

## ORIGINAL ARTICLE

## Wound Infection following Caesarean Section in a University Teaching Hospital in South-East Nigeria

Emmanuel C OJIYI<sup>1</sup>Ephraim I DIKE<sup>2</sup>Chijioke OKEUDO<sup>2</sup>Eke C EJIKEM<sup>3</sup>Akujiobi CE NZEWUIHE<sup>4</sup>

<sup>1</sup>Department of Obstetrics and Gynaecology Anambra State University Teaching Hospital Awka, NIGERIA

<sup>2</sup>Department of Obstetrics and Gynaecology, Imo State University Teaching Hospital Orlu, NIGERIA

<sup>3</sup>Department of Obstetrics and Gynaecology, Abia State University Teaching Hospital Aba, NIGERIA

<sup>4</sup>Department of Surgery Imo State University Teaching Hospital Orlu, Imo State NIGERIA

**Author for Correspondence**

Emmanuel C OJIYI

Department of Obstetrics & Gynaecology  
Imo State University  
Teaching Hospital, PMB 8  
Orlu, Imo State, NIGERIA

Email: [ojiyiemeka@yahoo.com](mailto:ojiyiemeka@yahoo.com)

Phone No: +234-803-932-9882

Received: October 18<sup>th</sup>, 2012Accepted: March 15<sup>th</sup>, 2013

## ABSTRACT

**Background:** Caesarean section is a common operation in obstetric practice, but there is a general aversion to caesarean section amongst Nigerian women due to a myriad of reasons amongst which are its associated morbidity and mortality. Surgical site infection following caesarean section is both a major cause of prolonged hospital stay and the wide spread aversion to caesarean delivery in our environment.

**Objective:** To determine the risk factors for surgical site infection following caesarean section as well as the relative contribution of each of the risk factors at the Anambra State University Teaching Hospital, (ANSUTH) Awka.

**Methodology:** A retrospective case controlled study of patients delivered by caesarean section in Amaku General Hospital now ANSUTH from January 1<sup>st</sup>, 2000 to December 31<sup>st</sup>, 2011. The cases were the patients whose caesarean sections were complicated by surgical site infections, while those without surgical site wound infection served as controls. The hospital records were compared.

**Results:** Five hundred and nine patients with complete records were analyzed. Fifty-six (56) patients (11%) had complicating wound infection. Statistically significant risk factors for infection were: body mass index >25 ( $p=0.003$ ), prolonged rupture of membranes ( $p=0.0003$ ), prolonged operation time ( $p=0.0011$ ), anaemia ( $p=0.0009$ ) and blood transfusion ( $p<0.0001$ ), multiple vaginal examinations during labour ( $p<0.0001$ ) and long duration of labour prior to caesarean section ( $p<0.0001$ ).

**Conclusion:** To make caesarean section more acceptable to women in our environment, efforts should be concentrated on strategies to prevent the risk factors.

**Keywords:** Awka, caesarean section, infection

## INTRODUCTION

Caesarean section is a common operation in obstetric practice, but there is a general

aversion to caesarean delivery amongst pregnant women in our environment. There are several reasons for this including the belief among some of our women that

caesarean delivery represents reproductive failure whereas vaginal delivery is a proof of womanhood, the morbidity and mortality associated with the operation, prolonged hospital stay and the higher cost of caesarean delivery vis-à-vis vaginal delivery.<sup>1,2,3,4,5,6,7</sup> Surgical site infection is a leading cause of prolonged hospital stay, high hospital bills as well as other morbidities and mortality.<sup>4,6,8,9</sup> It complicates up to 8.9% of caesarean deliveries.<sup>10</sup> In Nigeria, anaemia following severe intra-operative bleeding and sepsis are the leading causes of maternal morbidity post caesarean section.<sup>7,11</sup>

The causes of surgical site infection following caesarean section are universal with only slight variations from one region to the other, though the relative contributions of each of the risk factors vary from one region to the other, and even from centre to centre. The incidence of wound infection is associated with the weight of the patient, the duration of labour prior to the caesarean section, multiple vaginal examinations, duration of operation, time lag after membrane rupture, the skill of the operator, emergency section, booking status, internal foetal monitoring and maternal age.<sup>12,13,14,15</sup>

In order to control and prevent surgical-site infections following caesarean section in our environment, it is necessary to first and foremost determine the relative contribution of each of the outlined risk factors.

This study examined the aetiological factors associated with surgical site infection following caesarean section as well as the relative contribution of each of the risk factors at the Anambra State University Teaching Hospital, ANSUTH Awka, Nigeria. Information gathered will be employed in designing strategies for reducing surgical site infection following caesarean section and prolonged hospital stay. This will ultimately translate to lower caesarean section morbidity and mortality and decrease aversion to caesarean section in our environment.

## METHODOLOGY

This is a descriptive study. All patients who underwent caesarean operations at the Department of Obstetrics and Gynaecology, Amaku General Hospital (now Anambra State University Teaching Hospital, ANSUTH) Awka, or were referred from peripheral hospitals for caesarean sections from 1<sup>st</sup> January, 2000 to 31<sup>st</sup> December, 2011 were recruited into the study. Their case records were retrieved from the Medical Records Department.

The patients were divided into two groups:

- i. those whose wounds were infected
- ii. those whose wounds sites were not infected.

Those with infected wounds were the cases while those with uninfected wounds were the controls.

During the study period, 3335 deliveries were conducted in the Department of Obstetrics and Gynaecology of the hospital, and five hundred and twenty-five of these were by caesarean section. Eleven patients with incomplete case records were excluded from the study. The remaining 509 case files were analyzed. Almost all the patients were prophylactically covered with ampicillin and cloxacillin combination, metronidazole and gentamicin for five days. Some surgeons, however, used ceftriaxone and metronidazole, without cloxacillin. All the patients were followed up until they were discharged.

Information extracted from the case files included age, parity, weight, type of caesarean section, duration of labour, duration of rupture of membranes, operation time, number of vaginal examinations, cadre of surgeon, type of antibiotic coverage, booking status, pre and post-operative packed cell volume, blood transfusion and duration of post-operative hospital stay.

The data obtained were analyzed using the Epi-Info version 6 statistical package. Means, standard deviation and tests of statistical significance based on 95% confidence interval

of Chi-square test with Yates correction were used to determine the significant variables. A  $p$ -value  $<0.05$  was considered statistically significant.

For the purposes of this study, the following definitions were adopted:

- **Unbooked patient:** A patient who did not receive antenatal care in our unit.
- **Prolonged hospital stay:** Hospital stay lasting more than 7 days.<sup>5</sup>
- **Prolonged rupture of foetal membranes:** rupture of membranes exceeding 24hours.<sup>2</sup>
- **Prolonged operation time:** caesarean section lasting more than 1 hour from skin incision to the last skin stitch.<sup>9</sup>
- **Post caesarean wound infection:** A wound is said to have been infected if there were indurations and swelling of the wound edges, discharge of pus or wound dehiscence. This is based on the CDC definition of nosocomial infection.<sup>10</sup>

## RESULTS

Caesarean section was complicated by wound infection in 56 (11%), while 453 (89%) did not have any surgical-site infection. Table 1 shows the distribution of some selected socio-demographic characteristics of the women.

There were no statistically significant difference between the cases and controls in terms of their age and parity ( $p$  0.163 and  $p$  0.5227), respectively. However, the proportion of subjects with body mass index greater than 25 was significantly higher among the cases than in the controls (39.3% versus 20.3%;  $p=0.0033$ ).

Table 2 shows the distribution of obstetric characteristics among the women. The cases did not differ statistically from the controls with respect to their booking status, the surgeon, type of caesarean section (elective or emergency) and pre-operative packed cell volume. However, the cases had women with prolonged rupture of foetal membranes ( $p=0.0003$ ), prolonged operation time ( $p$  0.0009), longer duration of labour prior to the caesarean section ( $p<0.0001$ ) and had blood transfusion more than the controls.

**Table 1.** Distribution of socio-demographic characteristics among the women

Characteristics	Number		p-value
	Cases N=56	Control N=453	
Age (Yrs)			0.1603
≤20	9	42	
21-25	8	105	
26-30	20	140	
31-35	10	115	
≥36	9	51	
Parity			0.5227
0	25	216	
1-2	12	116	
3-4	8	39	
≥5	11	82	
Body Mass Index			0.0033
<25	34	361	
≥25	22(39.3%)	92(20.3%)	

## DISCUSSION

The prevalence of surgical site infection in this review was 11% which is similar to the 9.1%, 9.3%, 9.9% and 10% reported from Kano, Lagos, United Kingdom(UK) and Ilorin, respectively but much lower than the 23.4% reported from Ile-Ife, in South-West Nigeria and the range of 2.9% and 17.9% reported in a multi-centre collaborative study of post caesarean section wound infection in the UK.<sup>2,3,5,16,17,18</sup> These studies with recorded high prevalence of surgical site infection following caesarean sections were mostly prospective studies and employed the use of post-discharge surveillance using community midwives. We did not use post-discharge surveillance in our study, but those patients who had surgical site wound infection prior to discharge as well as those who reported back to the unit after discharge because of the complication were included.

In this series, there was statistically significant proportions of subjects with body mass index  $>25$  ( $p$  0.0033), longer duration of labour prior to the caesarean section ( $p<0.0001$ ), prolonged operation time ( $p=0.0011$ ), anaemia ( $p<0.0001$ ), prolonged rupture of foetal membranes ( $p$  0.0003) and multiple vaginal examinations during labour ( $p<0.0001$ ) among the women that had wound infections

compared to the women whose wounds were not infected. They also received more blood transfusion ( $p < 0.0001$ ).

**Table 2.** Distribution of obstetric characteristics among the women

Characteristics	Number		p-value
	Cases N=56	Control N=453	
<b>Duration of labour (Hrs)</b>			<b>&lt;0.0001</b>
≤6	16	223	
7-12	22	187	
>12	18	43	
<b>Type of Caesarean section</b>			<b>1.0000</b>
Elective	7	56	
Emergency	49	397	
<b>Operational time (Hrs)</b>			<b>0.0011</b>
<60	24	305	
60-90	20	101	
>90	12	47	
<b>Packed cell volume</b>			<b>0.0009</b>
Preoperative			
<30%	9	17	
>30%	47	436	
Postoperative			
<30%	30(53.6%)	89(19.6%)	
>30%	26	364	
<b>Rupture of membranes (hrs)</b>			<b>0.0003</b>
<24 hours	32	361	
>24 hours	24(39.3%)	92(20.3%)	
<b>Vaginal examinations</b>			<b>&lt;0.0001</b>
<4	30		
>4	26(46.4%)	89(19.6%)	
<b>Blood Transfusion</b>			<b>&lt;0.0001</b>
No	29	410	
Yes	27	43	
<b>Booking Status</b>			<b>0.5705</b>
Unbooked	27	199	
Booked	29	254	
<b>Hospital Stay (Days)</b>			<b>0.7575</b>
≤7	12	356	
≥	4	97	
<b>Surgeon</b>			<b>0.1483</b>
Consultant	29	281	
Resident	27	172	

With regards to prolonged rupture of membranes, in normal pregnancy, the cervical mucus plug, the amniotic sac and

fluid, all serve as barriers to infection. When foetal membranes are ruptured, however, this protective effect is lost over time, and microorganisms in the vagina would then easily migrate into the amniotic cavity causing chorioamnionitis and its sequelae.<sup>14</sup> This is also the observation of other authors.<sup>14,19,20</sup>

Regarding operation time, when there is a prolonged operation time there is significant tissue handling resulting in decreased tissue perfusion and tissue devitalisation.<sup>18</sup> The significant association between multiple vaginal examination and post-operative wound infection might be due to the fact that multiple vaginal examinations in the face of ruptured membranes would likely seed bacteria from the vulva and vagina into the amniotic cavity setting up chorioamnionitis and its sequelae. Long duration of labour prior to the caesarean section also produces a similar effect. These are the findings of other authors.<sup>2,3</sup>

In obesity, represented by a body mass index >25, the excess fat results in reduced tissue perfusion and tissue devitalisation leading to wound infection and wound breakdown.<sup>2</sup> Ezechi, *et al* and Jido, *et al* had similar findings.<sup>2,3</sup> Caesarean sections complicated by wound infection are more likely to lose more blood intra-operatively, receive blood transfusion and have packed cell volume <30%.<sup>2</sup> This means that intraoperative bleeding may be a risk factor in surgical site infection. This is in tandem with the findings of Jido and Ward.<sup>3,18</sup>

This review failed to demonstrate any significant association between maternal age, parity, type of caesarean section, booking status and the cadre of the surgeon with the risk of developing post-caesarean section wound infection. This is also the observation of other workers.<sup>2,3,5</sup>

Surprisingly, contrary to the finding of other writers, that patients undergoing emergency caesarean section are at increased risk of surgical site infection, when compared with those undergoing elective caesarean section

due to inadequate preparation time and lack of necessary precautions because of either maternal or foetal threat, type (emergency or elective) of caesarean section was not a major determinant of post caesarean section wound infection in this review.<sup>14,15</sup> Killian had a similar observation.<sup>21</sup> Similarly, the cadre of the surgeon was not a major determinant of post-caesarean wound infection even though there was a significant difference in the mean operating time. It appears that the major determinant factors are prolonged operating time and poor skills.<sup>14,22</sup> This might also explain why booking status failed to achieve statistical significance. Duration of hospital stay was longer in the cases with direct cost implications. Other workers had similar findings.<sup>2,3,13</sup>

This study has some obvious limitations and these limitations must be borne in mind when making generalizations on the findings. Being a retrospective study without any study design and inclusion/exclusion criteria, the type of skin incision (midline sub-umbilical or pfannenstiel) was not taken into consideration. This might impact on the infection rate.

## CONCLUSION

Post-operative wound infection commonly complicates caesarean section in our unit. Prolonged rupture of membranes, prolonged operative time, multiple vaginal examinations, long duration of labour prior to the caesarean section, and body mass index >25 were implicated as the risk factors. They should be utilized in designing wound infection prevention and control strategies.

## REFERENCES

1. Ojiyi EC, Dike EI. Caesarean section related morbidity and mortality at the Imo State University Teaching Hospital, Orlu. *Port Harcourt Medical Journal* 2009; 3:338-343.
2. Ezechi OC, Edet A, Akindele H, Gab-Okafor CV, Herbertson E. Incidence and risk factors for Caesarean section wound infection in Lagos, Nigeria. *BMC Research Notes* 2009, 2: 186 doi: 10.1186/756-0500-2-186.

3. Jido TA Garba ID. Surgical-site infection following Caesarean section in Kano, Nigeria. *Ann Med Health Sci Res* 2012; 2:33-36.
4. Ezechi OC, Fasuba OB, Dare FO. Socioeconomic barrier to safe motherhood among booked patients in rural Nigerian communities. *J Obstet Gynaec* 2000; 20:32-34.
5. Fasuba O, Ogunniyi SO, Dare FO, Isawunmi AI, Ezechi OC. Uncomplicated Caesarean section: Is prolonged hospital stay necessary? *East Afr J Med* 2000; 77:36-39.
6. Onwudiegwu U, Makinde ON, Ezechi OC, Adeyemi A. Decision- Caesrean section delivery interval in a Nigerian University Teaching Hospital; implication for maternal morbidity and mortality. *J Obstet Gynaecol* 1999; 19:30-33.
7. Ezechi OC, Nwokoro CA, Kalu BKE, Njokanma OF, Okeke GCE. Caesarean morbidity and mortality in a private hospital in Lagos, Nigeria. *Trop J Obstet Gynaecol* 2002; 19:97-100.
8. Heetha, *et al.* Pattern of antimicrobial use in Caesarean section in a tertiary care hospital in rural south India. *Int J Pharm Biomed Res* 2010; 1:57-61.
9. Alfirezia Z, Milan SJ, Livio S. Caesarean section versus vaginal delivery for preterm birth in singletons. *Cochrane Database Syst Rev.* 2012: Pubmed.
10. Opoien HK, Valbo A, Grinde-Anderson A, Walberg M. Post Caesarean surgical sit infections according to CDC standards: Rates and risk factors. A prospective cohort study. *Acta Obstet Gynaecol Scand* 2007; 86:1097-1102.
11. Chama CM, El-Nafty AU, Idrisa A. Caesarean section morbidity and mortality in Maiduguri, Nigeria. *J Obstet Gynaecol* 2000; 20:45-48.
12. Webster J. Post Caesarean wound infection: a review of the risk factors. *Aust N Z J Obstet Gynaecol* 1988; 28:201-207.
13. Mitt P, Lang K, Peri A, Marimets M. Surgical-site infections following Caesarean section in an Estonian University hospital: postdischarge surveillance and analysis of risk factors. *Infect Control Hosp Epidemiol* 2005; 26:449-454.
14. Litta P, Vita P, Konshi de Toffoli J, Omnis GL. Risk factors for complicating infections after Caesarean section. *Clin Exp Obstet Gynaecol* 1995; 22:71-75.
15. Beattie PG, Rings TR, Hunter MF, Lake Y. Risk factors for wound infection following Caesarean section. *Aust N Z J Obstet Gynaecol* 1994; 34:398-402.
16. Graffiths J, Demianczuk N, Cordoviz M, Joffe AM. Surgical site infection following

- Caesarean section: A Case- control study of post-discharge surveillance. *J Obstet Gynaecol Can* 2005; 27:340-344.
17. Makinde OO. A review of Caesarean section at the University Of Ife Teaching Hospital. *Trop J Obstet Gynaecol* 1987; 6: 26-30.
  18. Ward VP, Charlett A, Fagan J, Crawshaw SC. Enhanced surgical site infection surveillance following Caesarean section: Experience of a multi-centre collaborative post discharge system. *J Hosp Infect* 2008; 70:166-173.
  19. Okonufua FE, Makinde ON, Ayangade SO. 12 yearly trends in Caesarean section and Caesarean mortality in Ile-Ife, Nigeria. *Trop J Obstet Gynaecol* 1988; 31-35.
  20. Surgical site infection: Treatment and prevention. National Institute of Health and Clinical Excellence (NICE), London 2008; CG74:1-21.
  21. Killian CA, Graffunder EM, Vinciguerra TJ, Venezia RA. Risk factors for surgical-site infections following Caesarean section. *Infect Control Hosp Epidemiol* 2001; 22:613-617.