients end up with hospital acquired infections globally with more than1.4 million people suffering from infectious complications acquired in the hospital [23]. Surgical site infection is an important outcome indicator after surgery. The situation is worsened by the emergence of polymicrobial resistant strains of nosocomial pathogens [24]. The incidence of Caesarean section has dramatically increased in modern medicine and is attributed to many maternal and fetal factors. Out of 100 patients, 50% women underwent emergency LSCS and the rest 50% were electively operated. Emergency LSCS predisposes more to SSI as compared to elective surgery [10, 25]. In the present study a similar observation was made. In our study that majority patients were found belonged to age 25-29 years in both groups. The mean age was found 26.5±6.9 years in case group and 25.15±3.69 years in control group which is consistent with study of Aziz [26]. This study also confirmed reports of several investigators that there exist a direct correlation between increasing maternal weight and higher rate of wound infection [15, 19, 27]. The mean body mass index of the women with wound infection was significantly higher than the women without wound infection. Even after adjustment for confounders BMI >25(kg/m^2) still retain significant association with wound infection. Also noted in this study is that the mean body mass index among the women with wound infection was above the normal range. The mean BMI was found 34.3±2.72 (kg/m^2) in case group and 31.2±3.5(kg/m^2) in control group and the difference is statistically significant (p=0.001). Body mass index of more than 25(kg/m^2) has been shown to affect the outcome of surgery [10-12]. The local changes such as increase in adipose tissue, a need for larger incision, decreased circulation to fat tissue, and an increase in local tissue trauma related to retraction contribute to an increased incidence of SSI in these patients. Independent factors related to body homeostatic balance which take place in wound healing and immune function are disturbed in such patients. In the present study an increased BMI was seen to influence the outcome of surgery in terms of an increased rate of infection. Patients with anaemia were seen to be more prone to Caesarean infection. Anaemia diminishes resistance to infection and is frequently associated with puerperal sepsis. Preoperative anaemia is an important predictor of infection and has been proved by several other studies [13, 14]. In our study also, anaemia was found 37(74.0%) in case group and 21(42.0%) in control group and the difference is found statistically significant (p=0.001). Patients with preexisting illnesses like diabetes mellitus, or malnurished were seen more prone to infection. Hyperglycaemia has several deleterious effects upon host immune function, most notably on neutrophil function. Poor control of glucose during surgery and in the peri-operative period increases the risk of infection and worsen outcome from sepsis. Hypertension, preexisting or pregnancy induced, and other co-morbid states have been associated with surgical site infection in several studies [10, 27]. In the present study diabetes mellitus was found 6(12.0%) in case group and 5(10.0%) in control group (p=0.749). In this series 9(18.0%) of patients in case group and 7(14.0%) of patients in control received regular antenatal checkup. More than half 26(52.0%) of patients in case group and 26(52.0%) of patients in control group do not go for regular antenatal checkup. Infection was more who did not receive regular antenatal checkup. Ratten GJ et al. [28, 35] have shown that repeated antenatal visit reduce the rate of wound infection following Caesarean section. In this study presence of prolonged rupture of membrane was found 13(26.0%) in case group and 8(16.0%) in control group which is statistically significant (p=0.005). Premature rupture of membranes is associated with the largest bacterial inoculum and liquor gets infected and infection supervenes [15, 36]. Premature rupture of membranes or prolonged rupture (for more than 24 hours before surgery) were subsequently infected. Multivariate analysis also supported this finding. The surgeon may choose either a vertical or a transverse skin incision. Vertical incision may be infraumbilical midline or paramedian. Transverse, modified Pfannenstiel incision is made 3 cm above the symphysis pubis. We used Pfannenstiel incision for Caesarean section. A transverse incision has less chance of wound dehiscence [29]. Antibiotic prophylaxis in surgical patients has always been a matter of debate.

For prophylactic antibiotic the current recommendation states that the parenteral antibiotic must be given within 2 hours of incision so as to attain high tissue and serum levels during surgery. Obstetrics and Gynaecological Society of Bangladesh (OGSB) recommends one course of antibiotics should be given after cord is clamped following delivery of the baby or 30 minutes before the procedure. The antibiotic regimen is following: Inj. Amoxycillin 1gm IV stat and repeated 8 hourly for 3 doses plus inj Metronidazole 500 mg IV slowly for 3 doses. OR Inj Cefalosporine 1 gm IV stat and repeated 6 hourly for 4 doses plus inj Metronidazole 500 mg IV slowly for 3 doses. OR Inj Ceftriaxone 1 gm IV single dose, inj Metronidazole 500 mg IV slowly for 3 doses. Followed by cap. Amoxicillin 500 mg 8 hourly OR cap. Cefalosporine 500 mg 6 hourly for 5 days. A prolonged preoperative stay with exposure to hospital environment, its ubiquitous diagnostic procedures, therapies, and microflora, including multidrug resistant organisms, have been shown to increase the rate of SSI. Kowli et al.[19] found an infection rate of 17.4% when preoperative stay was 0–7 days and an infection rate of 71.4% with preoperative stay of more than 21 days. Anvikar et al. [30] in their study demonstrated an infection rate of 1.76% when preoperative stay was up to one day, which increased to 5% when preoperative stay was more than one week. In the present study, majority 22(44.0%) of patients in case group and 21(42.0%) of control group underwent Caesarean section within 6-12 hr after admission. Another 13(26.0%) of patients in case group and 25(50.0%) of patients in control group, undergone Caesarean section less than 6 hrs after hospitalization and the significant correlation was found between the duration of preoperative hospital stay and development of SSI. The difference is statistically significant (p=0.003). Shapiro et al. [31] reported that with each hour of surgery the infection rate almost doubles. The finding relates to the pharmacokinetics of the antibiotic prophylaxis and to the greater bacterial wound contamination that occurs in lengthy clean-contaminated surgeries. In the present study, 28(56%) of patients in case group and 39(78.0%) in control group required less than 1 hr for Caesarean section where as 22(44%) of patients in case group and 11(22%) of patients in control group required more than 1 hr which is found statistically significant (p=0.019). Lilani et al. [17] reported a rate of 38.46% for surgeries that lasted more than 2 hours and Johnson et al. [18] classified duration of LSCS into ≤ 30 minutes and 31–60 minutes and found an increased rate of SSI in the latter group. Our study also found similar results. The relationship between blood products and SSIs has been a matter of debate for more than two decades. Several studies have supported the association between the use of blood products and the development of postoperative surgical site infections. Allogeneic blood products have immunomodulatory effects that may increase the risk of nosocomial infections [20, 32]. It is also possible that the transfusion of blood products acts as a marker for individuals with a greater number of co-morbidities and other SSI risk factors, which independently places them at an inherently greater risk for infection. In our study patients received blood transfusion 24(48.0%) in case group and 4(8.0%) in control group which is statistically significant (p=0.003). In this study the peak incidence of wound infection was found between 6^{th} to 8^{th} postoperative days. Al-fallouje and Mcbrien in 1998 showed the same result. The highest was on the 7^{th} postoperative day consistent with study Hadded V [35]. In our study common causative organism leading to post-LSCS wound infection includes, Gram-negative bacteria, anaerobes, and Staphylococcus aureus [22]. In this series, the most frequently isolated organism was E. coli 15(30.00%) followed by Staph. aureus 7(14.0%). Pseudomonas 6(12.0%), Citobacter 1(2.0%) and klebsiella 1(2.0%) while 20 (40.0%) were sterile. The cause of sterile culture due to patient on antibiotics, wound seroma, anaemia etc. Here, E.coli found mostly sensitive to Imipenem (46%) followed by chloramphenicol (26.66%), in (13.33%) cases both amikacin and gentamicin. Staph. aureus was more sensitive to Imipenem (57.14%), chloramphenicol and gentamicin (28.56%) and cloxacillin (14.28%). In case of pseudomonas infection most sensitive antibiotic was Imipenem (66.66%), chloramphenicol (50%), gentamicin (33.33%). Klebsiella and Citobacter both were (100%) sensitive to Imipenem which is consistent with other studies [34]. Prolonged rupture of fetal membrane, emergency operation, prolonged operative time, anaemia, diabetes mellitus and BMI greater than 25(kg/m^2) were identified risk factors for Caesarean wound infection in this study. While use of prolonged prophylactic antibiotics should be the standard of care in cases, complicated by any of these factors. Patients with the identified risk factors more emphasis should be given to reduce morbidity.

Conclusion

Common indentified risk factors for wound infection were increased body weight, diabetes, anaemia, irregular antenatal check-up, prolonged rupture of membrane. Effort should be given towards the prevention of prolonged rupture of fetal membrane, reduction of prolonged operation time by training of surgeons to improve their skill to reduce intra-operative blood loss; correction of anaemia; use of potent antibiotics; use of good surgical technique.

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