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RISK FACTORS FOR PUERPERAL SEPSIS IN SOUTH-WESTERN NIGERIA

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ABSTRACT Puerperal sepsis is second leading cause of maternal mortality in this part of the world. High index of suspicion with prompt medical intervention will prevent its rapid progression to severe state where acute organ dysfunction and septic shock occur. The aim of this case-control study is to determine the risk factors for puerperal sepsis and their relative importance in South-Western Nigeria. Data management and statistical analyses were done with SPSS for Windows (Version 17.0). Lower socioeconomic class, obesity, anaemia, impaired glucose tolerance/diabetes, HIV and history of vaginal discharge/PID were found to be independent risk factors of puerperal sepsis. While obstetric factors such as home delivery, cervical cerclage, prolonged rupture of membranes, retained products of conception, prolonged/obstructed labour, caesarean section, and perineal trauma are also significantly risk factors. In view of the multiplicity of risk factors for puerperal sepsis, all parturient should be offered secondary prevention, including prompt diagnosis and treatment.

KEYWORDS : Puerperal sepsis, risk factors, maternal mortality prevention

INTRODUCTION

Puerperal sepsis is defined by the World Health Organization as the infection of the genital tract during labour or within the forty-two days of the postpartum period(Dolea C SC , 2003). The term sepsis is significant, as it denotes the addition of systemic manifestations to the infection (Dellinger et al, 2013). Although puerperal sepsis may present with lower abdominal pain as well as tenderness that are severe and unresponsive to usual analgesics, the symptoms may be less distinctive in the recently pregnant compared to the non-pregnant population. Indeed, the symptoms may be absent, and unless a high index of suspicion results in prompt medical intervention, the condition may progress rapidly to become severe. Severe sepsis is the onset of acute organ dysfunction or tissue hypoperfusion, and the latter if uncorrectable by fluid administration is termed septic shock (Dellinger et al, 2013). This distinction is important because the mortality rate with severe sepsis is 20-40%, doubling to 60% with the occurrence of septic shock.(Cantwell, 2011) Even in the developed world such as UK, despite advances in medical management, puerperal sepsis remain an important cause of maternal mortality, accounting for approximately 10 deaths per year(Arulkumaran , Singer ,2013). Worldwide an estimated 358,000 maternal deaths occur yearly, with up to 15% of these being associated with puerperal sepsis. The situation is more dismal in Nigeria, where puerperal sepsis accounts for 26% of maternal deaths, being the second leading cause of maternal mortality in the country(Audu, Takai, Bukar, 2010).

Many of those who died of puerperal sepsis in the UK CEMACE survey of 2005-2008 had one or more risk factors for maternal sepsis. These risk factors are multiple, and have been identified by various investigators. However, the relative contribution of each of these risk factors varies and therefore needs to be determined for different settings. The aim of this study, therefore, was to determine the risk factors for puerperal sepsis and their relative importance in Osogbo, South-Western Nigeria.

MATERIALS AND METHODS

This case-control study was conducted over a 10-year period in the obstetric and gynaecological department of Ladoke Akintola Univeristy of Technology Teaching Hospital, Osogbo, South-Western Nigeria. Cases were eligible if they were managed in our institution for puerperal sepsis. During this period, perinatal information was taken routinely on every delivery by the obstetricians, resident doctors, interns or midwives. In the case group, we included patients with puerperal sepsis. The control group included women who delivered immediately before each case. Inclusion criteria were pregnancy after 28 weeks of gestation, singletons and twins, with complete data available. Exclusion criteria were previable birth (less than 28 weeks), conditions causing puerperal pyrexia other than puerperal sepsis, such as mastitis, malaria, urinary tract infection, pneumonia, skin and soft-tissue infection, gastroenteritis, pharyngitis,or regional anaesthetic site infections. The controls were deliveries immediately preceding the cases, to attempt to achieve similar conditions in cases and controls, whenever possible. For all cases and controls, data from the antenatal, obstetric, and neonatal records were abstracted from the case notes.

For the identification of puerperal sepsis we employed the diagnostic criteria for sepsis published by the RCOG, which was modified by Levy et al (Dare, Bako, Ezechi, 1998), using chart reference to pregnancy-specific variables. Accordingly, a woman is deemed to have puerperal sepsis if within 42 days of delivery there was infection, suspected or documented, and a combination of some variables: general, inflammatory, haemodynamic, tissue perfusion and organ dysfunction variables. General variables include fever (>38^{0}C), hypothermia (core temperature < 36^{0}C), tachycardia (>90 beats/minute), tachypnoea (>20 breaths/minute), altered conscious level, considerable oedema or positive fluid balance (>20ml/kg over 24 hours), hyperglycaemia in the absence of diabetes (plasm glucose > 7.7 mmol/l). Inflammatory variables include leucocytosis (white blood cell (WBC) count > 12 x 10 ^{9}/l), leucopenia (<4 x 10 ^{9} /l), normal WBC count with > 10% immature forms, and plasma C-reactive protein > 7mg/l. Haemodynamic variables refer to measures of arterial hypotension (systolic blood pressure <90mmHg; mean arterial pressure < 70mmHg; or diastolic blood pressure <40mmHg). Tissue perfusion variables include raised serum lactate >4mmol/l, decreased capillary refill or motting. Organ dysfunction variables include Arterial hypoxaemia [PaO_2 (partial pressure of oxygen in arterial blood) /F IO^2 (fraction of inspired oxygen) < 40kPa], Oliguria (urine output < 0.5ml/kg/hr for at least two hours, despite adequate fluid resuscitation), Creatinine rise of > 44.2µmol/l), Coagulation abnormalities (International Normalised Ratio [INR] > 1.5 or activated partial thromboplastin time [APTT] > 60 seconds), Thrombocytopaenia (platelet count < 100 x109/l), Hyperbilirubinaemia (plasma total bilirubin > 70µmol/l) and Ileus (absent bowel sounds).

Data management and statistical analyses were done with SPSS for

Windows (Version 17.0, SPSS Inc., Chicago, IL, USA). For univariate analyses, continuous variables are expressed as mean (SD) and were compared using the Student's t-test. Categorical/discrete variables were compared with the Chi-square test or Fisher's exact test when the expected values were below 5. Variables found to be statistically significant ($p<0.05$) were subjected to Multiple logistic regression analysis. Similarly, previously reported risk factors of puerperal sepsis were entered into the multivariate logistic regression model(Royston, 2008). In case of a statistically significant odds ratio greater than 1, we computed attributable risk(Benichou, 2001) for the corresponding risk factor. Regardless of the certainty of causal association, the calculated attributable risk serves to quantify a portion of each factor present in puerperal sepsis (El-Mahally et al, 2004). All P-values were 2-tailed, and $P < 0.05$ was considered to be statistically significant.

Table 1. Maternal characteristics.

Variables	OR [95% CI]	p	aOR [95% CI]	p	Attributable risk
Maternal age (y)	1.7 [0.8-2.1]	0.51	-		
<20	1.0		-		
20-35	0.8 [0.1-1.6]		-		
>35			-		
Parity	0.7 [0.3-1.1]	0.72	-		
1	1.0		-		
2-4	1.2 [0.6-1.9]		-		
5+	1.4 [1.2-1.7]		-		
Unbooked		0.04	1.2 [0.9-1.5]	0.06	
Socioeconomic class		<0.01	-	<0.01	
1 & 2	0.4 [0.1-0.6]		0.5 [0.3-0.7]		
3	1.0		1.0		
4 & 5	6.8 [5.1-8.6]		5.5 [4.3-6.6]		13%
Christianity	0.9 [0.5-1.5]	0.81	-	-	
Obesity	4.1 [2.6-5.9]	<0.01	3.4 [1.7-5.0]	<0.01	11%
Anaemia,	6.3 [3.3-8.8]	<0.01	5.0 [2.5-7.6]	<0.01	13%
IGT/diabetes,	2.0 [1.5-2.5]	0.02	1.5 [1.1-1.9]	<0.01	6%
HIV	2.7 [1.7-3.9]	<0.01	1.9 [1.4-2.4]	0.02	8%
Vaginal discharge	3.4 [2.2-4.6]	<0.01	2.2 [1.5-3.0]	<0.01	9%
History of PID	2.6 [1.5-3.9]	<0.01	1.7 [1.2-2.2]	0.03	6%

Table 2. Obstetric Characteristics

Variables	OR [95% CI]	p	aOR [95% CI]	p	Attributable risk
Home delivery	9.1 [6.1-12.3]	<0.01	8.0 [5.1-11.0]	<0.01	9%
Cervical cerclage	1.7 [1.2-2.2]	0.03	1.4 [1.1-1.7]	0.04	2%
Prolonged PROM	3.7 [2.7-4.8]	<0.01	3.1 [1.9-4.1]	<0.01	5%
Retained products	6.0 [4.1-9.9]	<0.01	4.8 [3.0-6.8]	<0.01	7%
Prolonged labour	2.6 [1.5-3.6]	<0.01	2.3 [1.3-3.3]	<0.01	3%
Perineal trauma	1.8 [1.2-2.4]	0.02	1.3 [0.9-1.7]	0.03	-
Previous CS	1.4 [1.1-1.7]	0.04	1.2 [0.8-1.5]	0.07	-
Preeclampsia	1.4 [1.1-1.6]	0.04	1.1 [0.8-1.4]	0.09	-
Breech presentation	1.6 [1.1-2.0]	0.03	1.3 [0.9-1.6]	0.06	-
Labour induction	1.5 [1.1-1.9]	0.04	1.3 [0.8-1.7]	0.09	-
Labour augmentation	1.8 [1.2-2.4]	0.02	1.4 [0.9-1.9]	0.07	-
Fetal distress in labour	1.9 [1.1-2.7]	0.02	1.5 [1.0-2.7]	0.07	-
Meconium,	1.3 [1.1-1.5]	0.04	1.1 [0.9-1.4]	0.11	-
Forceps/vacuum	1.6 [1.2-2.1]	0.03	1.3 [0.8-2.0]	0.09	-
Caesarean section	5.3 [3.3-7.5]	<0.01	4.7 [2.8-6.0]	<0.01	6%

RESULTS

Table 1 shows the distribution of maternal and medical risk factors after univariable and multivariable analysis, as well as the attributable risk for each factor. Women with puerperal sepsis were more likely to be less than 20 years of age, and of lower social class. Obesity, lack of antenatal attendances, Anaemia, Impaired glucose tolerance (IGT)/diabetes, and HIV seropositivity occurred more often in the case group than in the controls. As expected, women with puerperal sepsis had history of vaginal discharge or pelvic infections significantly more often than did the control group. When we controlled for significant ($P<.05$) risk factors by using conditional logistic regression to estimate the adjusted risks for each maternal risk factor presented, the independent risk factors of puerperal sepsis were lower socioeconomic class, obesity, anaemia, IGT/diabetes, HIV and history of vaginal discharge/PID. Parity and religion were not significantly associated with puerperal sepsis.

In table 2, potential obstetric risk factors for puerperal sepsis are presented. Home delivery, cervical cerclage, prolonged rupture of membranes, retained products of conception, prolonged/obstructed labour, caesarean section, perineal trauma were significantly risk factors. All of these emerged as independent risk factors on logistic regression analysis after adjusting for potential confounders. On the other hand, while previous caesarean section , prior neonatal death, Preeclampsia, breech presentation, labour induction, labour augmentation, fetal distress in labour, meconium, forceps/vacuum were significant predictors on univariate analysis, their effects were mediated by other factors, as the adjusted odds on logistic regression were not significant.

DISCUSSIONS

We found that puerperal sepsis was associated with lower socioeconomic class, obesity, anaemia, IGT/diabetes, HIV and history of vaginal discharge/PID. Significant independent obstetric risk factors were Home delivery, cervical cerclage, prolonged rupture of membranes, retained products of conception, prolonged/obstructed labour, caesarean section, perineal trauma. The frequency of puerperal pyrexia (1.3%) was comparable to that found in other studies(El-Mahally , 2004; Ahmed, 2013; Bako, 2012; Khaskheli, 2013; Loudon, 2000; Yahaya, 2013).

Shamshad et al(2010) reported that more than 65% of cases of puerperal sepsis were of lower socioeconomic status. Similarly, in the study by El-Mahally and colleagues (2004), very low socioeconomic score confers a six fold odds of developing puerperal sepsis. The association is not surprising in view of the fact that infectious morbidity is linked to lower socioeconomic status.

The association between obesity and puerperal sepsis observed in our study is also supported across other studies. This is not surprising in view of the fact that obesity is associated with difficult delivery. Similarly, anaemia is consistently associated with puerperal sepsis across all previous studies.

IGT/diabetes and HIV infections are independent risk factors in our study, findings that supported by other studies. These conditions are associated with immunosupression, and indeed, in some settings immunosuppressant drugs are predisposing factors for puerperal sepsis. The presence of vaginal discharge and history of pelvic

inflammatory diseases could have implied the presence of bacteria in the cervix, which could readily invade the upper genital tract following delivery (Byrne, Aagaard-Tillery , Johnson, Wright, Silver, 2009).

The association of Home delivery, cervical cerclage, prolonged rupture of membranes, retained products of conception, prolonged/ obstructed labour, caesarean section, and perineal trauma with puerperal sepsis in our study is also supported by previous work (Benichou, 2001; El-Mahally , 2004; Bako, 2012; Khaskheli, 2013; Yahaya, 2013).

Home delivery is associated with use of unhygienic delivery materials, and effort to address this has been the focus of many studies. Retained products of conception provide a medium for bacterial proliferation, while traumatic deliveries provides breech of natural defenses to invasion by micro-organisms (Arulkumaran, Singer, 2013).

The most significant point to note is that the risk factors for puerperal sepsis are multiple, and therefore prevention should target all women. In CEMACE (Cantwell et al, 2011), the recommendation is that all women should be taught the symptoms and signs, and all health workers should be aware of the symptoms and signs so that prompt recognition and immediate therapy can be instituted. In a review of literature by Hussein and Fortney (2004), it was found that new technology could play a role in reducing the incidence of an old disease, and recommended wide adoption of infection-control protocols and evidence-based procedures--including prophylactic antibiotics for caesarean section or preterm rupture of membranes, and updated antibiotic regimens--should be widely adopted. Further, devices such as hand rubs, needle-disposal systems, and rapid microbiological diagnostic tests can improve compliance and efficiency. Operational research on promising developments like vaginal cleansing with antiseptics, vitamin A supplementation, and prophylactic antibiotics in high-risk women is needed.

The strength of our study derives from the strictness of the criteria we employed in the diagnosis of puerperal sepsis. The use of standard symptoms such as fever, low abdominal pain and vaginal discharge to make diagnosis as is done in previous studies could have introduced selection bias, as these classical symptoms and signs could be absent in the recently pregnant patients. But with the use of acceptable, well-defined diagnostic criteria, our case selection was likely to have been more accurate.

Regarding limitations, however, our study probably suffered from measurement/recall bias as it is based on information extracted from case records, which depended heavily on recall by the patient. As such, known risk factors would have been recorded for cases but not for controls and vice versa. Moreover, only few risk factors are routinely recorded in medical records. Fortunately, though, most risk factors studied in this work are routinely recorded irrespective of whether the patient had puerperal sepsis or not, thus minimising the effect of recall bias.

In conclusion, independent risk factors of puerperal sepsis are lower socioeconomic class, obesity, anaemia, IGT/diabetes, HIV and history of vaginal discharge/PID. Also obstetric factors such as home delivery, cervical cerclage, prolonged rupture of membranes, retained products of conception, prolonged/obstructed labour, caesarean section, and perineal trauma are significantly risk factors. In view of the multiplicity of risk factors for puerperal sepsis, all parturient should be offered secondary prevention, including prompt diagnosis and treatment.

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