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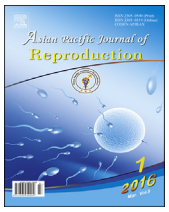

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Risk factors and adverse perinatal outcome associated with low birth weight in Northern Tanzania: a registry-based retrospective cohort study

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ABSTRACT

Objective: To determine the risk factors for low birth weight and adverse perinatal outcomes associated with low birth weight in Northern Tanzania.

Methods: A retrospective cohort study was designed using maternally linked data from Kilimanjaro Christian Medical Centre (KCMC) medical birth registry. A total of 37 799 singleton births delivered from 2000 to 2013 were analyzed. Multiple births, stillbirth and infants with birth defects were excluded. Data analysis was performed using SPSS version 16.0. *Chi*-square was used to compare difference in proportions between groups. The relative risks (*RR*) with 95% confidence interval (*CIs*) for the factors and adverse perinatal outcomes associated with LBW were estimated in a multivariate logistic regression models.

Results: The incidence of low birth weight was 10.6%. Multivariate logistic regression showed that pre-eclampsia (*RR* 3.9; 95% *CI* 3.6–4.2), eclampsia (*RR* 5.4; 95% *CI* 4.1–6.9), chronic hypertension (*RR* 2.8; 95% *CI* 2.1–3.8), maternal anemia (*RR* 1.7; 95% *CI* 1.4–2.2), HIV status (*RR* 0.8; 95% *CI* 0.7–0.8), smoking during pregnancy (*RR* 1.9; 95% *CI* 1.0–3.5), caesarean section delivery (*RR* 1.4; 95% *CI* 1.3–1.5), placental abruption (*RR* 3.7; 95% *CI* 1.3–4.7), placenta previa (*RR* 6.6; 95% *CI* 4.8–9.3), PROM (*RR* 2.5; 95% *CI* 1.9–3.3), maternal underweight (*RR* 1.3; 95% *CI* 1.2–1.6), and obesity (*RR* 1.2; 95% *CI* 1.1–1.4) and female gender of baby were significantly associated with delivery of low birth weight infants. On the other hand, LBW infants had increased risk of neonatal jaundice (*RR* 2.7; 95% *CI* 1.2–6.1), being delivered preterm (*RR* 2.0; 95% *CI* 1.8–2.3), Apgar score (<7) at fifth minute (*RR* 5.5; 95% *CI* 4.5–6.6) and early neonatal death (*RR* 3.5; 95% *CI* 2.6–4.6).

Conclusions: Low birth weight is associated with adverse perinatal outcomes. Early identification of risk factors for low birth weight through prenatal surveillance of high risk pregnant women may help to prevent these adverse perinatal outcomes.

1. Introduction

Low birth weight (LBW) is defined as birth weight of a live born infant of less than 2 500 g regardless of gestational age [1]. There is a strong relationship between preterm birth, intrauterine growth restriction and low birth weight [2]. Low birth weight is a public health problem in developing countries especially in sub Saharan Africa. It is associated with adverse perinatal outcomes such as perinatal asphyxia, prematurity, hypothermia, necrotizing enterocolitis, respiratory distress syndrome, neonatal jaundice, anemia, low Apgar score at 1st and 5th minutes and perinatal mortality [2–4]. Infants who are born with low birth weight experiences long term life consequences such as coronary heart disease, stroke, hypertension, type 2 diabetes, neurological sequel and recurrence of low birth weight in subsequent siblings [3,5,6].

Globally, the prevalence of low birth weight ranges from 3% to 15% [1]. However, the lowest prevalence of low birth weight

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of 3% has been reported in China [1]. Recent estimates show that the prevalence of low birth weight in sub-Sahara Africa is 12% [1]. The Tanzania demographic health survey reported prevalence of LBW of 16% [7].

Several factors have been associated with LBW including poor maternal nutrition before and during pregnancy, maternal diseases such as maternal anemia, chronic hypertension, renal diseases and heart diseases, alcohol, smoking, drug use during pregnancy, parity, low maternal education, maternal occupation, short stature, extreme maternal age, induced labor or elective caesarean section, physical, sexual, and emotional abuse [1–3,8–13].

Some interventions such as provision of pre-conceptual counseling and health services such as family planning services also have shown significant improvement in maternal health hence reduces prevalence of low birth weight [1].

Despite the fact that LBW has been reported to account for perinatal morbidity and mortality, there are few studies in Tanzania which have assessed on the risk factors for low birth weight and associated perinatal morbidity and mortality. These studies have also reported contradicting findings and used cross sectional data which makes it impossible to estimate incidence of LBW and accurate ascertainment of associations between various risk factors and adverse perinatal outcomes associated with LBW. The incidence and perinatal outcomes among LBW infants have not yet been extensively explored in Tanzania. Reduction in incidence of low birth weight may lead to improvement in child survival [14]. The aim of this study was to determine incidence and risk factors for low birth weight, and associated perinatal morbidity and mortality in northern Tanzania which will in turn help to design appropriate interventions to prevent adverse perinatal outcomes associated with LBW, and help to accelerate efforts towards Millenium Development Goal 4.

2. Materials and methods

2.1. Study design and setting

A retrospective study was designed using Kilimanjaro Christian Medical Centre (KCMC) medical birth registry data for women who delivered singleton infants for the period from 2000 to 2013 at the department of Obstetrics and Gynecology. KCMC is a referral and teaching hospital. It is located in Kilimanjaro region in Northern Tanzania. It serves a population over 11 million people from the nearby communities within the region and from the nearby regions. It has an average delivery rate of 4000 births per year.

2.2. Study population

All women who delivered singleton infants at KCMC from 2000 through 2013 who had complete birth records were eligible for this study. Women with multiple gestations, stillbirths and deliveries with birth defects were excluded. Multiple gestations and those with birth defects were excluded because they have a higher risk rate of low birth weight which could lead to overestimation of studied adverse pregnancy outcomes. The final sample comprised of 37799 singleton births.

2.3. Study variables

Main outcome measures were low birth weight, early neonatal death and morbidity (jaundice, preterm birth, Apgar score and neonatal infection). Low birth weight was defined as birth weight of less than 2500 g. We included only infants born at $\geq$28 weeks of gestation. The independent variables included; maternal demographic characteristics, maternal weight during pregnancy, maternal diseases (e.g. chronic hypertension and diabetes mellitus, maternal anemia, preeclampsia and eclampsia), maternal risk behaviors (e.g. smoking and drinking alcohol during pregnancy).

2.4. Data source

This study utilized medical birth registry data from KCMC. The medical birth registry of KCMC was established in the year 1999 as a collaborative project between medical birth registry of Norway through University of Bergen in Norway and KCMC via Kilimanjaro Christian Medical University College. It has been in operation since 2000 recording all births at KCMC in a computerized database. Information recorded in the birth registry has been described in detail elsewhere [15]. In summary, information collected includes maternal and paternal sociodemographic characteristics, maternal health before pregnancy, during pregnancy, after delivery and child status.

2.5. Data collection

A trained midwife nurses conducts interviews on daily basis using a standardized questionnaire for all women who deliver at the department of Obstetrics and Gynaecology within 24 h of delivery or as soon as mothers have recovered in case of complicated deliveries. In addition, information of neonates who are admitted at neonatal care unit is also recorded in neonatal registry form. Data from medical records is also extracted from the patient's file. Verbal consents are sought from each individual mother prior the interview.

2.6. Ethical clearance

The ethical approval was obtained from the Kilimanjaro Christian Medical College University (KCMU-Co) research ethics committee prior to commencement of the study. Permission to use medical birth registry data was obtained from the KCMC hospital and medical birth registry administration. Confidentiality of information was adhered by the use of maternal unique identification number.

2.7. Statistical analysis

Data were analysed using statistical package for social science (SPSS) version 16.0, (SPSS Inc. Chicago, III). Descriptive statistics were summarized using proportions, frequency, mean, and standard deviation (for normal distribution data). Student t test was used to compare means between groups for continuous variables. We used chi-square test (χ^2) to establish the relationship between various risk factors and LBW. The relative risk (RR) with 95% confidence interval (CI) for factors associated with LBW and adverse perinatal outcomes was estimated using multivariate logistic regression model while controlling for the potential confounding. A P value of less than 0.05 (two sided) was considered to be statistically significant.