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Original Article

Culture and Antibiotic Sensitivity of Bacterial pathogens responsible for Post Caesarean Wound Infection in a Tertiary Hospital

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Abstract

The objective of this study was to find out the most common bacterial pathogens responsible for post-caesarean wound infection and to determine their antibiotic sensitivity profile. This descriptive cross sectional study was carried out in Obstetrics & Gynaecology Department of Sir Salimullah Medical College & Mitford Hospital from September 2016 to February 2017. 50 admitted patients experienced post-caesarean wound infections and were enrolled in this study. Mean age of study patients was 24.24 years ± 4.39 SD, ranges 17-36 years, 60.0% of them were literate and 40.0% respondents came from lower middle class society. 68.0% respondents were multiparous and 48.0% had regular antenatal check-up. Anemia, hypertension and diabetes mellitus were associated in 54.0%, 18.0% and 6.0% respectively. Rupture of membrane and fetal distress were found in 52.0% and 32.0% cases respectively. In 40.0% cases no growth of organism took place. Growth of Staphylococcus aureus was noticed as predominant organism (28.0%). Pseudomonas, Acinetobacter, E. coli, Klebsiella and Staphylococcus epidermidis were found in 10.0%, 6.0%, 6.0%, 6.0% and 4.0% respectively. S. aureus was sensitive to meropenem (50.0%), imipenem (42.8%), cefuroxime, doxycycline and amikacin (28.5%). Pseudomonas spp. was sensitive to imipenem (80.0%), meropenem and amikacin (60.0%). Acinetobacter showed 100.0% sensitivity to imipenem followed by piperacillin and meropenem (66.6%). Klebsiella was sensitive to imipenem and amikacin (66.6%). E. coli was sensitive to imipenem (66.6%), meropenem and cefuroxime (33.3%). S. epidermidis was 100.0% sensitive to meropenem followed by doxycycline and imipenem (50%). This study concludes that there is an alarming increasing of wound infections caused by antibiotic-resistant bacteria. Staphylococcus aureus is the commonly responsible organism. Particularly, Pseudomonas and E. coli resistance to third generation cephalosporins are the real threats to control hospital acquired infection.

Key words: Common Bacterial Pathogens Culture & Antibiotic Sensitivity, Post-Caesarean Wound infection.

Introduction

Caesarean section is one of the most common obstetric surgeries done in women of reproductive age group. In Bangladesh, a survey showed that 7.5% births were delivered by caesarean section[1] but the incidence is rising worldwide ranging from 5 to 25% depending on the nature and area of practice.[2,3] Postcaesarean wound infection is defined as a microbial infection in the site of surgical incision.[4] Classically presence of postcaesarean wound infection is confirmed by documenting the typical clinical signs of acute inflammation along with discharge of serous, bloody or purulent material or culture positive organism from the wound.[5] Postcaesarean wound infection is one of the troublesome complications of caesarean section that remains a major source of postoperative morbidity, accounting for about a quarter of the total number of nosocomial infections.[6] It affects 3-6% of women having caesarean delivery and this rate can be much higher (15-75%) in high risk cases and in developing countries.[4] Though the etiology of postcaesarean wound infection is multifactorial, the pathogens implicated in the development of wound infection remains largely either the human microorganisms from the exogenous environment or the endogenous organ microflora.[6] Certain systemic host factors like age, malnutrition, obesity, anemia, metabolic diseases, immunosuppression, poor tissue perfusion and also obstetric & surgical factors like multi parity, premature or prolonged rupture of membrane, prolonged labour,

repeated internal examination during labour, trial of labour at home, emergency rather than elective caesarean section, vertical skin incision, prolonged duration of surgery, poor surgical technique, failure of timely antibiotic prophylaxis, increased need for drain within the wound, presence of foreign body material within the wound, intraoperative blood transfusion, development of subcutaneous haematoma after operation, prolonged perioperative hospital stay may contribute in development of postcaesarean wound infection.[7,8,9] Body Mass Index (BMI) of more than 25 kg/m^2 has been shown to affect the outcome of surgery.[8] Preoperative anemia is an important predictor of wound infection and is frequently associated with puerperal sepsis and has been proven by several studies.[9] Premature and prolonged rupture of membrane inoculate largest bacterial inoculum into liquor that supervenes infection.[10] High tissue and serum levels of antibiotics are achieved during surgery if administered parenterally within 2 hours of incision and this was found to be less prone to develop wound infection as compared to those who did not receive it in a timely fashion.[11] A Pfannenstiel incision rather than midline vertical incision has less chance of wound dehiscence.[12] Transfusion of whole blood and blood products may also increase the risk of postcaesarean wound infection.[13] 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.[14] Several studies demonstrated an association in colonization of postcaesarean wound by Staphylococcus species, Streptococcus pyogens, Escherichia coli, Enterococcus faecalis, Proteus mirabilis, Klebsiella species and Pseudomonas species.[15] Of them, Staphylococcus aureus has a greater propensity to cause postcaesarean wound infection[16] and is the most commonly isolated organism.[15] Occasionally, Bacteroides of genital tract are isolated from serious wound infection.[17] Postcaesarean wound infection causes anxiety, increases patient discomfort and is a major cause of prolonged hospital stay and more costs as well as maternal morbidity and mortality.[18] About 17% of deaths of caesarean patients are related to post caesarean wound infection.[19] Thus; it exerts major impact not only on patient health but also on health economies. Knowing the microbial association and rational use of antibiotics are very important aspect in the management of postcaesarean wound infection so as to reduce maternal morbidity and mortality. This study was conducted at this particular moment with the intention to address this gap.

Materials and Methods:

This was a descriptive cross sectional study conducted in Department of Obstetrics and Gynecology of Sir Salimullah Medical College and Mitford Hospital, Dhaka from September 2016 to February 2017. A pre-structured, peer reviewed and interview as well as observation based case record form (CRF) was developed. The inclusion criteria were set as patients who underwent caesarean section in SSMC & Mitford Hospital with subsequent development of wound infection before and after discharge. Women who had caesarean section other than Mitford Hospital and those had secondary post-caesarean wound infection were excluded from the study. Data regarding epidemiologic, clinical, obstetrical and surgical profile were collected by CRF. Culture and sensitivity testing was done in the Department of Microbiology, Sir Salimullah Medical College and the drugs used for sensitivity testing were produced from the microbiological laboratory as per Government supply. Data were analyzed through SPSS software version 23.

Results:

Table-1: Epidemiological variables of the study participants

Variables		Values
Mean age (±SD) (in years)		24.24 ± 4.39
Age range (in years)		17 – 36
Educational status		
Not attended school		19 (38%)
Primary		16 (32%)
Secondary		9 (18%)
Higher secondary		4 (8%)
Graduate and above		2 (4%)
Household income (taka/month)		
Lower class (< 10,000)		14 (28%)
Lower middle class (10	- 20,000)	20 (40%)
Upper middle class (21	- 30,000)	10 (20%)
Upper class (> 30,000)		6 (12%)

Table-2: Obstetric profile of the study patients

Obstetric profile	Frequency (%)
Para	
Primi	16 (32%)
Multi	34 (68%)
Gravida	
1 st	16 (32%)
2 nd	18 (36%)
3 rd or more	16 (32%)
Antenatal check-up	
Regular	24 (48%)
Irregular	19 (38%)
None	7 (14%)
Type of caesarean section	
Emergency	41 (82%)
Elective	9 (18%)
Duration of caesarean section	
< 30 minutes	17 (34%)
30-60 minutes	29 (58%)
> 60 minutes	4 (8%)

Majority of study patients who developed wound infection needed prolonged operation time.

Table-3: Co-morbidities and indications of caesarean section of study patients

Variables	Frequency (%)
Medical co-morbidities	
Anemia	27 (54%)
Obesity	10 (20%)
Hypertension	9 (18%)
Diabetes mellitus	3 (6%)
Indications of caesarean section	
Rupture of membrane	
Failed home trial of labour	8 (16%)
Meconium stained liquor	
Prolonged labour	8 (16%)
Obstructed labour	3 (6%)
Fetal distress	
Pre-eclampsia	6 (12%)
Eclampsia	2 (4%)
Malpresentation	2 (4%)
Previous history of 1 C/S	7 (14%)
Previous history of 2 C/S	2 (4%)

Figure-1: Use of prophylactic antibiotic

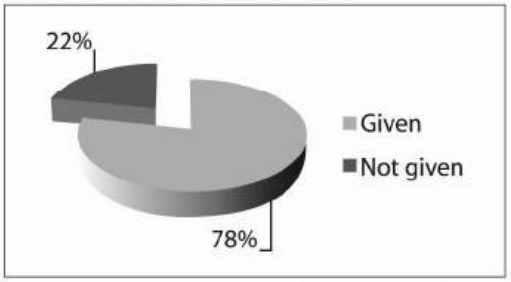


Figure-1 shows that most of the patients (78.0%) developed wound infection despite getting prophylactic antibiotic.

Figure-2: Skin closure technique of the caesarean wounds

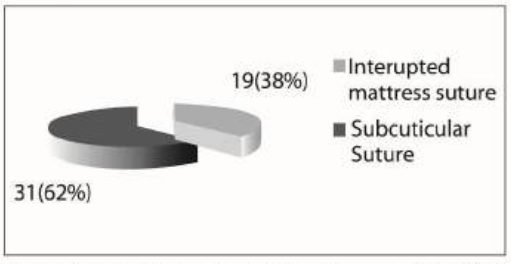


Figure-2 shows that subcuticular suture (n=31, 62.0%) had increased association with wound infection.

Table-4: Distribution of organisms isolated from wound swab culture

Isolated organisms	Values
No growth	20 (40%)
Staphylococcus aureus	14 (28%)
Pseudomonas spp.	5 (10%)
Acinetobacter	3 (6%)
Escherichia coli	3 (6%)
Klebsiella spp.	3 (6%)
Staphylococcus epidermidis	2 (4%)

Table-4 shows that no growth of organism was found in 20 (40.0%) cases. Staphylococcus aureus was found as the commonest organism (14, 40.0%) and Pseudomonas spp. was the second most common organism (10.0%) followed by Acinetobacter (6.0%), E. coli (6.0%), Klebsiella spp. (6.0%) & Staphylococcus epidermidis (4.0%).

Figure-3: Frequency distribution of various types of wound discharge

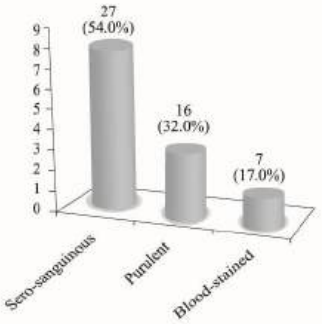
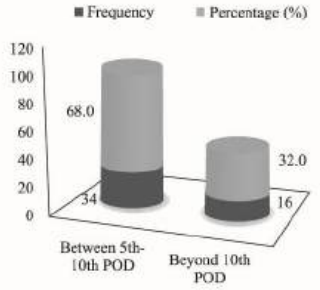


Figure-3 shows that most (27, 54.0%) of the study patients had sero-sanguinous discharge.

Figure-4: Distribution of appearance of post-caesarean wound infection on different postoperative days



Most of the wound infections (n=34, 68.0%) appeared between 5th to 10th postoperative day and it was 16 (32.0%) beyond 10th POD.

Table-5: Post-caesarean hospital stay of the study patients

Post-caesarean hospital stay	Values
≤ 3 days	16 (32%)
4-6 days	28 (56%)
≥ 7 days	6 (12%)

This study showed that most of the study patients (n=28, 56.0%) stayed 4-6 days in hospital after caesarean section operation. 16 (32.0%) and 6 (12.0%) patients were discharged within ≤ 3 days and ≥ 7 days respectively.

Table-6: Distribution of sensitivity pattern of isolated microorganisms to various antibiotics

Isolated organism (no. of cases)	Antibiotics and their sensitivity in percentage (frequency)										
	Meropenem	Cefuroxime	Doxycycline	Chloramphenicol	Cefotaxime	Imipenem	Amikacin	Ceftazidime	Piperacillin	Gentamycin	Co-trimoxazole
Staphylococcus aureus (14)	50.0 (7)	28.5 (4)	28.5 (4)	14.2 (2)	21.4 (3)	42.8 (6)	28.5 (4)	14.2 (2)	14.2 (2)	21.4 (3)	21.4 (3)
Pseudomonas spp. (5)	60.0 (3)	20.0 (1)	20.0 (1)	20.0 (1)	-	80.0 (4)	60.0 (3)	40.0 (2)	40.0 (2)	40.0 (2)	20.0 (1)
Acinetobacter (3)	66.6 (2)	-	-	-	-	100 (3)	33.3 (1)	-	66.6 (2)	-	-
Klebsiella spp. (3)	33.3 (1)	-	-	33.3 (1)	-	66.6 (2)	66.6 (2)	33.3 (1)	-	33.3 (1)	33.3 (1)
Escherichia coli (3)	33.3 (1)	33.3 (1)	-	-	-	66.6 (2)	-	33.3 (1)	-	-	-
Staphylococcus epidermidis (2)	100 (2)	-	50.0 (1)	-	-	50.0 (1)	-	-	-	-	-

Discussion:

This study found no definite relationship of age and socio-economic status with wound infection. This might because of operated cases were more in similar age group and regarding socioeconomic status, majority of them were from a particular area. Foord (1973) found in their series that increasing age directly influences wound infection.20 Regarding educational level most of the patients were found illiterate or having primary education which was 38.0% and 32.0% respectively. Occurrence of caesarean wound infection was found more (68.0%) in multiparous women than in primi parous and possibly malnutrition and anemia due to repeated childbirth acted as the predisposing factors. In this series, wound infection was more in 26 (52.0%) patients who did not receive regular antenatal check up. Preoperative anemia is an important predictor of wound infection and has been proved by several other studies.9 This study also found 54.0% of patients anemic. Obesity, hypertension and diabetes mellitus were associated in 20.0%, 18.0% and 6.0% respectively. Premature and prolonged rupture of membrane, prolonged labour and repeated internal examination during labour invite largest bacterial inoculum and increase the chance of wound infection. This study found association of wound infection with rupture of membrane (52.0%), prolonged labour (16.0%) and obstructed labour 6.0% patients. Despite always antibiotic prophylaxis been a matter of debate, Obstetrics and Gynaecological Society of Bangladesh (OGSB) recommends any one course of antibiotics among the available regimens should be given after cord is clamped following delivery of the baby or 30 minutes before the procedure. In this study 78.0% (n=39) patients developed postcaesarean wound infection in spite of getting prophylactic antibiotic possibly as of antimicrobial resistance against antibiotic that was prophylactically used. This study found increased incidence of wound infection among the population underwent emergency caesarean section (82.0%) than elective ones. The obstetric conditions in labour mentioned earlier are the factors possibly lie behind this. A similar observation was made by Ward (2008).[21] Shapiro et al.[22] reported that with each hour of surgery the infection rate almost doubles. In this study wound infection rate was 34.0% when duration of operation was < 30 minutes but the rate rose to 58.8% with the prolongation of operation to ½-1 hour. In more than half of the population (n=34, 68.0%) wound infection appeared between 5th to 10th post-operative day that indicates source of infection was possibly not from the operation theatre rather from patients' surroundings like patients' ward and attendances. Among the wound infection of this series 54.0% presented with serosanguinous discharge. Bacteriological study of wound discharge showed the growth of organism in 60.0% cases. Of them Staphylococcus aureus was noticed in 28.0% cases followed by Pseudomonas spp. (10.0%), Acinetobacter (6.0%), E. coli (6.0%), Klebsiella spp. (6.0%) and Staphylococcus epidermidis (4.0%). Several studies found that Staphylococcus has a greater propensity to cause SSI because of its' endogenous source that easily find their way into wounds upon disruption of natural skin barrier.[16,19] S. aureus found sensitive to meropenem (50.0%), imipenem (42.8%), cefuroxime, doxycycline, amikacin (28.5%) and cefotaxime, gentamycin, co-trimoxazole (21.4%). Pseudomonas spp. showed reduced sensitivity to commonly used antibiotics like cefuroxime, doxycycline, chloramphenicol, co-trimoxazole (20.0%) except imipenem (80.0%), meropenem (60.0%) and amikacin (60.0%). The incidence of Pseudomonas spp. associated

wound infection among admitted patients is becoming more serious in developing countries because of lack of general hygienic conditions, production of low quality antiseptics and medicinal solutions for treatment.[13] Acinetobacter was (100.0%) sensitive to imipenem followed by piperacillin and meropenem (66.6%) although it showed less sensitivity to commonly available antibiotics like amikacin (33.3%), doxycycline, cefuroxime, chloramphenicol, cefotaxime, ceftazidime, co-trimoxazole and gentamycin. Klebsiella showed sensitivity to imipenem, amikacin (66.6%), chloramphenicol, ceftazidime, meropenem, and co-trimoxazole (33.3%). However, this study had shown reduced sensitivity to ceftazidime (33.3% vs. 100%) and co-trimoxazole (33.3% vs. 100%) as compared to previous study.[23] Sensitivity of Escherichia coli to meropenem, ceftazidime and cefuroxime was 33.3%. Reduced antibiotic sensitivity pattern noted for E. coli suggests its importance to hospital acquired infection. In this study, Staphylococcus epidermidis was 100.0% sensitive to meropenem followed by doxycycline and imipenem (50%).

Conclusion:

Postcaesarean wound infection is intimately related to anemia, diabetes mellitus, multi parity and irregular ANC. Rupture of amniotic membrane, emergency caesarean section, prolonged operation time, and use of subcuticular suture significantly raises wound infection rates. Staphylococcus aureus was found as the commonly responsible organism for this notorious event. It is noteworthy that Pseudomonas and E. coli resistance to third generation cephalosporins are the devastating threats to control hospital acquired infection.

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