

# Perinatal outcomes in pregnancies with one abnormal oral glucose tolerance test value: a retrospective cohort study

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## Abstract

**Objective:** To compare perinatal, neonatal, and early childhood outcomes among pregnant women classified into three groups based on oral glucose tolerance test (OGTT) results: gestational diabetes mellitus (GDM), normal glucose tolerance, and one abnormal OGTT value.

**Material and Methods:** This single-center retrospective cohort study included singleton pregnancies screened between 24 and 28 weeks of gestation and delivered at the same institution. Participants were categorized into GDM, normal glucose tolerance, or one abnormal OGTT value. Maternal demographic data, obstetric outcomes, neonatal outcomes [birth weight, Apgar scores, neonatal intensive care unit (NICU) admission], and early childhood developmental data were collected retrospectively from hospital records. Statistical analyses were performed using the Kruskal-Wallis and chi-square tests.

**Results:** The study included 292 pregnancies categorized into GDM (n=28), normal glucose tolerance (n=224), or one abnormal OGTT value (n=40). Women in the GDM group were significantly older and had higher gravidity and parity than those in the normal glucose tolerance group (p=0.01 and p=0.003, respectively). No significant differences were observed between the groups in terms of birth weight (p=0.651) or NICU admission rates (p=0.29). Although NICU admission rates were higher in the GDM group (12.5%) and in the group with one abnormal OGTT value (10.0%) than in the normal glucose tolerance group (5.8%), these differences did not reach statistical significance. No clinically meaningful differences were identified during early childhood follow-up.

**Conclusion:** Pregnant women with one abnormal OGTT value did not differ significantly from those with GDM or normal glucose tolerance in terms of adverse perinatal outcomes. Larger prospective studies are required to guide clinical management. [J Turk Ger Gynecol Assoc. 2026; 27(2): 99-106]

**Keywords:** Gestational diabetes mellitus, oral glucose tolerance test, one abnormal OGTT value, perinatal outcomes

**Received:** November 14, 2025 **Accepted:** February 19, 2026 **Publication Date:** June 02, 2026

## Introduction

Gestational diabetes mellitus (GDM) is defined as glucose intolerance that is detected for the first time during pregnancy. It is currently considered one of the most significant metabolic

issues in obstetric care (1,2). The global prevalence of hyperglycemia during pregnancy is high, and GDM affects a significant proportion of pregnancies, posing both short- and long-term risks to the mother and fetus (3).



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**DOI:** 10.4274/jtgga.galenos.2026.2025-11-12

**Cite this article as:** İsmayilov T, Ateş Ç, Kubat Küçüküyük A. Perinatal outcomes in pregnancies with one abnormal oral glucose tolerance test value: a retrospective cohort study. J Turk Ger Gynecol Assoc. 2026; 27(2): 99-106



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From a maternal perspective, GDM is associated with preeclampsia, cesarean delivery, and the development of type 2 diabetes in later years (4-6). For fetuses and newborns, exposure to an intrauterine hyperglycemic environment increases the risk of short-term complications, such as macrosomia, birth trauma, neonatal hypoglycemia, and respiratory distress syndrome (7-10). These findings indicate that glucose metabolism during pregnancy directly affects the pregnancy and perinatal outcomes.

However, it is increasingly understood that the effects of hyperglycemia during pregnancy are not limited to the perinatal period. It has been reported that children of mothers with a history of GDM have an increased risk of obesity and metabolic disorders, and that there may be long-term effects on neurocognitive and neuropsychiatric development (11-13). These data further highlight the clinical significance of the degree of glucose tolerance during pregnancy.

Different test approaches and diagnostic thresholds are used for GDM screening and diagnosis, and in clinical practice, single-step and two-step oral glucose tolerance test (OGTT) methods are widely used. In the single-stage approach, exceeding the fasting and postprandial glucose thresholds determined by a 75 g OGTT is considered sufficient for diagnosis. In the two-stage method, a 50 g screening test is first administered, and if the threshold value is exceeded, a 100 g OGTT is performed for diagnostic evaluation (14-17). These different screening and diagnostic strategies have led to the emergence of pregnancies that do not fully meet the GDM diagnostic criteria but show limited glucose elevation in the OGTT, leading to the formation of a clinically heterogeneous patient group.

The aim of the present study was to compare the perinatal, neonatal and early childhood outcomes of three groups of women classified according to their glucose tolerance status during pregnancy; women diagnosed with gestational diabetes, women with normal glucose tolerance and women with only one abnormal value detected in the OGTT. We hypothesized that, as the degree of maternal glucose intolerance increased, so will the frequency of adverse perinatal and neonatal outcomes; pregnancies with a single abnormal OGTT value will show an intermediate risk profile between normal glucose tolerance and GDM.

## Material and Methods

### Ethical approval

This study was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Training and Research Hospital (approval number: 310, date: 24.11.2023). This study was conducted using a retrospective

cohort design. As our center is a teaching and research hospital, routine informed consent was obtained from all patients who applied, stating that their medical data may be used for scientific research. Throughout the research process, all data were anonymized and evaluated in accordance with the Declaration of Helsinki principles.

### Study design and setting

This single-center retrospective cohort study included pregnant women who gave birth at a tertiary referral center between January 1 and December 31, 2021. At our center, gestational diabetes screening, diagnosis, and follow-up processes are performed in a standardized manner in accordance with national and international guidelines.

### Study population

During the specified study period, a total of 3,947 births occurred at our center. Of these, 292 were included in the study: they had singleton pregnancies; underwent glucose screening and/or diagnostic OGTTs at our institution between the 24<sup>th</sup> and 28<sup>th</sup> weeks of pregnancy; and had complete basic clinical data for the delivery and newborn periods. The process of selecting the study population is illustrated in Figure 1.

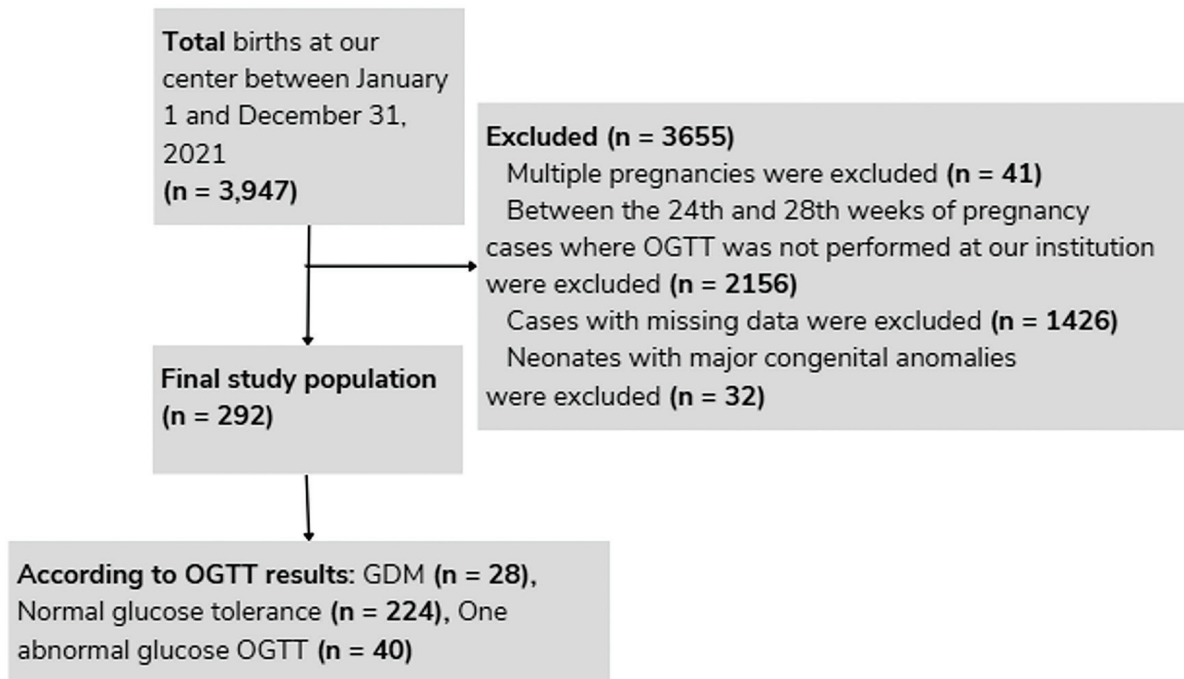
### Exclusion criteria

Pregnancies with the following characteristics were excluded from the study: (1) multiple pregnancies; (2) type 1 or type 2 diabetes diagnosed before pregnancy; (3) OGTT or delivery performed at another healthcare facility; (4) incomplete basic obstetric or neonatal data for the mother or newborn; and (5) newborns with major congenital anomalies.

### Glucose screening and diagnostic criteria

At our center, GDM screening is routinely performed between weeks 24 and 28 of pregnancy. In clinical practice, single-step or two-step screening and diagnostic strategies have been employed. In the single-stage approach, a 75 g OGTT is performed and a diagnosis of GDM is made if the fasting plasma glucose level is  $\geq 92$  mg/dL, the 1-hour glucose level is  $\geq 180$  mg/dL or the 2-hour glucose level is  $\geq 153$  mg/dL.

In the two-step approach, a 50 g glucose challenge test is first performed, and if the one-hour plasma glucose value is  $\geq 140$  mg/dL, a 100 g OGTT is administered. At least two of the following measurements exceeding the diagnostic thresholds (fasting  $\geq 95$  mg/dL, 1-hour  $\geq 180$  mg/dL, 2-hour  $\geq 155$  mg/dL, and 3-hour  $\geq 140$  mg/dL) were considered sufficient for a diagnosis of GDM in the 100 g OGTT. These diagnostic thresholds are consistent with the recommendations of the IADPSG, ADA and World Health Organization.



**Figure 1. Patient selection flowchart showing the inclusion and exclusion process of the study population**  
OGTT: Oral glucose tolerance test, GDM: Gestational diabetes mellitus

### Classification of OGTT groups

The cases included in the study were divided into three clinical groups based on OGTT results: cases diagnosed with gestational diabetes (Group A); cases with all OGTT measurements within normal limits (Group B); and cases with only one OGTT measurement exceeding the diagnostic thresholds (Group C). Cases with a single abnormal OGTT value were evaluated as a separate category, as this group is frequently encountered in clinical practice but there is no clear consensus in the literature regarding its diagnostic and prognostic significance.

### Data collection

All clinical data were retrospectively obtained from the hospital's electronic medical records system. Maternal variables included age, gravida, parity and body mass index (BMI). Obstetric data were limited to gestational age at delivery and mode of delivery. Data on the newborns included birth weight, Apgar scores at one and five minutes, and admission to the neonatal intensive care unit (NICU) or not. The reasons for admission to the NICU were classified through a detailed review of clinical records.

### Early childhood follow-up

Data on early childhood were obtained from routine pediatric outpatient follow-up records. Clinical notes on achieving the milestones of sitting and walking unaided, as well as general

health status, were evaluated in the records for the sixth, twelfth, and twenty-fourth months. These evaluations were not based on a standard developmental screening scale, but rather on routine clinical observations and physician records.

### Statistical analysis

Statistical analyses were performed using SPSS (IBM Inc., Armonk, NY, USA). The distribution characteristics of continuous variables were assessed using the Shapiro-Wilk test. Data with a normal distribution are presented as the mean and standard deviation whereas data without a normal distribution are presented as the median and minimum-maximum values. For intergroup comparisons, the Kruskal-Wallis test was used for continuous variables, and the chi-squared test was used for categorical variables. Where necessary, pairwise comparisons were performed using the Mann-Whitney U test. Statistical significance was set at  $p < 0.05$ .

## Results

### Study population

A total of 3,947 births occurred at our center during the study period. Of these, 292 pregnancies that met the inclusion criteria were included in the study. All participants underwent glucose screening and/or diagnostic testing between the 24<sup>th</sup> and 28<sup>th</sup> weeks of pregnancy, and gave birth at the same center.

Participants were divided into three groups based on their OGTT results: Group A, those diagnosed with GDM (n=28, 9.6%); Group B, those with normal glucose tolerance (n=224, 76.7%); and Group C, those with a single abnormal OGTT value (n=40, 13.7%).

### Maternal characteristics

The maternal demographic and obstetric characteristics are shown in Table 1. The mean maternal age across the entire cohort was 29.6±5.9 years. Most cases were multiparous, with a median gravida of 3 (range 1-10) and a median parity of 2 (range 0-9).

Statistically significant differences were observed in maternal age, gravida, and parity when the groups were compared according to OGTT results (Table 2). Women in the GDM group were older than those in the normal glucose tolerance group

(median age: 32.0 vs. 28.0 years; p=0.01). Similarly, gravida and parity values were higher in the GDM group (p=0.011 and p=0.003, respectively). However, no significant difference was found between the groups in terms of BMI (p=0.431).

### Obstetric outcomes

The obstetric outcomes of the entire cohort are summarised in Table 3. The median gestational age at delivery was 39 weeks (range 24-42 weeks). The most common mode of delivery was cesarean section (55.1%), followed by vaginal delivery (44.5%). A statistically significant difference in gestational age at delivery was found when comparing OGTT groups (p=0.040) (Table 2). However, the absolute value of this difference was limited, with the median gestational age at delivery falling within the term range for all groups.

**Table 1. Maternal demographic and obstetric characteristics (n=292)**

Variables	n (%) / mean ± SD / median (min-max)
Maternal age (years)	29.6±5.9 (18-47)
Gravidity	3 (1-10)
Parity	2 (0-9)
Number of abortions	0 (0-5)
Body mass index (kg/m <sup>2</sup> )	29 (19-47)
History of intrauterine fetal demise	Yes: 8 (2.7%) No: 284 (97.3%)
<b>Maternal comorbidities</b>	
- None	187 (64.0%)
- Hypothyroidism	35 (12.0%)
- Hypertension	11 (3.8%)
- Cardiac disease	3 (1.0%)
- Other conditions	56 (19.2%)
<b>Prenatal ultrasound findings</b>	
- Normal	252 (86.3%)
- Soft marker (+)	20 (6.8%)
- SGA/FGR	7 (2.4%)
- Macrosomia	4 (1.4%)
- Polyhydramnios	4 (1.4%)
- Macrosomia + polyhydramnios	2 (0.7%)
- Cardiac anomaly	1 (0.3%)
- Oligohydramnios	1 (0.3%)
- SGA/FGR + soft marker	1 (0.3%)
<b>Placental pathology</b>	
- None	287 (98.3%)
- Placenta previa	5 (1.7%)

**Table 1. Continued**

Variables	n (%) / mean ± SD / median (min-max)
<b>50 g glucose challenge test</b>	
- Not performed	234 (80.2%)
- < 140 mg/dL	48 (16.4%)
- ≥ 140 mg/dL	10 (3.4%)
<b>75 g OGTT</b>	Performed: 218 (74.4%) Not performed: 74 (25.6%)
<b>100 g OGTT</b>	Performed: 21 (7.2%) Not performed: 271 (92.8%)
<b>Classification according to OGTT results</b>	
- One abnormal value (impaired glucose tolerance)	40 (13.7%)
- Gestational diabetes mellitus (GDM)	28 (9.6%)
- Normal glucose tolerance	224 (76.7%)
<b>Method of GDM diagnosis</b>	
- 50 g > 180 mg/dL	2 (0.7%)
- 75 g OGTT	22 (7.5%)
- 100 g OGTT	5 (1.7%)
- Subsequent fasting glucose follow-up	4 (1.4%)
<b>GDM management</b>	
- None	238 (81.5%)
- Diet only	49 (16.8%)
- Insulin therapy	5 (1.7%)
<b>Antenatal blood glucose monitoring</b>	Performed: 20 (6.2%) Not performed: 274 (93.8%)
OGTT: Oral glucose tolerance test, SGA/FGR: Small for gestational age/ fetal growth restriction, SD: Standard deviation, min: Minimum, max: Maximum	

### Neonatal outcomes

Neonatal outcomes are presented in Tables 2 and 3. The mean birth weight for the entire cohort was  $3,233.8 \pm 567.8$  g, with median first- and fifth-minute Apgar scores of 8 and 9, respectively.

No significant difference in birth weight was observed among the OGTT groups ( $p=0.651$ ). Although a statistical difference was observed between the groups in terms of first-minute Apgar scores ( $p=0.019$ ), no significant difference was found in the pairwise comparison between the GDM and normoglycemic groups ( $p=0.16$ ). A small difference in fifth-minute Apgar scores was observed between the GDM and normoglycemic groups ( $p=0.038$ ); however, all group values were within the clinically normal range.

### Neonatal intensive care unit admissions

A total of 20 newborns (6.8%) were admitted to the NICU (Table 2). NICU admission rates according to OGTT groups were: GDM group 12.5%; normal glucose tolerance group: 5.8%; single abnormal OGTT value group: 10.0%.

No statistically significant difference was found among the groups in terms of NICU admission rates ( $p=0.29$ ). The reasons for NICU admission are summarized in Table 4. The most common causes were maternal complications (severe preeclampsia, placental abruption, intrahepatic cholestasis), accounting for 35% of all NICU admissions. Respiratory and metabolic causes related to the newborn include transient tachypnea, respiratory distress syndrome, hypoglycemia, and polycythemia.

### Early childhood follow-up observations

Early childhood data were available for a subset of the cohort from routine pediatric outpatient records. It is important to note that these data were not collected using standardized

developmental assessment tools but represent descriptive clinical observations recorded by physicians. Based on these records, it was noted that 76.7% of infants could sit unsupported at six months and 60.3% were walking by twelve months. At the 24-month follow-up, 57.9% of children were documented as “healthy”. No notable differences were observed across the OGTT groups based on these limited, descriptive follow-up data (Table 3).

### Discussion

This retrospective cohort study comparatively examined the effects of different levels of impaired glucose tolerance during pregnancy on perinatal, neonatal and early childhood outcomes. Our main finding was that, in terms of most adverse perinatal outcomes examined, pregnant women with a single abnormal OGTT value (Group C), those diagnosed with GDM (Group A), and those with normal glucose tolerance (Group B) had similar outcomes. In particular, no significant differences were found between the groups in critical outcome metrics, such as birth weight and admission rates to the NICU. These results contribute valuable data to the ongoing debate about the clinical management and prognostic significance of mild glucose intolerance during pregnancy.

There is no consensus in the literature regarding the clinical significance of an abnormal OGTT result. Our results contradict those of a comprehensive systematic review and meta-analysis conducted by Roeckner et al. (18), which included 25 studies. This meta-analysis revealed that women with an abnormal OGTT result were at significantly higher risk of adverse outcomes such as macrosomia, large-for-gestational-age babies, neonatal hypoglycemia, cesarean section and pregnancy-related hypertension, compared to women with normal glucose tolerance. This risk profile was similar to that

**Table 2. Maternal and neonatal characteristics across study groups**

Variable	Group A (n=28)	Group B (n=224)	Group C (n=40)	p-value (KW/ $\chi^2$ )	p-value (A vs. B)
Age (years)	32.0 (21-42)	28.0 (18-47)	31.5 (18-41)	0.0066**	0.019
Gravidity	3.0 (1-6)	2.0 (1-10)	2.0 (1-7)	0.0355*	0.011
Parity	3.0 (1-6)	2.0 (0-9)	2.0 (0-6)	0.0135*	0.003**
Abortions	0.0 (0-2)	0.0 (0-5)	0.0 (0-2)	0.546	0.694
BMI (kg/m <sup>2</sup> )	29.4 (22.6-40.6)	28.4 (19.1-46.7)	30.0 (22.2-38.5)	0.431	0.370
Gestational age at delivery (weeks)	38.5 (29.3-41.2)	39.0 (24.0-42.2)	38.6 (29.4-41.4)	0.0402*	0.022
Birth weight (g)	3265 (1295-4600)	3290 (710-4740)	3225 (1270-4215)	0.651	0.844
Apgar score, 1 min	8.0 (6-9)	8.0	8.0 (5-9)	0.0192*	0.160
Apgar score, 5 min	9.0 (7-9)	9.0 (7-10)	9.0 (7-9)	0.0372*	0.038*
NICU admission (%)	4 (12.5)	13 (5.8)	4 (10.0)	0.29	0.20

Values are presented as median (minimum–maximum) unless otherwise specified; NICU: Neonatal intensive care unit, BMI: Body mass index, KW: Kruskal–Wallis test, \* $p < 0.05$  was considered statistically significant, \*\* $p < 0.01$

of patients diagnosed with GDM. However, in our study, no significant increase in risk was observed between the group with a single abnormal value and the group with normal glucose tolerance. Reasons for this discrepancy may include the heterogeneity of the study populations, differences in diagnostic and screening strategies, and center-specific follow-up and treatment protocols. Furthermore, the limited sample size of our study, particularly in Groups A and C, may have reduced our ability to detect smaller effect sizes.

However, our findings are indirectly consistent with some studies suggesting that the risk increases gradually as the number of abnormal OGTT values increases. Indeed, Eteläinen et al. (19) reported that the risk of adverse perinatal outcomes in women with two or more abnormal OGTT values was significantly higher than in those with a single abnormal value. The fact that no significant difference was found between the GDM group and the other groups in our study can be interpreted as the limited sample size, as well as the strict metabolic monitoring and treatment approaches applied to cases diagnosed with GDM in our clinic, which may have reduced the occurrence of adverse perinatal outcomes.

**Table 3. Perinatal and neonatal outcomes (n=292)**

Variables	n (%) / mean ± SD / median (min-max)
<b>Gestational age at delivery (weeks)</b>	39 (24-42)
<b>Mode of delivery</b>	
– Vaginal delivery	130 (44.5%)
– Cesarean section	161 (55.1%)
– Operative vaginal delivery	1 (0.3%)
<b>Neonatal birth weight (g)</b>	3233.8 ± 567.8 (710-4740)
<b>Apgar score, 1<sup>st</sup> minute</b>	8 (5-10)
<b>Apgar score, 5<sup>th</sup> minute</b>	9 (7-10)
<b>NICU admission</b>	No: 272 (93.2%) Yes: 20 (6.8%)
<b>Primary indications for NICU admission</b>	Respiratory distress, transient tachypnea, hypoglycemia, polycythemia, maternal complications (preeclampsia, placental abruption, cholestasis)
<b>Maternal hospital stay (days)</b>	2 (1-7)
<b>Developmental milestones</b>	
– Sitting without support at 6 months	224 (76.7%)
– Walking independently at 12 months	176 (60.3%)
– Healthy child at 24 months	169 (57.9%)
Follow-up data unavailable for remaining cases; NICU: Neonatal intensive care unit, SD: Standard deviation, min: Minimum, max: Maximum	

Another notable finding of our study relates to NICU admission rates. While the differences between the groups did not reach statistical significance, we noted that the admission rates were numerically higher in the GDM (12.5%) and single abnormal OGTT (10.0%) groups compared to the normal glucose tolerance group (5.8%). Given the study's limited sample size, this non-significant trend should be interpreted with caution. It may suggest a potential area for future investigation in larger cohorts, where sufficient statistical power could clarify whether a clinically meaningful difference exists. In a large-scale cohort study published by Hillick et al. (20) in 2025, the NICU admission rate was reported as 12.5% in 3,712 GDM cases, which is significantly lower than that in pregnant women with pregestational diabetes (type 1 diabetes 41.8%, type 2 diabetes 31.1%). The NICU admission rates obtained in our study are consistent with these data, supporting the notion that GDM has a lower risk profile than pregestational diabetes regarding neonatal morbidity.

In contrast, Geng et al. (21) showed that a single abnormal OGTT value did not increase the risk of NICU admission in pregnant women undergoing early screening, and that the risk increased only with three or four abnormal OGTT values. These findings indicate that pregnant women with a single abnormal OGTT value should not automatically be considered high-risk. However, in a study conducted by Ostlund et al. (22) in cases of untreated impaired glucose tolerance, although NICU admission rates were lower than the control group in absolute terms, an increased risk of NICU admission was detected in adjusted analyses (adjusted odds ratio 2.0, 95% confidence interval 1.1-3.8). When all these data are considered together, the degree of glucose intolerance and treatment status emerge as possible key factors that significantly influence neonatal

**Table 4. Risk factors associated with NICU admissions (n=20)**

Risk factor category	n (%)	Representative examples*
<b>Maternal complications</b>	7 (35%)	Severe preeclampsia; placental abruption; intrahepatic cholestasis
<b>Fetal/perinatal causes</b>	2 (10%)	Intrapartum fetal distress; preterm premature rupture of membranes after cerclage
<b>Neonatal respiratory</b>	5 (25%)	Respiratory distress; transient tachypnea of the newborn
<b>Neonatal metabolic/hematologic</b>	4 (20%)	Hypoglycemia; polycythemia with feeding difficulty; jaundice due to ABO incompatibility
<b>Combined (maternal + neonatal)</b>	2 (10%)	Severe preeclampsia with neonatal respiratory distress syndrome
*Based on manual review of case notes; NICU: Neonatal intensive care unit		

outcomes. Prospective studies with larger sample sizes are necessary to statistically confirm this relationship and define it in different populations.

### Study limitations

The fact that women in the GDM group in our study were older and had higher gravidity/parity is consistent with known risk factors for GDM. However, this retrospective study had significant limitations. The retrospective collection of data makes it difficult to control for potential confounding factors. The reliance on routine clinical records rather than a standardized screening scale for early childhood developmental data and the unavailability of these data for the entire cohort limit the interpretation of the findings in this area. Furthermore, the lack of detailed data on specific management strategies (diet, exercise, blood glucose monitoring, etc.) for women with a single abnormal OGTT value prevents a full explanation of why this group did not show similar adverse outcomes to the GDM group.

### Conclusion

The findings of this study suggest that pregnant women with one abnormal OGTT value did not demonstrate a statistically significant increase in the risk of key adverse perinatal and neonatal outcomes, such as macrosomia and NICU admission, when compared to women with normal glucose tolerance. Their outcome profile was also comparable to that of the GDM group, potentially reflecting the impact of effective management in GDM patients. These results suggest that a single abnormal OGTT value may not automatically place a pregnancy in a high-risk category for the primary outcomes studied. However, to establish definitive clinical guidelines for this intermediate group, larger prospective studies are essential to validate these findings and inform management strategies.

### Ethics

**Ethics Committee Approval:** *This study was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Training and Research Hospital (approval number: 310, date: 24.11.2023).*

**Informed Consent:** *This study was conducted using a retrospective cohort design. As our center is a teaching and research hospital, routine informed consent was obtained from all patients who applied, stating that their medical data may be used in scientific research.*

### Footnotes

**Author Contributions:** *Surgical and Medical Practices: T.İ., A.K.K., Concept: T.İ., Ç.A., Design: T.İ., Ç.A., Data Collection or*

*Processing: T.İ., Ç.A., A.K.K., Analysis or Interpretation: Ç.A., Literature Search: T.İ., Ç.A., Writing: T.İ., Ç.A., A.K.K.*

**Conflict of Interest:** *No conflict of interest is declared by the authors.*

**Financial Disclosure:** *The authors declared that this study received no financial support.*

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