RISK FACTORS AND MICROBIOLOGICAL PATTERN OF POST CAESAREAN WOUND INFECTION IN FEDERAL MEDICAL CENTRE OWERRI

Onwube OC, Nzeribe EA, Onyegbule E, Osuagwu EC, Okoye CC, Iyiegbu C, Njemanze C.

Department of Obstetric and Gynaecology, Federal Medical Centre, Owerri, Imo State

ABSTRACT

Background: *Delivery by caesarean section has been reported as the single most important risk factor for maternal infection. Post caesarean wound infection continues to be a source of maternal morbidity and mortality in developing countries despite the recent advances in aseptic techniques. Wound infection is not only a leading cause of prolonged hospital stay, but also a major cause of widespread aversion to caesarean delivery in developing countries. In order to control and prevent post caesarean wound infection in our environment, there was a need to evaluate the relative contribution of each aetiological factor and the microbiological pattern as these will help to ensure better management of the patient.*

Objectives: The study determined the incidence of and predisposing factors to wound infection in elective versus emergency caesarean sections, and the associated micro-organisms.

Design: This was a prospective comparative cohort study

Setting: The study was carried out at the ward 4 obsterics, ward 4 extension and Microbiology department of the Federal Medical Centre, Owerri between February and April 2015.

Methodology: A total of 276 patients who underwent caesarean sections (138 elective and 138 emergency) and who met the inclusion criteria were recruited longitudinally for the study. Swabs taken from infected wounds were subjected to gram staining and culture and results were analysed using the computer Software Package for Social Sciences (SPSS) version 20.

Results: The outcome of the study showed that the incidence of post caesarean section wound infection in elective and emergency caesarean section was 9.4% and 17.4% respectively, giving an overall incidence of 13.4%. Additionally, only 3 risk factors out of the seventeen (17) risk factors studied were found to be independent variables for post caesarean wound infection.

Conclusion: The study showed conclusively that prolonged rupture of membranes, post-operative anaemia and a midline sub-umbilical incision were independent risk factors contributing directly to a higher incidence of post-caesarean wound infection with Staphylococcus aureus being the single most common organism implicated.

Keywords: Federal Medical Centre Owerri, Risk factors, microbiological pattern, Caesarean section, wound infection

Corresponding Author: DR. OLIVER C. O.; ***MBBS, FWACS***
Consultant Obstetrician and Gynaecologist
Calif Specialist Hospital Osisokpo Aba,
Abia State, Nigeria
E-mail: livermeks@yahoo.com

INTRODUCTION

Post operative wound infections remains a significant cause of maternal morbidity and mortality[1] Maternal mortality after caesarean section has been estimated to be between 5.8 to 6.1/100,000 procedures[2]. About 20-50% of these death results from the anaesthetic complications of the caesarean section and the remaining being the result of the complications of the etiology for the procedure[3]. In general, obstetric infections account for more than 12% cause of maternal death. Caesarean section has similar complications to other cases involving laparotomy except for endomyometritis[4]. Those complications include wound infection, thromboembolism, and damage to contiguous structures (Bladder 0.3%, Ureters 0.1%, and Bowel 0.1%)[3]

The rate of post caesarean wound infection

varies across localities and countries. An incidence of 2-7% was reported in United States[5,] 2-15% in United Kingdom[3] and 4.2% in Saudi Arabia[6]. Morhason-Bello et al reported an incidence of 16.2% at the University College Hospital Ibadan[7] while Jido et al reported an incidence of 9.1% at the Aminu Kano University Teaching Hospital, Kano[8]. Earlier studies conducted by Fasubaa and colleagues in South West of Nigeria showed that post caesarean wound infection was not only the leading cause of prolonged hospital stay but also a major cause of widespread aversion to caesarean section in the region[9]. In addition, obstetric infections result in increased health costs related to prolonged hospital stay, re-admission and the use of oral and parenteral antibiotics[10]. Recovery from caesarean section is more difficult for women who develop post-operative wound infection[11]. Maternal morbidity related to infection after caesarean section was found to be higher than that of vaginal delivery[12].

Developing infection at the surgical site depends on the interaction between different risk factors which include patient's characteristics like age, parity, maternal weight and gestational age, pre-operative conditions, intra-operative circumstances and post-operative wound management. Some medical conditions which are associated with increased risk of wound infection include diabetes mellitus, sickle cell anaemia, obesity and anaemia.[13,14] Other risk factors include patients on prolonged corticosteroid therapy, low socioeconomic status, immunosuppresion and abdominal wall haematoma[13]. The preoperative conditions which could predispose to post caesarean wound infection include prolonged rupture of membranes, multiple vaginal examinations during labour, amnionitis, previous meconium passage and internal foetal monitoring during labour. The intra-operative risk factors include inappropriate operating room environment (air, ventilation, sterilization of the surgical instruments), inadequate scrub, caps, shoe covers, masks, gloves and gowns, risky practices of Anaesthesiologists like invasive procedure and breaks in aseptic techniques[15]. Others include hazardous surgical techniques such as extensive dissection with devascularization of tissues, rigorous handling of tissues and inappropriate use of suture material[16]. The duration of surgery especially when more than one hour has been proposed as a risk factor for surgical site infection[16]. Post-operative care of the incision site before and after discharge from the hospital may also contribute to post caesarean wound infection[16].

In view of the fact that post operative wound infection has several risk factors each with its own unique time of onset and different causative bacteria, it becomes pertinent that the obstetrician should have the knowledge of these risk factors and their resultant bacterial pattern as these would help to facilitate decision making when antibiotics are empirically selected to treat such patients[17]. The diagnosis and treatment of infected wound should be based on basic principles of the aetiopathology of the infecting organisms. The infection could be caused by the patient's normal flora[18]. Many gram negative bacteria produce endotoxin, this stimulates cytokine production. Cytokine can trigger systemic inflammatory response syndrome that sometimes lead to organ failure.

Staphylococcus aureus has been found to be the commonest cause of wound infection.[19] Other pathogens include Group A, B, C Streptococcus, Bacteroides[20]. Other frequently isolated pathogens include Enterococus species and Escherichia coli.

Besides, proper patient's evaluation is very important and culture of the wound swab is necessary in establishing diagnosis. Important methods to reduce post caesarean wound infection include proper pre-operative skin preparation and maintenance of aseptic techniques during surgery, judicious use of peri-operative antibiotics, ensuring haemostasis around the wound edges and control of diabetes mellitus and other medical conditions. Some factors are not easy to

control before surgery, e.g. obesity. Some mechanical strategies for prevention of infections include closed suction drainage and closure of the subcutaneous tissue; however, these have varying degrees of success[21]. Prevention of wound infection using the above methods will reduce morbidities like incisional hernia, thrombophlebitis, and pelvic abscess and their attendant complications. Other problems like psychologic stress and economic problems suffered by the patient are also prevented[22].

AIMS AND OBJECTIVES

To determine the incidence of wound infection and identify the pre-disposing factors and micro-organisms responsible for wound infections in women undergoing caesarean section at the Federal Medical Centre, Owerri, Imo State.

The specific objectives were:

- To compare the incidence of wound infections in elective versus emergency caesarean sections.
- To determine the factors predisposing to wound infection in emergency versus elective caesarean section
- To determine the micro-organisms associated with post-caesarean wound infection at Federal Medical Centre, Owerri.

SUBJECTS AND METHODS

STUDY DESIGN: This was a prospective comparative cohort study which aims at identifying the risk factors and micro-organisms responsible for wound infection in patients that had emergency or elective caesarian section during the study period at FMC Owerri.

STUDY SETTING: The study was carried out in ward 4 obstetrics, ward 4 extension and microbiology department of Federal Medical Centre Owerri. Owerri is a cosmopolitan city and the capital of Imo state, Southeastern Nigeria Federal Medical Centre Owerri (FMCO) is a tertiary referral hospital that is conveniently located near the major business areas of Southeastern Nigeria. It serves as a referral centre serving Imo, Anambra and Abia states, Nigeria.

STUDY DURATION: The eligible patients were recruited between 6th February 2015 and 31st May 2015.

STUDY POPULATION: The subjects of the study were recruited from pregnant women who had emergency caesarean section and an equal number of pregnant women who had elective caesarean section.

Inclusion criteria

- All pregnant women in labour scheduled for emergency caesarean section or pregnant women for elective caesarean section without the exclusion criteria below.
- Pregnant women who consented to the study.

Exclusion criteria

The following pregnant women were excluded:

a) Women who refused to give consent for the study.

b) Women who did not receive our routine antibiotics according to the protocol.

SURGICAL PROCEDURE: Immediately before the antiseptic preparation of the surgical site, the abdominal skins were shaved. Caesarean section was performed by senior obstetric residents or the consultant when necessary. A Pfannenstiel incision was used on the patients except for those with previous midline incisions in who repeat caesarean sections were indicated. The same scalpel was used for skin and subcutaneous tissue incision.

Transverse lower segment caesarean sections were performed according to standard approach. The placenta was delivered by controlled cord traction, however manual removal was done when controlled cord

traction is not possible. The uterus was closed in two layers using polyglactin (Vicryl) suture size two, followed by polyglactin suture size 2-0 for peritoneal layers. The rectus sheet was closed continuously using Nylon suture size 2 and plain catgut suture size 2-0 was used for closure of the subcutaneous layer. Pfannenstiel skin incisions were closed with subcuticular stitches using vicryl 2-0 or interrupted stitches using Nylon 2-0, and the latter also for vertical skin incisions. All the patients received post operative antibiotics according to the departmental protocol viz; intravenous Metronidazole 500mg 8hourly and intravenous Ceftriaxone 1gram daily all for 48 hours. This was followed by tablets Metronidazole 400mg 8hourly and tablets Cefuroxime 500mg 12 hourly for five days.

Wounds were examined on the 3rd post-operative day and 5th post-operative day for pfannenstiel incisions and on the 7th post-operative day for midline sub-umbilical incisions for any evidence of infection. Wound infection was diagnosed when a wound discharged purulent material or serosanguinous fluid, presence of induration, erythema, warmth and tenderness in the presence or absence of fever. Those with features of infection had wound swab taken. Inoculation of the culture plate was done on the patient's bedside immediately after collection. The wound swab specimen was coded and numbered consecutively by the researcher in such a way that the designated laboratory scientist (microbiologist) analyzing the specimen did not know at any time which of the specimen was from a patient that will have emergency or elective caesarean section. The test result was kept sealed and the codes broken by the researcher only after the samples have been analyzed by the laboratory scientist. The wound was dressed thereafter with Eusol once or twice daily till discharge depending on the degree of infection.

ANALYSIS OF DATA: At the end of the laboratory work, the data was processed and analyzed using the computer Software Package for Social Science (SPSS) version 20. (IBM SPSS statistics 20) Pearson's Chi square test was used to compare the susceptibility of patients that had emergency or elective caesarean sections to wound infections. Multiple logistic-regression was used to identify factors that are independently associated with an increased risk of post caesarean wound infection. P-value <0.05 at 95% confidence interval was considered statistically significant.

DISCUSSION

Caesarean sections continue to be a component part of achieving safe delivery of the fetus. It is however notoriously fraught with a lot of dangers. One of these is post operative wound infection. This study has critically taken a look at the incidence of this menace, the risk factors predisposing to post caesarean section wound infection and the microbiological pattern. A total of 276 cases were studied with 138 elective and 138 emergency cases.

The overall incidence of post caesarean wound infection was 13.4%. An incidence of 9.4% was found in the elective group and 17.4% in the emergency group. This result agrees with the findings of Hassan S et al[24]

TABLES AND RESULTS

TABLE 1: INCIDENCE OF POST CAESAREAN WOUND INFECTION IN THE SUBJECTS

		Type of Caesarean Section		Total
		Elective	Emergency	
Gram stain	No growth	125	114	239
	gram positive	9	13	22
	gram negative	4	11	15
Total		138	138	276

Incidence in elective cases = (No. of cases of wound infection in elective cases/total no. of elective cases) x 100 = (13/138)x 100 = 9.4%

Incidence in emergency cases= (No. of wound infection in emergency cases/ total no. of emergency cases) x 100 = (24/138) x 100 = 17.4%

Therefore, overall incidence = (9.4%+17.4%)/ 2
26.8%/2 = 13.4%

TABLE 1B: SOCIODEMOGRAPHIC CHARACTERISTICS OF SUBJECTS

	Elective C/S (%)	Emergency C/S (%)	Totals (%)	P- value
AGE(years)				0.001
< 30	56 ((39.4)	86 (60.6)	142 (100.0)	
=30	82 (61.2)	52 (38.8)	134 (100.0)	
Parity				0.011
Primipara	38(40.0)	57(60.0)	95(100.0)	
Multipara	91(53.5)	79(46.5)	170(100.0)	
Grandmultipara	9(81.8)	2(18.2)	11(100.0)	
Social Class				0.721
Upper	78(48,8)	82(51.2)	160(100.0)	
Middle	48(53.3)	42(46.7)	90(100.0)	
Lower	12(46.2)	14(53.8)	26(100.0)	
Educational Status				0.232
Primary	3(49.2)	4(57.1)	7(100.0)	
Secondary	48(44.0)	61(56.0)	109(100.0)	
Tertiary	87(54.4)	73(45.6)	160(100.0)	
Religion				0.500
Islam	1(33.3)	2(66.7)	3(100.0)	
Christianity:	137(50.2)	136(49.8)	276(100.0)	

TABLE 2A: ASSOCIATION OF SOCIODEMOGRAPHIC CHARACTERISTICS WITH RISK FACTORS FOR POST CAESAREAN WOUND INFECTIONC IN FMC OWERRI.

	NO INFECTION	GRAM POSITIVE INFECTION	GRAM NEGATIVE INFECTION	Totals	P-value
AGE(years)					0.023
<30	107(89.2)	4(3.3)	9(7.5)	120(100.0)	
=30	132(84.6)	18(11.5)	6(3.8)	156(100.0)	
Total:	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Parity					0.351
Primipara	81(86.2)	8(8.5)	5(5.3)	94(100.0)	
multipara	149(87.1)	14(8.2)	8(4.7)	171(100.0)	
Grandmultipar	9(81.8)	0(0.0)	2(18.2)	11(100.0)	
a	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Total					
Social class					0.385
High	139(86.9)	10(6.2)	11(6.9)	160(100.0)	
Middle	79(87.8)	9(10.0)	2(2.2)	90(100.0)	
Low	21(80.8)	3(11.5)	2(7.7)	26(100.0)	
Total	239(86.6)	22((8.0)	15(5.4)	276(100.0)	
Booking					0.000
status	194(89.4)	8(3.7)	15(6.9)	217(100.0)	
Booked	45(76.3)	14(23.7)	0(0.0)	59(100.0)	
Unbooked:	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Total:					
Previous					0.045
Caesarean					
Section	91 (85.0)	6(5.6)	10(9.3)	107(100.0)	
YES	148(87.6)	16(9.5)	5(3.0)	169(100.0)	
NO	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Total:					

P-VALUE=LESS THAN 0.05 AT 95% CONFIDENCE INTERVAL

TABLE 2B: ASSOCIATION OF PREOPERATIVE FACTIONS WITH POST CAESAREAN WOUND INFECTION IN FMC, OWERRI

	NO INFECTION	GRAM POSITIVE INFECTION	GRAM NEGATIVE INFECTION	TOTALS	P VALUE
Duration of Membrane Rupture (hours)					0.00
<24	235(89.7)	16(6.1)	11(4.2)	11(4.2)	
=24	4(28.6)	6(42.9)	4(28.6)	4(28.6)	
Total	239(86.6)	22(8.0)	15(5.4)	15(5.4)	
Duration of Labour					0.004
<12	176(90.8)	9(4.6)	9(4.6)	194(100.0)	
=12	63(76.8)	13(15.9)	6(7.3)	82(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Number of Vaginal Examinations					0.017
<6	43(91.5)	0(0.0)	4(8.5)	47(100.0)	
=6	74(76.3)	15(15.5)	8(8.2)	97(100.0)	
Total	117(81.2)	15(10.2)	12(8.3)	144(100.0)	
Pre-operative packed cell volume (%)					0.002
<30	56(83.6)	11(16.4)	0(0.0)	67(100.0)	
=30	183(87.6)	11(5.3)	15(7.2)	209(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Gestational Age at Delivery (weeks)					0.063
<37	50(96.2)	2(3.8)	0(0.0)	52(100.0)	
=37	189(84.4)	20(8.9)	15(6.7)	224(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	

P-value = < 0.05 with 95% confidence interval

TABLE 2C: ASSOCIATION BETWEEN INTRA AND POST-OPERATIVE FACTORS WITH POST CAESAREAN WOUND INFECTION IN FMC, OWERRI

	NO INFECTION	GRAM POSITIVE INFECTION	GRAM NEGATIVE INFECTION	TOTALS	P VALUE
Type of Caesarean Section					0.105
Elective	125(90.6)	9(6.5)	4(2.9)	107(100.0)	
Emergency	114(82.6)	13(9.4)	11(8.0)	167(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Duration of surgery (minutes)					0.036
=60:	74(94,8)	2(2.6)	2(2.6)	78(100.0)	
>60:	165 (83.3)	20(10.1)	13(6.6)	198(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Rank of the Surgery					0.562
Resident	175(86.2)	18(8.9)	10(4.9)	203(100.0)	
Consultant	64(87.7)	4(5.5)	5(6.8)	73(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Intra-operative Blood loss (Mls)					0.000
<1000	132(80.0)	20(12.1)	13(7.9)	270(100.0)	
=1000	107(96.4)	2(1.8)	2(1.8)	6(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Post-operative pack cell volume(Mls)					0.000
<30	132(80.0)	20(12.1)	13(7.9)	165(100.0)	
=30	107(96.4)	2(1.8)	2(1.8)	111(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Abdominal incision type					0.004
Pfannenstiel	186(89.4)	16(7.7)	6(2.9)	208(100.0)	
Midline sub-umbilical	53(77.9)	6(8.8)	9(13.3)	68(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	
Body Mass Index(Kg/m^2)					0.671
<30	112(86.2)	12(9.2)	6(4.6)	130(100.0)	
=30	127(87.0)	10(6.8)	9(6.2)	146(100.0)	
Total	239(86.6)	22(8.0)	15(5.4)	276(100.0)	

P-value = < 0.05 with 95% confidence interval

TABLE 3: MULTIPLE LOGISTIC REGRESSION ANALYSIS OF RISK FACTORS FOR POST CAESAREAN SECTION WOUND INFECTION IN FMC OWERRI.

VARIABLES	Wound Infection		P-value	OR(CI)
	NO	YES		
AGE(years)				
<30	107	13	0.550	3.99(0.97 – 16.37)
=30	132	24		
Booking status				
Booked	194	23	0.605	1.45(0.36 – 5.85)
unbooked	45	14		
Duration of membrane rupture(hours)	235	27	0.001	31.92 (4.10 – 248.47)
<24	4	10		
=24				
Duration of labour (hours)				
<12	176	18	0.491	1.70(0.38 – 7.64)
=12	63	19		
Number of vaginal examinations				
<6	43	4	0.121	4.82(0.66 – 35.32)
=6	74	23		
Preop pcv (%)				
<30	56	11	0.760	1.25(O.29 – 5.37)
=30	183	26		
Duration of surgery (minutes)				
=60	74	4	0.540	1.62(0.35 – 7.50)
>60	165	33		
Intra-operative blood loss(mls)				
<1000	239	33	0.677	2.12(O.O6 – 72.84)
=1000	0	4		
Postop pcv(%)				
<30	132	33	0.002	0.04(0.004- 0.31)
=30	107	4		
Abdominal incision type				
Pfannenstiel	186	22	0.016	5.75(1.38 – 23.94)
Midline subumbilical incision	53	15		
Previous caesarean sections				
YES	91	16	0.546	0.19(0.03 – 1.12)
NO	148	21		

CODE: OR = Odds ratio
CI = Confidence interval

TABLE 4: MICROBIOLOGICAL PATTERN OF POST CAESAREAN WOUND IN FEDERAL MEDICAL CENTRE OWERRI

Wound culture

Organism isolated	Frequency	Percent	Valid Percent	Cumulative Percent
staphylococcus	22	59.46	59.46	59.46
coliforms	7	18.92	18.92	78.38
Streptococcus faecalis	6	16.23	16.23	94.
pseudomonas	2	5.39	5.39	100.0
Total	37	100.0	100.0	

that found an incidence of 4.34% and 16.5% in elective and emergency cases respectively. However, Raees M et al[26] in 2012 in Pakistan reported a lower incidence of 4% and 8% for elective and emergency cases respectively. Al Nuam et al[27] in Riyahd, Saudi Arabia reported an incidence of 6.2% and 6.5% for elective and emergency cases respectively. In Nigeria, Ezechi et al[28] and Fasuba et al[9] reported similar incidences of 9.3% and 10% respectively. This result was not statistically significant (P-value= 0.105, see table 2). Therefore, this study has found that there is no statistical difference in post caesarean wound

infection between elective and emergency caesarean sections. The study by Al Nuam et al[27] above agrees with this. The **null hypothesis** is therefore **accepted.**

Table 1 displays the sociodemographic characteristics of the subjects. They are categorized into elective and emergency casaerean sections. The table shows that women aged less than 30years were twice more likely to have an emergency caesarean section than those who were 30 or more(86% as against 38.8%) while 82% of those 30 years or more were more likely to have an elective casarean section. This is because the younger women are more likely to be primiparous or of lower socioeconomic status and the pregnancies may less likely been planned or booked. Primiparity is associated with obstructed labour, pre-eclampsia, cephalopelvic disproportion, prolonged labour and prolonged pregnancy

Table 1 also shows that an overwhelming majority of patients who had caesarean section during the study were multiparous women. They were 170 in number accounting for 61.65 of the study population. Social which is closely related to educational status of the subjects did not show any significant difference in terms of either having elective or emergency caesarean sections. Women in the upper social class who had tertiary education constituted the highest number in both groups (160 in both groups). This goes to show that majority of the antenatal care population in FMC Owerri are well informed therefore readily accept caesarean section when counseled. The predominant religion in the study population is Christianity. Christians accounted for 273 out of the 276 sampled representing 98.9% of the study population. This is not surprising since the study was carried out in Southeastern Nigeria which is predominantly Christian.

Table 2A, 2B and 2C show the risk factors understudied. A total of 17 possible risk factors were statistically analyzed for significance using the IBM SPSS statistics 20 software. Out of these, only 11 variables were found to be statistically significant using a P-value of < 0.05 as the level of significance in the Chi square analytical platform. These include age, booking status, number of vaginal examinations, duration of membrane rupture, duration of labour, duration of surgery, preoperative packed cell volume, intraoperative blood loss, postoperative packed cell volume, abdominal incision type and previous caesarean section. In table 4, these 11 variables were further subjected to multiple logistic regression analysis. Still using a p-value of 0.05 as the level of significance, only 3 variables were found to be significant. Therefore, these three are the independent variables. They are duration of membrane rupture, postoperative packed cell volume and abdominal incision type.

Older age affects wound healing by causing a delay in wound healing and not by impairment of the quality of the wound healing process. About 13(10.8%) of women below the age of 30 had wound infection while 24(15.3%) women 30 years or more had post operative wound infection. Despite the apparent association, this was not statistically significant following multiple regression analysis (p-value= 0.55, CI=0.973-16.37). It therefore implies that other confounders must have caused the higher rate of wound infection in older women.

Booking for antenatal care on time especially in a tertiary centre like FMC Owerri is a good indicator of the quality of care a woman receives. Out of the 276 women involved in the study 217 were booked while 59 were unbooked. Booked patients had 23 (10.6%) while the unbooked had 14(23.7%) cases of post caesarean wound infection. However, subjecting this finding to multiple logistic regression showed that booking status was not statistically significant (P-value= 0.605, CI= 0.36 – 5.85).

The role of prolonged rupture of membranes as a predisposing factor to developing wound infection reported by Ezechi et al[29] was confirmed in this study (P-value=0.001). Women with rupture of membrane less than 24 hours had 68.1% lower odds of developing

post caesarean wound (OR 31.92: CI 4.10-248.47). Usually in pregnancy, cervical mucus plug, fetal membranes, and amniotic fluid serve as barriers to infection, however, when fetal membranes are ruptured, the 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 sequelae.

Prolonged labour has been noted in several studies to be responsible for post caesarean wound infection. However, prolonged labour was not found to be an independent risk factor for wound infection in this study (P-value= 0.491). Out of the 194 Women with labour duration less than 12 hours, only 18(9.2%) had post caesarean wound infection while out of the 82 who had labour for 12 hours or more, 19(23.2%) had infected wounds. This could be attributed to the fact that most patients that had prolonged labour were unbooked and were of lower socioeconomic class. These women were likely to labour in a dirty environment and were usually referred to FMC Owerri as a potential septic case.

Low socio-economic status had been found to be associated with increased risk of post caesarean wound infection. This finding was not validated in this study. Low socioeconomic status was noted in 26 subjects with 19.2% having wound infection while out of the 160 subjects in the high socioeconomic status 13.1% had wound infection. However, when these results were subjected to Pearson Chi Square test it was found to be statistically insignificant.

Multiple vaginal examinations was found to be associated with post caesarean wound infection but following multiple regression analysis, it did not show any statistically significant contribution to wound infection (P value =0.121) as seen in table 3. This was similar to the finding by Ezechi et al[28] who was of the view that multiple vaginal examinations with sterile gloves were not likely to increase infection rate. Though no significant risk was associated with multiple vaginal examinations, it does not obviate the need for restricting vaginal examination to the minimum necessary and the use of antiseptic technique for its performance.

Post operative anaemia was noted to have a significant association in the emergency caesarean section group with post caesarean wound infection (P- value =0.000, see table 2). It also retained its statistical significance after adjustment was made for confounding factors (OR 0.04: CI 0.004- 0.313), P value 0.002 see table 3). This finding was similar to findings from other studies. 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 uterus. It also causes tissue enzyme and cellular dysfunction. Reduced oxygen delivery can also result in impaired wound healing. Closely affecting the post operative packed cell volume are the preoperative packed cell volume and the intra operative blood loss. These two variables were found to be statistically associated (See table 2). However, following multiple logistic regression, they were eliminated (P-values= 0.760 and 0.677 respectively, see table 3). This can be explained by noting that patients are adequately optimized if the pre operative packed cell volume is low and transfused intra operatively if there is significant blood loss.

Duration of surgery greater than 60 minutes has been associated with higher rate of post caesarean wound infection. Out of the 78 patients whose surgery duration was 60 minutes or less only 4(5.2%) had post caesarean wound infection whereas, of the 198 patients whose surgery lasted more than 60 minutes, 33(17.7%) had post caesarean wound infection. This was a statistically significant association (P-value= 0.039). However, following multiple regression analysis it was eliminated (P-value= 0.540: OR=1.62, CI= 0.35 – 7.50)

There was a statistically significant association between previous caesarean section and increased risk of wound infection in this study (P value= 0.045).However, subjecting this to further logistic regression showed that having a previous caesarean section scar did not have any significant association with increased risk of post-

caesarean wound infection (P-value= 0.546, OR= 0.19: CI= 0.032 – 1.12).

Obesity has been implicated as a risk factor for surgical site infection. From the study, this was however not statistically significant (P-value=0.671). Possible explanations for increased risk for wound infection in such patients include relative avascularity of adipose tissue, serous fluid collection and haematoma formation. Consequently, an obese woman is more prone to wound infection even with the use of antibiotics. Vermillion et al[29] concluded that the subcutaneous tissue thickness at the site of incision perhaps play more significant role.

Choice of abdominal incision type remains an area determined by the skill of the surgeon, the choice of the patient and the presence or absence of a previous scar. The midline sub umbilical incision is the older of the two but it has been overtaken by the Pfannenstiel incision for obvious advantages. These include its cosmetic nature, low incidence of wound dehiscence, low incidence of wound infection and low incidence of incisional hernia. This low incidence of wound infection has been validated by this study. Of the 276 subjects sampled, an overwhelming majority 207(75%) had a pfannenstiel incision with 22(10.6%) having post caesarean wound infection while 67(25%) had a midline sub umbilical incision with 15(22.1%) having post caesarean wound infection. This was statistically significant (P-value= 0.004). Subjecting this variable to multiple regression still found it to be statistically significant (P-value= 0.016, OR = 5.75, CI = 1.38 – 23.94)

Among the thirty-seven patients that had wound infection, the pathogens isolated were Staphylococcus aureus 22(59.46%), Coliforms 7(18.92%), Streptococcus faecalis 6(16.23%), Pseudomonas 2(5.39%) This pattern of distribution was diverse constituting gram positive and negative organisms. The fact that one woman among the emergency group had clinical evidence of wound infection but negative culture might be attributed to the antibiotics they were taking. Staphylococcus aureus was the predominant organism isolated and this finding was comparable with findings of Kaplan et al and Jido et al [30,,8]. This finding was in contrast with the finding of Vermillion et al[29] where enterococcus species was the predominant organism. It has been postulated that post caesarean wound infection may be derived from the microbial flora of the lower genital tract and this may occur during manual extraction of the fetal presenting part from the lower uterine segment which further facilitates the contamination of uterine cavity by vaginal microorganisms

CONCLUSION AND RECOMMENDATIONS

The study highlights the possible aetiology of post-caesarean wound infection. It was evident that prolonged rupture of membranes, post operative anaemia and midline sub umbilical incision were independent variables contributing directly to a higher rate of post caesarean wound infection Staphylococcus aureus was found as the most common aerobe causing wound infection.

The major strengths of this study were the inclusion of a very large number of potential risk factors for post caesarean wound infection and the use of multivariate analysis. The use of microbiology to confirm wound infection in our patients was also remarkable.

Though surgical care is very important to prevent wound infection, some pre and post operative steps could reduce post operative wound infections. Avoidance of prolonged labour by public enlightenment, free antenatal and delivery services and the use of partograph and the use potent antibiotics in cases of rupture of membrane would reduce the incidence of post-caesarean wound infection in our environment. The use of Pfannenstiel incision instead of a midline sub umbilical incision will also reduce the infection rate. Optimizing the patient' haemoglobin concentration especially post operatively is also important. The ability to diagnose promptly wound infections and instituting appropriate intervention to control

the situation prevents further progression to overwhelming septicaemia which might have a fatal outcome.

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