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Maternal hypoglycaemia on the 50 g oral glucose challenge test — evaluation of obstetric and neonatal outcomes

Mehmet Şükrü Budak[1], Eşref Araç[2]

[1]Health Sciences University Diyarbakır Gazi Yaşargil Training and Research Hospital, Department of Obstetrics and Gynecology, Diyarbakır, Turkey

[2]Health Sciences University, Gazi Yaşargil Education and Research Hospital, Department of Internal Medicine, Diyarbakır, Turkey

ABSTRACT

Objectives: To discuss obstetric and neonatal outcomes of maternal hypoglycaemia observed after the 50 g oral glucose challenge test.

Material and methods: A retrospective evaluation was made of the results of patients at 24–28 weeks gestation of a live singleton pregnancy who underwent a 50 g OGCT at the Health Sciences University Gazi Yaşargil Training and Research Hospital, between September 2016 and August 2017. In the 50 g OGCT, 1-hour blood glucose results were divided into Low OGCT (< 90 mg/dL) and Normal OGCT (90–139 mg/dL). The groups were compared in respect of obstetrics and neonatal outcomes.

Results: Of 2623 pregnant patients applied with the 50 g OGCT, blood glucose was < 140 mg/dL in 77.16% (n = 2024), with 11.9% (n = 312) in the Low OGCT group, and the remaining 65.26% (n = 1712) in the Normal OGCT group. Based on the comparison of the groups, the SGA rate was 7% in the Low OGCT group and 4% in the Normal OGCT group; the 5th minute APGAR score was < 7 in 2% of the Low OGCT group and in 1% of the Normal OGCT group, while caesarean section rates were 25% and 32% respectively ($p < 0.05$).

Conclusions: The results of the study showed a significant association between maternal hypoglycaemia and increased SGA rate, decreased 5-minute APGAR scores and reduced caesarean section rates, and this relationship should be confirmed with further comprehensive studies.

Key words: Oral glucose challenge test, hypoglycaemia, obstetric outcome

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INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the major complications of pregnancy affecting approximately 2–5% of pregnancies and resulting in negative pregnancy results (including fetal macrosomia, shoulder dystocia, polyhydramnios, operative delivery, preeclampsia, increased caesarean rates and poor neonatal outcomes) [1–2]. Negative pregnancy outcomes in GDM have been associated with maternal hyperglycaemia [3]. Thus, it is important to prevent the development of complications by establishing early diagnosis and controlling the maternal hyperglycaemia. Therefore, The American College of Obstetricians and Gynecologists recommends screening of GDM in all pregnancies [4].

While GDM screening has been performed at 24–28 gestational weeks using 50 g OGCT for a long time in many centres [5], it has recently been performed alternatively using a 75 g oral glucose tolerance test (OGTT) in some centres [6]. The test is considered normal when the 1-hour blood glucose is < 140 mg/dL after the 50g OGCT, while a result between 140–199 mg/dL is considered increased and a 75 g or 100 g OGTT is then recommended. When the blood glucose level is > 200 mg/dL, it is accepted as GDM [7].

Although complications due to maternal hyperglycaemia in GDM pregnancies are well known [2], complications due to maternal hypoglycaemia are not well known. Two recent studies have reported that hypoglycaemic pregnancies

Corresponding author:
Mehmet Şükrü Budak
University of Health Sciences Diyarbakır Gazi Yaşargil Training and Research Hospital, Department of Obstetrics and Gynecology
Diyarbakır, Turkey, TR 21500
tel.: +90 505 7739009
e-mail: dr.budakms@gmail.com

have a higher rate of low birth weight compared with normoglycaemic patients [8–9] while another study has stated no difference in these results [10]. Therefore, there remains confusion on this subject.

Objectives

The aim of this study was to compare the obstetrics and neonatal outcomes in pregnant patients with low blood glucose levels (< 90 mg/dL) and those with normal blood glucose levels (90–139 mg/dL) with the administration of the 50 g OGCT.

MATERIAL AND METHODS

Approval for this retrospective study was granted by the Local Ethics Committee. The patients included were 24–28 weeks pregnant with a live singleton gestation, who were administered the 50 g OGCT in the Health Sciences University Gazi Yaşargil Training and Research Hospital between September 2016 and August 2017. Information about the pregnancies was obtained by reviewing the hospital medical records. In all cases, obstetric ultrasound (OB-USG) was performed before OGCT. The gestational week was determined by comparing the OB-USG results with the last menstrual period and the first trimester OB-USG result. The patients with a blood glucose value < 140 mg/dL 1 hour after the 50 g OGCT were considered normal, and a 100 g OGTT was applied to patients with a value of 140–199 mg/dL. Those with a blood glucose level of ≥ 200 mg/dL were considered as GDM. In patients submitted to 100 g OGTT, the GDM diagnosis was established for those with two or more high blood glucose values from four results (fasting blood glucose level: 95 mg/dL, 1st hour 180 mg/dL, 2nd hour 155 mg/dL and 3rd hour 140 mg/dL) according to the Carpenter-Coustan Conversion criteria [11].

In the 50 g OGCT, the 1-hour blood glucose results were divided into Low OGCT (< 90 mg/dL) and Normal OGCT (90–139 mg/dL). These two groups were compared in respect of obstetrics and neonatal outcomes. The groups were also compared in terms of age, gravida, parity, weight gain in pregnancy, chronic maternal hypertension**,** pregnancy-induced hypertension (PIH), type of delivery (vaginal or caesarean delivery), reasons for caesarean delivery, gestational age, birth weight, 5-minute APGAR, 5-minute APGAR < 7, preterm birth (< 37 gestation weeks), post term birth (> 42 gestation weeks), and small for gestational age (SGA) and newborns defined as birth weight < 10th percentile according to the gestational age (13). Multiple pregnancies, patients with a Diabetes Mellitus diagnosis before the pregnancy, pregnancies with chronic disease (asthma, corticosteroid use and chronic hypertension) and known foetal anomalies were not included in the study.

Statistical Evaluation

All data analyses were performed using SPSS (Statistical Package for Social Sciences) version 18.0 for Windows software. Normally distributed numerical variables were shown as mean ± standard deviation. Normally distributed numerical variables were compared using the Student's T-test. The Chi-square test was used to compare categorical variables between the groups. A value of $p < 0.05$ was considered statistically significant.

RESULTS

The study included 2623 pregnant women at 24–28 gestational weeks who underwent 50 g OGCT for GDM screening between September 2016 and August 2017. The GDM screening results of the cases are summarized in Figure 1.

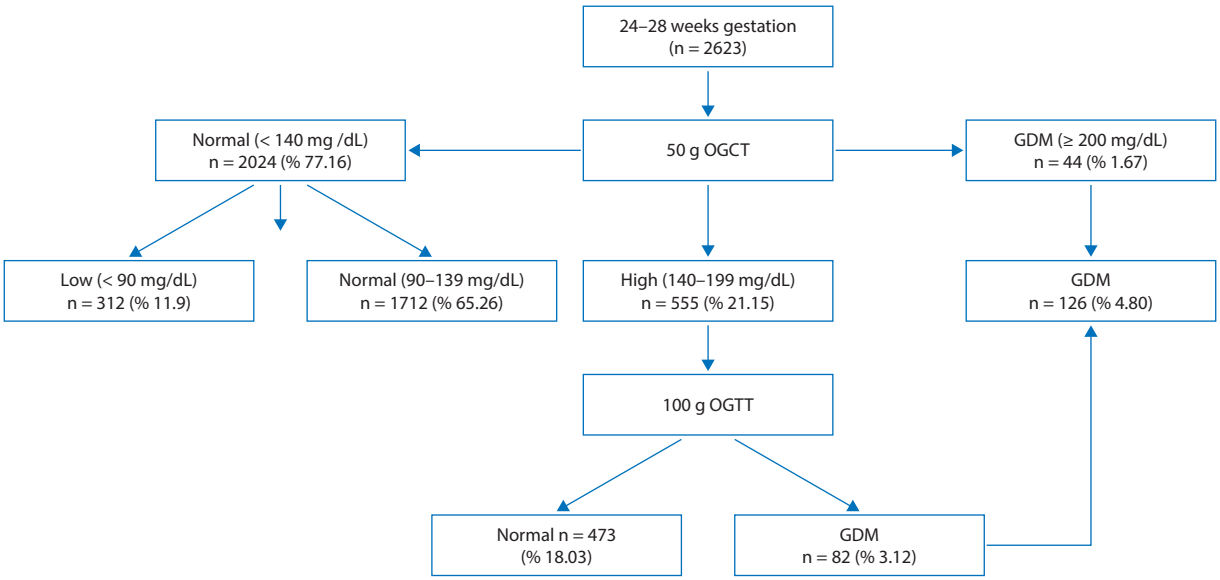

Figure 1. 50 g oral glucose challenge and 100 g oral glucose tolerance test results

Following the 50 g OGCT, 77.16% (n = 2024) of the patients were determined with a normal 1-hour blood glucose level (< 140 mg/dL), with 11.9% (n = 312) in the Low OGCT group, and the remaining 65.26% (n = 1712) in the Normal OGCT group. Of the 21.15% (n = 555) of patients with a 1-hour blood glucose level of 140–199 mg/dL, 18.03% (n = 473) had a normal 100 g OGTT result and 3.12% (n = 82) were diagnosed with GDM. In 1.67% (n = 44) of the patients, the 1-hour blood glucose level was determined as ≥ 200 mg/dL and these patients were diagnosed with GDM without requiring any other evaluation. As a result of the 50 g OGCT and 100 g OGTT, a total of 126 (4.80%) patients were diagnosed with GDM. The clinical characteristics according to the 50 g OGCT are summarized in Table 1. When comparing the groups, Group 1 and Group 2 presented the following results respectively; average maternal age 26.82 ± 5.7 and 26.54 ± 5.3 years, multiparity 73% and 72%, primiparity 27% and 28%, weight gain in pregnancy 11.1 ±4.1 and 11.1 ±4.06, birth weight 3233 ± 483 and 3226 ± 376 g, preterm birth 6% and 6%, term birth 87% and 86%, post term birth 7% and 8%, maternal chronic hypertension 1.9% and 1.8%, PIH 5% and 6% and no statistically significant differences were determined ($p > 0.05$). For the remaining characteristics, Group 1 and Group 2 presented the following results respectively; average rate of vaginal delivery 75% and 68%, caesarean section 25% and 32%, 5-minute APGAR 9.02 ± 0.96 and 9.26 ± 0.52, 5-minute APGAR < 7, 2% and 1%, SGA 7% and 4% and the differences in these parameters were determined to be statistically significant ($p < 0.05$).The distribution of reasons for caesarean section in the Low and Normal OGCT groups are summarized in Table 2. When the groups were compared in respect of reasons for caesarean delivery, Group 1 and Group 2 presented the following results respectively; previous caesarean 14% and 16%, abnormal presentation 2% and 2%, pregnancy-induced hypertension 1.9% and 2.3%, umbilical cord prolapse 0.3% and 0.3%, abnormal placentation 0.6% and 0.7%, other fetal and maternal reasons 0.3% and 0.5% and no statistically significant differences were determined ($p > 0.05$). For the remaining reasons for caesarean section, Group 1 and Group 2 presented the following results respectively; obstructed labor 1% and 4%, cephalopelvic disproportion 2% and 5%, suspected fetal distress 3 % and 1% and the differences in these parameters were determined to be statistically significant ($p < 0.05$).

DISCUSSION

Studies in literature have provided conflicting results in respect of maternal hypoglycaemia and negative pregnancy outcomes. While some studies have reported no negative effects of maternal hypoglycaemia on pregnancies [8–9], others have shown an association with negative pregnancy outcomes [9, 13–14]. The results of the current study showed that maternal hypoglycaemia has negative effects on pregnancy outcomes (including increased SGA rates and 5-minute APGAR scores < 7) and these results are similar to the findings reported by Shinora et al. [9] and Kwon et al. [14].

Table 1. Clinical characteristics according to maternal oral glucose challenge test results

	Low OGCT (n = 312)	Normal OGCT (n = 1712)	p-value
Age (years), [mean ± SD]	26.82 ± 5.7	26.54 ± 5.3	0.398*
Multiparity, % (n)	73% (227)	72% (1232)	0.799
Primiparity, % (n)	27% (85)	28% (480)	0.774
Weight gain in pregnacy, kg, (mean ± SD)	11.1 ± 4.1	11.1 ±4.06	0.957
Vaginal delivery, % (n)	75% (234)	68% (1165)	**0.015***
Caesarean section, % (n)	25% (78)	32% (547)	**0.015***
Gestational age (weeks), [mean]	39.1 ± 1.74	38.9 ± 1.58	**0.043***
Birth weight (gr), [mean ± SD]	3233 ± 483	3226 ± 376	0.793
5-minute APGAR [median(min-max)]	9.02 ± 0.96	9.26 ± 0.52	**0.001***
5-minute APGAR < 7 (n)	2 % (7)	1% (14)	**0.020***
Preterm birth, % (n)	6 % (19)	6 % (102)	0.928
Term birth, % (n)	87 % (271)	86 % (1512)	0.720
Postterm birth, % (n)	7 % (22)	8 % (136)	0.589
SGA, % (n)	7 % (22)	4% (68)	**0.015***
Chronic maternal HT, % (n)	2% (6)	2% (31)	0.892
PIH, % (n)	5 % (16)	6 % (98)	0.675

Values are presented as mean ± standard deviation or number (%); OGCT — oral glucose challenge test; SGA — small for gestational age; PIH — pregnancy-induced hypertension; HT — hypertension *Chi-Square $p < 0.05$

Table 2. Distribution of reasons for caesarean section in the Low and Normal OGCT groups

	Low OGCT (n = 312)	Normal OGCT (n = 1712)	p-value
Previous caesarean, % (n)	14% (44)	16% (275)	0.382
Obstructed labor, % (n)	1% (3)	4%(69)	**0.007**
Cephalopelvic disproportion, % (n)	2% (6)	5%(86)	**0.016**
Suspected fetal distress, % (n)	3% (9)	1% (17)	**0.012**
Abnormal presentation, % (n)	2% (6)	2% (32)	0.949
Pregnancy-induced hypertension, % (n)	1.9% (6)	2.3% (40)	0.652
Umbilical cord prolapse, % (n)	0.3% (1)	0.3 %(6)	1,000
Abnormal placentation, % (n)	0.6% (2)	0.7% (13)	1,000
Other fetal and maternal reasons, % (n)	0.3% (1)	0.5% (9)	1,000

OGCT — oral glucose challenge test

Shinora et al reported SGA ratios of 15.3% in the Low OGCT group (≤ 90 mg/dL) and of 9.7% in the Normal OGCT group (91–139 mg/dL) [9], while Kwon et al reported SGA ratios of 10.8% in the Low OGCT group (≤ 85 mg/dL) and of 7.9% in the Normal OGCT group (86–130 mg/dL) (14). Both of these studies reported that the difference between the groups was statistically significant. However, in a study by Ma et al, SGA ratios were reported to be 9% in the Low OGCT group (< 90 mg/dL) and 4.8% in the Normal OGCT group (90–119 mg/dL), with no statistically significant difference determined [10]. In the current study, the SGA ratios were 7% in the Low OGCT group and 4% in the Normal OGCT group, and this difference was found to be statistically significant, in agreement with the studies of Shinora et al. [9] and Kwon et al. [14]. However, the SGA ratios in both groups in the current study were found to be lower than the ratios in those three studies. In a previous animal experimental study, maternal hypoglycemia during pregnancy was associated with a decrease in fetal glucose, an increase in protein breakdown, and increased oxidative metabolism [15]. These factors were considered to have contributed to high SGA rates in the pregnancies with hypoglycemia in the current study.

In a study by Feinberg et al., a 5-minute APGAR score < 7 was determined in 1.7% of the Low OGCT group (< 88 mg/dL) and in 0.8% of the Normal OGCT group (88––140 mg/dL) respectively, but this difference between the groups was not found to be statistically significant [16]. In contrast, these ratios in the current study were 2% and 1%, respectively, and the difference was were statistically significant. It was thought that the high rate of APGAR score < 7 in the Low OGCT group of the current study may have been related to the elevated SGA infant ratio. McIntire et al. showed that APGAR score is significantly lower in SGA infants [17].

Shinora et al. [9] reported caesarean section delivery at a rate of 18.8% in the Low OGCT group and 25.7% in the Normal OGCT group, whereas Kwon et al reported these rates as 32.6% and 42.8%, respectively [14]. Both researchers reported that the difference between the groups was statistically significant. However no statistically significant difference was seen in a study by Ma et al. with these ratios reported as 24.1% and 24.9%, respectively (10). In the current study, caesarean section rates were 25% in the Low OGCT group and 32% in the Normal OGCT group, and this difference was found to be statistically significant, which was consistent with the studies of Shinora et al. [9] and Kwon et al. [14]. In the current study, caesarean rates due to fetal distress were found to be significantly higher in the Low OGCT group compared to the Normal OGCT group, which could have been due to the high rate of SGA in the Low OGCT group. However, in the Normal OGCT group, the rates of caesarean delivery performed because of obstructed labor and cephalopelvic disproportion were significantly higher than those of the Low OGCT group. In addition to these results, there were no statistically significant differences between the two groups in respect of other reasons for caesarean delivery, such as previous caesarean, abnormal presentation, pregnancy-induced hypertension, umbilical cord prolapse, abnormal placentation and other fetal-maternal reasons.

A significant difference from previous studies was seen in the current study in respect of gestational age, while weight gain in pregnancy, birth weight, preterm birth, term birth, post term birth and PIH results were not significant and similar to previous findings in literature [9, 10, 14].

The maternal chronic hypertension rates of the groups in the current study were found to be 1.9% and 1.8%, similar to those in literature [18–19] and there was no significant difference in maternal hypertension rates between the groups.

In conclusion, the results of this study showed a significant association between maternal hypoglycaemia and increased SGA rate, decreased 5-minute APGAR scores and reduced caesarean section rates, and this relationship should be confirmed with further comprehensive studies.

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