Pregnancy outcomes in relation to different types of diabetes mellitus and modes of delivery in macrosomic foetuses in Bahrain

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Abstract

Objectives: The mode of delivery in diabetic patients is debatable. This study was designed to assess the pattern of delivery of macrosomic babies with a high prevalence of diabetes mellitus in Bahrain.

Methods: This retrospective analysis was conducted on mothers who delivered babies weighing ≥4.0 Kgs from 2001 to 2011 at Bahrain Defence Force Hospital. Data regarding patients’ age, weight, mode of delivery, diabetic status, gestational age and parity were recorded. The main outcome was the effect of diabetes mellitus on the decision to allow vaginal delivery for macrosomic babies. Other outcomes were failed trial of labour, parity, maternal age and foetal weight on the trial of labour and neonatal morbidity associated with vaginal births.

Results: The incidence of macrosomic babies was 2.2% of total births. Pre-existing diabetes mellitus was 3.9% of the study cohort. The rate of elective Caesarean section increased from 12.5% in non-diabetic mothers to 50% in patients with pre-existing diabetes. In cases of allowing a trial of labour, approximately 70% of patients with pre-existing diabetes had successful vaginal delivery. Patients with a previous delivery were less likely to undergo emergency procedures, but had the same probability for elective Caesarean compared with primigravida. Patient’s age and foetal weight had no influence on successful trial of vaginal birth.

Conclusions: There was a trend to offer more elective Caesarean sections in patients with macrosomic babies in the presence of pre-existing diabetes. The majority of
patients who were offered a trial of labour achieved vaginal delivery with minimal morbidity.

**Keywords**: Caesarean section; Diabetes; Foetal macrosomia; Gestational diabetes; Shoulder dystocia

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**Introduction**

Macrosomia is defined by the American College of Obstetricians and Gynecologists (ACOG) as a birth-weight over 4000 g with no correlation to gestational age.1 Macrosomia affects approximately 3–15% of all pregnancies. The diagnosis can only be confirmed retrospectively after delivery of the neonate.2 Genetic, ethnic and racial factors are associated with foetal macrosomia.3 Pre-gestational diabetes results in foetal macrosomia in 40% of pregnancies.3

Furthermore, when patients have gestational diabetes, the risk of having macroscopic babies increases to 50%.4 A KSA study was conducted from 2004 to 2006 and confirmed the prevalence of macrosomic babies to be 5.6% using the same birth weight definition.5 Another recent large birth cohort Kuwaiti study reported macrosomia in 6.1% of the cohort, and 23.0% of babies were large for their gestational age.5

Macrosomia can cause numerous perinatal and maternal complications.6 Large babies can be traumatized during vaginal birth, especially those with shoulder presentation. Even with an uncomplicated delivery, macromomiac babies, especially those born to diabetic mothers, have an increased incidence of admission to intensive care infant units to regulate their blood sugar levels and electrolytes. Macrosomia can also lead to maternal complications, such as prolonged labour, Caesarean delivery (CSD), labour assisted with oxytocin, postpartum haemorrhage, infection, serious perineal tears of the 3rd and 4th degree, thromboembolic events (DVT) and anaesthetic accidents.7

To prevent any chance of birth trauma to mother and baby, some authors suggested induction of labour before 40 gestational weeks, others recommend routine Caesarean section (CS) for the delivery of foetuses >4500 g.8 Al-Haddabi’s group reported that among 7367 deliveries in a three-year study conducted in the Department of Obstetrics and Gynecology, Sultan Qaboos University Hospital, Sultanate of Oman, the CS rates were increased in the macrosomic group compared with the general group (25.8% vs. 13.1%).9 Ultrasound techniques are not very reliable in detecting and diagnosing macrosomia.10

Unfortunately, there are still no clear guidelines governing the management of macrosomia in diabetic patients, and this issue should be given serious consideration due to its consequence.

The present retrospective analysis aims to assess the mode of delivery in patients with large babies associated with different types of diabetes. The analysis also assessed other factors that might influence the clinical decision and final outcome.

**Materials and Methods**

Data were collected retrospectively at the BDFMH. Patients who gave birth to babies weighing ≥4.0 Kg were included. Patients’ birth records and birth registry were reviewed between 2001 and 2011. The mode of delivery was recorded in the form of vaginal, emergency lower segment Caesarean section (LSCS) and elective LSCS. Cases were divided into three groups: non-diabetic, gestational diabetes and pre-existing diabetes. All pregnant women included in the study were screened with the 50-g glucose tolerance test at approximately 20 weeks of gestation. Patients who screened positive were subject to a full glucose tolerance test. Patients with one abnormal reading were considered to be glucose intolerant. Patients with two abnormal readings were confirmed to have gestational diabetics. In our analysis, BDF Hospital patients with glucose intolerance were included in the gestational diabetic group. All patients with pre-existing diabetes were either induced or had elective Caesarean before reaching full term. Patients with gestational diabetes were offered delivery at term. Failure to progress was diagnosed based on Friedman’s curve.

Patient’s age, weight, gestational age at delivery, parity and 3rd and 4th degree tears were recorded. Shoulder dystocia was diagnosed when gentle traction failed to deliver the shoulder and additional obstetric manoeuvres were required. Birth trauma, including Erb’s palsy and clavicular/humeral fractures in our birth registry, were recorded.

The main outcome was the effect of DM on the decision to allow macrosomic baby vaginal delivery. Other outcomes included the rate of emergency LSCS with trial of labour, effect of previous delivery/maternal age/foetal weight on the trial of labour and neonatal morbidity associated with vaginal birth. Data were analysed using the StatsDirect statistical package. Two-sided Mann–Whitney U tests were used to compare the medians between two groups, and two-sided unpaired t tests were used to compare the means between two groups. Chi square tests were used in crosstabs, and Fisher–Freeman–Halton exact test was employed in crosstabs when any cells had an expectation of less than 5. P-values of less than 0.05 were considered statistically significant.

**Results**

The incidence of macromomiac babies represented approximately 2.2% of all recorded deliveries (811 out of 36,827 cases). Approximately 78% (634/811) of patients did not have gestational or pre-existing diabetes. Gestational diabetes was noted in 18% (145/811) of patients, and pre-existing diabetes was only found in 4% (32/811).

Thirty-four patients with glucose intolerance were added to the gestational diabetes group. Approximately 25% of the patients with gestational diabetes (26/111) were managed with insulin during pregnancy, whereas the remaining majority (76.6%) were managed with diet. Three-fourths of patients with pre-existing diabetes (24/32) were type 1, and
the remaining (8/32) were type 2 diabetics. None of the diabetic patients received oral anti-diabetic therapy during pregnancy within the study period.

Trial of normal labour (TOL) was offered to 685 (84.4%) of the total number of patients in this study. Diabetes significantly influenced the mode of delivery (MOD), with a trend of offering more elective LSCS to patients with pre-existing diabetes (Table 1). Only 50% of patients with pre-existing diabetes and large babies were given the trial of vaginal birth. This number increased to 78.6% in the GDM group (P = 0.0001) with a linear trend (P < 0.0001) (Table 1). Unfortunately, 12.5% of non-diabetic patients with large babies were delivered by elective LSCS.

Out of the 685 patients, 563 (82.1%) had a normal vaginal delivery when allowed a normal trial of labour. The emergency LSCS rates in patients allowing vaginal birth were significantly different between the study groups (P = 0.018).

In total, 69% of patients with pre-existing diabetes and large babies underwent successful vaginal birth. The emergency LSCS rate in patients with large babies and non-diabetic was 16% compared with 25% in the gestational diabetic group (P = 0.01) (Table 2). The emergency LSCS group included patients who had LSCS due to other obstetric reasons and not necessarily ‘failure to progress’ in labour.

The present analysis confirmed that patient’s age and foetal weight had no effect on successful trial of vaginal birth with macrosomic babies. The mean age of patients who had emergency LSCS was 30.4 years compared with 31.2 for the vaginal delivery group. The median foetal weight was similar for the 2 groups (4.18 Kgs and 4.15 Kgs) (Table 3). There was a trend toward emergency Caesarean for patients with a median gestational age of 41 weeks compared with those at 41 weeks (P < 0.0001).

The majority of screened patients (90%) had a previous delivery, including a previous LSCS. No difference was noted in the elective Caesarean rate between primigravida and patients with previous delivery (18% compared with 15%, respectively). Primigravida in the present analysis exhibited an increased rate of emergency LSCS compared with patients with previous delivery (56% vs. 14%) (Table 4).

The emergency Caesarean rate for ‘failure to progress’ was significantly increased in patients with pre-existing diabetes (31%) compared with patients with no diabetes (9%). For patients with gestational diabetes, the ‘failure to progress’ rate was 16.7% (Table 5).

None of the patients who delivered vaginally had an extended vaginal tear of the 3rd or 4th degree. Furthermore, there were no reported serious complications, such as a ruptured uterus or hysterectomy for postpartum haemorrhage. None of the 22 cases of shoulder dystocia reported in the study had pre-existing diabetes. Shoulder dystocia was reported in 6 patients (27%) with gestational diabetes, 3 of whom were receiving insulin treatment. The median foetal weight of these patients was 4.2 kgs. Shoulder dystocia also occurred in 8 patients with no diabetic history who delivered after 41 weeks. It is important to note that all diabetic mothers delivered before 40 weeks, yet shoulder dystocia was not prevented. A single case of clavicular fracture was reported in a 4-kg baby whose mother had diet-controlled gestational diabetes. Another case of Erb’s palsy was reported for a 4.5-kg baby whose mother was non-diabetic. Fortunately, the injury resolved without any permanent damage.

Discussion

In current obstetric practice, a macrosomic foetus represents a clinical challenge, especially during the process of vaginal delivery. The rate of macrosomia was estimated at (10.19%) in a recent Algerian study; their foetal complications primarily involved neonatal infections (88%), followed by shoulder dystocia.1

A number of studies assessed the most appropriate and safe approach to deliver macrosomic babies. Inducing labour prior to 40 weeks of gestation was offered to some women with predicted foetal macrosomia. This approach would help

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**Table 1: The effect of DM on the decision to allow macrosomic babies a trial of vaginal birth.**

|                  | No DM | GDM | Pre-existing DM |
|------------------|-------|-----|-----------------|
| Allowed TOL 685  | 555 (87.5%) | 114 (78.6%) | 16 (50%)        |
| Elective CS 126  | 79 (12.5%)  | 31 (21.4%)  | 16 (50%)        |
| Chi-square P     | < 0.0001  |     |                 |

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**Table 2: Emergency Caesarean rate in patients allowed a trial of vaginal birth.**

|                  | No DM  | GDM  | Pre-existing DM |
|------------------|--------|------|-----------------|
| Emergency CS 122 | 88 (16%) | 29 (25%) | 5 (31%)         |
| SVD 563          | 467 (84%) | 85 (75%) | 11 (69%)        |
| Chi-square P     | 0.0187 |      |                 |

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**Table 3: Characteristics of patients who were allowed a trial of labour.**

|                  | Emergency CS | SVD | P-value |
|------------------|--------------|-----|---------|
| Patient mean age | 30.4 (29.3–31.5) | 31.2 (30.8–31.8) | 0.1605 |
| Gestational mean age in weeks | 39 (35–41) | 41 (35–41) | < 0.0001 |
| Foetal mean weight in kg      | 4.18 (4–5.34) | 4.15 (4–5.37) | 0.06   |

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**Table 4: Mode of delivery and previous birth.**

|                  | Primigravida | Previous delivery |
|------------------|--------------|-------------------|
| Elective CS 126  | 14 (18%)     | 112 (15%)         |
| Emergency LSCS 122 | 36 (56%)   | 86 (14%)          |
| SVD 563          | 28 (44%)     | 535 (86%)         |
| Chi-square P     | < 0.0001     |                   |
mothers to achieve a normal vaginal delivery before the increase in foetal weight, which causes foetal and maternal injuries.\

Cheng et al. reported a reduction in the risk of CSD if the foetal weight was known at 39 weeks and labour had been induced. However, Combs’ group suggested that induction of labour increases the Caesarean section rate without altering perinatal complications.\

Elective CS seems to be safe with regard to preventing most of the complications associated with such a delivery. However, the number of Caesareans required to prevent a single case of permanent injury is so high that it does not justify its use for all cases of macrosomia. In addition, the procedure places the mother and subsequent pregnancies at risk, as noted in a study conducted in the Al Jouf region, KSA. Al-Samman and co-workers also reported that the high CS rate observed in their study at the Maternity and Child Hospital, Qassim, KSA was mainly due to elective CS in accordance with hospital policy and not to other risk factors, such as foeto-pelvic disproportion.

In our study, approximately 88% of patients with macrosomic babies were allowed a vaginal trial, and 84% of these achieved their goal. However, we noted a longer gestational age (41 weeks) in the group that achieved vaginal delivery compared with patients who had an emergency Caesarean section (39 weeks). This finding could be due to poor patience compliance or failure to follow-up in the obstetric outpatient clinic. Following the exclusion of other causes of emergency abdominal delivery, the actual rate of ‘failure to progress’ in those patients was only 9%. Our analysis demonstrates that diabetic patients with a large baby and pre-existing diabetes were offered elective abdominal delivery immediately. After excluding other indications for elective Caesarean in that group, 30% of patients only had an elective abdominal birth due to macrosomia.

In total, 3.9% of vaginally delivered patients had shoulder dystocia, with neonatal injuries reported in 0.35%. The rate of shoulder dystocia in our cases is less than that reported by Rouse (13.5–52.5%). This finding could be due to under reporting or misdiagnosis in our population. However, our rate is similar to the 4.1% reported by Mulik’s group.

The association of a history of previous CS with the current foetal macrosomic state has become a common clinical problem. Previous observations support a policy of trial of labour in this group of women with an estimated foetal weight greater than 4000 g.

Later studies indicate that a previous vaginal birth predicts success in women with macrosomic foetuses undergoing trial of labour after a previous CSD. Furthermore, the indication for a previous CSD may affect the success rate of induction. Failure to progress, as an indication for previous CS, seems to be associated with a lower success rate during trial of labour. Obesity appears to be an independent risk factor for failed trial of labour in women with previous CSD.

In our study, there was no difference in the elective Caesarean rate between primigravida and patients with previous delivery (18% vs. 15%, respectively) (Table 4). Of note, 41.2% of patients with previous delivery in the elective list had a previous Caesarean section. However, primigravida patients had a higher rate of emergency LSCS compared with patients with previous delivery (56% vs. 14%) (Table 5). Unfortunately, because the study was retrospective, it was not possible to analyse the mode of delivery in patients who had macrosomic babies with previous CSD and the effect of diabetes on the success of vaginal birth. Additionally, the impact of maternal body mass index (BMI) on clinical and sonographic antenatal assessment is of paramount importance, and it was not possible to address this issue in this analysis.

Table 5: Emergency Caesarean rate for ‘failure to progress’ in patients allowed a trial of vaginal birth.

|                      | No DM | GDM  | Pre-existing DM |
|----------------------|-------|------|-----------------|
| Emergency CS 68      | 46 (9%) | 17 (16.7%) | 5 (31%) |
| SVD 563              | 467 (91%) | 85 (83.3%) | 11 (69%) |

Fisher–Freeman–Halton exact P = 0.003, Linear trend P = 0.0006.
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