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Original Article

BACTERIOLOGY OF POST CAESAREAN WOUND INFECTION IN A SPECIALIST HOSPITAL IN KANO, NORTH WESTERN NIGERIA

Nwankwo E[1], Shuaibu S[2]

[1]Department of Microbiology and Parasitology, Faculty of Medicine, Bayero University, Kano [2]Department of Obstetrics and Gyneanocology, Aminu Kano Teaching Hospital/Bayero University Kano

Abstract

Post caesarean wound infection is a common cause of maternal morbidity and mortality especially in developing countries where strict adherence to infection control procedures is low. The aim of the present study is to establish the spectrum of microbes causing post caesarean wound infection and antibiotic sensitivity pattern in our locality. Specimens collected were processed and antibiotic sensitivity pattern determined by disc diffusion method. Out of 1,230 patients in this study, 246(20%) were infected. Of which 206 (83.7%) yielded growth. *E. coli* 65(28.8%) was the most frequently isolated pathogen followed by *Proteus mirabilis* (23.0%) and *Staphylococcus aureus* (19.0%) Bacterial pathogens were resistant to commonly used antibiotics such as cotrimoxazole, tetracycline, cefuroxime and cloxacillin, while cephalosporin and fluoroquinolones were highly effective against the isolates. Emergency caesarean section received the risk of post caesarean wound infection. The cephalosporin especially ceftriaxone will be useful as prophylactic antibiotic when combined with metronidazole and administered just before surgery is commenced.

Key words: **Post caesarean wound infection, bacterial isolates, antibiotic sensitivity pattern**

Introduction

Post caesarean wound infection is a common cause of maternal morbidity and mortality. In a study carried out in Nigeria, the authors showed that post caesarean wound infection was not only a leading cause of prolonged hospital stay with its attendant high hospital bill, but a major cause of disaffection among women (Fasubaa *et al*., 2000). Unlike in the developed countries, caesarean delivery is not usually a welcome development because traditionalist and uneducated people see it as an unnatural alternative to normal delivery and a bad omen to be avoided if possible. Increased exogenous bacterial contamination and flora consistent with skin species or break in sterile techniques often accompany difficult or emergency surgery (Martens *et al*. 1995). Though the cases of caesarean wound infection are similar globally with slight regional variations, the relative contributions differ from region to region and even from centre to centre (Chukudebelu and Okafor, 1978). The rate of post caesarean wound infection varied from 0 - 20.5% in a hospital survey conducted by Moir-Bussy and colleagues (Moir-Bussy *et al*., 1978) Two hospital based studies from Nigeria reported rates within the range (Osime *et al*., 1998;
Chukudebelu and Okafor, 1978). While some scholars reported *S. aureus* as the single organism most frequently isolated organism (Chia *et al*., 1993; Ako-Nai *et al*., 1992), others observed more Gram negative organism like *E. coli*, *Proteus mirabilis, Pseudomonas spp.* and *Klebsiella spp.* in surgical site infection (Kamat *et al*., 2008; Efem *et al*., 1986).

*Corresponding author: Emmanuel Nwankwo Email:emmaonwubiko@yahoo.com

This variation in spectrum of causative organism means that prophylactic antibiotic though efficacious may fail when the wrong agent is used (Ujah *et al*., 1992). Many risk factors have been documented as correlating with post caesarean wound infection such as duration of labour prior to the caesarean section, prolonged rupture of membranes, post operation anaemia, competence of the surgeon, duration of operation and multiple vaginal examinations (Rehu and Nilson, 1980).
In order to control and prevent post caesarean wound infection in our locality, there is the need to monitor the prevailing type of bacterial pathogens and antibacterial resistance testing with a view to using appropriate antibiotic for prophylactic purposes. This would definitely reduce the morbidity and mortality arising from this condition. This is the focus of the present study.

Materials and Methods

Type of study: Prospective cohort study.
Pus samples were taken from 246 consecutive patients attending obstetrics and gynaecology clinic diagnosed with clinically confirmed post caesarean wound infection after informed consent in Murtala Mohammed Specialist Hospital (MMSH), Kano between January and December 2009. Specimens were taken to a nearby microbiology laboratory at Aminu Kano Teaching Hospital (AKTH) where they were processed by standard procedures (Cheesebrough, 1993). The infection types were predominantly superficial incisional 192(78%) whereas 54(21.9%) were deep incisional. Antibiotic sensitivity pattern was determined by disc diffusion method (Bauer *et al*., 1966). After cleaning the surface of the wound, pus was collected using cotton wool sterile swab stick. This was later inoculated onto blood, MacConkey, and Mannitol salt agar plates and incubated for 18-24 hrs at 37^{o}C. The following morning the plates were examined and bacterial isolates identified by standard bacteriological methods (Cheesebrough, 1993). Overnight peptone water culture of the isolates were matched with McFarland turbidity standard 0.5 and spread over the surface of Mueller-Hinton agar. Antibiotic discs were placed on the surface of the medium with the aid of sterile forceps. For Methicillin resistant *Staphylococcus aureus* (MRSA), Mueller-Hinton agar was supplemented with 4% NaCl. Oxacillin disc 1µg and Vancomycin 10µg were asceptically placed on the sensitivity plate. These were incubated at 18-24 hrs at 35^{o}C and the sensitivity plates interpreted by comparing the zones of inhibition observed with CLSI 2010 charts and standard control organisms (CLSI, 2010). *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853 obtained from AKTH were used as control organisms. Antibiotics (oxoid) disc potency were as follows Gentamicin(CN)10µg, Ceftazidime (CAZ) 30µg, Ofloxacin (OFL) 10µg, Cloxacillin (CXC)10µg, Ceftriaxone (CRO) 30µg, Ciprofloxacin (CIP) 10µg, Amoxycillin/Clavulanate (AMC) 30µg, Tetracycline (TE)10µg, Cotrimoxazole (COT) 10µg, Cefuroxime (CXM) 30µg, Vancomycin 10µg, Erythromycin 10µg, Clindamycin 10µg. Statistical analysis: Chi-square analysis was carried out by Epi Info Version 6. Simple percentages were used to describe the infection rates and predominance of various types of bacterial isolates in the study.

Results

Table 1 shows the age distribution of the patients in the study. Out of 1,230 Caesarean sections (CS) recorded in the facility during the period of study, 246(20.0%) were infected. Out of 246 infected cases, 206(83.7%) yielded growth while 40(16.3%) yielded no growth. There was a negative correlation between maternal age and wound infection as infection decreased with increase in age. This was not statistically significant (X^2 =5.86 df=5 p=0.3).
Table 2 shows the antibiotic susceptibility testing of gram positive isolates. The flouroquinolones, Ofloxacin showed good invitro result when tested against MRSA isolates. There was no vancomycin resistant MRSA or E. faecalis. MRSA isolates were

resistant to both clindamycin and erythromycin. The prevalence rate of MRSA in the study is 10(23.3%).Table 3 shows comparison of infection rate in emergency and elective caesarean operations. A higher infection rate was associated with emergency caesarean section compared to elective caesarean sections and the difference was statistically significant. X^2=8.1 df=1 P<0.004.

Table 4 shows the frequency of isolates/ culture type from post caesarean wound infection patients at MMSH, Kano. While 18(8.7%) patients had mixed infection, 188(91.3%) occurred as pure or single isolates. In all, 226 isolates were obtained from this study with *E. coli* 65(28.8%) the most frequently isolated organism followed by *Proteus mirabilis* 52(23%) and *S. aureus* (19.0%). Out of 15 cases of infection in elective caesarean section 2(13.3%) had mixed infection, 2(13.3%) showed no growth, while 11(73.3%) yielded single isolates. The following isolates were obtained *E. coli* 4(26.7%), *Proteus mirabilis* 4(26.7%), *Proteus vulgaris* 2(13.3%), *S. aureus* 2(13.3%), *Klebsiella* spp. 1(6.7%), *Pseudomonas aeruginosa* 1(6.7%).

Table 5 shows antibiotics sensitivity pattern of gram negative bacterial isolates in the study. Tetracycline and Cotrimoxazole were ineffective against most isolates. Ofloxacin, Ceftazidime, Ciprofloxacin and Ceftriaxone showed good percentage sensitivity against most isolates.

Table 1 Age distribution of Patients with Post caesarean wound infection in MMSH, Kano

Age(Years)	Number of caesarean delivery in study	Number of wound infections	Percentage infected
15- 20	330	74	**22.4**
21-25	296	66	**22.2**
26-30	372	70	**18.8**
31-35	141	23	**16.3**
36-40	71	11	**15.4**
>41	20	2	**10.0**
	1230	**246**	**20**

X^2=5.86 df = 5 p = 0.3

Table 2 **Antibiotics sensitivity pattern of bacteria pathogens isolated in post caesarean wound infection in MMSH**

	Gram Positive Isolates			
	MSSA	**MRSA**	**Strep spp**	**E. feacalis**
No. tested	33	10	3	19
Number and proportion of isolates sensitive to (%)				
AMC	20(60.6)	0(o)	2(66.6)	15(78.9)
OFX	30(90.9)	7(70.0)	3(100)	16(84.2)
CXM	20(60.6)	0(0)	0(0)	0(0)
CLX	18(54.5)	0(0)	2(66.6)	6(31.0)
CLD	17(51.5)	0(0)	1(33.3)	9(47.0)
CAZ	17(51.5)	0(0)	1(33.3)	8(42.1)
CN	20(60.6)	0(0)	2(26.6)	6(31.0)
CIP	25(75.7)	2(20.0)	2(66.6)	16(84)
CRO	28(84.8)	0(0)	1(33.3)	12(63.2)
ERY	18(54.5)	0(0)	0(0)	11(58.0)
VAN	33(100)	10(100)	3(100)	19(100)

AMC- Amoxycillin/clavulanate, OFX- Ofloxacin, CXM- Cefuroxime, CLX- Cloxacillin, CLD- Clindamycin, CAZ-Ceftazidine, GN-Gentamicin, CIP- Ciprofloxacin, CRO- Ceftriaxone, ERY- Erythromycin, VAN – Vancomycin, MSSA – Methicillin Sensitive *S. aureus*, MRSA- Methicillin Resistant *S. aureus*

Table 3

Comparison of infection rate in emergency and elective Caesarean Operation in patients at MMSH, Kano

Types of surgery	**Infected**	**Not Infected**	**Infection rate(%)**
Elective	15	123	10.8%
Emergency	231	861	21.1%

$X^2 = 8.1$ df = 1 $p<0.004$

Table 4 –

Frequency of isolates/culture type from Post caesarean wound infection patients at MMSH, Kano

Isolates and culture	*No./frequency of isolates*	*Total no.of isolates*
Pure culture		
E. coli	56	56
Proteus mirabilis	40	40
Proteus vulgaris	19	19
Staphylococcus aureus	35	35
Klebsiella spp.	2	2
Pseudomonas aeruginosa	15	15
Citrobacteria freundii	2	2
Enterococcus faecalis	17	17
Candida albicans	2	2
Mixed culture		
E. coli and Streptococcus spp	3	6
E. coli and Proteus mirabilis	3	6
Proteus mirabilis and S. aureus	6	12
Pseudomonas aeruginosa and P.mirabilis	1	2
Proteus mirabilis, E coli and S. aureus	1	3
Pseudomonas aeruginosa and E. coli	1	2
Enterococcus faecalis and Klebsiella spp.	1	2
Proteus mirabilis, E. coli and E. faecalis	1	3
Pseudomonas aeruginosa and S. aureus	1	2
	206	**226**

Table 5

Antibiotic sensitivity pattern of bacteria pathogens isolated in post caesarean wound infection

	Gram Negative Isolates					
		E. coli	***P.mirabilis***	***P. vulgaris***	***P.aeruginosa***	***Klebsiella* spp.**	***C. freundii***
	No. tested	65	52	19	18	3	2
Number and proportion of isolates sensitive to (%)	**AMC**	45(69.2)	35(67.3)	10(52.6)	4(22.2)	2(66.6)	0(0)
	OFX	60(92.3)	50(96.0)	14(73.7)	16(88.8)	3(100)	1(50.0)
	CXM	32(50.7)	36(69.2)	8(42.1)	0(0)	0(0)	0(0)
	CLX	NT	NT	NT	NT	NT	NT
	TET	5(7.90)	3(5.80)	0(0)	NT	1(33.3)	0(0)
	CAZ	58(89.0)	45(86.0)	17(89.5)	16(88.8)	2(66.6)	1(50.0)
	GN	30(46.1)	15(28.8)	5(26.3)	11(61.1)	2(66.6)	1(50.0)
	CIP	56(86.0)	52(100)	15(78)	6(33.3)	1(33.0)	0(0)
	CRO	52(80.0)	40(76.9)	52(100)	15(83.3)	2(66.6)	2(100)
	COT	10(15.3)	4(7.7)	0(0)	NT	0(0)	0(0)

AMC- Amoxycillin/clavulanate, OFX- Ofloxacin, CXM- Cefuroxime, CLX- Cloxacillin, TET- Tetracycline, CAZ-Ceftazidime, GN-Gentamicin, CIP- Ciprofloxacin, CRO- Ceftriaxone, COT- Cotrimoxazole, NT-Not tested

Discussion

Post caesarean wound infection constitutes a serious maternal health concern in obstetric practice especially in developing countries where higher infection rate have been reported (Moir-Bussy *et al*., 1984). Caesarean delivery is not a welcome phenomenon because most people see it as unnatural and also the long hospital stay when there is an infection, with attendant high hospital cost, does not help this situation. However, in elective and emergency cases it is presented as the only therapeutic intervention that can save life.

In the present study, an infection rate of 20% observed is lower than the findings of two other researchers (Beattie *et al*., 1994; Makinde *et al*., 1987) but much higher than the findings in two other reports from Nigeria (Fasubaa *et al*., 2000). Various risks factors associated with post caesarean wound infection have been extensively studied including the contribution of each factor. The records of most of these patients also confirmed these factors with few variations. The negative correlation found between maternal age and development of wound infection agrees with the report of an earlier finding (Beattie *et al*., 1994). Infection rate decreased with increase in age although this was not statistically significant. The most frequently isolated bacteria in the present study is *E. coli* followed by *Proteus mirabilis* and *Staphylococcus aureus*. This agrees with the report of a study (Kamat *et al*., 2008) while other reports (Chia *et al*., 1973; Ako-Nai *et al*., 1992) documented *S. aureus* as the most frequently isolated bacterium in their centers. However, the preponderance of gram negative bacilli in the aetiology of post caesarean wound sepsis in elective surgery reflects the low level of hygiene and socioeconomic status of the patients.

Martens and his co researchers (1995) recognized emergency caesarean section to have increased risk for wound infection. In most cases the circumstance that leads to emergency caesarean section such as prolonged rupture of membrane would have created contamination of both the patient and immediate environment and this will negatively affect infection control procedures. The present study is in agreement with the findings of the above report. The third

generation fluoroquinolones and Cephalosporins showed encouraging results in the present study. However since prophylactic antibiotics are administered just before surgery, the fluoroquinolones may not be used since they are contraindicated in pregnant mothers as the fetus may be affected.

Antibiotic prophylaxis was reported to be the most singular factor that reduced post caesarean wound infection in a study (Beatie *et al*., 1994).

A prevalence rate of 23.3% MRSA observed in this study compares favorably with an earlier study in Kano (Nwankwo *et al*., 2010) but lower than the report from Ilorin (Taiwo *et al*., 2005) all in Nigeria. The actual incidence of post caesarean wound infection in this locality will be difficult to determine because there is no post discharge surveillance system in the hospital. Some reports (Petrosillo *et al*., 2008; Prospero *et al*., 2006) have earlier confirmed an increase in the incidence of wound infection in their centres following post discharge surveillance. The presence of Extended Spectrum Betalactamase (ESBL) producers and multi-drug resistant isolates which were not sought for in this study has been attracting attention of late in this hospital. This will form a major focus of future research on this subject.

Conclusion

The finding of a preponderance of gram negative bacilli in both elective and non elective surgery in this study with a good antibiotic percentage sensitivity against the cephalosporin and fluoroquinolone is of local clinical relevance. Since a higher infection rate was associated with emergency caesarean surgery when compared to elective surgery, the group of antibiotics observed to be effective on invitro antibiotic sensitivity pattern will likely reduce the infection rate when applied as prophylaxis.

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