Determinants and outcome of fetal macrosomia in a Nigerian tertiary hospital

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ABSTRACT

Background: To determine the incidence and risk factors of fetal macrosomia and maternal and perinatal outcome. Patients and Methods: This was a 1-year prospective case–control study of singleton pregnancies in a Nigerian tertiary hospital. Only women who gave consent were recruited for the study. The maternal and perinatal outcomes in women who delivered macrosomic infants (birth weight ≥4000 g) were compared with the next consecutive delivery of normal birth weight (2500–3999 g) infants. Results: The total deliveries for the study period were 2437, of which 135 were macrosomic babies. The incidence of fetal macrosomia was 5.5%. The mean birth weights of macrosomic and nonmacrosomic babies were 4.26 ± 0.29 kg and 3.20 ± 0.38 kg, respectively, P = 0.000. Mothers with macrosomic babies were more likely to be older (P = 0.047), of higher parity (0.001), taller (P = 0.007), and weighed more at delivery (P = 0.000). Previous history of fetal macrosomia (P = 0.000) and maternal diabetes (P = 0.007) were factors strongly associated with the delivery of macrosomic infants. Pregnancies associated with fetal macrosomia had increased duration of labor (P = 0.007), interventional deliveries (P = 0.000), shoulder dystocia, and genital laceration (P = 0.000). There was no significant difference in the incidence of primary postpartum hemorrhage (P = 0.790), birth asphyxia, and perinatal mortality (P = 0.197). Conclusion: Fetal macrosomia is associated with maternal and fetal morbidities. The presence of the observed risk factors should elicit the suspicion of a macrosomic fetus and the need for appropriate management to reduce maternal and fetal morbidities.

Key words: Birth weight, fetal macrosomia, risk factors, shoulder dystocia

INTRODUCTION

There is no universally accepted definition of fetal macrosomia. While some clinicians believe that infants with birth weight ≥4000 g or above the 90th percentile for the population and sex-specific growth curve can be said to be macrosomic, others have used birth weight ≥4500 g.1-3

Fetal macrosomia poses a significant obstetric challenge because diagnosis can be problematic and inaccurate.4 Due to the maternal and neonatal morbidities associated with pregnancies of macrosomic fetuses, such pregnancies are often termed high-risk pregnancies.4,5

Pregnancies complicated with fetal macrosomia have been linked with longer duration of labor, instrumental and cesarean delivery, genital trauma, postpartum hemorrhage (PPH), birth injuries, and asphyxia;4,4,6 conditions which are likely to impart negatively on the drive to achieve the millennium development goals of reduction in child mortality and improving maternal health. For instance, reports show that fetal macrosomia is significantly associated with birth trauma,2 increased risk of premature rupture of membranes and placenta previa, and an increased incidence of perinatal mortality.7

Fetal macrosomia complicates about 1–10% of pregnancies2,6,9 and antenatal diagnosis is essential as it

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may help to guide decision on route of delivery. Increased index of suspicion based on knowledge of determinants of fetal macrosomia may assist in selecting women, in which antenatal fetal weight estimation is important. The incidence of macrosomia among diabetic pregnant women is higher than nondiabetics. Apart from maternal diabetes, other determinants include: Previous delivery of a macrosomic fetus, excessive weight gain in pregnancy, maternal obesity, prolonged pregnancy, multiparity, male fetus, and parental stature. However, fewer than 40% of macrosomic infants are born to mothers with identifiable risk factors.

In this center, the only published work that assessed the risk factors of macrosomia was done 25 years ago. With the general improvement in the socioeconomic status of the Nigerian populace, the incidence of fetal macrosomia and its attendant complications are expected to rise. There is a need for increased documentation of the determinants and outcome of pregnancies complicated by fetal macrosomia in this environment, thus necessitating this study.

The objective of this study was to determine the incidence, risk factors, and the maternal and perinatal outcome of pregnancies with fetal macrosomia.

METHODS

This was a facility-based study conducted at the Obstetric Unit of the University of Benin Teaching Hospital (UBTH). The UBTH is a tertiary health facility situated in an urban center and serves as a major referral center for Benin City and its environ with an estimated population of about 1.1 million people.

This was a prospective case–control study of mothers whose infant birth weights were 4000 g and above (fetal macrosomia) delivered at the UBTH labor ward. The controls were the next consecutive women who had normal birth weight babies (2500–3999 g). The labors were actively managed using the modified WHO partograph with individualized alert and action lines separated by 2 h. Labor was prolonged if active phase lasted longer than 12 h.

Women with multiple pregnancies, low birth weight (weight <2500 g) babies, and babies delivered preterm were excluded from the study.

Using a structured questionnaire, the bio-socio-demographic data were obtained. The following maternal variables were obtained: Age, parity, height, maternal weight at delivery, body mass index (BMI) at delivery, gestational age at delivery, history of previous fetal macrosomia, and maternal diabetes mellitus (whether pregestational or gestational diabetes mellitus). Intrapartum events obtained included duration of labor, mode of delivery, and occurrence of shoulder dystocia.

The outcome measures included: Incidence of PPH, genital laceration, birth injury, sex of babies, Apgar scores, and perinatal mortality. BMI was classified using the WHO classification: Underweight (<18.5), normal (18.5–24.9), and overweight (≥25). Asphyxia was classified as mild (Apgar score of 6), moderate (Apgar score of 4–5), and severe (Apgar score 1–3) at the 1st and 5th min. Maternal and fetal outcomes of mother–baby pairs of macroscopic and nonmacrosomic infants were compared.

Data analysis

The data were analyzed using SPSS for Windows (Statistical Package for Social Sciences, SPSS version 16.0, Chicago, IL, USA). Group means were compared using analysis of variance and statistical significance was ascertained using Chi-square test. A probability level of ≤0.05 was considered statistically significant.

Ethical approval for this study was obtained from the UBTH Ethics Review Committee. All participants gave informed consent.

RESULTS

The total deliveries for the study period was 2437, of which 135 (5.5%) were macrosomic babies. Table 1 shows determinants of fetal macrosomia. The mean age of mothers that had macrosomic babies was significantly higher than that of mothers with normal birth weight.

| Variable | Pregnancies with macrosomia (n=135) (%) | Pregnancies with normal birth weight (n=135) (%) | P |
|----------|----------------------------------------|-----------------------------------------------|---|
| Age (years) | | | |
| Means±SD | 30.47±4.91 | 29.35±4.26 | 0.047 |
| <35 | 108 (80.0) | 122 (90.4) | 0.016 |
| ≥35 | 27 (20.0) | 13 (9.6) | |
| Height (cm) | | | |
| Means±SD | 163.59±6.39 | 161.67±5.13 | 0.007 |
| Parity | | | |
| Nulliparity | 35 (25.9) | 63 (46.7) | 0.001 |
| Multiparity | 94 (69.6) | 70 (51.9) | |
| Grandmultiparity | 6 (4.4) | 2 (1.5) | |
| History of macrosomia | 33 (24.4) | 4 (3.0) | 0.00 |
| History of diabetes mellitus | 7 (5.2) | 0 (0) | 0.007 |
| Maternal weight at delivery | | | |
| Means±SD (kg) | 90.28±13.92 | 75.27±14.02 | 0.000 |
| Mean maternal weight gain (kg) | 7.06±4.15 | 6.23±3.33 | 0.098 |
| BMI* at delivery | | | |
| Underweight | 0 (0.0) | 3 (2.2) | 0.000 |
| Normal | 2 (1.5) | 34 (25.2) | |
| Overweight | 33 (24.4) | 98 (72.6) | |
| Mean BMI | 33.73±4.96 | 28.80±4.81 | 0.000 |
| EGA* at delivery (weeks) | | | |
| Means±SD | 39.63±1.60 | 39.20±1.49 | 0.020 |

*BMI – Body mass index; †EGA – Estimated gestational age; SD – Standard deviation
babies (30.47 ± 4.91 years vs. 29.35 ± 4.26 years, \( P = 0.047 \)). Mothers of macrosomic babies were significantly older than 35 years (20.0% vs. 9.6%, \( P = 0.016 \)) and multiparous or grandmultiparous (\( P = 0.001 \)). They had a higher mean height (163.59 ± 6.39 cm vs. 161.67 ± 5.13 cm, \( P = 0.007 \)), higher mean weight at delivery (90.28 ± 13.92 kg vs. 75.27 ± 14.02 kg, \( P = 0.000 \)), higher mean BMI at delivery (33.73 ± 4.96 kg/m² vs. 28.80 ± 4.81 kg/m², \( P = 0.000 \)), and were significantly more overweight (98.5% vs. 72.6%, \( P = 0.000 \)) compared to mothers of normal birth weight babies.

A history of previous macrosomia (24.4% vs. 3.0%, \( P = 0.000 \)) and maternal diabetes mellitus (5.2% vs. 0.0%, \( P = 0.007 \)) were more common among mothers who had macrosomic babies than those that had normal birth weight babies. Similarly, the mean gestational age at delivery was higher for women with macrosomic babies compared with controls; 39.63 ± 1.60 weeks vs. 39.20 ± 1.49 weeks, \( P = 0.020 \). There was no significant difference in the mean weight gain in pregnancy in the two groups (7.06 ± 4.15 kg vs. 6.23 ± 3.33 kg, \( P = 0.098 \)).

Table 2 shows the intrapartum events. The mean duration of labor was 5.67 ± 3.64 h vs. 4.32 ± 2.87 h for the subjects and controls, respectively, \( P = 0.007 \). The macrosomic pregnancies had significantly higher rate of cesarean section (C/S) (51.1% vs. 18.5% \( P = 0.000 \)) as well as higher rate of instrumental delivery (6.7% vs. 1.5% \( P = 0.000 \)). The main indication for C/S in the two groups was cephalopelvic disproportion (CPD); 49.3% and 24.0%, respectively. Subgroup analysis showed that the mean birth weight of macrosomic babies delivered by C/S was significantly higher than that of macrosomic babies delivered per vagina (4.31 ± 0.29 kg vs. 4.21 ± 0.28 kg, \( P = 0.043 \)). The incidence of shoulder dystocia was significantly higher in the macrosomic group (5.2% vs. 0.0%, \( P = 0.000 \)). No shoulder dystocia occurred in the normal birth weight babies. There was no significant difference in the mean birth weight of macrosomic babies with shoulder dystocia and those without shoulder dystocia (4.27 ± 0.28 kg vs. 4.20 ± 0.28 kg, \( P = 0.546 \)). Similarly, frequency of genital laceration was significantly higher in mothers of macrosomic babies compared to the controls (15.6% vs. 3.0% \( P = 0.000 \)). However, the incidence of PPH was comparable in the two groups (5.9% vs. 5.2%, \( P = 0.790 \)).

Table 3 shows the perinatal outcome. The mean birth weights of macrosomic and nonmacrosomic babies were 4.26 ± 0.29 kg and 3.20 ± 0.38 kg, respectively, \( P = 0.000 \). The incidence of birth injuries was comparable in the two groups; 1.4% vs. 0.0%, \( P = 0.365 \). Macrosomic babies were more likely to be males 63.0% vs. 49.6%, \( P = 0.027 \). Though perinatal mortality was higher among macrosomic infants 5.2% vs. 2.2%; this did not reach statistically significant level; \( P = 0.197 \).

When the incidence of mild and severe birth asphyxia at 1 min were compared in the two groups, there was no statistically significant difference (\( P = 0.142 \) and 0.555, respectively). However, macrosomic babies were more likely to have moderate birth asphyxia at 1 min (\( P = 0.041 \)). There was no significant difference in the incidence of mild, moderate, and severe birth asphyxia at 5 min between the two groups (\( P = 0.758 \), 0.176 and 0.176, respectively).

**DISCUSSION**

This study has highlighted the importance of fetal macrosomia in obstetrics, especially the maternal and perinatal outcome. The incidence of fetal macrosomia of 5.5% in this study is higher than the 3.5% reported in Ibadan\(^8\) and 2.5% in Abia State.\(^8\) The incidence is lower than 14.65% found in Port Harcourt\(^1\) and 10% found in the United States of America.\(^2\) These differences in incidence may be due to differences in the definition of fetal macrosomia. It may also be due to differences in geographical and socioeconomic factors of the study population.

To make the diagnosis of fetal macrosomia antenatally, it is important to be aware of the predisposing factors. This

| Variable | Macroscopic group (% (n=135)) | Control (% (n=135)) | \( P \) |
|----------|-------------------------------|---------------------|-------|
| **Table 2: Intrapartum events** | | | |
| Duration of labor (h) | Means SD | 5.67±3.64 | 4.32±2.87 | 0.007 |
| Mode of delivery | | | |
| Spontaneous vaginal delivery | 57 (42.2) | 108 (80.0) | 0.000 |
| Cesarean section | 69 (51.1) | 25 (18.8) | 0.000 |
| Instrumental delivery | 9 (6.7) | 2 (1.5) | 0.176 |
| Shoulder dystocia | 7 (5.2) | 0 (0.0) | 0.000 |
| Genital laceration | 21 (15.6) | 4 (3.0) | 0.000 |
| Primary postpartum hemorrhage | 8 (5.9) | 7 (5.2) | 0.790 |
| | SD – Standard deviation | | |

| Variable | Macroscopic group (% (n=135)) | Control (% (n=135)) | \( P \) |
|----------|-------------------------------|---------------------|-------|
| **Table 3: Perinatal outcome** | | | |
| Mean birth weight (kg) | 4.26±0.29 | 3.20±0.38 | 0.000 |
| Birth injury | 2 (1.4) | 0 (0.0) | 0.360 |
| Sex | Male | 85 (63.0) | 69 (49.6) | 0.027 |
| | Female | 50 (37.0) | 68 (50.4) | 0.197 |
| Asphyxia at 1 min | | | |
| Mild | 9 (6.7) | 16 (11.9) | 0.142 |
| Moderate | 15 (11.1) | 6 (4.4) | 0.041 |
| Severe | 7 (5.2) | 3 (2.2) | 0.277 |
| Asphyxia at 5 min | | | |
| Mild | 6 (4.4) | 3 (2.2) | 0.758 |
| Moderate | 4 (3.0) | 1 (0.7) | 0.176 |
| Severe | 4 (3.0) | 1 (0.7) | 0.176 |
| Perinatal mortality rate | 7 (5.2) | 3 (2.2) | 0.397 |
study found that increasing maternal age, multiparity, maternal height, maternal overweight, maternal diabetes mellitus, and previous delivery of a macrosomic baby were risk factors for fetal macrosomia in an index pregnancy. Maternal complications included increased duration of labor, increased C/S rate, and increased genital laceration. There were no statistically significant differences in the occurrence of birth injury, birth asphyxia, and perinatal mortality in the two groups. In this study, maternal overweight at term was significant for fetal macrosomia. Similar findings have been reported in other studies.6,8,9 Though some studies have reported maternal weight gain exceeding 13 kg at term,6,9 we found no significant difference in the maternal weight gain in pregnancy among the two groups. Determination of prepregnancy weight in our environment is difficult. There are no preconception clinics. While some of the patients registered for antenatal care late, others were not registered. Hence, the effect of weight gain in pregnancy on fetal weight could not be properly determined in this study. This may account for the difference in observation. The association of maternal height with fetal macrosomia in this study is in agreement with reports from previous studies.13 However, a study from Ibadan in South-West Nigeria found no association.9 Maternal diabetes (pregestational or gestational) was associated with increased incidence of macrosomic births as previously reported5,6,11 Maternal hyperglycemia begets fetal hyperglycemia through utero-placenta transfer of maternal glucose and thus increased fetal weight. Being a male fetus was a factor associated with macrosomia in this study. Adesina and Olayemi11 in South-West Nigeria and Sermer et al.16 in Toronto had previously reported similar observations for their population.

We found higher mean gestational age at delivery for macrosomic fetuses. Other workers have reported similar findings.6 This is probably a reflection of the increased incidence of CPD among macrosomic fetuses.

While awareness of the antenatal risk factors is certainly important in the suspicion and subsequent management of macrosomia, fetal and maternal outcome depends largely on how well-labor was managed. In this study, though the mean duration of labor for the macrosomic group was higher than the control, there was no case of prolonged labor. By our unit’s protocol, every labor is actively managed using the modified WHO partograph. Signs of slow labor progress and CPD were recognized early and appropriate management was instituted. Though not all macrosomic infants were delivered by C/S, the high C/S rate of 51% for the macrosomic group (compared with 18.8% for controls) was significantly contributed to by the subgroup with CPD. As in this study, in well supervised labors and deliveries, timely recognition of CPD and prompt intervention can prevent irreversible damage to both mother and baby.

This underscores the importance of using partograph in the management of labor.

Genital laceration was more common among women who delivered macrosomic babies vaginally, but there was no significant difference in the incidence of PPH between the two groups. Some other studies5 have reported similar observation. In our unit protocol, third stage of labor is actively managed with oxytocics and timely repair of episiotomy and perineal laceration is mandatory. This may account for the low incidence of PPH. Birth injuries, asphyxia, and perinatal mortality are critical issues in obstetric practice. In this study, there was no significant difference in the incidence of these indicators between the two groups. This was probably due to the knowledgeable supervision of labor with prompt intervention, when indicated as practiced in our unit. This is at variance with the findings from Port Harcourt that showed increased perinatal mortality and birth asphyxia among macrosomic babies.7

CONCLUSION

This study has highlighted common predisposing factors for fetal macrosomia. Measures to identify mother-baby pairs to prevent or reduce complications associated with the deliveries of such babies have also been highlighted. Maternal health education including appropriate nutrition and screening for diabetes are important antenatal interventions.

Pregnancies with macrosomic fetuses pose higher materno-fetal complications. However, with high index of suspicion, knowledgeable supervision of such pregnancies, and active management of such labors using the partograph by skilled birth attendants, the complications can be reduced to acceptable levels as shown in this study. Consequently, a policy of elective C/S for all cases of suspected fetal macrosomia may not be a favorable practice in our environment, especially as our women have strong aversion to cesarean delivery.20

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Conflicts of interest

There are no conflicts of interest.

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