Review Article

Predictive nursing is beneficial to improve the pregnancy outcomes, blood glucose levels and complications of gestational diabetes patients

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Abstract: Objective: To investigate the effects of predictive nursing on pregnancy outcomes, blood sugar levels, complications and related indicators of patients with Gestational diabetes mellitus (GDM). Methods: A total of 180 cases of GDM patients admitted to our hospital were selected as research subjects. Among them, 100 cases of GDM patients receiving routine nursing plus predictive nursing were enrolled in the predictive group (PG), and 80 cases of GDM patients receiving routine nursing were included in the routine group (RG). Their pregnancy outcomes, blood sugar levels, neonatal complications, Apgar score, self-rating anxiety scale (SAS), self-rating depression scale (SDS), disease specific quality of life (DQOL), summary of diabetes self care activities (SDSCA) and nursing satisfaction were observed and compared to analyze the influence of the predictive nursing for patients. Results: The incidence of adverse pregnancy outcomes, blood glucose level, incidence of neonatal complications, SAS and SDS scores in the PG were significantly lower than those in the RG, and their Apgar score, quality of life and self-care behaviors were significantly higher than those in the RG, and its nursing satisfaction was significantly better than that in the RG. Conclusion: Predictive nursing can improve the pregnancy outcomes, blood glucose levels, complications and psychological state of GDM patients, and improve the quality of life, self-care behaviors and nursing satisfaction of GDM patients.

Keywords: Gestational diabetes mellitus, predictive nursing, pregnancy outcome, blood glucose level, complication

Introduction

Gestational diabetes mellitus (GDM) is a kind of pregnancy complications associated with chronic low-grade inflammatory state. Its increased incidence has negative economic and health impacts on patients and society [1, 2]. According to statistics, GDM occurs in about 2-6% of pregnant women in Europe, and about half of GDM patients are likely to develop diabetes within 10 years [3]. Risk factors for GDM are correlated with both individuals and families. History of GDM, high body mass index (BMI), diabetes, and family history of diabetes are all risk factors for GDM [4]. At present, the first-line treatment of GDM is life intervention, followed by drug intervention. Insulin is the first-line drug, and the alternative drugs are metformin and glibenclamide [5, 6]. Although the treatment of life or drug intervention for GDM patients has a good effect, some women with GDM lack the cognition of GDM and are prone to complications and negative emotions during pregnancy, which puts forward a nursing appeal for the management of GDM [7, 8]. It is of great value to study the nursing management of GDM to improve the condition, complications and negative emotions of patients with GDM.

GDM is a chronic disease during pregnancy that requires continuous medical care, and medical care intervention is conducive to the control of blood glucose level and the prevention of complications in GDM patients [9]. Although medical care of GDM is maturing, the effect of routine nursing intervention of GDM is no longer remarkable. For example, in the study of Kunath’s team [10], routine nursing interven-
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tion does not significantly prevent excessive weight gain in pregnant women. Moreover, there is no significant difference in the diagnosis rate between the GDM group and the control group, and the average birth weight and body length of newborns are even slightly lower. This means that routine nursing is not only fail to prevent GDM, but also incapable of preventing complications caused by excessive weight gain in pregnant women. Predictive nursing is a kind of nursing model that predicts and prevents potential adverse events during the progress and development of disease of patients according to patients' vital signs, clinical symptoms and the nature of the disease. It is suitable for various diseases including GDM, especially severe diseases and cancer. Some studies show that predictive nursing is not only beneficial to the accelerated recovery of patients in the intensive care unit and the reduction of adverse mental conditions, but also to improve the comfort of hospitalization, the mental state and quality of life of cancer patients [11, 12].

At present, there are few studies on predictive nursing for GDM patients. We will implement predictive nursing on GDM patients and explore the effect of this nursing mode on pregnancy outcome, blood glucose level and complications of patients, hoping to provide a feasible clinical reference for the nursing management of GDM patients.

Data and methods

General data

A total of 180 cases of GDM patients admitted to our hospital were elected as study subjects. Among them, 100 cases of GDM patients receiving routine nursing and predictive nursing were included in the predictive group (PG), with an age of (18-40) years old and average age of (28.33±6.05) years old. Another 80 cases of GDM patients receiving routine nursing were enrolled in the routine group (RG), with an age of (20-43) years old and average age of (29.62±5.97) years old. This study has been approved by the ethics committee of our hospital, and both subjects and their guardians have been informed and signed the full informed consent. Inclusion criteria were as follows: Patients whose symptoms were in line with the standard established by the American Diabetes Association in 2012 [13] (Patients underwent 75g glucose tolerance test at 24-28 weeks of gestation, and were diagnosed as GDM if the fasting blood glucose (FBG) exceeded 5.1 mmol/L, or the blood glucose at 1 h exceeded 10.0 mmol/L, or the blood glucose at 2 h exceeded 8.5 mmol/L). Patients without communication barrier or mental illness, Patients without undergoing operation in the last 3 months, Patients who had been informed and consented and were willing to cooperate with the researcher. Exclusion criteria were as follows: Patients with malignant tumor or severe organ dysfunction, Patients with infectious diseases, Patients who were multipara. Inclusion criteria were applicable to both the PG and the RG.

Nursing methods

Patients in the RG received routine nursing care: Patients were educated with knowledge of conventional diseases, given life care and blood glucose monitoring. And they were given diet guidance and treatment drugs according to blood glucose level, as well as timely psychological care.

Patients in the PG were treated with predictive nursing based on routine nursing: Improve the level of blood glucose management: patients' blood glucose was monitored. FBG was monitored in the morning and every 2 h after treatment for the patients with initial treatment, and FBG was monitored 2 h after three meals for the patients without initial treatment. Patients' blood glucose status would be accurately and timely informed to the attending doctor.

Prevent hypoglycemia: After treatment and diet management, patients with GDM were at risk for hypoglycemia, especially in the newly treated patients. Nursing staff should memorize the common symptoms and initial symptoms of hypoglycemia, and assess the potential risk of hypoglycemia by monitoring patients' blood glucose level. According to the patients’ own conditions, they should be given extra meals or instructions to take food to avoid the occurrence of hypoglycemia.

Prevent ketoacidosis: Ketoacidosis was likely to occur in patients with GDM if their blood glucose levels rise sharply. This situation was found in patients with poor blood glucose control and combined infection, which might give rise to metabolic disorder and lead to the occurrence of ketoacidosis. This further reflected the importance and necessity of strict monitoring of patients’ blood glucose by nursing staff. They
needed to remind patients to keep warm to prevent the occurrence of cold or upper respiratory tract infection, which is conducive to the prevention of patients’ ketoacidosis.

Prevent other complications: Patients with GDM had weak peripheral sensation. They were not only vulnerable to injury, but also heal slowly after injury. They should avoid contact with sharp objects. If they needed to exercise, special personnel must accompany them. In addition, in order to accelerate the recovery of patients, warm foot soak could be provided before going to bed. What’s more, for patients who were prone to microvascular disease, thereby inducing damage of system functions such as renal and cardiovascular, and organ dysfunction, nursing staff needed to pay attention to the existence of related symptoms, and provide rescue equipment such as oxygen cylinders to guide patients to avoid renal toxicity drugs as much as possible. Low-flow oxygen was given regularly every day to reduce myocardial burden. In daily life, nursing staff should give constipation patients laxative to prevent them from sudden blood pressure rise caused by overexert. For patients with poor skin nutrition, they should be remind of sunblock when doing outdoor activities. And for elderly patients with poor mobility who was in bed for a long time, skin care should be given to them, as well as regularly turn over and bedding change, to avoid skin pressure ulcers.

Popularize health knowledge to patients after discharge: Based on GDM basic knowledge, prevention and disease management, patients were educated to improve self-monitoring awareness and self-treatment skills, informed of the need for long-term diet control and exercise, and urged to avoid strenuous exercise (pay attention to blood sugar management during exercise).

Outcome measures

Pregnancy outcomes, blood glucose levels, neonatal complications, Apgar score, self-rating anxiety scale (SAS) and self-rating depression scale (SDS) [14], disease specific quality of life (DQOL), summary of diabetes self care activities (SDSCA) and nursing satisfaction were observed and compared to analyze the effects of predictive nursing on patients. Among them, FBG level and postprandial 2 h blood glucose (PBG) level of GDM patients were regularly monitored by blood glucose tester (Yuyan Instruments Co., Ltd., Shanghai, China). Apgar score was assessed 1 min after delivery and had a score of 0-10, which was proportional to the health of the newborn. SAS scores ranged from 0 to 80 points. A score of 50-60, 61-70 and 70 above corresponded to mild, moderate and severe anxiety, respectively. SDS scores were similar to those described above. In DQOL score, there were physical function dimension (with a score of 1-60), psychological dimension (with a score of 8-40), social relationship (with a score of 4-20), and therapeutic dimension (with a score of 3-15), all aspects of quality of life were inversely related to the score. In the SDSCA assessment, we mainly assessed the four dimensions of diet, exercise, blood glucose monitoring, and foot care, with two items of 0-7 points for each dimension, and the ability of self-care behaviors in each dimension was proportional to the score.

Statistical analysis

Statistical analysis was performed using SPSS22.0 (Beijing Bioeasy Technology Co., Ltd., China). Enumeration data were represented by cases/percentage (n/%). Chi-square test was used for comparison of enumeration data between groups. When the theoretical frequency is less than 5, the continuous correction chi-square test was used. Measurement data was expressed by mean ± SEM. The comparison of measurement data between groups were qualified by independent sample t test. The intergroup comparison before and after treatment was qualified by paired t test. When P<0.05, the difference was statistically significant.

Results

Baseline data

There were no significant differences in progestation BMI, age, gestational weeks, systolic pressure, diastolic pressure, abdominal circumference, total cholesterol, history of hypertension, history of diabetes, drinking history, smoking history, and place of residence between the two groups (P>0.05). As shown in Table 1.

Adverse pregnancy outcomes of GDM patients

The incidence of adverse pregnancy outcomes in the PG was significantly lower than that in the RG (P<0.05). As shown in Table 2.
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Blood glucose levels of GDM patients

Both FBG and PBG levels in the PG were significantly lower than those in the RG (P<0.05). As shown in Figure 1.

Neonatal complications and Apgar score in GDM patients

The incidence of neonatal complications in the PG was significantly lower than that in the RG (P<0.05), while Apgar score of PG was significantly higher than the RG. See Table 3 and Figure 2.

Psychological status of GDM patients before and after nursing

There was no significant difference in SAS score and SDS score between the two groups before nursing (P>0.05). After nursing, both SAS score and SDS score of the two groups decreased significantly, and the SAS score and SDS score of the PG were significantly lower.
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than that of the RG, with statistically significant differences (P<0.05). As shown in Figure 3.

Quality of life in GDM patients

In this study, DQOL was used to evaluate the quality of life of patients, and the score was inversely proportional to the level of quality of life. The life quality scores of the PG in physiological function, psychological dimension, social relationship, treatment dimension and other aspects were significantly lower than those of the RG (P<0.05). As shown in Figure 4.

Self-care ability of GDM patients

There was no significant difference in the scores of diet, sports, blood glucose monitoring and foot care between the two groups before nursing (P>0.05). After nursing, the scores of the four self-care abilities of patients in the two groups were significantly increased, and the scores of self-care abilities in the PG were significantly higher than those in the RG, with statistically significant differences (P<0.05). As shown in Figure 5.

Nursing satisfaction of GDM patients

The nursing satisfaction of the PG was significantly better than that of the RG (P<0.05). See Table 4.

Discussion

The pregnancy outcomes of GDM patients include pregnancy hypertension, preterm delivery, cesarean section, pre-eclampsia, etc., and neonatal complications such as neonatal jaundice and macrosomia are more likely to occur in newborns. Moreover, the incidence of adverse pregnancy outcomes and neonatal complications in GDM women remains high [17-19]. In order to improve the pregnancy outcomes and neonatal complications of GDM patients, it is of great significance to study the nursing mode that can effectively prevent the occurrence of GDM or alleviate the disease of GDM.

In this study, predictive nursing model was used in GDM patients, aiming to effectively manage blood glucose levels of patients, and to improve adverse pregnancy outcomes and neonatal complications of patients. According to the results of our study, the levels of FBG and
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PBG in the PG were significantly lower than the RG, suggesting that predictive nursing could effectively manage blood glucose level of GDM patient. Previous studies have shown that FBG and PBG are blood glucose indicators to evaluate the risk of GDM, and they can also be applied to analyze the relationship between nutrition during pregnancy and the risk of GDM [20]. In our study, there were adverse pregnancy outcomes such as premature birth, infection, postpartum hemorrhage and gestational hypertension. We evaluated the incidence of adverse events in the two groups of patients, and the results showed that the incidences of adverse pregnancy outcomes in the PG was significantly lower than the RG, indicating that the predictive nursing intervention could remarkably improve patients’ adverse pregnancy outcomes. In addition, there were also neonatal complications such as neonatal jaundice, pneumonia, macrosomia, fetal abnormalities. We also analyzed the incidence of these complications in two groups of patients, and the results exhibited the incidence of neonatal complications in the PG was significantly lower than the RG, indicating that predictive nursing intervention could significantly curb neonatal complications. The results of Apgar score [21] showed that the Apgar score of the PG was significantly higher than that of the RG, indicating that predictive care can help maintain the physical health of newborns. The team of Mitanchez [22] supported that adverse diseases such as metabolic and hematological diseases in the newborn of GDM patients were related to the mother’s blood glucose level, which emphasized again that the importance of intensive nursing care in controlling the blood glucose level of GDM patients. In addition to predictive nursing, nutritional care can also help improve pregnancy outcomes and neonatal

Figure 3. Psychological status of patients in the two groups before and after nursing. A: SAS score in the PG was significantly lower than that in the RG after nursing care. B: SDS score of the PG was significantly lower than that of the RG after nursing. Note: **P<0.01.

Figure 4. Quality of life in the two groups. A: Physiological function score of the PG was significantly lower than that of the RG. B: Psychological dimension score of the PG was significantly lower than that of the RG. C: Social relationship score of the PG was significantly lower than that of the RG. D: Treatment dimension score of the PG was significantly lower than that of the RG. Note: ***P<0.001.
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complications in patients with GDM and is also a form of care worth promoting. Nutrition care based on glycemic load can also effectively manage the blood glucose level of patients with GDM and reduce the incidence of pregnancy complications, which once again reminds us of the importance of glycemic load management [23].

SAS and SDS scores are self-rating scales used to assess the psychological state of depression and anxiety in pregnant women. Studies have revealed that maintaining a good psychological state of GDM patients is conducive to the control of blood glucose levels in patients [24, 25]. In this study, SAS and SDS score were measured to evaluate the status of anxiety and depression of patients in the two groups before and after nursing. The study showed that SAS and SDS scores of the PG were significantly lower than those of the RG, indicating that the application of predictive nursing was conducive to reducing the occurrence of depression and anxiety in GDM patients. In the study of team of Marchetti [26], GDM may cause short-term or long-term deterioration of patients’ quality of life, and the implementation of intervention plan for GDM is conducive to improving patients’ quality of life. Another report by Yee’s team [27] emphasized the importance of ability of self-care behaviors for blood glucose management in patients with GDM. DQOL and SDSCA can be used to evaluate the quality of life and self-care behavior of GDM patients, respectively. And the score of DQOL is inversely proportional to the quality of life, and SDSCA is proportional to the ability of self-care behavior. Seeing from this angle, we also included DQOL and SDSCA for related evaluations. The results showed that the scores in the four dimensions of physiological function, psychological dimension, social relationship, and treatment dimension in the PG were significantly lower than those in the RG, and the scores in the four aspects of diet, sports, blood glucose monitoring, and foot care were significantly higher than those in the RG. This indicated that the quality

### Table 4. Nursing satisfaction of GDM patients in the two groups [n (%)]

<table>
<thead>
<tr>
<th>Class</th>
<th>Predictive group (n = 100)</th>
<th>Routine group (n = 80)</th>
<th>$\chi^2$ value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissatisfaction</td>
<td>3 (3.00)</td>
<td>26 (32.50)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Basically satisfied</td>
<td>18 (18.00)</td>
<td>35 (43.75)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Quite satisfied</td>
<td>22 (22.00)</td>
<td>16 (20.00)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fully satisfied</td>
<td>57 (57.00)</td>
<td>23 (28.75)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total satisfactory degree</td>
<td>97 (97.00)</td>
<td>54 (67.50)</td>
<td>28.618</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Figure 5. Self-care ability of patients in the two groups. A: Score of diet in the PG improved significantly after nursing, and was notably higher than those in the RG. B: Score of sports in the PG improved significantly after nursing, and was notably higher than those in the RG. C: Score of blood glucose monitoring in the PG improved significantly after nursing, and was notably higher than those in the RG. D: Score of foot care in the PG improved significantly after nursing, and was notably higher than those in the RG. Note: **P<0.01.
of life and self-care behavior of GDM patients receiving predictive care had been significantly improved. Finally, we also compared the nursing satisfaction of the two groups of patients. The results showed that the nursing satisfaction of the PG was significantly better than that of the RG, suggesting that predictive care was more welcomed by GDM patients.

To sum up, predictive nursing is beneficial to the improvement of pregnancy outcomes, blood glucose level, complications and psychological state of GDM patients, as well as the improvement of life quality, self-care behaviors ability and nursing satisfaction of GDM patients. However, there is still some room for improvement in this study. For example, we can analyze the risk factors affecting adverse pregnancy outcomes or neonatal complications in patients with GDM, which will help nurses identify which risk factors need additional attention. In the future, further studies will be conducted gradually from the above perspectives.

Disclosure of conflict of interest

None.

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