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RESEARCH

Causes of prematurity in the Bloemfontein Academic Complex

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Background: Prematurity is globally the leading cause of neonatal mortality, morbidity and long-term disability. The Millennium Development Goals (MDG) of the United Nations, and specifically MDG 4, address child mortality. Neonatal mortality rates contribute to 37% of all under-five mortality, with the largest proportion (30%) due to prematurity. The overall purpose of this study was to determine factors associated with prematurity and to identify treatable and preventable causes at the Bloemfontein Academic Complex in order to decrease the morbidity and mortality associated with prematurity in line with MDG.
Methods: A case control study design was used including all premature babies referred to the Kangaroo Care Unit of the National District Hospital between December 2010 and March 2011. Each baby was included with his/her mother as a pair. For each premature baby and mother pair a term baby and mother pair was included as a control. Data were collected on a data sheet from the mothers' antenatal records, and from maternal notes as well as the neonatal follow-up and discharge notes. Data gathered included baseline characteristics, habits, diseases and medication of the mother during the antenatal period and delivery as well as baseline demographics of the babies.
Results: A total of 194 mothers and 198 babies were included in the study with 109 case mothers and 85 control mothers. Pre-existing medical conditions were more prevalent in the premature group (69%) compared with the control group (27%) with $p < 0.0001$. These conditions included hypertension, HIV disease and syphilis. Possible causes for prematurity identified in this study included teenage mothers and premature rupture of membranes.
Conclusion: Risk factors identified for prematurity were: teenage mothers, pre-existing medical conditions in the mother, and preterm rupture of membranes. Smoking and alcohol consumption during pregnancy could not be identified as risk factors for prematurity. It is recommended that patients with any of the above-mentioned identified risk factors be classified as high risk for the development of prematurity and shorter follow-up intervals and more aggressive management of pre-existing medical conditions should be practised.

Keywords: causes; morbidity; mortality; neonatal; prematurity

Background

The definition of a premature baby in this study, as well as in other studies referred to, is a baby born before 37 completed weeks (259 days) of gestation.[1,2] Prematurity is globally the leading cause of neonatal mortality, morbidity and long-term disability.[2,3] The most common reasons for death in premature babies in South Africa are respiratory distress syndrome, sepsis and intra-ventricular haemorrhage.[4] Prematurity can also cause long-term neurodevelopmental disorders such as cerebral palsy, blindness and deafness of different degrees.[5,6]

The Millennium Development Goals (MDG) of the United Nations, and specifically MDG 4, address child mortality.[7] Neonatal mortality rates contribute to 37% of all under-five mortality, with the largest proportion (30%) due to prematurity.[8]

According to the World Health Organization (WHO) more than 15 million premature babies are born annually, of whom more than 1 million will die due to conditions associated with prematurity.[1] The global incidence of prematurity is around 10%, with figures of less than 5% reported for some European countries and around 18% for most sub-Saharan African countries.[2,9] In South Africa more than 1.2 million babies are born annually,[10] of whom 14% are born prematurely.[6,11]

No study was found that looked at specific causes of prematurity in the Free State or Bloemfontein and as each facility is responsible for contributing to the MDGs it is important to address appropriate causes of prematurity.

The overall purpose of this study was to determine causes of prematurity in the Bloemfontein Academic Hospital Complex. The main objective was to determine treatable and preventable causes of prematurity in order to decrease the morbidity and mortality associated with prematurity in line with MDG 4.

Method

The Bloemfontein Academic Complex consists of Universitas Hospital (Tertiary), Pelonomi Hospital (Secondary,) National District Hospital and the Free State Psychiatric Hospital. The Free State Psychiatric Hospital was excluded from this study as it does not care for babies. Premature babies born or transferred for care to Universitas and Pelonomi hospital are transferred to the Kangaroo Care Unit at the National District Hospital for weight gain as soon as they are stable. Most term and healthy babies are delivered in primary health care facilities, including the National District Hospital.

A case control study design was used including all premature babies referred to the Kangaroo Care Unit of the National District Hospital between December 2010 and March 2011. Each baby was included with his/her mother as a pair. For each premature baby and mother pair a term baby and mother pair was included as a control. The date and time of birth of the premature baby

were used and from the birth register at the National District Hospital the baby born closest to the premature baby with his/her mother was included as the control.

Data were collected on a data sheet from the mothers' antenatal records (H10 charts), and from maternal notes as well as the neonatal follow-up and discharge notes. Data gathered included baseline characteristics, as well as habits, diseases and medication of the mother during the antenatal period and delivery, as well as baseline demographics of the babies.

A pilot study was performed on premature baby and mother pairs transferred during October 2010 and their control pairs. Minor changes were made to the data form.

The Department of Biostatistics used SAS® (SAS Institute Inc. 2004) to analyse the data quantitatively. Results were summarised by frequencies and percentages (categorical variables) and means, standard deviations or percentiles (numerical variables, depending on data distribution). Cases and controls were compared using Mann–Whitney tests, chi-square or Fisher's exact test as appropriate. Odds rations with 95% confidence intervals were calculated for significant variables.

The Ethics Committee of the Faculty of Health Sciences at the University of the Free State approved the study and the Chief Executive Officer of the National District Hospital gave permission to conduct the study at the National District Hospital from patient records. All data were handled confidentially and no patient was identified.

Results

A total of 194 mothers and 198 babies were included in the study. Originally 97 premature baby/mother pairs and 97 control pairs were included in the study. However, it was discovered that some of the control babies were actually premature when all available information (sonar date, first day of last menstruation and follow-up gestation) were taken into consideration and these pairs were then put in the correct group according to gestation. There were 109 mothers in the case group and 85 in the control group. As some mothers had twins, there were more babies than mothers in the study.

Baseline characteristics of the mothers

The median ages of the case and control mothers were 25 and 24 respectively with no statistically significant difference between the groups. The percentage of teenage mothers (26% of cases and 11% of controls) differed significantly (odds ratio 2.9 (95% CI 1.3, 6.6), $p < 0.01$). The percentage of mothers above 35 years (7% of cases and 1% of controls) differed close to significantly ($p = 0.08$). The mothers' Rhesus blood groups (92% vs. 94% Rh^+, $p = 0.16$), number of pregnancies (both groups with a median of 2, $p = 0.98$) and previous miscarriages (11% vs. 13%, $p = 0.61$) were comparable for the two groups.

Baseline characteristics of the babies

The median gestational age of the premature babies was 33 weeks and that of the term babies 40 weeks. The median weight of the premature babies was 1620 g and that of the term babies 3000 g.

Maternal habits, diseases and medication

In Table 1 the percentages of mothers who smoked and consumed alcohol during the pregnancy are displayed.

Table 1: Comparison of smoking and alcohol use during pregnancy of the premature and control groups

	Premature	Control	*p*-value
Smoking	5%	14%	0.02
Alcohol	4%	12%	0.03

Pre-existing medical conditions were more prevalent in the premature group (69%) compared with the control group (27%) (odds ratio 5.9, 95% CI 3.2, 11.1), $p < 0.0001$. These conditions included hypertension, HIV disease, tuberculosis, syphilis and diabetes mellitus. All of these conditions occurred more in the premature group except for diabetes mellitus, which occurred more in the control group.

In Figure 1 the percentage of mothers with medical conditions before delivery is displayed for each group. Some mothers presented with more than one condition.

Medications used during the pregnancy can be divided into three groups, namely medication used for associated medical conditions such as anti-hypertensive treatment, medication to support the pregnancy such as folic acid and iron, and medication used during specific emergency conditions such as steroids and magnesium sulphate. More patients in the premature group used medication and more suffered from medical conditions. Only 4% of patients in the premature group used iron and folic acid compared with 28% in the control group. Emergency medications

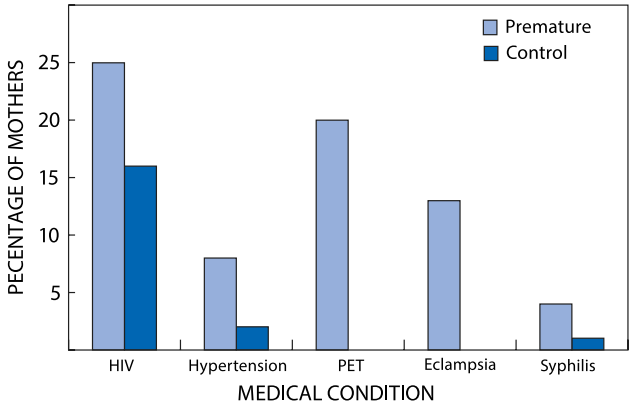

Figure 1: Percentage of mothers with pre-existing medical conditions in the premature and control groups

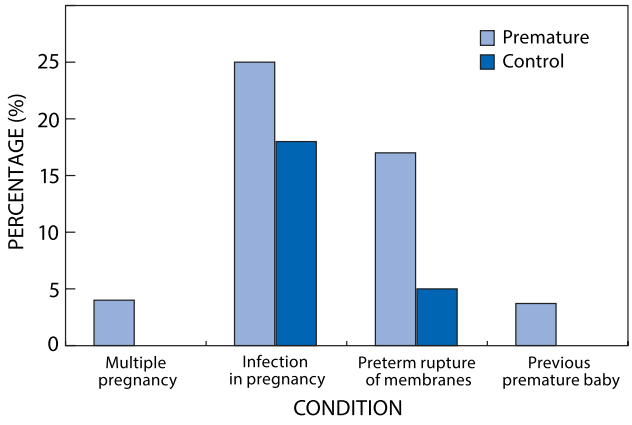

Figure 2: Conditions associated with premature delivery

to improve foetal lung maturity as well as magnesium sulphate were exclusively used in the premature group of mothers.

Possible causes for prematurity identified in this study included multiple pregnancies (p = 0.13), infection during pregnancy (p = 0.24), premature rupture of membranes (odds ratio 4.3 (95% CI 1.4, 13.1), p = 0.01) and a previous premature baby (p = 0.13). In Figure 2 the percentage of cases and controls are displayed.

Short-term outcome of the babies

As only stable babies were included in the study, no deaths occurred in any of the groups. No serious neurological conditions evident at birth or before discharge were reported in any of the babies.

Discussion

The baseline characteristics regarding median age, blood groups, number of previous pregnancies and miscarriages of mothers did not differ statistically significantly between the two groups of mothers. Our results agree with a number of studies that found teenage mothers and mother above 35 years of age to be at risk of delivering premature babies.[12–16]

Information regarding smoking and alcohol consumption was self-reported and gathered from patient records and could therefore not be confirmed. However, the same sources were used for both groups. Smoking and alcohol use during pregnancy are well described as causes for low birth weight in babies, but a study in South Africa could only find smoking and not alcohol consumption as a cause of prematurity.[17–20] In this study only 5% of mothers of premature babies indicated that they smoked during the pregnancy. A study conducted among black women in South Africa found that only 5% of them smoke regularly.[20] Although more mothers in the control group smoked and consumed alcohol during the pregnancy, no conclusion can be made.

Regarding medical conditions during the pregnancy, the presence of HIV disease and hypertension constituted definite risk factors for prematurity, while previous premature labour and multiple pregnancies occurred only in the premature group. These findings are consistent with the literature findings.[18]

Specific medication used by patients was in line with the specific conditions that occurred in individuals. Medication for medical conditions such as infections and gestational hypertension, as well as medication for emergency management such as pre-eclampsia and preterm rupture of membranes, occurred statistically more in the premature group. However, medications to support pregnancy, such as folic acid and iron supplementation, were almost exclusively used in the control group (4% vs. 28%). All pregnant patients should routinely receive these medications, which poses the question as to why only 16% of all pregnant mothers in this study had evidence of its use on their records.

Although the cause of preterm labour is not known in the majority of cases, some conditions may precipitate labour. Most cases of prematurity are preceded by spontaneous rupture of membranes.[21] Conditions that may predispose an individual to spontaneous preterm premature rupture of membranes include infections during pregnancy, over-distension of the uterus such as in multiple pregnancies and previous premature labour.[21,22] In this study all the aforementioned factors occurred more in the premature group of patients and can therefore be considered as possible risk factors for prematurity.

The limitations of the study include the following:

The original wrong classification of some of the controls that were actually premature babies; however, this was rectified in the analysis of the data.

The small number of patients who reported smoking and alcohol consumption during pregnancy.

Possible missing information on patient data, especially regarding the use of iron and folic acid supplementation.

No long-term follow-up of premature babies to identify possible complications of prematurity.

Conclusion and recommendations

Risk factors identified for prematurity in the Bloemfontein Academic complex were:

- teenage mothers;
- pre-existing medical conditions in the mother, which included hypertension, HIV disease, tuberculosis and syphilis;
- spontaneous preterm rupture of membranes.

Smoking and alcohol consumption during pregnancy could not be identified as risk factors for prematurity.

It is recommended that patients with any of the above-mentioned identified risk factors be classified as at high risk for the development of prematurity and shorter follow-up intervals and more aggressive management of pre-existing medical conditions should be practised.

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