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Application of online-offline integrated medical care management in patients with gestational diabetes

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ABSTRACT

Objectives: To investigate efficacy of online-offline integrated medical care management in patients with gestational diabetes.

Material and methods: A total of 140 patients with gestational diabetes were randomly divided into two groups: integrated management (IM) group (n = 70) and control group (n = 70). Patients in the control group were treated with routine nursing intervention, and the patients in the IM group were treated with integrated care (offline medical and nursing management combined with WeChat online management). The fasting plasma glucose (FPG), 2h postprandial plasma glucose (2hPG), Self-rating Anxiety Scale (SAS) score, Self-rating Depression Scale (SDS) score, Diabetes Care Profile (DPC) score, 36-item Short-Form (SF-36) score, and poor pregnancy outcomes were compared between the two groups.

Results: After intervention, the FPG, 2hPG, SAS score, SDS score, DPC score and SF-36 score were improved in both groups. All indicators in the IM group were better than the control group (p < 0.05). The incidence of premature delivery, polyhydramnios, neonatal respiratory distress, intrauterine distress, and postpartum hemorrhage in the IM group were lower than those in the control group (p < 0.05).

Conclusions: The online-offline integrated medical care management effectively improved the blood glucose level, mental state, self-management behavior, quality of life and pregnancy outcomes of patients with gestational diabetes.

Key words: Integrated medical care; WeChat; gestational diabetes

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INTRODUCTION

Gestational diabetes is a common comorbidity in women during pregnancy. It refers to diabetes that appear or are diagnosed during pregnancy with normal glucose metabolism or potential impaired glucose tolerance, which poses a certain threat to maternal-neonatal life and health [1–4]. It takes several weeks from diagnosis to delivery for gestational diabetes, and the traditional in-hospital face-to-face communication is relatively short, and it is difficult to predict long-term effects on patients with gestational diabetes.

Objectives

This study uses the integrated intervention services which combined offline medical-nursing management and online management, aiming to explore a more effective management model for patients with gestational diabetes.

MATERIAL AND METHODS

Study population

A total of 140 patients with gestational diabetes in The Sixth Affiliated Hospital of Xinjiang Medical University were enrolled in this study. The inclusion and exclusion criteria were shown as following: 1) Inclusion criteria: first-diagnosed gestational diabetes; without any treatment; consent and sign informed consent; 2) Exclusion criteria: complication with pregnancy-induced hypertension, pregnancy-related heart disease and other pregnancy complications; accompanied by premature rupture of membranes, threatened abortion and other dangerous pregnancy conditions; severely obese pregnant women; accompanied by mental system disorders Sexual diseases; withdraw during study. The 140 enrolled patients were randomly assigned to integrated management (IM) group (n = 70) or control group

(n = 70). The age of patients in the IM group ranged from 21 to 36 years old, with an average of (29.47 ± 3.23) years old; gestational age was 24 to 28 weeks, with an average of (26.70 ± 3.11) weeks. The age of the control group ranged from 23 to 37 years, with an average of (29.78 ± 3.22) years; gestational age was 24 to 28 weeks, with an average of (27.87 ± 3.02) weeks. There was no statistical difference between these two groups of age and gestational age (p > 0.05).

Interventions

The control group used routine interventions, working from two paths: doctor-patient and nurse-patient. Two doctors were mainly responsible for the formulation and implementation of the diagnosis and treatment plan, and 2 nurses were mainly responsible for the guidance of medication, diet, and psychology. Doctors conducted ward rounds once a day, and nurses conducted ward rounds 3–6 times a day based on patient's condition. The responsible nurse gave introduction to patients to help them adapt to the new environment as soon as possible. During the hospitalization period, patients were guided to eat a healthy diet, recommended to eat small and frequent meals (5–6 times a day, ensure that pregnant women do not feel hungry) and avoid high-sugar, high-oil, and high-fat foods. Patients were advised to strictly follow the doctor's suggestion of medication. Moreover, nurses introduced the importance of standardized medication to patients in detail, actively communicated with patients and gave encouragement and support to reduce their psychological burden. After plasma glucose of patients were stably controlled and they were discharged from the hospital, discharge guidance was given to patients and their families. The patients were reexamined once a week. Each reexamination investigated the diet, exercise and medication of the patients, and conducted education again until the end of the day before delivery.

Patients in the IM group were given an integrated online and offline medical management: 1) Establish an integrated medical and nursing management team: one section director, one attending doctor, one head nurse, and one responsible nurse. 2) Integrated medical and nursing rounds: Doctors and nurses conduct ward rounds together to enhance the integration of medical and nursing communication in order to provide a full range of nursing services. Doctors and nurses conduct ward rounds more than three times a day, and nurses conduct rounds 3–6 times a day based on patient's condition. 3) Offline management of integrated medical care: Doctors were responsible for explaining the diagnostic criteria, clinical symptoms and interpretation of individualized treatment plans for individual patients with gestational

diabetes. Nurses were responsible for explaining how to take and inject hypoglycemic drugs and insulin face-to-face and giving dietary advice (5–6 meals a day, ensure that pregnant women do not feel hungry), for example, pay attention to intake of protein, vegetables, fruits, vitamins, etc., and avoid high sugar, high oil, high fat, and spicy diet. Nurses recommended patients to take a walk for 20–30 minutes after lunch and dinner daily, instructed patients to do pregnancy gymnastics every Tuesday and Thursday afternoon. Nurses also needed to actively communicate with patients, listen to their inner needs and concerns, give feedback to the attending doctor and evaluate patient's mental state with doctor, in order to give suggestions and encouragement to relieve the patient's negative emotions. 4) Online management of integrated medical care: Establish a WeChat group by integrated medical and nursing management team and add patients and their families to the WeChat group one day before discharge. WeChat group publishes relevant knowledge about gestational diabetes including precautions, reasonable diet, exercise guidance, etc. At the same time, comfortable atmospheres were created, patients were encouraged to actively and freely talk in the WeChat group, share their experience and form an atmosphere of mutual assistance, conduct one-to-one WeChat guidance once a week to answer questions from patients, and urge patients to strengthen self-management and follow up on time. After discharge, on-line review for each patient was conducted once a week to investigate the diet, exercise and medication of each patient. The offline one-to-one guidance was conducted if necessary. Both groups were intervened until the end of the day before delivery.

Outcomes

The fasting venous blood of the two groups of patients was collected before and after the intervention at the early morning. The fasting plasma glucose (FPG) and the 2 h postprandial plasma glucose (2hPG) were measured using an automatic biochemical analyzer.

The mental states of the two groups of patients were evaluated before and after the intervention. The evaluation tools were the self-rating anxiety scale (SAS) [5] and the self-rating depression scale (SDS) [6]: there are 20 items in the SAS scale with 4-level. The statistical scores of each item were multiplied by 1.25 to obtain standard score after the evaluation is completed. The upper limit of the normal standard score was 50 points. 50–59 for mild anxiety, 60–69 for moderate anxiety, and > 69 for severe anxiety. For SDS scale, there are also 20 items with 4-level. The statistical scores of each item were multiplied by 1.25 to obtain standard score after the evaluation is completed. The upper limit of the normal standard score was 53 points. 53–62 for

mild depression, 63–72 for moderate depression, > 72 is severe depression. For both scales, the higher score stands for more severe symptoms.

The self-management behaviors of the two groups of patients were evaluated before and after the intervention. The evaluation tool used was Michigan Diabetes Care Profile (Diabetes Care Profile, DCP) [7]. There were five factors including patients' self-management attitude (11 items), self-management ability (4 items), diet compliance (4 items), exercise problems (5 items) and blood glucose or urine glucose monitoring problems (11 items) were evaluated. Each item was divided into five levels, from 1 to 5 points. The score of each factor was obtained by adding the scores of all items under each factor and then dividing by the number of items. Among them, the higher the scores of self-managements attitude, self-management ability, and dietary compliance, reflect the better behavior of the self-management. However, the higher the scores of exercise problems and blood sugar or urine glucose monitoring reflect the worst behavior of the self-management.

The quality of life of the two groups of patients was evaluated before and after the intervention using Concise Health Status Scale (SF-36, 0–100) [8]. The higher the score, the better the quality of life.

Finally, occurrence of poor pregnancy outcomes between the two groups were recorded and compared.

Statistical analysis

Statistical software SPSS19.0 was used for data analysis. The data conforms to the normal distribution were presented as mean ± standard deviation. Student t-test was used for the comparison between the two groups. For data that does not conform to the normal distribution is represented by the median (quartile) and analyzed with rank sum test. The enumeration data were presented as n (%) and analyzed with the $X\sim2$ test. $P < 0.05$ was considered as statistically significant.

RESULTS
Blood glucose test

Before intervention, for FPG and 2hPG, there was no difference between the two groups ($p > 0.05$). After intervention, the levels of FPG and 2hPG were decreased in both groups. Moreover, the levels of FPG and 2hPG in IM group were significantly lower than control group ($p < 0.05$). Results were shown in Table 1.

Mental state

Before intervention, the SAS and SDS scores between the two groups was not statistically significant ($p > 0.05$). After intervention, the SAS and SDS scores of the two groups were decreased, and the scores of the IM group were remarkably lower than that in the control group ($p < 0.05$). Results were shown in Table 2.

Self-management behavior

Before intervention, there was no significant difference between the two groups in self-management attitude, self-management ability, diet compliance, exercise problems, blood sugar or urine glucose monitoring problems ($p > 0.05$). After intervention, the score of self-management attitude, self-management ability and dietary compliance in IM group were significantly higher than that in control group ($p < 0.05$), while the cores of exercise problems, blood sugar or urine glucose monitoring problems were significantly lower than those of the control group ($p < 0.05$). Results were shown in Table 3.

Quality of life

Before intervention, the difference in the quality-of-life scores between the two groups was not statistically significant ($p > 0.05$). After intervention, the scores were increased in both groups. Moreover, he scores of the IM group were remarkably higher than that of control ($p < 0.05$). Results were shown in Table 4.

Table 1. Comparison of blood glucose testing between the two groups				
Time	**Group**	**Cases**	**FPG [mmol/L]**	**2hPG [mmol/L]**
Pre-Intervention	IM	70	8.07 ± 1.23	11.70 ± 2.06
	Control	70	8.18 ± 1.24	11.86 ± 2.18
	t		0.500	0.431
	p		0.618	0.667
Post-Intervention	IM	70	5.02 ± 0.64[a]	7.12 ± 1.02[a]
	Control	70	6.27 ± 0.77[a]	7.93 ± 1.24[a]
	t		10.386	4.179
	p		0.000	0.000

FPG — fasting plasma glucose; 2hPG — 2h postprandial plasma glucose; IM — integrated management; Pre-Intervention vs Post-Intervention, [a]p < 0.05

Table 2. Comparison of the mental state of the two groups

Time	Groups	Cases	SAS score	SDS score
Pre-Intervention	IM	70	56.44 ± 6.42	58.70 ± 5.24
	Control	70	56.81 ± 5.34	59.53 ± 5.93
	t		0.369	0.870
	p		0.712	0.386
Post-Intervention	IM	70	45.14 ± 3.53[a]	46.10 ± 3.27[a]
	Control	70	49.34 ± 3.11[a]	51.11 ± 3.65[a]
	t		7.418	8.494
	p		0.000	0.000

SAS — self-rating anxiety scale; SDS — self-rating depression scale; IM — integrated management; Pre-Intervention vs Post-Intervention, [a]$p < 0.05$

Table 3. Comparison of self-management behavior between the two groups

Time	Group	Cases	Self-management attitude	Self-management ability	Diet compliance	Exercise problems	Blood glucose or urine glucose monitoring problems
Pre-Intervention	IM	70	3 (3.4)	3 (3.3)	2 (2.2)	4 (4.4)	4 (3.4)
	Control	70	3 (3.4)	3 (3.3)	2 (2. 2.5)	4 (4.4)	4 (3.4)
	Z		0.816	0.577	1.633	0.577	0.251
	p		0.414	0.564	0.102	0.564	0.801
Post-Intervention	IM	70	4 (4.4)[a]	4 (4.4)[a]	3 (3.3)[a]	3 (3.3)[a]	3 (3.4)[a]
	Control	70	4 (4.4)[a]	4 (3.4)[a]	2 (2.3)[a]	3 (3.3)[a]	4 (4.4)[a]
	Z		2.282	4.472	6.272	2.021	5.393
	p		0.005	0.000	0.000	0.034	0.000

IM — integrated management; Pre-Intervention vs Post-Intervention, [a]$p < 0.05$

Poor pregnancy outcomes

The incidence of premature delivery, polyhydramnios, neonatal respiratory distress, intrauterine distress, and postpartum hemorrhage in the observation group were lower than those in the control group ($p < 0.05$). Results were shown in Table 5.

DISCUSSION

Gestational diabetes is a common comorbidity in pregnant women. In recent years, the incidence of gestational diabetes in pregnant women has increased, which may have a certain impact on pregnancy outcome and even influence the metabolic system of newborns after adulthood [9–12]. At present, the pathogenesis of gestational diabetes is not completely clear, most studies believe that high-oil and high-fat diet, insufficient vitamin intake, and insufficient exercise are all risk factors for promoting gestational diabetes [13–16]. The above-mentioned risk factors can be improved through lifestyle intervention. Therefore, the development of a comprehensive nursing management model is of great significance to promote the rehabilitation of patients with gestational diabetes.

The integrated medical and nursing management is to integrate the traditional two independent and separate working modes: doctors to patients and nurses to patients. Under this working mode, doctors participate in nursing work, and nurses understand the diagnosis and treatment plans made by doctors. The two have common medical goals and responsibilities under an integrated framework, cooperate with each other, participate in the decision-making process together, thereby improving the efficiency of medical services and promoting patient recovery [17]. Several studies have shown that the integration of medical care and nursing can help achieve the desired nursing effect [18, 19]. For patients with gestational diabetes, it takes at least several weeks from diagnosis to delivery. The traditional in-hospital face-to-face communication is relatively short, and it is difficult to produce long-term effects on patients with gestational diabetes. In recent years, with the widespread establishment and promotion of the Internet, APP software such as WeChat has emerged, providing an effective platform for extended medical services. A meta-analysis on diabetes intervention showed that the health education and management of diabetic patients through

Table 4. Comparison of the quality of life between the two groups

Time	Group	Cases	SF-36 score
Pre-Intervention	IM	70	74.63 ± 9.89
	Control	70	71.14 ± 11.19
	t		1.939
	p		0.055
Post-Intervention	IM	70	88.24 ± 7.75[a]
	Control	70	79.61 ± 7.84[a]
	t		6.501
	p		0.000

IM — integrated management; SF-36 — 36-item short-form; Pre-Intervention vs Post-Intervention, [a]$p < 0.05$

Table 5. Comparison of adverse pregnancy outcomes between the two groups

Group	Premature delivery	Polyhydramnios	Macrosomia	Neonatal respiratory distress	Intrauterine distress	Postpartum hemorrhage
IM	3 (4.29)	1 (1.43)	2 (2.86)	4 (5.71)	2 (2.86)	3 (4.29)
control	14 (20.00)	10 (14.29)	4 (5.71)	15 (21.43)	12 (17.14)	18 (25.71)
x^2	8.101	7.992	0.697	7.368	7.937	12.605
p	0.004	0.005	0.404	0.007	0.005	0.000

IM — integrated management

mobile APP can effectively reduce the patient's blood glucose and glycosylated hemoglobin, and the weight is also significantly improved [20]. O'Reilly *et al*'s study showed that patients with gestational diabetes have fully affirmed the health information and resource support provided by mobile APP [21]. A study from University of Berlin demonstrated that extended interventions for patients with gestational diabetes through mobile APP can effectively reduce the occurrence of poor pregnancy outcomes [22].

In the present study, patients in the control group were treated with conventional nursing care, while the patients in the IM group were treated with integrated care which combined offline medical and nursing management with WeChat online management. The results showed that after intervention, the levels of FPG, 2hPG, SAS score, SDS score, self-management behavior score, and quality of life score was better in IM group than that in control ($p < 0.05$), while the incidence of premature delivery, polyhydramnios, neonatal respiratory distress, intrauterine distress, and postpartum hemorrhage were lower than those in the control group ($p < 0.05$), suggesting that the online-offline integrated medical care management had better nursing effect. The possible reason could be that the integrated medical care management has improved the efficiency of medical services. Doctors and nurses conduct rounds together and carry out health guidance together. At the same time, the application of WeChat APP provides an effective extended platform for integrated medical and nursing management. Patients can also get health consultation in time after discharged from the hospital, so that they could transform from passive treatment model to active self-management, thereby improving the level of self-management and pregnancy outcomes.

CONCLUSIONS

To sum up, the online-offline integrated medical care management could effectively decrease the level of blood glucose, improve the mental state, self-management behavior, quality of life and pregnancy outcome of patients with gestational diabetes.

Conflict of interests

The authors state that there are no conflicts of interest to disclose.

Ethics approval

Not applicable.

Statement of Informed Consent

Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Authors' contributions

Ying Guo and Ling Zhou designed the study, supervised the data collection, Bei Sun and Chenhui Wang analyzed the data, interpreted the data, Jinling Zhang prepare the manuscript for publication and reviewed the draft of the manuscript. All authors have read and approved the manuscript.

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