Evaluating Pre-Incision Versus Post Umbilical Cord Clamping Antibiotic Prophylaxis in the Prevention of Post Caesarean Section Infections in a Nigerian Specialist Teaching Hospital

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Abstract: *Introduction*: Caesarean delivery is the single most important factor associated with post partum infection and carries a 5-20 fold increased risk of infection compared to vaginal delivery. With the increase in Caesarean delivery rates worldwide, post-Caesarean delivery infections are likely to become a significant health and economic burden. Pre-incision antibiotic prophylaxis prevents maternal infectious morbidity without prejudice to neonatal infectious morbidity. This Study compared pre-incision versus post-umbilical cord clamping antibiotic prophylaxis in the prevention of post caesarean section infection.

Methods: This is an interventional, single blinded, two-armed, randomized, single centre study using amoxicillin/ clavulanic acid plus metronidazole. One hundred and fifty patients that met the inclusion criteria were randomised into pre-incision and post umbilical clamp arm with seventy five patients in each study arm. Patients were followed up for six weeks postpartum.

Results: The overall post-operative fever rate was 10.7% with 4.00% in pre-incision and 6.67% in post umbilical clamp group (fisher's exact test of 0.428 and cumulative incidence relative risk of 0.533 (95%CL: 0.194-1.64). Two percent and 4.67% of studied population developed endometritis in pre-incision and post umbilical groups respectively (fisher's exact test of 0.327 and cumulative incidence relative risk of 0.44(95%CL: 0.101-1.625). Superficial wound infection occurred in 2.00% of the studied population in pre-incision group and 3.33% in post umbilical group. The overall wound infection prevalence rate was therefore 5.33% (fisher's exact test of 0.719 and cumulative incidence relative risk of 0.66 (95%CL: 0.395-7.446). *Staphylococcus aureus* was the commonest isolate. No significant difference between the study groups in this study in terms of neonatal outcome.

Conclusion/Recommendation: Antimicrobial agent for surgical prophylaxis could prevent surgical site infection and related morbidity, reduce the duration of hospital stay and therefore cost of health care. Post caesarean section infectious surveillance should be encouraged in all delivery units.

Keywords: Caesarean section, Wound infection, antibiotic prophylaxis.

1. INTRODUCTION

Puerperal infection is a general term used to describe any bacterial infection of the genital tract after delivery. The earliest reference to puerperal infection date back to antiquity. Puerperal infection remains a significant cause of maternal morbidity and mortality both in the developed and in developing countries. Fortunately, because of effective antimicrobials, maternal deaths from infection have become uncommon. Postpartum infections still are costly to both patient and society, not only in additional days of hospitalization and medications but also in time lost from work and they are associated with an admittedly small but not negligible threat of serious disability and death, and remains among the top five causes of pregnancy-related maternal mortality and morbidity worldwide [1-3].

According to World Health Organization puerperal sepsis is defined as infection of the genital tract occurring at any time between the rupture of membranes or labour and the 42nd day post partum in which 2 or more of the following are present: pelvic pains, fever (that is oral temperature 38,5°C or higher on any occasion, abnormal vaginal damage (example presence of pus), abnormal smell or foul odour of discharge, delay in the rate of reduction of the size of the uterus (less than 2 cm per day during the first 8 days) [4]. Puerperal morbidity due to infection has occurred if the patient's temperature is higher than 38 °C (100.4 °F) on 2 separate occasions at least 24 hours apart following the first 24 hours after delivery. Overt infections can and do occur in the absence of these criteria, but fever of some degree remains the

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hallmark of puerperal infection, and the patient with fever can be assumed to have a genital infection until proved otherwise. Most persistent fevers after childbirth are caused by genital tract infection. It is reported that only about 20 percent of women that are febrile within the first 24 hours after giving birth vaginally were subsequently diagnosed with pelvic infection. This was in contrast to 70 percent of those undergoing caesarean delivery [5]. It must be emphasized that spiking fevers of 39°C or higher that develop within the first 24 hours postpartum may be associated with virulent pelvic infection caused by group A streptococcus.

Puerperal infectious morbidity affects 2-8% of pregnant women and is more common in those of low socioeconomic status, who have undergone operative delivery, premature rupture of the membranes, long labours, or who have multiple pelvic examinations. During labour and particularly after rupture of the membranes, some of the protective mechanisms are no longer present. Examinations and invasive monitoring apparatus probably facilitate the introduction of vaginal bacteria into the uterine cavity. Bacteria can be cultured from the amniotic fluid of most women undergoing intrauterine pressure monitoring, but overt postpartum infection is seen in fewer than 10% of these cases. Contractions during labour may spread bacteria present in the amniotic cavity to the adjacent uterine lymphatic's and even into the bloodstream.

Caesarean delivery is the single most important risk factor for puerperal infection [6]. Women who undergo caesarean section have a 5- to 20-fold greater risk of postpartum infection than women having a vaginal delivery [7]. During the last few years, a growing body of evidence suggests that the single most important risk factor for postpartum infection is caesarean section [8-10]. The incidence of post-caesarean infection varies widely worldwide from 2.5% to 20.5% [5, 11, 12]. The incidence is rising worldwide and the reported incidence ranges from 5 to 25% depending on the nature and area of practice [13, 14]. Many women have come to associate caesarean section and wound infection with long hospital stay, high bill, as well as other morbidities and mortality. Recovery from Caesarean section is more difficult for women who develop postoperative wound infection [13, 15-17]. Attempts to make the operation of caesarean section more acceptable to women in our environment must address these problems [13].

Wound infection occurs in 4-12% of patients following caesarean section [19]. Rates of post-operative wound infection varied from 0 to 20.5% in a hospital survey conducted by Moir-Bussy and colleagues [20]. Two hospital based studies from Nigeria reported rates within this range [21, 22]. 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 [22]. Yokoe *et al.* found a rate of puerperal infections following Caesarean section of 7.4%, compared to 5.5% in women who had vaginal delivery [23]. Considering the increasing trend of rates of caesarean section all over the world, it is likely that puerperal infection incidence will see a similar trend in future years.

Post-caesarean infections are polymicrobial, involving aerobes, anaerobes and ureaplasma. The main source of postpartum infection after caesarean section is the lower genital tract, particularly if the membranes are ruptured, but this still occurs with intact membranes following preterm birth. The most common isolated pathogens are anaerobes and gram-negative aerobes. Gram-negative aerobes include *Escherichia coli*, *Klebsiella spp*, *Enterobacter spp*. and *Proteus spp*. The anaerobes include *Bacteroides spp*., *Clostridium spp*., and *Fusobacterium spp*. [23]. However, exogenous bacterial contamination by skin flora (such as *Staphylococcus aureus*) as a result of a break in sterile technique may occur, especially following a difficult or complicated surgery [24]. Mawalla *et al.*, in a prospective cross-sectional study, reported that most common isolates in surgical site infection at Bugando Medical Centre are gram-negative bacteria. *Staphylococcus aureus* was found in only 28.6% of study patients; and 18.8% were MRSA (Methicillin resistant *Staphylococcus aureus*) [25].

The prophylactic antibiotics used for caesarean section should have a wide spectrum of activity, including reasonably good activity against pathogens likely to be present at the incision site. The dosage regimen should be designed to ensure adequate tissue levels at the time the operation begins or shortly thereafter. The drug should not be one that is used to treat serious, established infections. The duration of therapy should be short thus, antimicrobial prophylaxis should last only 1-3 doses (Antibiotics administered for > 48 hours can hardly be called prophylactic but rather therapeutic antibiotic usage). The drug should be free

of major side effects and should be relatively inexpensive [5, 26].

In all situations in which antimicrobials are administered with the hope that they may have a prophylactic effect, the risk from these same drugs (e.g., allergy, toxicity, selection of super infecting microorganisms) must be evaluated daily, and the course of prophylaxis must be kept as brief as possible [26]. Administration of antibiotic prophylaxis within an hour prior to skin incision is more effective in reducing post-caesarean infectious morbidity when compared to administration of the same drugs after cord clamping, and has no effect on neonatal infection [27, 28]. Owens *et al.*, in a systematic review, reported that provision of antibiotic prophylaxis for caesarean section before skin incision compared with after umbilical cord clamping is associated with a 40% decrease in postpartum endometritis and a 30% decrease in wound infection [29]. Provision of a single dose of antibiotics preoperatively has been found to be as effective as multiple doses, in prevention of postpartum infection [30]. Single dose ceftriaxone was as effective as a combination of ampiclox, gentamicin, and metronidazole in preventing post-elective caesarean section complications [31, 32].

Prophylactic antibiotics for caesarean section can be expected to result in a major reduction in post-operative infectious morbidity. The question that remains, therefore, is not whether to use an agent for prophylaxis but rather, which regimen to use. Currently the caesarean section rate is about 26 % in the centre which is on the high side and no defined antibiotic protocol exist in the centre, however commonly used antibiotic include amoxicillin/clavulanic acid, metronidazole, ceftiaxone, gentamycin and cefuroxime based on physician choice. Endomyometritis is a common puerperal complication as well as post-operative surgical site infection and presumed neonatal sepsis. No similar study has been done in our environment and there is the urgent need to have antibiotic protocol based on randomized controlled study.

This study was done to compare the efficacy of 3 doses intravenous amoxicillin/clavulanic acid 1.2g plus metronidazole 500 mg given 8 hourly interval with the first dose given 30 to 60 minutes before skin incision and 3 doses of intravenous amoxicillin/clavulanic acid 1.2g plus metronidazole (500 mg) given 8 hourly interval with the first dose given after umbilical cord clamping.

2. AIM AND OBJECTIVES

The general aim of this study is to compare the efficacy of pre-incision versus post-umbilical cord clamping antibiotic prophylaxis in the prevention of post caesarean section infection.

3. OBJECTIVES

1. To determine post-caesarean section infection rate in women following the administration of antibiotic pre-incision.
2. To determine post-caesarean section infection rate in women following the administration of antibiotic post-cord clamping.
3. To compare 1 and 2 above
4. To determine foetal outcome in both groups.

3.1. Hypothesis

Working Hypothesis

There is no difference between Pre-incision broad-spectrum antibiotics and post-umbilical cord clamping antibiotic prophylaxis in preventing post-Caesarean section delivery surgical site infection infections and neonatal infectious morbidity.

Alternate Hypothesis

There is significant difference between Pre-incision broad-spectrum antibiotics and post-umbilical cord clamping antibiotic prophylaxis in preventing post-Caesarean section delivery surgical site infections and neonatal infectious morbidity.

4. METHODS

4.1. Study Design/Area

This is was an interventional, single blinded, two-armed, randomized, single centre study that was conducted in the Department of Obstetrics and Gynaecology of the Irrua Specialist Teaching Hospital, Irrua, Edo State.

4.2. Sample Size Determination

The sample size of 136 was calculated using the structural formula based on the prevalence of surgical site infection of 9.3% and a confidence level of 95%. When considering 10% of participants drop out or are lost to follow-up, the required sample size was increased to 150; i.e. 75 participants per study group.

4.3. Study Population

Women undergoing emergency and elective caesarean section were recruited to participate in the study.

4.3.1. Eligibility/Enrolment

After the decision for caesarean section is made, eligible pregnant woman were selected for this study. The assessment for eligibility was based on inclusion and exclusion criteria given below.

4.3.2. Inclusion Criteria

The targeted study population were pregnant women who are admitted at the labour ward and planned for emergency and elective caesarean section and have consented for the study and are eligible for inclusion in the study.

4.3.3. Exclusion Criteria

All pregnant women with fever (temperature of 38°C and above), prolonged obstructed labour and premature rupture of membranes (rupture of membrane more than 12 hours) were excluded. Pregnant women presenting with features of chorioamnionitis (that is, foul smelling lochia, uterine tenderness associated with fever), allergic to the antibiotics used in the study or those who have used antibiotics in the 24 hours preceding the operation were also excluded.

4.3.4. Randomization

Intervention starts after allocating eligible candidates into two study arms: A and B. Study arm A were those who received pre-incision intravenous of amoxicillin/clavulanic acid 1.2G plus metronidazole 500 mg 30 to 60 minutes before operation and thereafter every 8 hours for subsequent two doses. Study arm B were those who received post umbilical cord clamping intravenous amoxicillin/clavulanic acid 1.2G plus metronidazole (500 mg) immediately after clamping of umbilical cord and every 8 hours for 24 hours.

Simple randomization was used to allocate study participants.

4.3.5. Primary Outcome Measures

Surgical site infection was our primary outcome - the assessment for any evidence of surgical site infection was done 72 hours after caesarean section, as well as on follow-up days (Day 7, Day 14, Day 30 and sixth week post-caesarean section).

The presence of fever (febrile morbidity), signs and symptoms of abdominal wound infection or endometritis indicated surgical site infection. Febrile morbidity was defined by temperature above 38°C at least 4 hours apart on two or more occasions, excluding the first 24 hours after delivery [33].

Abdominal wound infection was defined by partial or total dehiscence or presence of purulent or serous discharge from the wound with indurations, warmth and tenderness.

Endometritis defined by the presence of fever (38°C or above) in association with one or more of the following: uterine tenderness or foul smelling lochia [31, 33]. The bladder catheters were removed after 24 hours. Wound care followed the standard scheme in both groups, the occlusive dressing applied in the theatre and removed after 48 hours. The patients were discharged on Day 5 if there is no sign of infection or complication and stitches removed. Each patient were sent reminder text messages on their follow up date after discharge from the hospital and those who defaulted on follow up were called via their contact phone numbers. Patient with febrile morbidity were examined to localize the potential source of infection (tonsils, breasts, chest, abdomen and pelvis). Urinalysis (followed by urine culture and sensitivity testing were for patients with features suggestive of infection) full blood cell count, and blood and cervical swabs were sent for culture (MacConkey agar) and sensitivity testing. Blood films (thin and thick) were taken by finger pricks and Giemsa stain to confirm or to exclude malaria. Patient with puerperal infection were given therapeutic antibiotics. Then, the patients returned on Day 14 and Day 30 and six week post-caesarean section for reassessment.

Secondary maternal outcome: Endometritis and urinary tract infection post-caesarean between both arms of the study.

Neonatal outcome evaluated included frequency of neonatal sepsis workup and proven sepsis amongst the study arm.

4.3.7. Data Collection

All data were extracted from patients' antenatal case note, labour ward register and special care baby unit of the hospital and entered into proforma designed for this study. Data collected included the women's socio-demographic characteristics, Obstetric history (past and present), and labour history if any (stage of

labour, state of amniotic membrane-whether intact or ruptured) and others. Information on the HIV status of all women was collected. Patients' information was added during follow up.

4.3.8. Data Analysis

Data was entered in into SPSS version 16.0 (University of Chicago, Chicago, USA) for analysis. Baseline analysis involved comparing of the baseline characteristics between the two study arms. Hypothesis testing done to determine if there is significant difference in cumulative incidence rate of post-caesarean infection between women on the different study Arms. The absolute difference in the proportion of women who developed surgical site infection in the two study arms would be the effectiveness of one regimen over the other. Results were presented in cumulative incidence relative risk together with 95% confidence intervals and P-value. Sub-group analysis to determine the association between surgical Site Infection and other covariates, such as HIV status, duration of operation, and type of caesarean section. Covariates with P-value less than 0.05 considered significant.

4.3.9. Ethical Consideration

Approval for the study was obtained from the ethical committee of the Irrua specialist Teaching Hospital and based on the general ethical principles as applicable to human subjects. These are respect for persons, beneficence, non-malficience and justice.

5. RESULTS

During the study period one hundred and fifty consecutive women who consented and met the criteria scheduled for Caesarean Section in Irrua Specialist Teaching Hospital were enrolled into the study. Each study arm had 75 participants. The findings are presented in tables, bar charts and pie charts.

Table **1** shows the sociodemographic and obstetric characteristics of the patients. The age distribution of the participants shows that age group 30-34 years in group A 26(30.7%) and group B 23(30.7%) were the highest participants. Age group 40-44 years were the lowest participants with 2(2.7%) and 4(5.3%) in group A and group B respectively. Patients with Para 2 were more in the study with 30(40.00%) and 35(46.7%) in group A and group B, respectively.

Most of the patients in the study were booked with a higher contribution from group B 49(65.3%). Emergency Caesarean Section was done in 57(76.00%) of cases in group A and 53(65.3%) in group B, however group A, group B. Elective caesarean section contributed 18(24.00%) and 22(29.3%) for group A and group B, respectively.

Figure **1** shows the occurrence of post-operative fever in each study arm. Six (4.00%) had post-operative fever in group A and 10(6.67%) in group B. The overall prevalence of post-operative fever rate was 10.7%. There was no statistical difference between the groups (The Pearson chi-square of 0.290, the odd ratio is 0.565 and the relative risk for fever was 0.600 and for absence of fever was 1.062).

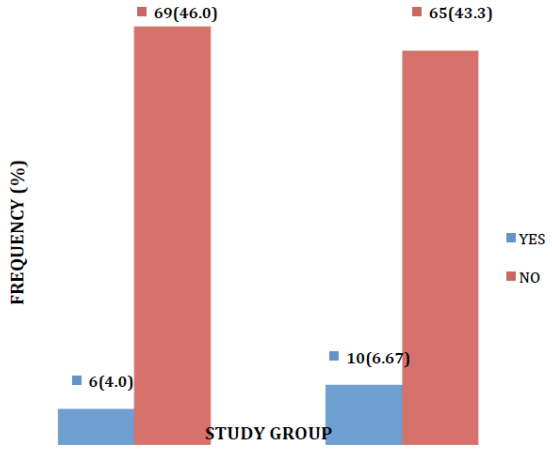

Figure 1: Bar chart showing post op fever in each study group.

Figure **2** shows the onset of fever in the study groups. Only 5(29.41%) had fever on the third day

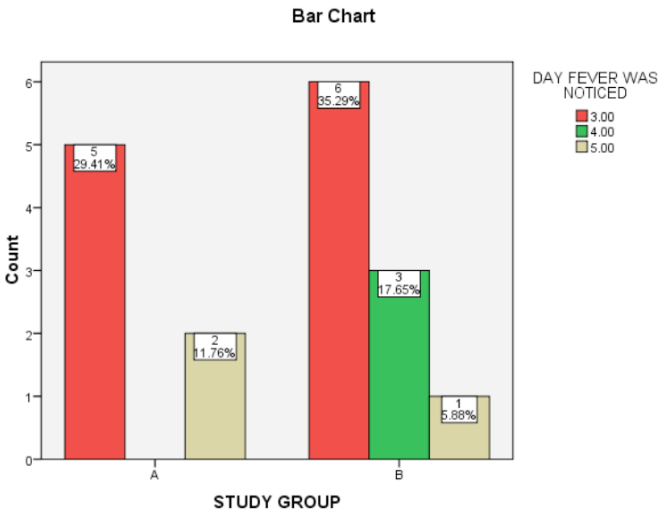

Figure 2: The onset of ever in the study groups.

Table 1: Shows the Sociodemographic and Obstetric Characteristics of the Patients

Variables	Group A (Pre-incision) (n=75) n (%)	Group B (post-umbilical cord) (n=75) n (%)	N=150(%)		P-Value
Maternal age (yrs)				Fisher's exact test	0.461
20-24	18(24.00%)	12(16.0%)	30(20.0%)		
25-29	21(28.0%)	22(29.3%)	43(28.7%)		
30-34	26(34.7%)	23(30.7%)	49(32.7%)		
35-39	8(10.7%)	14(18.7%)	22(14.7%)		
40-44	2(2.7%)	4(5.3%)	6(4.0%)		
Mean age ± SD	29 ± 5.228	30.4± 5.547	29.67 ± 5.336	t= 68.10 df=149	0.00
Parity				Fisher's exact test	0.385
1	17(22.7%)	9(12.0%)	26(17.3)		
2	30(40.0%)	35(46.7%)	65(43.3)		
3	21(28.0%)	24(32.0)	45(30.0)		
4	6(8.0%)	7(9.3%)	13(8.7)		
5	1(1.3)	0(0.0%)	1(0.7)		
Booking status					
Booked	41(54.7%)	49(65.3%)	90(60)	Fisher's exact test	0.243
Unbooked	34(45.3%)	28(34.7%)	60(40)		
Educational level					
illiterate	1(1.3%)	0(0%)	1(0.7)	Fisher's exact test	0.454
primary	4(5.3%)	4(5.3%)	8(5.3)		
secondary	62(82.7%)	57(76%)	119(79.3)		
tertiary	8(5.3%)	14(9.3%)	22(14.7)		
Occupation					
housewife	37(49.3%)	43(54.7%)	78(52.0)	Fisher's exact test	0.625
employed	38(50.7%)	34(45.3%)	72(48.0)		
Type of CS					
Emergency	57(76.0%)	53(70.7%)	35(23.3)	Fisher's exact test	0.247
Elective	18(24%)	22(29.3%)	115(76.7)		
Status of membrane					
Intact	21(28.0%)	24(32.0%)	105(70.0)	Fisher's exact test	0.722
not intact	54(72.0%)	51(68.0%)	45(30)		
Number of vaginal examination					
not done	5(6.3%)	9(12.0%)	14(9.3)	Fisher's exact test	0.581
<5	61(81.3%)	58(77.3%)	119(79.3)		
>5	9(12.0%)	8(10.7%)	17(11.3)		

post-operative period in group A while in group B 6(35.29%) had fever on the third post-operative period. No participant developed post-operative fever on the fourth day in group A whereas 3(17.65%) of participants in group B developed fever on the same day. Two (11.76%) participants in group A developed fever on the fifth day and this occurred in only one participant in group B. Generally fever occurred more on day 3 with 11(64.7%) cases with higher contribution from Group B (58.8% versus 41.2 %) but there was no statistical difference between groups (Pearson chi-square of 0.224 and p-value set at $p<0.05$).

Three (2.00%) and 7(4.67%) of the participants developed endometritis in group A and group B respectively (Pearson chi-square of 0.190 was not significant. The odd ratio is 0.405 and the relative risk for endometritis is 0.429 and no other complication is 1.05).

Figure **3** shows types of wound infection in each study group. Three (2.00%) and 5(3.33%) of group A and group B had superficial wound infection respectively. The overall wound infection prevalence rate was 5.33% (Pearson chi-square of 0.467 was not significant however the odd ratio was 1.714 and the relative risk for superficial infection is 0.600 and for no wound infection is 1.029).

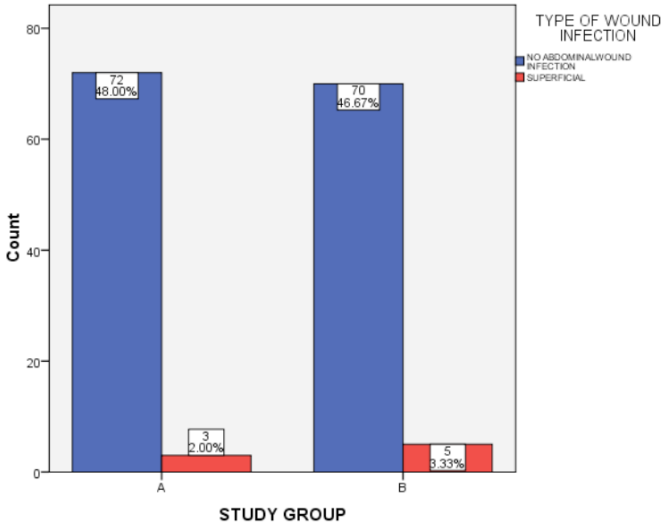

Figure 3: Shows bar chart of wound infection in each study group.

Table **2**, shows the cultured organism from superficial wound infection in each study group. Staphylococcus aureus was cultured in 2(66.7%) and 3(60.0%) in patient with superficial wound infection in group A and group B respectively. Staphylococcus aureus was found in 62.5% of the patient with superficial wound infection while in 37.5% no isolate was found. The isolates were sensitive to gentamycin and metronidazole. There was no statistical difference between the two groups. One (11.11%) in group A developed wound infection on the third day of operation while 4(44.44%) in group B developed wound infection within the same period. However, 2(22.22%) were noticed to have wound infection on the fifth day of operation in both groups. Wound infection occurred commonly on the third day in 55.6% of cases in group A while 44.4% of cases in group B developed wound infection on the fifth day.

Table 2: Showed Cultured Organisms in each Group

Culture organism	Group A (Pre-incision) (N=75) (%)	Group B (Post-umbilical cord) (N=75) (%)	Statistics	P-Value
Staphylococcus aureus	2(1.3)	3(2.0)	Fisher's exact test	1.000
No isolates	73(48.3)	72(48)		

Wound healing duration was observed between 5th - 10th day post caesarean section 52 (34.67%) in both group A and B the wound healed on the fifth day. 21 (14.00%) in group A wound healed well on the seventh day while 19(12.67%) wound healed by the seventh day.

Figure **4** Pie chart showing the frequency and percentages distribution of post-operative fever on account of malaria in each study arm. One (0.67%) in group A had post op malaria while 2(1.33%) in group B had post-operative malaria. The incidence of post-operative malaria infestation is 2.00% (The Pearson chi-square of 0.560 is not significant and the odd ratio is 0.565, the relative ratio for positive malaria parasite is 0.493 and that for negative malaria parasite is 1.014).

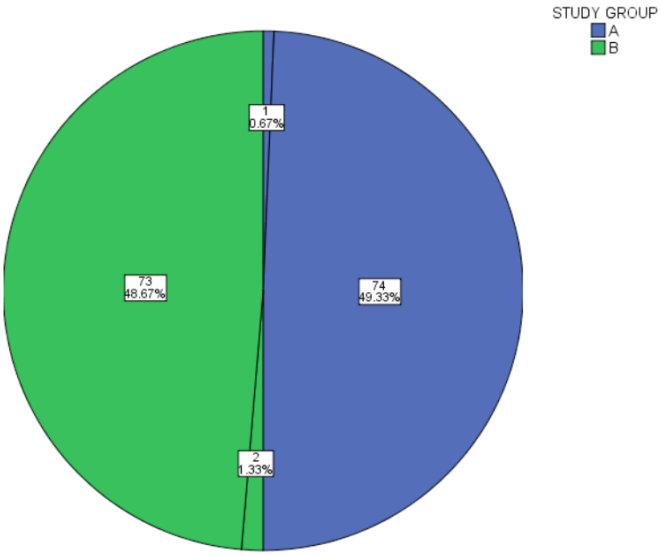

Figure 4: Pie chart showing the frequency and percentages of postpartum malaria in each study arm.

Cadre of professional that performed the Caesarean Section and the occurrence of postoperative fever were compared. Post op fever was noticed in 1(0.67%) consultant/consultant and registrar/registrar arm,

respectively. 2 (1.33%) post-operative fevers was observed in consultant/registrar arm. Highest post-operative fever was observed in 6(4.00%) senior registrar/senior registrar cadre of specialists and senior registrar/registrar arm respectively.

Table **3** shows that preoperative packed cell volume in group A 35(47.8%) had mild anaemia and 32(47.8%) had mild anaemia in group B. The mean and standard deviation preoperative packed cell volume was 33.2±3.42. 13(56.5%) in group A had moderate anaemia while 10(43.3%) in group B had moderate anaemia. No severe anaemia in the postpartum period. The mean post operative packed cell volume and standard deviation was 29.8±2.71. The mean blood loss is 501.1ml and standard deviation of 245.9.

Table **4** shows the reason for admission into special baby care unit in each study groups. Four neonates where admitted for observation during the study period.

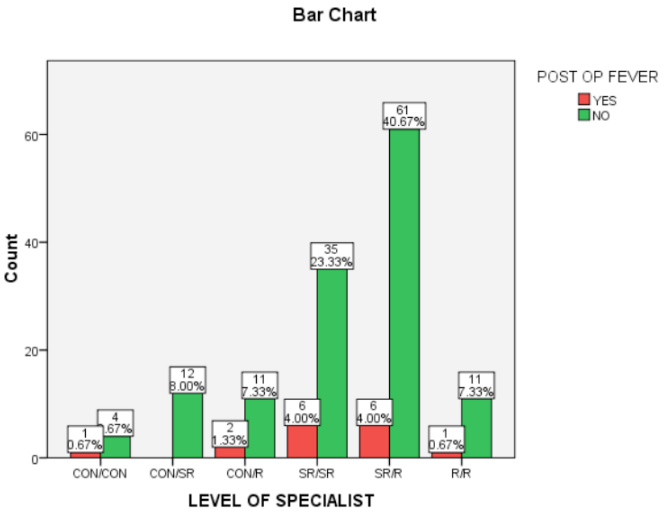

Figure 5: Bar chart comparing level of specialist and post operative fever.

HIV exposed baby 2(2.7%) in group A, foetal macrosomia1 (1.3%) in group A, and transient

Table 3: Shows the Perioperative Packed Cell Volume; Estimated Blood Loss and Duration of the Surgery

PCV, EBL and CS Duration	Group A (Pre-incision) (N=75) n (%)	Group B (Post-umbilical cord) (N=75) n (%)		P-Value
Preop pcv				
Normal	39(47.6)	43(52.4)	χ^2=12.329	0.623
Mild anaemia	35(47.8)	32(47.8)	df=3	
Moderate anaemia	1(100)	0(0)		
Severe anaemia	0(0)	0(0)		
Mean pre op pcv ±SD		33.2±3.42		
Post op pcv				
Normal	6(28.6)	15(71.4)	χ^2=4.588	0.106
Mild anaemia	56(52.8)	50(47.2)	df=3	
Moderate anaemia	13(56.5)	10(43.3)		
Severe anaemia	0(0)	0(0)		
Mean post op pcv±SD			29.8±2.71	
Blood loss (ml)				
<500	50(53.2)	44(46.8)		
500-1000	24(47.1)	27(52.9)		
>1000	1(20)	4(80)		
Mean ±SD (501.5±245.9)	423.3±251.6	483.3±298.14	t= 24.98, df= 149	0.000
Duration of Caesarean section (minutes)				
<30	3(30)	7(70)		
30-60	46(45.5)	55(54.5)		
60-90	24(66.7)	12(33.3)		
90-120	2(66.7)	1(33.3)		
Mean±SD (52.14±16.81)	55.4±17.9	47.8±16.38	t=37.98, df= 149	0.000

Table 4: Showing the Foetal Outcome in each Study Arm

Foetal outcome	Study Group			
	Group A (N=75)		Group B (N=75)	
	n	(%)	n	(%) Statistics P- Value
Reason for admission HIV	2	(2.7)	0	(0) fisher's exact test 0.370
Macrosomia	1	(1.3)	0	(0)
Nil	72	(96.0)	74	(98.7)
TPN	0	(0)	1	(1.3)
Gestational age Preterm	37	(49.3)	32	(42.7) fisher's exact test 0.512
Term	38	(50.7)	43	(57.3)
One minute apgar Normal	9	(12.0)	10	(13.3) $\chi 2$=6.826 0.035
Mild asphyxia	55	(73.3)	63	(84.0) df=2
Moderate asphyxia	11	(14.7)	2	(2.7)
Severe asphyxia	0	(0)	0	(0)
Five minute apgar Normal	71	(94.7)	73	(97.3) fisher's exact test 0.681
Mild asphyxia	4	(5.3)	2	(2.7)
Moderate asphyxia	0	(0)	0	(0)
Severe asphyxia	0	(0)	0	(0)

tachypnoea of the newborn 1(1.3%) in group B. No foetal death during the study period. 37(49.3%) of neonates in group A were delivered preterm and 32(42.7) in group B were delivered preterm while 38(50.7) in group A and 43(57.3) in group B are term babies.

6. DISCUSSION

This study was carried out to evaluate pre-incision versus post umbilical cord clamping antibiotic prophylaxis in the prevention of post caesarean section infections. Wound infection is a common surgical complication, often requiring a prolonged hospital stay and leading to increased costs. It represents the most common serious complication of caesarean section [8, 34].

The sociodemographic characteristics of the respondents as shown in Table **1** revealed that majority of the respondent were within age group of 30-34 years. However participants in the age group within 20-34 years represent 81.3% of cases which is similar to the finding of 80.4% by Ezechi *et al.* [9]. Most of the patients in the study were booked with highest number of participants in group B 49(65.3%) which is a similar finding to elsewhere [8,9]. Emergency caesarean section was the commonest type of surgery and accounting for 76% in group A and 70.7% in group B. Some of the participants were already in established labour before surgery and there was an absolute indication for emergency caesarean section. Elective caesarean section patients presented with less post-operative complications. In this study superficial wound infection rate was 6.7% in those that have emergency procedure and 4% in the elective cases with higher superficial wound infection in the post umbilical group. This similar to the findings of other researchers' elsewhere [35]. The booking status was an important contributor to obstetric outlook of the participants. 6.7% of superficial wound infection was in the unbooked category while 4% was in the booked respondents. Generally, patients undergoing emergency Caesarean section are at higher risk of infections. This is because of inadequate preparation time owing to maternal or foetal threat. Similar result was found by others authors [36]. While some investigators were able to demonstrate an association between maternal ages, anaemia, prolonged labour, previous caesarean section, multiple vaginal examination and unbooked status and post caesarean wound infection, this study like the report of Beatle [37] could not confirm the association. This finding is not surprising in that multiple vaginal examination with sterile gloves and aseptic technique is not likely to increase infection rate. This is the practice in our setting.

The overall incidence of febrile morbidity rate in the study was 10.7% as shown in Figure **1**. Preoperative antibiotic prophylaxis group has febrile morbidity of 4% and post umbilical cord clamping antibiotic prophylaxis of 6.67%; there is no significant statistical difference between the study groups. The incidence of post-operative febrile morbidity has been put at 6%-7% in some studies [38]. The incidence of post-operative febrile morbidity in this study may be influenced by a unique factor (malaria). Recently it has been reported that susceptibility to malaria may extend even to the postpartum period and this may be due to the extension of alteration in cellular immunity [39]. Fever may occur after any surgical procedure and Caesarean section may not necessarily be a marker of infection. In this study the overall prevalence of malaria is 2.00%; while there is no statistical difference between group A and B as shown in Figure **4**. Post caesareans section fever occurred on day 3 in 71.4% in the study group A and in 90% in post umbilical cord clamping group. This finding is similar to other studies [30].

The prevalence of post caesarean wound infection in this study is 5.33% as shown in Figure **3** is similar to the incidence of post caesarean section wound infection of 4.5% in a tertiary hospital in Saudi Arabia [39] but lower then 9.1%-10% reported in some studies in Nigeria [9, 13, 40], but much lower than 23.4% reported by Makinde [14] from Ile Ife Nigeria. It is also important to state that though the rate of 5.33% is within 0 to 20.5% reported by Moir-Bussy and colleagues in a hospital survey in London, however it is much higher than figures reported from most developed countries [20, 21]. The reported rate of wound infection after caesarean section ranges widely, largely because of different risk factors among diverse patient populations. In this study the prevalence of superficial wound infection in pre-incision group 2.00% and 3.33% in the post umbilical cord clamping group. Endometritis occurred in 2.00% in pre-incision group and 4.67% in post umbilical cord group in the study. There was no significant difference in the two groups. It is not surprising that antibiotics failed to eliminate post-caesarean morbidity completely irrespective of the study groups; these findings resemble other investigations which demonstrated that prophylactic antibiotics were effective in reducing (not eliminating) approximately 50% of post-caesarean section infections [42]. The overall infectious morbidity in the study for pre-incision group is 4.00% and 8.00% in post umbilical group which is similar to the finding of Sullivan *et al.* of 4.5% and 11.5% respectively [42] and other studies did not find a significant difference in total infectious morbidity [43, 44], one trial [42] found a significantly lower incidence when the antibiotic was administered before incision.

The most common post-caesarean infections are surgical site infections (endomyometritis and wound infection) and infection of the urinary tract. Pelvic abscess, septic pelvic phlebitis, pneumonia and sepsis, although rare, are also increased with caesarean delivery; however urinary tract infection and pneumonia were absent in the study. Antibiotic prophylaxis has been found to be the most significant protective factor in reducing both the rate of post-caesarean section wound infection and costs [45-47]. The commonest causative organism of post-caesarean section wound infection in this study was S. aureus. S. Aureus isolated in 62.5% of the wound infection and no isolate in 37.5% in the study. *S. aureus* was isolated in 31.8% of the cultures in a retrospective study in Aminu Kano Teaching Hospital, Nigeria [48]. This bacteria has been shown to be the predominant agent in post-caesarean wound infection and most post surgical infections are due to patient's own organism [45]; although others [46] reported more infection with gram negative enteric bacilli. The choice of antibiotics was guided by the knowledge of organisms causing infections within the institution and their susceptibility pattern. In our hospital, the choice of antimicrobial for prophylaxis was appropriate for the expected pathogens and their antimicrobial susceptibility. Staphylococcus aureus, sensitive to gentamicin, and the patient responded satisfactorily to treatment. The variation in the spectrum of causative organism's means that prophylactic antibiotic though effective may fail when the wrong agent is used or used inappropriately [46, 47].

The mean and standard deviation of pre-operative packed cell volume in the study is 33±3.42 there is no statistical difference between the two study groups. The mean and standard deviation post-operative packed cell volume is 29±2.71. Although that intra - operative bleeding may predispose to infectious morbidity as shown by other workers [40, 41] this was not so in this study. Blood loss in the study was not a significant contributor to the infectious morbidity in the study. The mean and standard deviation of blood loss is observed to be 501.5±245.9.

The reasons for admission into special care baby unit included foetal macrosomia, HIV exposed baby,

transient tachypnoea of new born. Four neonates admitted revealed that only one neonate with transient tachypnoea was observed in the post umbilical group. No neonatal death during this study. No significant difference between the study groups in this study in terms of neonatal outcome as shown in table 4 which is similar to the finding in most studies [42-44]. ACOG [28] guidelines currently recommend preoperatively administered antimicrobial prophylaxis for all caesareans and no deleterious effects on mother or new-born as re-affirmed in this study.

7. CONCLUSION This study randomized one hundred and fifty women into two arms of seventy five into either pre incision or post umbilical cord clamping antibiotic prophylaxis for prevention of post caesarean section wound infection. One of the important finding in this work was that the overall caesarean section wound infection was 5.33% with 2.00% in the pre incision group which when compared with the post umbilical cord clamping arm of 3.33% validates the null hypothesis. Post-operative fever was commoner in the post umblical clamping group i.e. group B than pre incision group i.e. group A. Pre-incision antibiotics prophylaxis is not more effective in the prevention of endometritis than with post umbilical cord clamping antibiotics prophylaxis (2.00% versus 4.67% but there was no statistical difference).

The mean preoperative packed cell and post-operative packed cell volume were 33.2% and 29.8% respectively in the study. The mean blood loss was 501ml and no severe anaemia was recorded postoperatively in the study. There was no neonatal death and there was no discrimination in neonatal outcome between the study arms. The findings of this study re-affirm ACOG guidelines for use of preoperative antimicrobial prophylaxis use in caesarean section with no untoward effects to either mother or new-born.

7. RECOMMENDATION

Based on the findings of the study it is recommended that:

1. Every labour ward unit is encouraged to have guidelines for antibiotic prophylaxis for caesarean section.

2. Short course of antibiotic should be encouraged for caesarean section as the antibiotics is just for prophylaxis and not therapeutic. This will help save cost and prevent the development of antimicrobial resistance.

3. There should be regular review of medical records of patient with post caesarean section infections in each labour ward unit to portray any trend in the microbiological microscopy culture and sensitivity pattern in the unit.

4. It is strongly recommended that data on post-discharge surveillance should always be collected to estimate the true rates of post-caesarean section wound infection delivery units in every.

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