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CLINICAL ARTICLE

Risk factors for stillbirths in Tete, Mozambique

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ABSTRACT

Objective: To evaluate known risk factors for stillbirth and identify local priorities for stillbirth prevention among institutional deliveries in Tete, Mozambique. *Methods:* A case–control study was conducted among 150 women who experienced stillbirths and 300 women who experienced live deliveries at three health facilities between December 1, 2009, and April 30, 2011. Case and control individuals were matched for health facility, age, and parity. Sociodemographic, pregnancy, and delivery characteristics (including HIV and syphilis serology) were assessed. Bivariate associations and a conditional logistic regression model identified variables contributing to fetal outcome. *Results:* No between-group differences were recorded in the frequency of infection with HIV (25 [16.7%] cases vs 55 [18.3%] controls; $P = 0.663$) or syphilis (6 [4.0%] vs 16 [5.3%]; $P = 0.536$) at delivery. Multivariate analysis revealed that stillbirth was associated with direct obstetric complications (mutually adjusted odds ratio [OR] 6.7; 95% confidence interval [CI] 3.6–12.1), low socioeconomic status (mutually adjusted OR 1.8; 95% CI 1.1–3.1), and referral during childbirth (mutually adjusted OR 3.2; 95% CI 1.7–6.1). *Conclusion:* Stillbirths in Tete, Mozambique, were predominantly caused by direct obstetric complications requiring referral among women of low socioeconomic status. Prenatal management of HIV and syphilis limited effects on fetal outcome. Emergency obstetric care and referral systems should be the focus of interventions aimed at stillbirth prevention.

1. Introduction

High perinatal mortality remains a problem for many low-income countries, including Mozambique. According to WHO, approximately half of all perinatal mortality reflects intrauterine fetal death during pregnancy and childbirth [1]. Many stillbirths are associated with obstetric complications or maternal infectious diseases, including syphilis and possibly HIV [2–4]. Southern Africa has a heavy burden of such diseases, and stillbirths attributed to infections are reported to occur frequently [5,6]. Consequently, screening and management of syphilis and HIV during pregnancy has been widely introduced in the past decade [7,8].

Despite these efforts, little progress has been made in reducing perinatal mortality (including stillbirths) in Sub-Saharan Africa; indeed, many countries in this region report a stillbirth rate of greater than 25 per 1000 births [9]. The stillbirth rate in Mozambique is even higher, at 29 per 1000 births in 2008, and shows little sign of falling [10]. Furthermore, routine reports from local health authorities have highlighted a persistently high institutional stillbirth rate of 43 per 1000 births for Tete City, a town in northwestern Mozambique with approximately 175 000 inhabitants [11].

Tete has acceptable coverage of free obstetric services (including basic and complete emergency obstetric care) and prenatal care, with HIV and syphilis screening and management. Use of services is high because almost all pregnant women in the local population complete at least one prenatal care visit, and many give birth in the city's maternity wards. However, the local health system presents challenges for quality of care, including lack of adequately qualified staff, functional equipment, and ambulances for emergency referrals, as well as an irregular supply of essential drugs. The prevalence of syphilis and HIV among pregnant women in Tete is estimated to be 5% [12] and 19% [13], respectively.

The aim of the present study was to evaluate the relative importance of known risk factors for institutional stillbirth in Tete so that future priorities for stillbirth prevention could be identified.

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2. Materials and methods

A case–control study was conducted in three maternity facilities in Tete City between December 1, 2009, and April 30, 2011. Women included in the case group were mothers of neonates born without signs of life after at least 28 weeks of pregnancy and/or with a birth weight of at least 1500 g, according to what is usually considered as stillbirth in Mozambique. Women included in the control group had had live births; they were matched to cases on the basis of health facility attended and the strata of maternal age and parity. The present study conformed to the internationally recognized ethical standards for health research and was authorized by both national and local health authorities in Mozambique. Approval was obtained from the Mozambican Ministry of Health and Ghent University Hospital, Belgium. All participants provided written informed consent.

The sites selected for the present study included two urban health centers (No 2 and No 4) designated to give basic emergency obstetric care. Both these health centers provide one nurse specializing in maternal and child health per shift in the maternity ward. The third site was Tete Provincial Hospital, which offers comprehensive emergency obstetric care. On a per shift basis, this hospital provides two specialist nurses in the maternity ward, one non-specialist clinician, one specialist clinician (gynecologist or surgeon) on-call, and one surgical team [14]. All three facilities regularly have insufficient stock of essential medications for emergency obstetric care. Deliveries at these centers account for more than 90% of all institutional births in Tete each year (approximately 8000 births in total); the remaining births take place in small health facilities. Tete Provincial Hospital is accessible to patients either directly or through referral from health centers within or outside the city.

Recruitment and data collection were performed by four trained research assistants shortly after delivery at all three study sites. Controls were selected in parallel to cases: the first subsequent woman with correct matching criteria was invited to enroll in the control group. Every eligible participant received a personal identification number for use in data collection. A structured face-to-face interview (in the local language) and a review of the medical files (in Portuguese) were conducted to assess prenatal and delivery care. A venous blood sample was taken for laboratory analysis at Tete Provincial Hospital. All instruments were pretested and the principal investigators closely supervised ongoing data collection and laboratory procedures.

The interview provided information not routinely recorded in the medical file, including level of education, occupation of the participant and her partner, availability of water and electricity at the participant's home (subsequently combined into the variable socioeconomic status), smoking, alcohol consumption, height, and weight. The medical files provided all other pertinent information, including medical history and care during pregnancy and childbirth, HIV and syphilis serology, and newborn characteristics. Fetal heartbeat on arrival was determined by auscultation with a Pinard fetoscope on arrival at the health facility of first contact (either one of three study sites or another facility with subsequent referral to a study site). However, a negative fetal heartbeat on arrival at the health facility of first contact did not necessarily reflect prepartum intrauterine death. Many women started labor at home but faced considerable delays before reaching a health facility owing to late recognition of complications while at home, slow decision making to seek professional assistance (which often involved key male relatives), and difficulties in obtaining transport to attend the nearest health facility. Variables related to complications and progress of labor and delivery reflected only events observed within the health system, because medical files did not usually record any events that occurred before admission.

Laboratory tests were performed following standardized procedures. Infection with HIV was diagnosed by detection of antibodies using either the Determine HIV-1/2 test (Abbott Laboratories, Chicago, IL, USA) or the Uni-Gold Recombigen HIV-1/2 test (Trinity Biotech, Bray, Ireland). Syphilis was diagnosed by antibody testing and titration using either the Macro-Vue rapid plasma reagin (RPR) card test (BD Diagnostics, Sparks, MD, USA) or the SERODIA *Treponema pallidum* particle agglutination (TPPA) test (Fujirebio Diagnostics, Malvern, PA, USA). Syphilis and HIV tests performed at childbirth complemented the results of tests performed during prenatal care (often at the first visit), because they permitted the identification of seroconversion during pregnancy after starting prenatal care and the titration of syphilis antibodies. Participants were encouraged to collect test results from maternity staff using their personal identification number; any treatment required was administered in accordance with national standards. Quality control of in-house laboratory testing was performed in the national reference laboratory at Maputo for all positive test results and 15% of all negative test results.

The required sample size was calculated as 150 cases plus 300 controls, with a confidence interval of 95% and power of at least 80%. These values were based on the reported prevalence of syphilis and HIV in Tete [12,13], with the expectation of at least four-fold (syphilis) and two-fold (HIV) increased seropositivity among the cases than the controls [15–17]. Recruitment continued until the required number of participants for whom all necessary data collection steps (informed consent, interview, medical file review, and laboratory results) had been completed was reached. The number of participants who had completed all the necessary data collection steps was verified; only those with all four steps completed were included in the present analysis.

All data were digitized using EPI Info version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, GA, USA). Observations were then validated by double data entry and analyzed using Stata/IC version 11.2 (Stata Corp, College Station, TX, USA). Differences in proportions were calculated using χ^2 tests; $P < 0.05$ was considered statistically significant. Many of the variables examined in the present study were interdependent; therefore, a multivariate analysis was conducted to determine which of the possible explanatory factors influenced the outcome of stillbirth. A conditional logistic regression model was fitted by stepwise elimination of variables that did not contribute significantly to fit (initially taken as $P < 0.10$, followed by $P < 0.05$). Sociodemographic factors considered in this model were parity, socioeconomic status (low vs other), residence (in Tete vs outside Tete), and total number of prenatal visits (≥4 vs <4). Obstetric factors were direct complications during pregnancy and childbirth (prolonged labor, ruptured uterus, hemorrhage, preeclampsia, sepsis, and cord complications), indirect complications during pregnancy and childbirth (malaria, anemia, and non-obstetric sepsis), referral during pregnancy and childbirth, instrumental or operative delivery, and level of the attending health professional (medical doctor/specialist vs other). Additional factors considered were body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters; <18.5 vs ≥18.5) and alcohol use.

3. Results

A total of 169 potential cases were identified during the present study period, but 19 (11.2%) were excluded owing to incomplete data collection. Likewise, 359 potential controls were identified but 59 (16.4%) were excluded for not completing the data collection process. Consequently, the case and control groups included 150 and 300 women, respectively.

Of the 150 cases, 50 (33.3%) had a fetal heartbeat on arrival in the health facility of first contact, 70 (46.7%) no fetal heartbeat on arrival, and 30 (20.0%) no information regarding fetal heartbeat on arrival, indicating that between 33.3% and 53.3% (including cases for which no information was available) of stillbirths occurred during labor or childbirth after arrival in a health facility. No significant differences between groups were detected for sociodemographic characteristics (Table 1).

The distributions of various known risk factors for stillbirth are presented in Table 2. The frequencies of positive HIV or syphilis test results at childbirth were not significantly different between the two groups. Among all 450 women, 80 (17.8%) tested positive for HIV at childbirth, 58 (72.5%) of whom were known to be HIV positive during or before