***Open Access Maced J Med Sci* electronic publication ahead of print,**
published on May 14, 2019 as https://doi.org/10.3889/oamjms.2019.286

ID Design Press, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences.
https://doi.org/10.3889/oamjms.2019.286
eISSN: 1857-9655
Basic Science

Microbiological Pattern of Surgical Site Infection Following Caesarean Section at the University of Calabar Teaching Hospital

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Citation: Njoku CO, Njoku AN. Microbiological Pattern of Surgical Site Infection Following Caesarean Section at the University of Calabar Teaching Hospital. Open Access Maced J Med Sci. https://doi.org/10.3889/oamjms.2019.286

Keywords: Caesarean section; Surgical site infection; Wound infections; Antibiotic sensitivity

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Received: 08-Mar-2019; **Revised:** 05-May-2019; **Accepted:** 06-May-2019; **Online first:** 14-May-2019

Funding: This research did not receive any financial support

Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: Surgical site infection (SSI) is among the most common problems of patients who undergo a caesarean section, despite improved infection control practices. It contributes to increased morbidity and negative impact on the mental, social and economic aspect of patients' life.

AIM: To determine the incidence, risk factors and the bacteriological aetiology for SSI following caesarean section and their antimicrobial susceptibility patterns at UCTH.

METHODS: This was a prospective study of 600 patients who had a caesarean section over 6 months. Wound swab was collected from the patients who developed clinical evidence of SSI during this study period were recorded. Microbiology culture and antibiotic sensitivity were conducted for both aerobic and anaerobic organisms. The data obtained were analysed using the SPSS version 22 statistical program.

RESULTS: Out of the 600 participants who had a caesarean section, 51 patients had SSI, giving an incidence of 8.5%. The common isolates were S. aureus (37.3%), Klebsiella pneumonia (27.1%) and E. coli (22.0%). Independent risk factors significantly associated with post caesarean section wound infection in the logistic regression model were emergency caesarean section, prolonged rupture of membrane rupture greater than 24 hours, prolonged labour, intra-operative blood loss greater than one litre, duration of surgery greater than one hour and post-operative PCV less than 30%. Most isolates were highly resistant to cephalosporins, gentamycin and amoxicillin; moderately resistant to fluoroquinolones and highly sensitive to amikacin and imipenem.

CONCLUSION: The post-caesarean wound infection rate in our centre of 8.5% was high. Imipenem and amikacin antibiotics were very sensitive for SSIs and can be used as evidenced-based sensitive antibiotics to be commenced initially when wound infection is identified in our wards while awaiting the result of wound swab microscopy, culture and sensitivity to reduce the complications of post-caesarean wound infection in our centre.

Introduction

Surgical site infection is defined as an infection occurring within 30 days after a surgical operation (or within 1 year if an implant is left in place after the procedure) and affecting either incision or deep tissues at the operation site. These infections may be a superficial or deep incisional infection or infections involving organ or body space [1]. Postoperative SSI is among the most common problems for patients who undergo caesarean section and the third most frequently reported nosocomial infection in the hospital population [1]. Postoperative SSI following caesarean section is associated with increased morbidity, mortality, prolonged hospital stay, secondary infertility and increased economic costs for patient care [2]. The incidence of postoperative SSI varies widely between procedures, hospitals, surgeons, patients and geographical locations. It complicates 2.85% in India [3], 21% in Ethiopia [4] and 7-9.6% in Nigeria [5], [6]. Staphylococcus aureus is a commonly isolated organism in SSI, accounting for 20-30% of SSI occurring in hospital [7]. Other organisms regularly isolated from SSIs include gram-negative bacilli, Pseudomonas aeruginosa, Klebsiella, and Escherichia coli [5], [6].

There has been advance in SSI control practices which include: improved operating room ventilation, sterilisation methods, use of barriers, surgical techniques and availability of antimicrobial prophylaxis. Despite these, SSIs still occur and remain common causes of morbidity and mortality in the hospital setting mostly in developing countries [1]. This is partly contributed by the emergence of antimicrobial resistant pathogenic bacteria [1]. Reported risk factors for caesarean section wound infection include emergency caesarean section, prolonged labour prior caesarean section, prolonged rupture of membranes, multiple vaginal examinations, unbooked status and prolonged obstructed labour [5]. Other factors are inadequate skills or poor technique of the surgeon, prolonged operating time, prolonged obstructed labour, postoperative anaemia, high body mass index, diabetes mellitus, immunosuppressive disorders and certain medications like steroids [1]. Also, the surgical infection rate is higher in our environment due to poor adherence to infection prevention and control practices in theatre. Potential sources of infection identified include unfiltered air, antiseptic solutions, transporting of patients, surgical team, over-crowding in theatre, theatre gowns, inadequately sterilised equipment, contaminated environment and grossly contaminated surfaces [8]. Complications of SSIs include prolonged wound healing, wound dehiscence, wound pain, burst abdomen, necrotising fasciitis and pelvic abscess. Others are prolonged admission, a prolonged course of antibiotics, the possibility of re-admission, secondary repair surgery, incisional hernia, disfiguring scar, and in rare condition can lead to severe sepsis and mortality [1]. Surgical site infections also hurt the physical, emotional, social and economic aspects of life.

The common organisms causing infection after caesarean section in our department and their sensitivity patterns are unknown because no such study has been done in our centre on caesarean sections. Also, there is a paucity of study on the extent to which anaerobes are involved in the aetiology of SSIs in Nigeria. This gap makes the choice of empirical therapy more difficult to the clinicians. Therefore a better understanding of the spectrum of pathogens causing SSI as well as their susceptibility pattern in our department is important for prompt management of patients and provides evidenced-based sensitive antibiotics to be commenced initially when wound infection is identified in our wards while awaiting the result of wound swab microscopy, culture and sensitivity in 48-72 hours. Having such data would help to establish guidelines for the prevention and management of SSIs and contribute to the planning of surveillance and control of this group of infections.

Methods

This prospective study was carried out in the maternity unit of the Department of Obstetrics and Gynaecology of UCTH, Calabar, Cross River State, Nigeria. Caesarean section accounted for 37% and 38.2% in 2015 and 2016 respectively.

The study population comprised of patients that had a cesarean section and then followed-up to document those that developed post-caesarean section surgical site infections. The exclusion criteria were women with wound infections occurring after 30 days of surgery, caesarean sections done outside our hospital admitted following wound infection and refusal to give consent.

Post-operative surgical site infection was as defined according to CDC criteria [1]. Timing and classification of SSI were used. SSI was classified as superficial, deep incisional or organ/space infection [1]. It includes purulent drainage with or without laboratory confirmation from the superficial or deep incision, organism isolated from an aseptically obtained culture of fluid or tissue from the superficial or deep incision or organ/space and sign or symptoms of infection such as pain, tenderness and localised swelling, or heat. It also includes purulent drainage from the drain that is placed into the organ/space.

The study lasted for 6 months, and all eligible patients that had caesarean sections over the study period that consented to participate in the study were included. Structured questionnaires were used to extract data from the patients undergoing caesarean sections. The information includes demographic data, existing chronic disease (such as diabetes mellitus, hypertension), past medical history, current drug use such as steroid and smoking. Physical examination was done to determine the weight, height and body mass index (BMI). The indication for the caesarean section was documented, and the patients were followed up to document the surgical complications, duration of the operation and post-operative PCV. For those patients that developed SSI, physical examination was done to determine the diagnosis and type of the surgical site infection. Wound swabs for microbiologic culture were taken from the infection site using sterile swabs sticks before the wound is cleaned with an antiseptic solution without contaminating with skin commensals and sent to the hospital laboratory immediately for microscopic, culture and sensitivity.

The data were analysed using SPSS version 22. Statistical comparison was made using Chi-square (χ^2) test at 95% confidence and level of significance less than 0.05.

Results

During this period, there were a total of 1,584 deliveries. Of this, 953 were vaginal deliveries, and

631 were caesarean sections giving the prevalence of caesarean section of 39.8%.

Figure 1 shows that 51 patients out of 600 participants (8.5%) had surgical site infection following caesarean section.

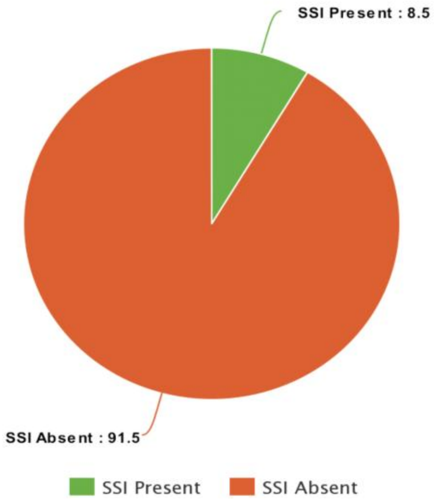

Figure 1: A pie chart of percentages of patients with a wound infection after caesarean section

Table 1 shows the demographic characteristics of women with SSI following caesarean section. Majority of the patients with post-caesarean wound infection were teenagers (16.7%), single women (35%), Artisans (15.9%), had primary education (18.2%) and unbooked (13.3%). Surgical site infection following caesarean section was significantly higher among unbooked pregnancy (13.3%) than booked pregnancy (7.4%) (p = 0.042).

Table 1: Demographic characteristics of women with SSI following caesarean section

VARIABLES	Total	SSI present (%)	SSI absent (%)	p-value
Age				
≤ 19	24	4 (16.7)	20 (83.3)	
20-29	229	17 (7.4)	212 (92.6)	χ^2 = 2.704
30-39	328	29 (8.8)	299 (91.2)	Df = 3
≥ 40	19	1 (5.3)	18 (94.7)	P value = 0.44
Parity				
1	248	14 (5.7)	234 (94.3)	χ^2 = 5.052
2	179	18 (10.1)	161 (89.9)	Df = 3
3	94	9 (9.6)	85 (90.4)	P value = 0.168
≥ 4	79	10 (12.7)	69 (87.3)	
Marital Status				χ^2 = 18.68
Married	580	44 (7.6)	536 (92.4)	Df = 1
Single	20	7 (35.0)	13 (65.0)	P value = 0.000
Occupation				
Housewife	243	12 (4.9)	231 (95.1)	χ^2 = 9.547
Trader	203	19 (9.4)	184 (90.6)	Df = 3
Civil servants	85	9 (10.6)	76 (89.4)	P value = 0.023
Artisans	69	11 (15.9)	58 (84.1)	
Educational level				χ^2 = 8.851
Primary	44	8 (18.2)	36 (81.8)	Df = 2
Secondary	236	24 (10.2)	212 (89.8)	P value = 0.010
Tertiary	320	19 (5.9)	301 (94.1)	
Tribe				
Ibibio	218	25 (11.5)	193 (88.5)	
Efik	144	15 (10.4)	129 (89.6)	χ^2 = 12.172
Ejagam	97	3 (3.1)	94 (96.9)	Df = 6
Igbo	88	3 (3.4)	85 (96.6)	P value = 0.06
Bête	35	3 (8.6)	32 (91.4)	
Yoruba	10	2 (20.0)	8 (80.0)	
Hausa	8	0 (0)	8 (100)	
Estimated GA				
≥ 37 weeks	556	46 (8.3)	510 (91.7)	χ^2 = 0.501
< 37 weeks	44	5 (11.4)	39 (88.6)	Df = 1
				P value = 0.479
Booking Status				
Booked	487	36(7.4)	451 (92.6)	χ^2 = 4.08
Unbooked	113	15(13.3)	98 (86.7)	Df = 1
				P value = 0.043

Figure 2 shows the number of bacterial isolates from culture. A total of 51 wound swabs were collected from patients with postoperative wound infections. Among these, 47 (92.2%) had bacterial growth. Thirty-five (74.5%) had one bacterial growth (mono isolate) while 12 (25.5%) had more than one growth (mixed growth or bi-isolate)

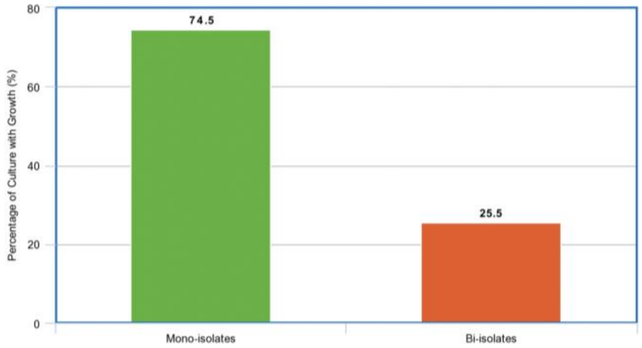

Figure 2: Percentage of culture with growth

Figure 3 shows the frequency of pathogenic bacteria isolates from post-operative wound infection.

Gram-negative organisms were more prevalent (62.7%) than gram-positive bacteria (37.3%). The isolated bacteria were *S. aureus* 22 (37.3%), *Klebsiella pneumoniae* 16 (27.1%), *E. coli* 13 (22.0%), *Pseudomonas aeruginosa* 3 (5.1%), *Klebsiella oxytoca* 3 (5.1%) and Bacteroides 2 (3.4%).

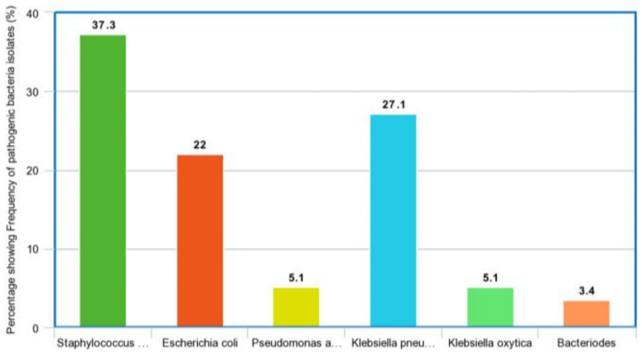

Figure 3: Frequency of pathogenic bacteria isolates from post-operative wound infection

Table 2 shows the risk factors for post-caesarean wound infection. SSI was significantly higher among emergency caesarean section (11.0%) than the elective caesarean section (3.6%) (p = 0.001). SSI was significantly higher among patients with prolonged rupture of membranes (> 24 hours) (p = 0.000) and prolonged labour (> 12 hours) (p = 0.000). Other factors associated with increased risk of post-caesarean wound infection were intra-operative blood loss greater than one litre (p = 0.020), blood transfusion (p = 0.029), history of previous surgery (p = 0.024), duration of surgery (> 1 hour) (p = 0.001) and post-operative PCV less than 30% (p = 0.000).

Table 2: Risk factors for post-caesarean section wound infection

VARIABLES	Total (%)	SSI		
		PRESENT (%)	ABSENT (%)	
BMI				χ^2 = 4.94
< 30	391	26 (6.9)	365 (83.1)	Df = 1
≥ 30	209	25 (11.5)	184 (88.5)	P value = 0.026
Types of surgery				χ^2 = 10.20
Elective	190	6 (3.2)	184 (96.8)	Df = 1
Emergency	410	45 (11.0)	365 (89.0)	P value = 0.001
Indications for C/S				
Preeclampsia/Eclampsia	69	5 (7.2)	64 (92.8)	χ^2 = 49.413
≥ 2 previous C/S	66	4 (6.1)	62 (93.9)	Df = 5
Prolonged Obstructed	58	19 (32.8)	39 (67.2)	P value = 0.000
labour	52	4 (7.7)	48 (92.3)	
CPD	32	1 (3.1)	31 (96.9)	
Abnormal Labour	323	18 (5.6)	305 (94.4)	
*Others				
Membrane rupture				χ^2 = 12.737
Yes	258	34 (13.2)	224 (86.8)	Df = 1
No	342	17 (5.0)	325 (95.0)	P value =0.000
Duration of Membrane rupture				χ^2 = 15.213
≤ 24hours	174	13 (7.5)	161 (92.5)	Df = 1
> 24 hours	84	21 (25.0)	63 (75.0)	P value = 0.000
Duration of labour				χ^2 = 20.002
≤ 12 hours	176	11(6.3)	165 (93.7)	Df = 1
> 12hours	85	22(25.9)	63 (74.1)	P value = 0.000
HIV				χ^2 = 1.181
Yes	47	2 (4.3)	45 (95.7)	Df = 1
No	553	49 (8.9)	504 (91.1)	P value = 0.277
Status of surgeon				
Registrar	2	0 (0)	2 (100)	χ^2 = 2,495
Senior registrar	452	43 (9.5)	409 (90.5)	Df = 2
Consultant	146	8 (5.5)	138 (94.5)	P value = 0.287
Estimated blood loss				χ^2 = 5.440
≤ 1litre	539	41 (7.6)	498 (92.4)	Df = 1
> 1litre	61	10 (16.4)	51 (83.6)	P value = 0.020
Blood transfusion				χ^2 = 4.79
Yes	39	7 (17.9)	32 (82.1)	Df = 1
No	561	44 (7.8)	517 (92.2)	P value = 0.029
History of previous surgery				χ^2 = 5.08
Yes	166	21 (16.3)	145 (83.7)	Df = 1
No	434	30 (5.5)	404 (94.5)	P value = 0.024
Type of Incision				χ^2 = 0.676
Transverse suprapubic	532	47 (8.8)	485 (91.2)	Df = 1
subumbilical midline	68	4 (5.9)	64 (94.1)	P value = 0.410
Duration of Surgery				χ^2 = 10.398
≤ 1 hour	462	30 (6.5)	432 (93.5)	Df = 1
> 1 hour	138	21 (15.2)	117 (84.8)	P value = 0.001
Post-operative PCV				χ^2 = 42.787
< 30	134	30 (22.4)	104 (77.6)	Df = 1
≥ 30	466	21 (4.5)	445 (95.5)	P value = 0.000

*****Others include abnormal lie, fetal distress, placenta previa, failed induction, breech presentation, severe oligohydramnios, bad obstetric history, cord prolapse; PCV-Packed cell volume; BMI-Body mass index; CPD-Cephalopelvic disproportion.

Table 3 shows the multivariate analysis on risk factors for post-caesarean section wound infection using logistic regression. The finding showed that the independent variables found to be significant risk factors for post caesarean section wound infection in the logistic regression model were types of caesarean section (OR = 4.707, CI = 3.191-5.346); indications for caesarean section (OR = 1.351, CI = 1.001-1.648), duration of membrane rupture (OR = 0.520, CI = 0.322-0.946); duration of labour (OR= 0.469, CI = 0.197, 0.785); intra-operative blood loss greater than one litre (OR = 1.219, CI = 1.168-2.901); duration of surgery greater than 1hour (OR = 0.027, CI = 0.013-0.069) and post-operative PCV less than 30% (OR = 2.595, CI = 1.464-4.121).

Table 3: Multivariate analysis of Risk factors for Post-Caesarean Section Wound Infection

VARIABLES	ODDS RATIO	95% CI	P-VALUE
BMI	2.017	(0.810, 5.040)	0.133
Types of Surgery	4.707	(3.191, 5.346)	0.001
Indications for caesarean section	1.351	(1.001-1.648)	0.002
Membrane rupture	3.028	(1.337, 6.858)	0.008
Duration of Membrane Rupture	0.520	(0.322, 0.946)	0.002
Duration of Labour	0.469	(0.197, 0.785)	0.001
HIV	0.964	(0.758, 1.226)	0.765
Status of surgeon	0.990	(0.296, 3.306)	0.987
Estimated Blood Loss	1.291	(1.168-2.901)	0.048
Blood transfusion	1.207	(0.954-2.136)	0.072
History of previous surgery	1.052	(0.942, 1.250)	0.258
Type of Incision	1.049	(0.904, 1.216)	0.543
Duration of Surgery	0.027	(0.013-0.069)	0.028
Postoperative PCV	2.595	(1.464-4.121)	0.002

CI - Confidence interval

Table 6 shows the antimicrobial sensitivity pattern of gram-positive and gram-negative isolates. Among the S. aureus isolates, the majority are highly sensitive to amikacin (72.7%) and imipenem (72.7%). Some had low to moderate sensitivity to several antibiotics including ceftriaxone (13.6%), cefoxitin (13.6%), cefuroxime (18.1%), levofloxacin (31.8%) and erythromycin (40.9%). *S. aureus* isolates showed high resistance to multiple antimicrobial agents tested; most of the *S. aureus* are highly resistant to amoxicillin/clavulanate (100%) and meropenem (100%). Sixty-eight per cent were resistant to fluoroquinolones, and 59.1% were resistant to macrolides (erythromycin and clindamycin).

All E. coli isolates were sensitive to imipenem (100%). E. coli had moderate sensitivity to amikacin (76.9%), levofloxacin (53.9%) and cefoxitin (53.9%), while 23.1% were sensitive to ceftriaxone, cefuroxime and cefepime. E. coli is highly resistant to amoxicillin/clavulanate (100%) and meropenem (100%).

TABLE 4: Susceptibility profile of bacterial isolates from Surgical Wound infections

ORGANISM CULTURED	Total (%)	ANTIBIOTICS SUSCEPTIBILITY PROFILE (%)													
		CEFT	CEU	CEF	GEN	AMK	LEV	CPR	IMI	AMX	ERY	CLI	MER	CEP	CFT
GRAM +ve															
Staph aureus	22														
Sensitive		3 (13.6)	4 (18.1)	3 (13.6)	3 (13.6)	16 (72.7)	7 (31.8)	7 (31.8)	16 (72.7)	0 (0.0)	9 (40.9)	9 (40.9)	0 (0.0)	3 (13.6)	3 (13.6)
Resistant		19 (86.4)	18 (81.1)	19 (86.4)	19 (86.4)	6 (27.3)	15 (68.2)	15 (68.2)	6 (27.3)	22 (100)	13 (59.1)	13 (59.1)	22 (100)	19 (86.4)	19 (86.4)
GRAM –ve															
E Coli	13														
Sensitive		3 (23.1)	3 (23.1)	3 (23.1)	7 (53.9)	10 (76.9)	7 (53.9)	7 (53.9)	13 (100)	0 (0)			0 (0)	3 (23.1)	7 (53.9)
Resistant		10 (76.9)	10 (76.9)	10 (76.9)	6 (46.1)	3 (23.1)	6 (46.1)	6 (46.1)	0 (0)	13 (100)			13 (100)	1 (76.9	6 (46.1)
K.oxytoca	3														
Sensitive		0 (0)	0 (0)	0 (0)	0 (0)	3 (100)	2 (66.7)	2 (66.7)	3 (100)	0 (0)			0 (0)	0 (0)	2 (66.7)
Resistant		3 (100)	3 (100)	3 (100)	3 (100)	0 (0)	1 (33.3)	1 (33.3)	0 (0)	3 (100)			3 (100)	3 (100)	1 (33.3)
K.pneumonia	16														
Sensitive		0 (0)	0 (0)	0 (0)	0 (0)	12 (75.0)	12 (75.0)	10 (62.5)	16 (100)	0 (0)			0 (0)	0 (0)	8 (50.0)
Resistant		16 (100)	16 (100)	16 (100)	16 (100)	4 (25.0)	4 (25.0)	6 (37.5)	0 (0)	16 (100)			16 (100)	16 (100)	8 (50.0)
Pseudomonas	3														
Sensitive		0 (0)	0 (0)	0 (0)	0 (0)	2 (66.7)	2 (66.7)	2 (66.7)	3 (100)	0 (0)			0 (0)	0 (0)	1 (33.3)
Resistant		3 (100)	3 (100)	3 (100)	3 (100)	1 (33.3)	1 (33.3)	1 (33.3)	0 (0)	3 (100)			3 (100)	3 (100)	2 (66.7)
Bacteroides	2														
Sensitive		0 (0)	0 (0)	0 (0)	0 (0)	2 (100)	1 (50.0)	1 (50.0)	2 (100)	0 (0)			0 (0)	2 (100)	1 (50.0)
Resistant		2 (100)	2 (100)	2 (100)	2 (100)	0 (0)	1 (50.0)	1 (50.0)	0 (0)	2 (100)			2 (100)	0 (0)	1 (50.0)

CEFT = Ceftriaxone; CUE = Cefuroxime; CEF = Ceftazidine; GEN = Gentamicin; AMK = Amikacin; LEV = Levofloxacin; CPR = Ciprofloxacin; IMI = Imipenem; AMX = Amoxicillin/clavulananic acid; ERY = Erythromycin; CLI = Clindamycin; MER = Meropenem; CEP = Cefipime; CFT = Cefoxitin.

Pseudomonas aeruginosa isolates were highly sensitive imipenem (100%) and 66.7% sensitive to amikacin, levofloxacin, ciprofloxacin and imipenem. All pseudomonas (100%) were resistant to Ceftriaxone, cefuroxime ceftazidine, gentamicin, amoxicillin/clavulanic acid, cefipime and meropenem.

Discussion

The study gives an insight into the causative pathogens of post-operative wound infections in this hospital and their sensitivity profiles. The incidence of post-caesarean wound infection in this study was 8.5%, which is comparable to 7.0% reported in Abakiliki, Nigeria and 9.1% reported in Kano, Nigeria [5], [6]. However, it is lower than 10% reported in Lagos and 12.5% in Nnewi, Nigeria [9], [10]. The possible reason for variation in these studies could be attributed to differences in the populations investigated; diversity of indications for caesarean sections performed in different centres, as well as risk factors for surgical site infection prevalent in the facility. In the present study, the majority of the isolates were obtained from patients who were already on antimicrobial prophylaxis routinely given to women after caesarean section in our centre, and this could have reduced the pathogens identified. Post caesarean wound infection in this study may not be the true representative of what currently obtains in most of our secondary facilities where most of the caesarean sections occur and where it is likely to be higher due to lack of or poor adherence to surgical protocol and post-operative management.

Booking status was a significant determinant of SSI in this study, commoner among unbooked women than booked women and is similar to the findings from previous studies [5], [9]. The reason may be that some unbooked patient is likely to labour in churches and traditional birth attendance places, and present in labour with complications like prolonged rupture of membranes, chorioamnionitis and obstructed labour. Most unbooked women are poor and more likely to be malnourished.

There was an inverse association between educational status and surgical site infection, with least educated women showing the highest prevalence of SSI. This may be due to the positive influence of education and public enlightenment/awareness on utilization of health facility for antenatal care, hospital delivery and low parity common among more educated women than less educated women.

The predominant organism isolated was Staphylococcus aureus, as it had the highest prevalence with 37.3%. Staphylococcus aureus is one of the predominant causes of SSI and has been documented in many studies in keeping with this finding [5], [6], [11]. Other isolated bacteria were Klebsiella pneumoniae (27.1%), E. coli (22.0%), Pseudomonas aeruginosa (5.1%), Klebsiella oxytoca (5.1%) and Bacteroides (3.4%). In the present study, the only (3.4%) anaerobic organisms cultured were Bacteroides. The probable reasons for the low culture of the anaerobic organism in this study could be wide prevalent use of metronidazole as a prophylactic antibiotic in our centre for the postoperative patient, which kills anaerobes. It was observed that the two patients that had cultures positive for Bacteroides in this study were unbooked women who presented in obstructed labour and did not commence prophylactic antibiotics due to financial constraints.

The incidence of post-caesarean wound infection among those who had an emergency caesarean section was 11.0% compared to only 3.2% of elective caesarean. This was similar to a study in Nnewi where caesarean wound infection rate was seen in 20% of emergency cases and 5% in the elective group [10]. A similar result was reported by other researchers [5]. The role of prolonged rupture of the membrane as a predisposing factor for the development of wound infection was confirmed in this study. Normally in pregnancy, cervical mucus plug, foetal membranes and amniotic fluid all serve as barriers to infection. However, when foetal membranes are ruptured, this protective effect is gradually lost with time. Bacteria are now able to transverse the cervical canal into the amniotic cavity leading to chorioamnionitis and its sequel [12]. Prolonged labour was noted to be an independent risk factor for wound infection in this study. Women with prolonged labour have a higher risk of developing a post-caesarean wound infection. This was similar to other studies [11], [13]. This could be attributed to the fact that most patients that had prolonged labour were unbooked and were of low socioeconomic class. It may also be because most patients that had prolonged labour were likely to labour in a dirty environment and were usually referred to the Teaching Hospital as potential septic cases.

In the present study estimated blood loss of more than one litre had higher odds of developing a post-caesarean wound infection. Postoperative anaemia (hematocrit < 30%) have a significant association with post-caesarean wound infection. The possible relationship between post-operative anaemia and wound infection might be explained by the fact that iron deficiency anaemia results in impaired transport of haemoglobin and thus oxygen to the surgical site. It also causes tissue enzyme and cellular dysfunction. Reduced oxygen delivery can also result in impaired wound healing.

In this study, S. aureus isolates were highly sensitive to amikacin and imipenem, and highly resistant to cephalosporins, amoxicillin/clavulanate, gentamicin and meropenem, and moderately resistant to fluoroquinolones. High resistance patterns have been reported [14]. These findings are in contrast with a previous study in Ibadan, southwest Nigeria, which reported that S. aureus isolates were highly sensitive to cephalosporins and amoxicillin [15]. Another study done in Ife, Nigeria, observed that S. aureus isolates are highly sensitive to fluoroquinolones and cephalosporins [16]. The high resistant to a first-line antimicrobial agent like amoxicillin, gentamicin, cephalosporins observed in this study may be as a result of injudicious use of these drugs in our environment.

The gram-negative isolates were highly sensitive to imipenem and amikacin; highly resistant to cephalosporins, gentamicin and amoxicillin/clavulanate, and moderately resistant to fluoroquinolones. However, a study in southwest Nigeria observed that gram-negative isolates were highly sensitive to cephalosporins and fluoroquinolones [15]. This disparity in resistant pattern to first-line antimicrobial agent observed in this study may be due to injudicious use of these drugs in our environment. This may be a reflection of the pattern of antibiotic use and abuse in the study setting, especially with the common non-prescription use of beta-lactam antibiotics for treatment of many clinical syndromes which encourages resistance. High sensitivity to imipenem and amikacin may be due to the limited exposure of these drugs to the prescription antibiotics, which are relatively more expensive.

In conclusion, the post-caesarean wound infection rate of 8.5% in our hospital was high. Staphylococcus aureus, Klebsiella pneumonia and Escherichia coli were the commonest isolates from post-caesarean wound infection. Advocacy should be stepped up for universal sensitization and education on the need for antenatal booking during pregnancy and hospital delivery to reduce the rate of prolonged rupture of membranes, chorioamnionitis, prolonged labour and obstructed labour. Imipenem and amikacin should be used as the first line antibiotics for empirical treatment of post-caesarean wound infection in our centre while awaiting the result of wound swab microscopy culture and sensitivity.

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