Effect of different preoperative fasting and abstinence programs on blood glucose levels and nutritional status of women with gestational diabetes mellitus undergoing cesarean delivery

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Introduction. Comparative analysis of the effectiveness of different preoperative fasting and abstinence programs in women with gestational diabetes mellitus undergoing cesarean delivery.

Methods. From January 2021 to December 2022, 90 cases of cesarean delivery with gestational diabetes mellitus admitted to our hospital were selected for the study, and grouped into two groups (45 cases in the control group and 45 cases in the observation group) by randomized numerical table method, all of the mothers underwent cesarean section and implemented cesarean section related education, based on which 45 cases in the control group were given the conventional preoperative fasting and drinking program (preoperative fasting of 8h, 6h), and 45 cases in the observation group were given the shortened fasting and drinking time program (preoperative fasting of 6h, 2h). In the observation group, 45 cases were given a shortened fasting and drinking program (6h and 2h preoperative fasting and drinking), comparing the preoperative maternal subjective comfort, perioperative blood glucose level, nutritional status, intraoperative bleeding, postoperative gastrointestinal function recovery time and perioperative adverse reactions between the two groups.

Results. Preoperative hunger, thirst, and anxiety were significantly lighter in the observation group than in the control group (Z=2.257、3.260、2.660, P<0.05). The preoperative fasting blood glucose level of the observation group was significantly higher than that of the control group (t=3.363, P<0.05), and the difference between the postoperative fasting blood glucose level and that of the control group was not statistically significant (P>0.05). There was no statistically significant difference between the preoperative serum prealbumin (PAB) and

albumin (ALB) measurements of the two groups (P>0.05), and the serum PAB and ALB levels of the two groups were significantly lower than the preoperative levels on the 1st postoperative day (P<0.05), and the PAB and ALB levels of the observation group were significantly higher than those of the control group (t=3.090, 4.328, P<0.05). Intraoperative bleeding in the observation group was significantly less than that in the control group (t=2.794, P<0.05), postoperative recovery time of gastrointestinal function was shorter than that in the control group (t=6.206, P<0.05), and perioperative hypoglycemia incidence was lower than that in the control group (χ^2=4.444, P<0.05).

Conclusion. A shorter fasting and fasting time regimen improves maternal comfort during cesarean delivery for gestational diabetes mellitus, controls preoperative blood glucose levels, improves nutritional status in the early postoperative period, reduces the incidence of preoperative hypoglycemia, and promotes postoperative recovery.

Keywords. Preoperative fasting and abstinence from food and drink; gestational diabetes mellitus; cesarean delivery; glycemic control; nutritional status

INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the common complications in the perinatal period, which refers to the abnormalities of maternal glucose metabolism for the first time after pregnancy, and its onset may be related to the disruption of the relative balance between glucose demand, insulin secretion, and insulin resistance [1].Patients with GDM usually do not have obvious symptoms, but poor glycemic control may increase the risk of miscarriage, infection, neonatal respiratory distress syndrome, macrosomia, and other health hazards during pregnancy. Poor glycemic control may increase the risk of miscarriage, infection, neonatal respiratory distress syndrome, and macrosomia, jeopardizing the health of mother and child [2]. Therefore, it is necessary to strengthen perioperative glycemic management of GDM patients to reduce surgery-related complications and ensure surgical safety. In recent years, cesarean section has been increasingly widely used in maternal labor, although it can reduce maternal pain, but as a traumatic surgery will still bring more postoperative

complications [3], how to ensure the perioperative safety of cesarean section mothers with gestational diabetes mellitus, a special group of women, has become an important issue for clinical exploration. Currently, it is believed that the development of a scientific and reasonable preoperative fasting and drinking program can not only improve perianesthesia comfort, but also effectively prevent intraoperative aspiration and ensure anesthesia safety and surgical efficacy [4]. Previous studies have pointed out that prolonged preoperative fasting and abstinence from food and drink will increase the discomfort of diabetic patients, affecting their comfort, and also induce insulin resistance, increasing the risk of preoperative hyperglycemia and postoperative hypoglycemia, which will prolong the length of stay in the hospital and affect postoperative recovery [5-6]. At the same time, with the increase of gestational weeks, the demand of the fetus for nutrients increases, and the blood glucose metabolism of GDM patients in the early clinical period is closely related to the diet and the nutritional status of the body, and the nutritional therapy is also the basis of the clinical treatment of GDM [7]. Prolonged preoperative fasting and abstinence from food and drink can cause intestinal mucosal barrier dysfunction in GDM patients, leading to an increase in its permeability, which affects the recovery of gastrointestinal function and postoperative nutritional status [8]. In view of the above reasons, this study compared and analyzed the effects of different preoperative fasting and drinking regimens on the blood glucose level and early postoperative nutritional status of GDM cesarean delivery mothers, with a view to evaluating the value of shortening the fasting and drinking time regimen in Gestational Diabetes Mellitus (GDM) cesarean delivery mothers and exploring a reasonable pathway for the management of perioperative fasting and water fasting of GDM cesarean delivery mothers, which is now reported as follows.

1 MATERIALS AND METHODS

1.1 Basic information

Ninety cases of GDM cesarean delivery admitted to our hospital from January

2021 to December 2022 were selected. Inclusion criteria: ① Meet the diagnostic criteria for GDM recommended by the American Diabetes Association (ADA) guidelines [9]; ② All were singleton pregnancies and full-term deliveries; ③ Meet the indications for cesarean section; ④ American society of anesthesiologists (ASA) classification I ~ II; ⑤ Patients voluntarily participated in the study and signed an informed consent form. The patients voluntarily participated in the study and signed an informed consent form. Exclusion criteria: ① GDM women who did not undergo cesarean section; ② intraoperative abdominal adhesions or postoperative infections; ③ contraindications to surgery or communication disorders; ④ excessive obesity; ⑤ combination of reflux esophagitis, cirrhosis of the liver, abnormal gastric dynamics, sleep disorders, systemic diseases, or previous history of gastrointestinal surgery. Randomized numerical table method was used to group the patients (control group and observation group), with 45 cases in each group. The age of the observation group was 20-42 (26.71±2.25) years old, 37-42 (38.29±0.35) months pregnant, and the body mass index (BMI) was 24.25-32.18 (28.73±2.20) kg/m2. The age of the control group was 20-41 (26.84±2.31) years old, and the pregnancy was 37-41 (38.22±0.32) months, and BMI was 24.31-32.56 (28.81±2.09) kg/m2. There was no significant difference in the general data of the two groups (P＞0.05) and they were comparable (see Table 1). The study was reviewed and approved by the Medical Ethics Committee of the hospital.

Table 1 Comparison of general information between the two groups（$\bar{x}$±s）

group	age (years)	Week of pregnancy (months)	BMI（kg/m²）	Neonatal body mass（g）	Time from anesthesia induction to delivery（min）
Observation Group（n=45）	26.71±2.25	38.29±0.35	28.73±2.20	3420.56±402.97	6.02±0.35

Control group （n=45）	26.84±2.31	38.22±0.32	28.81±2.09	3413.78±398.76	5.98±0.33
χ^2/t value	0.270	0.990	0.177	0.080	0.558
P value	0.788	0.325	0.860	0.936	0.578

1.2 Methods

1.2.1 Fasting and drinking programs

All the women underwent cesarean section and were educated about cesarean section, based on which the Control group was given a routine preoperative fasting program, i.e., preoperative fasting of food (solid food) for 8 h and fasting of drinks (clear liquids) for 6 h. If the operation was performed at 8:00 on the same day, then fasting of food was performed after 0:00 and fasting of drinks was performed after 2:00; if the operation was performed at 9:00, then the fasting of food and drinks was postponed for one hour each. Observation Group gave the program of shortening the time of fasting and drinking, i.e., fasting for 6h before surgery, fasting rice and pasta (noodle soup, bread, steamed bread, etc.), and fasting drinking for 2h, fasting drinking water, soft drink, tea, non-dregs of fruit juice and so on. If the operation was performed at 8:00 a.m. on the same day, the mother was instructed to eat 3 slices of soda cookies at 2:00 a.m. on the basis of routine listening to the fetal heartbeat, and then fasted; the mother's blood glucose level was measured at 6:00 a.m., and the mother was instructed to drink water or a functional beverage of 200 mL, and then fasted. In case of surgery at 9:00 a.m. on the same day, the above interventions were postponed for one hour each. No other treatments or interventions were given to the women in either group during the period of fasting and abstinence from food and drink.

1.2.2 Observation indicators

① Maternal subjective comfort: the preoperative maternal subjective comfort was assessed in both groups, including three items of hunger, thirst, and anxiety, in which the degree of hunger and thirst was scored on a 4-point scale from 0 to 3, with

a score of 0 indicating no hunger or thirst, a score of 1 indicating mild hunger or thirst, i.e., mild hunger or thirst; a score of 2 indicating significant hunger or thirst but tolerable, i.e., moderate hunger or thirst; and a score of 3 indicating very hungry or thirsty and intolerable, i.e., severe hunger or thirst [8]. Anxiety was assessed using the Hamilton anxiety rating scale (HAMA), which consists of 14 items, all of which are rated on a 5-point scale from 0 to 4, with a score of <7 indicating no anxiety, a score of 7 to 13 indicating mild anxiety, a score of 14 to 28 indicating moderate anxiety, and a score of >28 indicating severe anxiety[10]. ② Blood glucose level: the blood glucose level was determined at the time of surgery. (ii) Blood glucose level: a blood glucose detector (Bayanjin Blood Glucose Meter, Model: 7600P, National Instrument Injection 20192222306) was used to measure the fasting blood glucose level of the two groups of mothers in the preoperative and postoperative period for 30 min, and the presence of hypoglycemia was suggested if the blood glucose level was <3.9 mmol/L. (iii) Nutritional status: 4 mL of maternal fasting venous blood was collected in the morning before and on the 1st postoperative day, and the serum was centrifuged and separated to determine the levels of serum albumin (ALB), total protein (TP), and transferrin (TRF) using a fully automated biochemical analyzer. ④ Intraoperative bleeding and postoperative gastrointestinal function recovery time. Intraoperative bleeding and postoperative gastrointestinal function recovery time were recorded in both groups. ⑤ Perioperative adverse reactions. Record the occurrence of perioperative hypoglycemia, nausea and vomiting, and pneumonia in the two groups.

1.2.3 statistical processing

SPSS25.0 statistical software was used, the measurement information was expressed as（$\bar{x}\pm s$）, independent sample t-test was used between groups, paired sample t-test was used within groups, χ^2 test or Fisher's exact probability method was used for counting information, rank sum test was used for hierarchical information, and the difference of $P<0.05$ was considered to be statistically significant.

3 RESULTS

3.1 Comparison of subjective maternal comfort between the two groups

Preoperative hunger, thirst, and anxiety were significantly less severe in the Observation Group than in the Control Group.（$P<0.05$）。See table 2。

Table 2 Comparison of subjective maternal comfort between the two groups[n(%)]

group	starve			thirst			apprehensive		
	mildly	moderately	severe	mildly	moderately	severe	mildly	moderately	severe
Observation Group（n=45）	36	8	1	10	34	1	25	13	7
Control group（n=45）	27	11	7	2	35	8	13	17	15
Z value		2.257			3.260			2.660	
P value		0.024			0.001			0.008	

3.2 Comparison of perioperative maternal blood glucose levels in the two groups

The preoperative fasting blood glucose level of Observation Group was significantly higher than that of Control group ($P<0.05$), and the difference between the postoperative fasting blood glucose level and Control group was not statistically significant ($P>0.05$).See table 3、Figure 1～2。

Table 3 Comparison of perioperative maternal blood glucose levels in the two groups（mmol/L，$\bar{X}\pm s$）

group	Preoperative blood	postoperative glucose	*t* value	*P* value

	glucose			
Observation Group（n=45）	5.97±1.29	5.82±1.05	0.605	0.547
Control group（n=45）	5.08±1.22	5.79±1.03	2.983	0.004
t value	3.363	0.137		
P value	0.001	0.892		

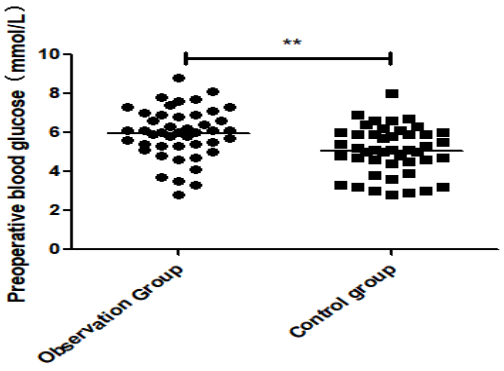

Figure 1

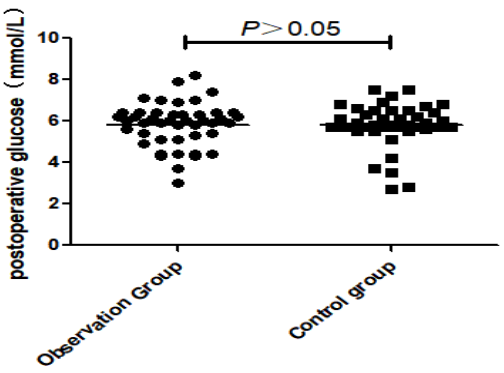

Figure 2

Figure 1 Comparison of preoperative blood glucose between the two groups（$^{**}P<0.01$）

Figure 2 Comparison of postoperative blood glucose between the two groups

3.3 Comparison of maternal perioperative nutritional indicators between the two groups

There was no statistically significant difference in the comparison of serum PAB and ALB levels measured in the two groups before operation ($P>0.05$), and the serum PAB and ALB levels in the two groups were significantly lower than those before operation in the 1st postoperative day ($P<0.05$), and the Observation Group PAB and ALB levels were significantly higher than those of the Control group ($P<0.05$).See table 4、Figure 3～4。

Table 4 Comparison of maternal perioperative nutritional indicators between the two groups（$\bar{X}\pm s$）

group	PAB（mg/L）		ALB（g/L）	
	preoperative	1d postoperative	preoperative	1d postoperative
Observation	248.91±41.36	183.47±31.20*	41.03±3.87	35.06±3.22*

Group（n=45）				
Control group（n=45）	245.69±36.54	164.50±26.88#	40.85±4.42	32.14±3.18#
t value	0.391	3.090	0.206	4.328
P value	0.697	0.003	0.838	＜0.001

Note: Comparison with preoperative *P＜0.05，#P＜0.05

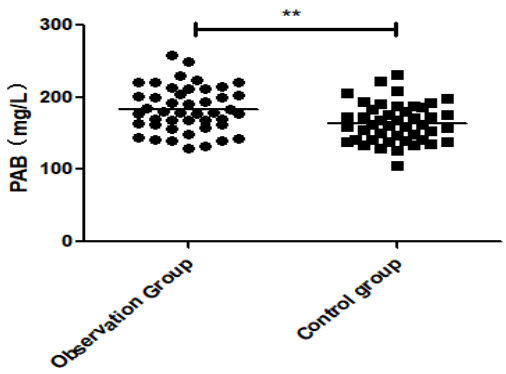

Figure 3

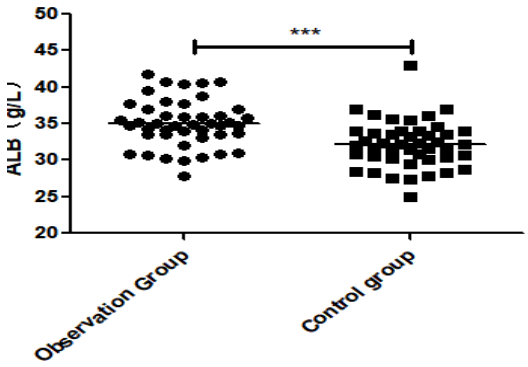

Figure 4

Figure 3 Comparison of 1d postoperative PAB levels between the two groups（**P＜0.01）

Figure 4 Comparison of 1d postoperative ALB levels between the two groups（***P＜0.001）

3.4 Comparison of intraoperative bleeding and postoperative recovery time of gastrointestinal function between two groups

The amount of intraoperative bleeding in Observation Group was significantly less than that in Control group (P<0.05), and the recovery time of postoperative gastrointestinal function was shorter than that in Control group (P<0.05).See table 5、Figure 5～6。

Table 5 Comparison of intraoperative bleeding and postoperative recovery time of gastrointestinal function between two groups（$\bar{X}$±s）

group	Intraoperative bleeding（mL）	Postoperative recovery time of gastrointestinal function（h）

Observation Group （n=45）	284.56±91.20	26.63±2.75
Control group （n=45）	339.87±96.54	30.91±3.72
t value	2.794	6.206
P value	0.006	＜0.001

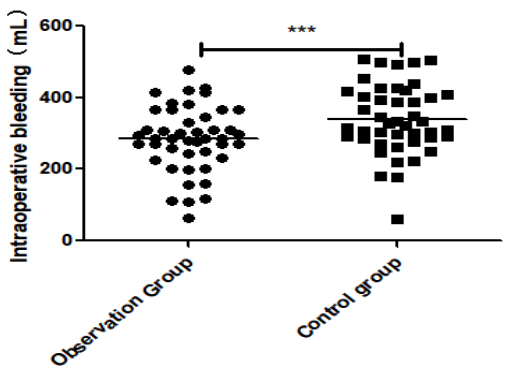

Figure 5

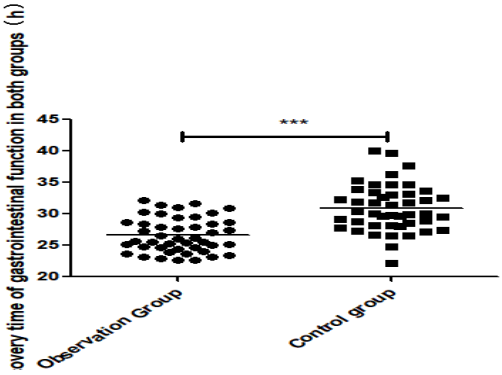

Figure 6

Figure 5 Comparison of intraoperative bleeding between the two groups（$^{**}P<0.01$）

Figure6 Comparison of postoperative recovery time of gastrointestinal function between the two groups（$^{***}P<0.001$）

3.5 Comparison of the incidence of perioperative adverse reactions between the two groups

The incidence of perioperative hypoglycemia and postoperative nausea and vomiting were lower in the Observation Group than in the Control group ($\chi^2 = 5.075$, $P<0.05$).See table 6。

Table 6 Comparison of the incidence of perioperative adverse reactions between the two groups [n(%)]

group	hypoglycemia	Nausea, vomiting	pneumonia	Total incidence
Observation Group（n=45）	1（2.22）	5（11.11）	0（0.00）	6（13.33）

Control group（n=45）	8（17.78）	4（8.89）	1（2.22）	13（28.89）
χ^2value	4.444	0.000	——*	3.269
*P*value	0.035	1.000	＞0.05	0.071

Note: *Fisher's exact probability method was used

4 DISCUSSION

In recent years, with the continuous development and maturity of cesarean section, coupled with the change of women's concept of childbirth, cesarean section has become an important means of assisted delivery.Preoperative fasting and abstinence from drinking and eating in GDM cesarean section mothers can help to eliminate the reflux of gastric contents during anesthesia and cause aspiration, to avoid aspiration pneumonia or asphyxia, and to ensure the safety of anesthesia to ensure that the operation is carried out smoothly [11]. In clinical work, it is usually usual to fast for 8-12h and 6h before surgery, but for GDM women, prolonged or inappropriate preoperative fasting and fasting may cause discomfort such as hunger and thirst, inducing mental agitation such as anxiety, nervousness and irritability, and in severe cases, even hypoglycemia or dehydration, which may affect surgical treatment and even postoperative recovery [12]. In addition, GDM cesarean delivery mothers who accept the routine fasting and drinking regimen may not be conducive to stabilizing perioperative blood glucose levels, increasing the risk of postoperative complications and affecting patient recovery. Therefore, it is necessary to further explore a more scientific and reasonable fasting and drinking regimen to promote the postnatal recovery of GDM cesarean delivery mothers and ensure the safety of newborns.

Preoperative hypoglycemia increases the risk of postoperative insulin resistance, stress ulcers, infections, and poor incision healing, so it is critical to avoid

hypoglycemia by reasonably fasting and abstaining from food and drink before surgery. In this study, we found that preoperative hunger, thirst, and anxiety were significantly lower in Observation Group than Control Group, while preoperative blood glucose level was significantly higher than Control Group, and the incidence of hypoglycemia was significantly lower than Control Group, which indicated that shortening the duration of preoperative fasting and abstaining from eating and drinking could alleviate preoperative hunger, thirst and other discomforts, and improve the subjective feeling of GDM cesarean section mothers. GDM cesarean section mothers' subjective comfort, stabilizes preoperative blood glucose level, and can reduce the occurrence of perioperative hypoglycemia, which is basically consistent with previous reports [8,13]. The reasons were analyzed as follows: prolonged fasting and abstinence from food and drink would reduce the preoperative blood glucose level of GDM women, while the surgical stress caused by cesarean delivery could trigger postoperative insulin resistance and elevate the glycemic stress. In contrast, adjusting to the last food intake 6h before surgery and the last water intake 2h before surgery can inhibit hepatic glycogenolysis, promote endogenous insulin secretion, reduce insulin resistance, enhance the body's ability to resist stress, and stabilize postoperative blood glucose levels [14]. This study also found that the serum PAB and ALB levels of the two groups were significantly lower than the preoperative levels in the 1st postoperative day, while the Observation GroupPAB and ALB levels were significantly higher than the Control group, and the intraoperative bleeding in this group was less than that of the Control group, while the recovery time of the gastrointestinal function in the postoperative period was shorter than that of the Control group, which suggests that preoperative This suggests that shortening the fasting and fasting time can help improve the early postoperative nutritional status of GDM mothers, reduce intraoperative bleeding, and promote the recovery of postoperative gastrointestinal function. The reasons for this are as follows: prolonged fasting and fasting in the preoperative period can lead to delayed recovery of gastrointestinal function in the postoperative period [15], which can delay the time for

resumption of postoperative eating and drinking, affecting the nutrient intake and absorption in the postoperative period, aggravating malnutrition and hypoproteinemia, and influencing the recovery of the nutritional status in the postoperative period. , brewing a vicious circle and affecting the recovery of postoperative gastrointestinal function. At the same time, a long period of preoperative fasting and fasting will trigger insulin resistance, induce metabolic stress of surgical trauma, which in turn affects contraction and even incision healing and increases bleeding, while shortening the preoperative fasting and fasting time can stabilize the patient's blood glucose level, shorten the recovery process of the postoperative body functions, which will be conducive to the healing of the incision and the recovery of the postoperative gastrointestinal function, and shorten the time of resuming the postoperative diet, which is beneficial for the postoperative nutritional intake and absorption, and thus improve the nutritional status. absorption, thus improving nutritional status [16].

In conclusion, preoperative intervention for cesarean delivery of women with gestational diabetes mellitus using a program to shorten the time of fasting and abstinence from food and drink can improve maternal comfort, facilitate control of preoperative blood glucose, improve the nutritional status in the early postoperative period, reduce the occurrence of preoperative hypoglycemia, and promote the recovery of the postoperative period, which is of clinical value for dissemination.

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