Revista Argentina de Clínica Psicológica
2020, Vol. XXIX, N°3, 854-861
DOI: 10.24205/03276716.2020.908

Effects of Comprehensive Nursing Interventions on HbAlc Levels and Pregnancy Outcomesi Patients with Gestational Diabetes Mellitus

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Abstract

Objective: This paper aimed at exploring the effects of comprehensive nursing (CN) interventions on HbAlc levels and pregnancy outcomes in patients with gestational diabetes mellitus (GDM)

Methods: Seventy-two GDM patients admitted to our hospital from April 2017 to September 2019 were enrolled as research objects in this experiment. Those receiving routine nursing were in a control group (n=35), whereas those receiving CN were in a study group (n=37). They were observed with respect to their HbAlc and fasting plasma glucose (FPG) expression before and after nursing, pregnancy outcomes, Self-Rating Anxiety Scale (SAS) scores, Hamilton Depression Rating Scale (HAMD) scores, 8-item Morisky Medication Adherence Scale (MMAS-8) scores, 36-Item Short-Form Health Survey (SF-36) scores and scores of satisfactions with the nursing contents in our hospital.

Results: After nursing, serum HbAlc and FPG expression in the study group was remarkably lower than that in the control group (P<0.05). After nursing, compared with those in the control group, patients in the study group had remarkably lower SAS scores (P<0.05), remarkably lower HAMD scores (P<0.05), remarkably higher MMAS-8 scores (P<0.05), and remarkably higher SF-36 scores (P<0.05). The nursing satisfaction with medical staff was 97.30% in the study group, remarkably higher than 51.43% in the control group (P<0.05). The incidence of adverse events in the study group was remarkably lower than that in the control group (P<0.05)

Conclusion: For GDM patients, CN can increase HbAlc and FPG expression, reduce negative emotions and adverse events of pregnancy outcomes, and improve quality of life.

Keywords: gestational diabetes mellitus; comprehensive nursing interventions; HbAlc; pregnancy outcomes

Introduction

Gestational diabetes mellitus (GDM) is a common pregnancy complication that causes spontaneous hyperglycemia during pregnancy. As estimated by International Diabetes Federation (IDF) in 2017, there are approximately 18 million newborns each year, and the disease affects approximately 14% of global pregnant women, which is related to adverse maternal and neonatal consequences. Therefore, maintaining sufficient blood glucose levels in GDM can reduce the incidence of mothers and infants. Risk factors for GDM include overweight/obesity, a westernized diet, micronutrient deficiency, elderly parturient women, insulin resistance and a family history of diabetes mellitus (DM). Although the disease is usually cured after delivery, it may have long-term effects on maternal and fetal health, such as increasing the risks of type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD) in mothers, and the risks of obesity, CVD and T2DM in children in the future. This leads to an intergenerational vicious cycle of obesity and DM, also affecting the health of mothers and infants. Therefore, the early screening and diagnosis of

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GDM are essential for preventing or reducing maternal and fetal complications during and after pregnancy.

In recent years, with the changes of the outlook on marriage and procreation and the acceleration of the pace of life, the incidence of GDM has increased annually, so the timely and effective control of maternal blood glucose levels is of great significance to improve pregnancy outcomes (Mensah et al, 2019). The disease is correlated with many maternal factors such as diet and living habits, treatment compliance, etc. Therefore, in addition to clinical symptomatic treatment, effective nursing interventions should be also performed to help pregnant women develop healthy living habits and improve treatment compliance, so as to reduce the incidence of adverse maternal and infant events. Besides, guidelines for comprehensive nursing (CN) should be strictly formulated to help nursing staff screen, diagnose and treat GDM. Since the staff are usually the first care point for GDM patients, CN is especially important when medical care is scarce (Nielsen et al., 2014). Therefore, we suspect that the CN model has a better effect on GDM patients. An experimental analysis was performed on this conjecture, in order to provide effective nursing reference and advice for clinically treating the patients in the future.

1. Materials and methods

1.1 Basic information

Seventy-two GDM patients admitted to our hospital from April 2017 to September 2019 were enrolled as research objects in this experiment. Among them, 35 cases receiving routine nursing were in the control group, and their age ranged from 24 to 33 years, with the average age of (28.16±2.58) years, the gestational week of 23-36 weeks, and the average gestational week of (31.34±2.28) weeks. The other 37 cases receiving CN were in the study group, and their age ranged from 24 to 32 years, with the average age of (28.23±2.62) years, the gestational week of 23-36 weeks, and the average gestational week of (31.46±2.06) weeks. This study has been approved by the Medical Ethics Committee of our hospital.

1.2 Inclusion and exclusion criteria

Inclusion criteria: All patients met GDM-related diagnostic criteria from the American College of Obstetricians and Gynaecologists (Hod et al., 2019). They were aged 22-35 years and willing to cooperate in the arrangement of medical staff in our hospital, with complete patient data. All patients had signed the informed consent form.

Exclusion criteria: Those complicated with other cardio-cerebrovascular diseases; those with other pregnancy complications, malignant tumors, hyperthyroidism, physical disabilities or language dysfunction; those with incomplete clinical data; those who had transferred halfway to other hospitals.

1.3 Nursing methods

Patients in the control group received routine nursing: The routine nursing included blood glucose monitoring, medication according to doctor's advice, prenatal examination according to doctor's advice, and the timely monitoring and prevention of adverse reactions.

Patients in the study group received CN: The patients were given CN based on the same routine nursing in the control group. (1) Health education: After understanding the educational background of the patients, nursing staff explained the causes, influencing factors, harm to mothers and infants, and therapeutic methods of GDM as well as the importance of active cooperation to the patients in plain language according to their receptive ability. The staff also gave answers to the questions raised by the patients and their families, and corrected the patients' wrong cognition on GDM and its treatment, so as to enable them to deeply understand the disease and improve their treatment compliance. Moreover, the staff handed out handbooks and books to them, so that they could know the relevant knowledge of GDM and the matters needing attention of related drugs. (2) Psychological nursing: The staff established a good communication mechanism with the patients, fully understood their pregnancy-labor history, and encouraged them to express their inner worries and worries, as well as comforted and encouraged them with an empathic attitude. Through clinical treatment and explanation, their inner worries were eliminated and their tension and anxiety were relieved, so they could face the disease with a peaceful mind and actively cooperate in clinical treatment and nursing. At the same time, the staff gave them examples of those who had given birth smoothly, built up their confidence in facing the disease, and communicated with their husbands when appropriate to tell them to encourage and understand the patients, thereby making the patients feel safe and reducing their negative emotions. (3) Diet guidance: Based on the patients' food preferences, the staff formulated a scientific diet plan and instructed the patients to eat more fresh fruits and vegetables, with reasonably eggs, meat, beans, cereals, green vegetables and low-

sugar fruits. The patients should insist on having more meals a day but less food at each and avoid spicy, irritating, raw and cold foods, so as to ensure balanced nutrition and reasonable body mass. (4) Medication guidance: Based on their blood glucose levels, the staff guided the patients to properly use insulin, and to regularly monitor their blood glucose levels and take the medicine on time and quantity according to the doctor's advice. The dosage should be adjusted in time based on the patients' conditions. (5) Exercise guidance: The staff explained the importance of exercise to blood glucose control to the patients, and guide them to choose aerobic exercises such as walking and yoga for pregnant women according to their own preferences. This is because proper exercise can enhance body resistance, strengthen insulin sensitivity, and improve blood glucose metabolism, as well as facilitate disease control, thus avoiding the excessive growth of body mass. Additionally, it can also help the patients develop healthy living habits and regular schedule. Besides, a patient's husband should ensure her safety during exercise, so that she can feel the care and love of her family, which can promote the implementation of the exercise plan.

1.4 Scoring standards

The Self-Rating Anxiety Scale (SAS) and the Hamilton Depression Rating Scale (HAMD) were used for assessing psychological health. The SAS has a total score of 100 points. After nursing, a score of 50-70 points indicates mild anxiety, a score of 71-90 points moderate anxiety, a score of >90 points severe anxiety. The HAMD that consists of 24 items can measure the depression severity of patients. A higher score indicates more serious depression. The 8-item Morisky Medication Adherence Scale (MMAS-8) was used for evaluating the patients' treatment compliance before and after nursing from the aspects of medication according to doctor's advice, body weight control, diet control and appropriate exercise. The MMAS-8 has a full score of 50 points. A score of 50 points indicates complete compliance, a score of 30-40 points indicates partial compliance, and a score of <30 points indicates non-compliance. The 36-Item Short-Form Health Survey (SF-36) was used for assessing the patients' quality of life (QOL), consisting of physical health [physiological function (PF), role physical (RP), bodily pain (BP), general health (GH)] and psychological health [vitality (VT), social function (SF), role emotional (RE), mental health (MH)]. The scale has 8 dimensions in total, with a total score of 100 points for each dimension.

The higher the score is, the better the QOL is. The self-made *Nursing Satisfaction Questionnaires* of our hospital were used for scoring, with 20 questions in total. The patients scored the satisfaction with the nursing contents, with 5 points for each question. A total score of <70 points indicates dissatisfied, a total score of 70-89 points indicates satisfied, and a total score of ≥90 points indicates very satisfied. Nursing satisfaction = (very satisfied + satisfied cases) / total number of cases ×100%.

1.5 Blood sample collection and major reagents

In the morning, 5 mL of fasting venous blood before and after nursing was collected, stored at 4℃ for 30 minutes, and then centrifuged for 10 minutes (3000 rpm/m), so as to extract the supernatant, which was stored in a refrigerator at -80℃. The patients' blood glucose function [glycosylated hemoglobin (HbAlc), fasting plasma glucose (FPG)] was detected using a fully automatic biochemical analyzer (LFF Technology Co., Ltd., Item No.: LFF-LC-1781), with the steps strictly carried out in accordance with the kit instruction. The Eppendorf CryoCube F740hi ultra-low temperature freezer was purchased from Eppendorf China Limited, Item No.: ep000000.

1.6 Outcome measures

Main outcome measures: The patients were observed with respect to their HbAlc and FPG expression before and after nursing and pregnancy outcomes.

Secondary outcome measures: The patients were observed with respect to their SAS, HAMD, MMAS-8 and SF-36 scores as well as scores of satisfactions with the nursing contents in our hospital.

1.7 Statistical analysis

In this study, SPSS20.0 (IBM Corp, Armonk, NY, USA) was used to statistically analyze the collected data. GraphPad 7 was used to plot the required figures. Kolmogorov-Smirnov (K-S) test was used to analyze the distribution of measurement data, in which the data conforming to normal distribution were expressed by mean ± standard deviation (Meas±SD), with their comparison between groups conducted by independent samples t test and the comparison within groups conducted by paired t test. Count data were expressed by rate (%), compared by chi-square test, and represented by

χ^2. When P<0.05, the difference was statistically significant.

2. Results

2.1 Clinical data

The differences were not significant between the

study and control groups in terms of age, body mass index (BMI), history of smoking, history of drinking, place of residence, food preference, exercise habits, gestational week, HbAlc and FPG, indicating comparability (P>0.05). See Table 1.

Table 1. **Basic data [n (%)]**

	Study group (n=37)	Control group (n=35)	χ^2 or t	P
Age (Years)	28.23±2.62	28.16±2.58	0.114	0.909
BMI	23.05±1.24	23.02±1.17	0.106	0.916
History of smoking				
Yes	9 (24.32)	10 (28.57)	1.167	0.683
No	28 (75.68)	25 (71.43)		
History of drinking				
Yes	17 (45.95)	19 (54.29)	0.500	0.479
No	20 (54.05)	16 (45.71)		
Place of residence				
City	31 (83.78)	30 (85.71)	0.052	0.820
Countryside	6 (16.22)	5 (14.29)		
Food preference				
Bland	7 (18.92)	9 (25.71)	0.481	0.488
Spicy	30 (81.08)	26 (74.29)		
Exercise habits				
Yes	11 (29.73)	13 (37.14)	0.445	0.505
No	26 (70.27)	22 (62.86)		
Gestational week (Weeks)	31.46±2.06	31.34±2.28	0.235	0.815
HbAlc (%)	11.03±1.18	11.05±1.12	0.074	0.942
FPG (mmol/L)	11.54±1.28	11.51±1.23	0.101	0.920

2.2 HbAlc and FPG expression before and after nursing

Serum HbAlc and FPG expression in the study and control groups was observed. Before nursing, the difference was not significant between the two groups in the expression (P>0.05), which was remarkably lower in the study group after nursing (P<0.05). See Figure 1.

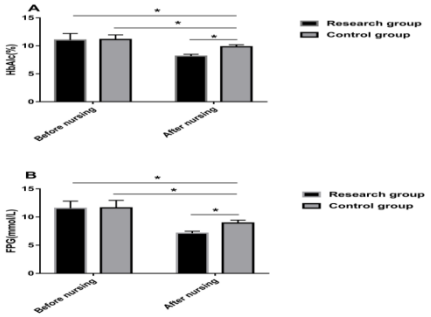


Figure 1. **HbAlc and FPG expression before and after nursing**

A: After nursing, HbAlc expression in the study group remarkably reduced, and was lower than that in the control group.

B: After nursing, FPG expression in the study group remarkably reduced, and was lower than that in the control group.

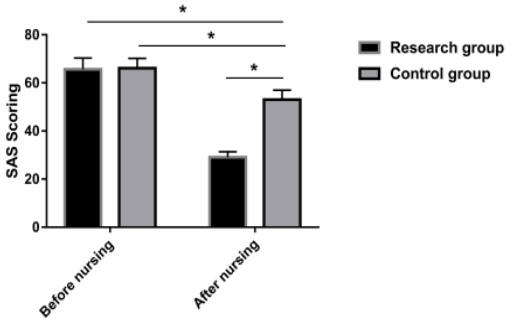
Note: * indicates a difference between two groups (P<0.05).

2.3 SAS scores

Before nursing, the differences were not significant in SAS scores between the study and control groups (P>0.05), while after nursing, the scores were remarkably lower in the study group (P<0.05). See Figure 2.

Figure 2. **SAS scores**

After nursing, SAS scores in the study group remarkably reduced, and was lower than those in the control group.



Note: * indicates a difference between two groups (P<0.05).

2.4 HAMD scores

Before nursing, the differences were not significant in HAMD scores between the study and control groups (P>0.05), while after nursing, the scores were remarkably lower in the study group (P<0.05). See Figure 3.

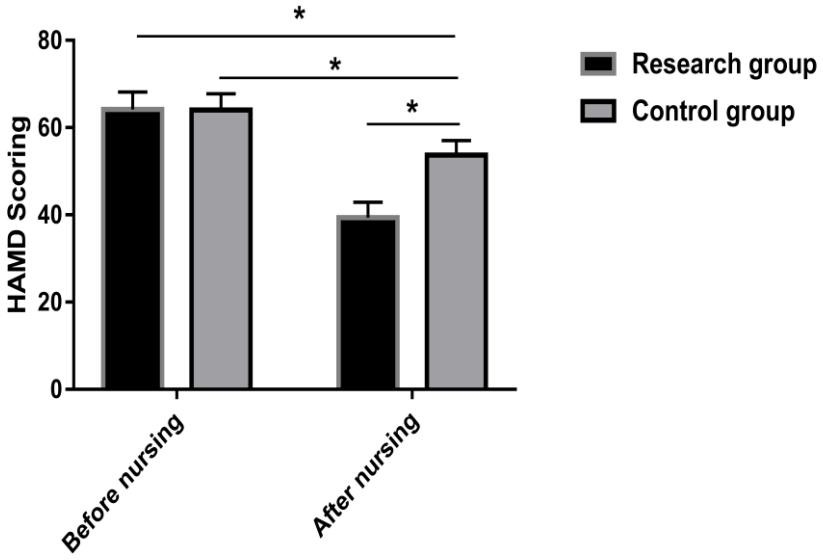


Figure 3. **HAMD scores**

After nursing, HAMD scores in the study group remarkably reduced, and was lower than those in the control group.

Note: * indicates a difference between two groups (P<0.05).

2.5 MMAS-8 scores

Before nursing, the differences were not significant in MMAS-8 scores (medication according to doctor's advice, body weight control, diet control and appropriate exercise) between the study and control groups (P>0.05). After nursing, the four scores were remarkably higher in the study group (P<0.05). See Figure 4.

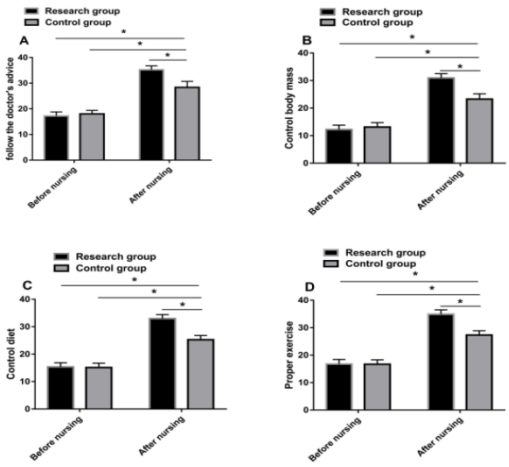


Figure 4. **MMAS-8 scores**

A: After nursing, the scores of medications according to doctor's advice in the study group were remarkably higher than those in the control group.

B: After nursing, the scores of body weight control in the study group were remarkably higher than those in the control group.

C: After nursing, the scores of diet control in the study group were remarkably higher than those in the control group.

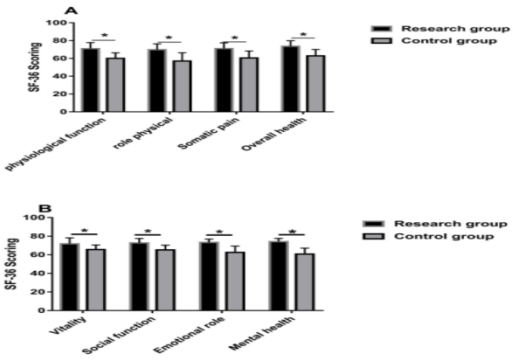
D: After nursing, the scores of appropriate exercises in the study group were remarkably higher than those in the control group.

Note: * indicates a difference between two groups (P<0.05).

2.6 SF-36 scores

In the SF-36 scale, the scores of physical health (PF, RP, BP, GH) and psychological health (VT, SF, RE, MH) in the study group were remarkably higher than those in the control group (P<0.05). See Figure 5.

Figure 5. **SF-36 scores**



A: The scores of physical health in the study group were remarkably higher than those in the control group.

B: The scores of psychological health in the study group were remarkably higher than those in the control group.

Note: * indicates a difference between two groups (P<0.05).

2.7 Scores of nursing satisfaction

The nursing satisfaction with medical staff was 97.30% in the study group, remarkably higher than 51.43% in the control group (P<0.05). See Table 2.

Table 2. **Scores of nursing satisfaction [n (%)]**

Groups	Number of cases	Satisfied	Generally satisfied	Dissatisfied	Satisfaction (%)
Study group	37	30 (81.08)	6 (16.22)	1 (2.70)	36 (97.30)
Control group	35	8 (22.86)	10 (28.57)	17 (48.57)	18 (51.43)
t	-	-	-	-	20.180
P	-	-	-	-	0.001

2.8 Pregnancy outcomes

The incidence of adverse maternal and infant events (polyhydramnios, premature rupture of membranes, postnatal infection, macrosomia, fetal distress) in the study group was remarkably lower than that in the control group (P<0.05). See Table 3.

Table 3. **Comparison of pregnancy outcomes [n (%)]**

Groups	Number of cases	Polyhydramnios	Premature rupture of membranes	Postnatal infection	Macrosomia	Fetal distress	Premature delivery	Incidence (%)
Study group	37	1 (2.70)	2 (5.40)	1 (2.70)	0 (0.00)	0 (0.00)	1 (2.70)	5 (13.50)
Control group	35	3 (8.57)	3 (8.57)	2 (5.71)	3 (8.57)	2 (5.71)	2 (5.71)	15 (42.84)
t	-	-	-	-	-	-	-	4.393
P	-	-	-	-	-	-	-	0.036

Discussion

As one of the most common complications in the Medical Department during pregnancy, GDM has a great effect on the health of mothers and infants, and the exact mechanism of its progression remains unclear. According to some studies, GDM patients cannot meet the increasing demand for insulin production during pregnancy (Barbour et al., 2007). Since the disease is associated with an increased risk of short-term and long-term pregnancy complications, the patients have a higher risk of preeclampsia, caesarean section and birth injury, and postpartum complications include macrosomia, shoulder dystocia, hyperinsulinemia, hypoglycemia and hyperbilirubinemia. (Young and Ecker, 2013; Mohammadbeigi et al., 2013; Alam et ai., 2018). In the long run, mothers and their offspring are prone to metabolic diseases, such as obesity, T2DM and CVD (Mitanchez et al., 2015). It is estimated that approximately 30% of children (Garcia-Vargas et al., 2012) and more than 70% of GDM patients (Kim et al., 2002) are vulnerable to T2DM in their later years. According to Buchanan et al., nutrition and nursing management is the cornerstone for treating GDM (Buchanan et al., 2012). Therefore, the nursing of GDM patients has become the research topic of the majority of scholars.

In this study, we observed HbAlc and FPG expression before and after nursing. Before nursing, the difference was not significant between the two groups in the expression, which was remarkably lower in the study group after nursing. This indicates that CN can control the patients' blood glucose levels. As reported by previous studies, GDM increases the possibility of pregnant women suffering from emotional distress (such as depression, anxiety or stress), and adversely affects

their self-awareness of health and QOL(Daniells et al., 2003; Rumbold and Crowther, 2002; Hjelm et al., 2008; Hirst et al., 2012; Greenhalghet al., 2015). In our study, before nursing, the differences were not significant between the two groups in the SAS, HAMD and SF-36 scores. After nursing, the three scores were remarkably higher in the study group. This suggests that CN can improve the patients' psychological health and QOL. In a study by Gonzalez and others, GDM always requires patients' autonomy and their strict abiding by lifestyle changes, so as to prevent its complications (Gonzalez et al., 2011). In addition, GDM patients also realize that the lack of self-control results in pregnancy-related complications and adverse neonatal outcomes (Kim et al., 2002). In our study, after nursing, the treatment compliance in both groups remarkably rose, and was remarkably better in the study group. The incidence of adverse maternal and infant events (polyhydramnios, premature rupture of membranes, postnatal infection, macrosomia, fetal distress) in the study group was remarkably lower than that in the control group. These findings indicate that CN can enhance the self-management ability of the patients and improve their adverse pregnancy outcomes. At last, we used the self-made questionnaires to score the patients' satisfaction with the nursing content in our hospital, and found that the nursing satisfaction was 97.30% in the study group and 51.43% in the control group. This suggests that CN is unanimously recognized by the patients and their families, which further confirms its practicability and great success in clinical practice.

Through the above research, we have preliminarily confirmed that CN can control the blood glucose levels of GDM patients, relieve their anxiety and depression, and improve their pregnancy outcomes. However, there are still certain limitations. First of all, nursing models are various in clinical practice, but only routine nursing is used as a control in this study, which is relatively single. Secondly, the prognosis of the patients was not followed up. Therefore, we hope to include more nursing models in future research, follow up patients, and expand the comprehensiveness of this study, so as to supplement the research results.

To sum up, for GDM patients, CN can relieve anxiety and depression, improve pregnancy outcomes, and effectively control blood glucose levels, as well as improve treatment compliance, so it is worthy of promotion in the clinical nursing of GDM.

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