Int J Clin Exp Med 2015;8(9):16688-16693
www.ijcem.com /ISSN:1940-5901/IJCEM0014379

Original Article

Application of seamless care service with multidisciplinary diagnosis and treatment in patients with gestational diabetes

Shen-Qiu Jie[1*], Xiao Liang[2*], Pu Hong[1], Dan Wu[1], Wei-Lin Ke[1]

[1]Department of Obstetrics, Shenzhen Second People's Hospital, No. 3002, West Sungang Road, Shenzhen, Guangdong, China; [2]Department of Anesthesiology, Affiliated People's Hospital of Jiangsu University, China. [*]Equal contributors.

Received August 12, 2015; Accepted August 25, 2015; Epub September 15, 2015; Published September 30, 2015

Abstract: Background: The objective of this article was to explore the effect of trinity seamless care service (TSCS) in patients with gestational diabetes with multidisciplinary diagnosis and treatment (MDT), and thus, to provide basis for improvement in the quality of patient care. Materials and methods: A total of 200 patients were recruited and randomly divided into observation group and control group with 100 cases in each group, who were diagnosed with gestational diabetes through oral glucose tolerance test (OGTT) at 24 to 28 weeks of gestation from September 2012 to September 2014. In order to control blood glucose and weight, patients in the control group received routine treatment and nursing after diagnosis, while those in the observation group received TSCS with MDT. Rate of insulin usage, weight changes and glycemic indexes before and after nursing were compared within the two groups during pregnancy. Results: Compared with the pregnant patients in the control group, the rate of those in the observation group who needed extra insulin to control blood glucose, or the change of body mass index during pregnancy (ΔBMI) ≥6 kg/m^2 and less average weight gain prior to delivery was significantly lower ($P<0.05$). Glycemic indexes in the observation group after nursing were significantly lower than those in the control group ($P<0.05$). Incidences of cesarean delivery, polyhydramnios, gestational hypertension and postpartum hemorrhage in the observation group were significantly lower than those in the control group ($P<0.05$). Incidences of macrosomia, hyperbilirubinemia, fetal distress, stillbirth and teratogeny in the observation group were also significantly lower than those in the control group ($P<0.05$). Conclusion: Application of TSCS with MDT in patients with gestational diabetes helps to keep appropriate weight gain, control blood glucose by improving glycemic indexes, significantly reduce the incidences of maternal perinatal and neonatal complications and improve pregnancy outcomes.

Keywords: Gestational diabetes, trinity seamless care services, multidisciplinary diagnosis and treatment

Introduction

In recent years, many women have paid more attention to nutrition during pregnancy with the continuous improvement in living standards. They tend to unconsciously take in high protein foods that could lead to hyper-nutritional state and overweight, which are extremely likely to induce gestational diabetes [1]. Although postpartum glucose metabolism of the majority of patients with gestational diabetes can return to normal, their risk of developing type 2 diabetes is increased. Moreover, diabetes not only increases the incidences of abortion and polyhydramnios, but also affects the fetus and infants greatly by raising the incidences of abnormalities, fetal macrosomia and neonatal hypoglycemia [2, 3]. Thus, weight control and blood glucose in pregnant women has a positive clinical significance for improving pregnancy outcomes. This requires scientific medical monitoring, as well as standardized and reasonable nursing care.

As a new model of care, trinity seamless care service (TSCS) presents a family-oriented multidisciplinary diagnosis and treatment (MDT) combining practitioners and nurses in obstetrics, endocrinology and nutrition as a whole, which has achieved good results in clinical practice [4, 5]. However, TSCS has not been studied in the treatment of patients with pregnancy-induced hypertension.

Table 1. Comparison of demographic and clinical data between control and observation group

	Control group (n=100)	Obsevation group (n=100)	*P value*
Age	26.7±4.9	27.1±4.5	0.548
BMI before pregnancy (kg/m^2)	21.8±3.0	22.0±2.8	0.626
Weeks of gestation	38.1±1.9	37.9±1.7	0.434
Fasting plasma glucose at 24 weeks of gestation (mmol/L)	8.7±1.5	8.6±1.8	0.670

Table 2. Comparison of insulin usage and weight changes between control group and observation group

	Control group	Observation group	*P* value
Ratio of insulin usage during pregnancy	31.0% (31/100)	6.0% (6/100)	0.000
Ratio of patients ΔBMI≥6 kg/m^2	45.0% (45/100)	19.0% (19/100)	0.000
Weight gain prior to delivery	15.07±3.14	8.95±2.67	0.000

Table 3. Comparison of glycemic indexes before and after nursing between control group and observation group

	Control group	Observation group	*P* value
FPG (mmol/L)			
Before nursing	9.57±1.38	9.61±1.25	0.830
After nursing	7.72±1.4	6.38±1.27	0.000
2hPG (mmol/L)			
Before nursing	14.36±1.22	14.19±1.30	0.342
After nursing	10.63±1.35	8.14±1.29	0.000
HbAlc (%)			
Before nursing	8.37±1.24	8.45±1.19	0.642
After nursing	6.24±1.17	7.09±1.26	0.000

This study aims to explore the effect of TSCS in gestational diabetic patients with MDT in control of blood glucose, maternal perinatal and neonatal complications and the impact on pregnancy outcomes.

Material and methods

Sample and setting

A total of 200 patients were recruited who were diagnosed with gestational diabetes through OGTT tests at 24 to 28 weeks of gestation from September 2012 to September 2014 in our hospital, with the following including criteria: (1) aged from 21 to 40 years old, diagnosed with singleton pregnancy; (2) hospitalized at 30 to 40 weeks of gestation and have integrated clinical data. Excluding criteria included patients with: (1) diabetes before pregnancy; (2) obesity or underweight before pregnancy; (3) repeated induced abortions; (4) concurrent pathology of vital organs and critical conditions in heart, liver and kidney, etc. Patients were randomly divided into observation group and control group with 100 cases in each group. Ages, body mass index (BMI) before pregnancy, weeks of gestation and fasting plasma glucose at 24 weeks of gestation of patients within the two groups were compared and no statistical significance was found (*P>0.05*). The according baseline clinical parameters were presented in **Table 1**.

Methods

Patients diagnosed with gestational diabetes in the control group were delivered with health education materials about gestational diabetes. Medical staff provided regular health education and advised patients and their family members to regularly participate in the training of pregnancy school in our hospital. For outpatients, medical staff suggested their family members to pay attention of their diet while inpatients were given diet instruction with routine nursing practice.

For patients diagnosed with gestational diabetes in the observation group, medical staff developed a TSCS program according to the nutritional status and BMI of them, which presented family-oriented MDT and combined practitioners and nurses in obstetrics, endocrinology and nutrition as a whole. The main content was as follows: (1) For patients with mild condition that did not require hospitalization,

Table 4. Comparison of incidences of perinatal complications between control group and observation group

	Control group	Observation group	*P* value
Cesarean delivery	63 (63.0%)	34 (34.0%)	0.000
Polyhydramnios	29 (29.0%)	10 (10.0%)	0.001
Pregnancy-induced hypertension syndrome	21 (21.0%)	8 (8.0%)	0.016
Postpartum hemorrhage	17 (17.0%)	6 (6.0%)	0.027
Others	6 (6.0%)	4 (4.0%)	0.746

care of them was family-oriented. According doctors' instructions, health education about gestational diabetes was given regularly to them and their family, including distribution of health education pamphlets, lectures about harm of obesity and optimized weight gain during pregnancy, as well as periodic measurement and record of weight. Obstetrics nurses taught the pregnant women and their families the calculation method of BMI and advised regular record of the results. Cognition assessment of gestational diabetes was conducted on patients and their families. To those at lower level of cognition, endocrine nurses gave detailed and accurate consultancy. Nutrition nurses helped to develop individualized diet list for patients according to their BMI and diet habits. (2) Nursing for patients who required hospitalization was as follows: ① When patients were admitted into the hospital, obstetric nurses need to obtain outpatient records of them as soon as possible, keep daily records of their weight, blood glucose, blood pressure, proteinuria and edema, and closely monitor the fetal development and placenta function. Any abnormal situation would be informed to doctors timely. ② Endocrine nurses explained the cause of gestational diabetes and the importance of diet control to patients and their families in simple words. They asked questions, corrected incorrect knowledge and answered questions patiently. ③ Nutrition nurses told the patients to keep strict control of daily intake of sugar and salt based on their glycemic indexes and BMI. They were also responsible to blood glucose monitoring, follow up treatment and postpartum diet guidance for patients after delivery. For patients with lighter weight or frailty, nurses would instruct them to take in enough amount of calories and adjust their diet according to their condition such as blood glucose and urine glucose. For patients who need physical exercise to control weight, nurses would help to develop suitable exercise plans such as gymnastics and walking in order to promote their postpartum recovery. ④ During the whole course, nurses would enhance the patient awareness of the disease and functions of the family, help the patients and their families develop correct knowledge of gestational diabetes and the awareness of the dangers of taking tonics blindly and their role in such a major event like high-risk pregnancy. Staff also emphasized that families were the basis of social support for patients with high-risk pregnancy and told the family members to monitor the patients' compliance to the prescriptions and their regular visits to the hospital.

Outcome measures

Insulin usage and weight changes of patients in the control and observation groups were measured and recorded. Glycemic indexes before and after nursing, incidences of perinatal complications and neonatal complications of patients in the two groups were statistically analyzed.

Statistical methods

Data were analyzed using SPSS version 17.0. Descriptive statistics were presented as mean and standard deviation ($\bar{x} \pm s$). Quantitative data was compared using *u test* while percentage (%) was applied for enumeration data using χ^2 *test*. *P<0.05* was considered statistically significant.

Results

Comparison of insulin usage and weight changes

Compared with those in the control group, less patients in the observation group needed extra insulin to control the blood glucose or the change of BMI during pregnancy (ΔBMI) ≥6 kg/m^2 and less average weight gain prior to delivery, with the difference statistically significant (P<0.05). More details were displayed in **Table 2**.

Table 5. Comparison of incidences of neonatal complications between control group and observation group

Groups	Cases	Macrosomia	Hyperbilirubinemia	Fetal distress	Stillbirth/teratogeny	Others
Control	100	27 (27.0%)	21 (21.0%)	15 (15.0%)	8 (8.0%)	2 (2.0%)
Observation	100	8 (8.0%)	6 (6.0%)	3 (3.0%)	0 (0.0%)	0 (0.0%)
χ^2 *value*	--	11.221	8.392	7.387	6.380	0.505
P value	--	0.000	0.004	0.007	0.012	0.477

Comparison of glycemic indexes before and after nursing

Differences of level of fasting plasma glucose (FPG), 2 h postprandial plasma glucose (2hPG) and hemoglobin alc (HbAlc) of the two groups before and after nursing were not statistically significant (P>0.05). However, glycemic indexes of the observation group after nursing were significantly lower than those in the control group (P<0.05) as shown in **Table 3**.

Comparison of incidences of perinatal complications

Incidences of cesarean delivery, polyhydramnios, pregnancy-induced hypertension syndrome which was defined as hypertension (blood pressure ≥140/90 mmHg) with or without proteinuria (≥300 mg/24 h) emerging after 20 weeks of gestation and resolving up to 12 weeks after delivery and postpartum hemorrhage (blood loss of more than 500 mL following vaginal delivery or more than 1000 mL following cesarean delivery) in the control group were significantly higher than those in the observation group (P<0.05) as displayed in **Table 4**.

Comparison of incidences of neonatal complications

Incidences of macrosomia, which was defined as birth weight of 4000-4500 g or greater than 90% for gestational age after correcting for neonatal sex and ethnicity, hyperbilirubinemia (total serum bilirubin level >5 mg/dL), fetal distress, stillbirth and teratogeny in the control group were significantly higher than those in the observation group (P<0.05) as displayed in **Table 5**.

Discussion

Gestational diabetes, which is a special type of diabetes, is a condition in which pregnant women have various degrees of impaired glucose tolerance or significant diabetes, no matter whether insulin or dietary therapy is applied or the condition maintains after delivery [1, 6]. The majority of patients have no obvious clinical symptoms in early stages. However, as the disease progressed, gestational diabetes can increase the incidences of hypertension and infection in pregnancy which not only affects pregnant women, but also has great potential to harm the fetus [7, 8]. It has been referred in a study that weight gain during pregnancy is an important factor affecting maternal and fetal health. Obesity can lead to high incidence of diabetes in pregnant women, which may cause increased incidences of abortion, polyhydramnios, macrosomia and fetal distress [9]. One study reported that women with gestational hyperglycemia could develop metabolic disorder caused by dysglycemia, leading to high cholesterol and high blood pressure, coupled with a significant increase in the incidence of preeclampsia induced by severe insulin resistance [10, 11]. Alberti *et al*. [12] mentioned in his article that factors Influencing blood glucose control are very complicated, in which BMI and weight gain during pregnancy are important ones for gestational diabetes that cannot be ignored. Moreover, progress in treatment depends largely on the pregnant women's understanding and cooperation toward the decisions and practice of medical staff.

Control of blood glucose during pregnancy has important clinical significance. Moreover, care of high quality will help control blood glucose during pregnancy. TSCS is a new model of care which presents a family-oriented MDT which combines practitioners and nurses in obstetrics, endocrinology and nutrition departments as a whole, [4] and its clinical effect is worth discussing. The findings of the study showed that there was significantly lower rate of those in the observation group who needed extra insulin to control blood glucose or ΔBMI≥6 kg/m^2 and less average weight gain prior to deliv-

ery compared with patients in pregnancy in the control group. Furthermore, glycemic indexes of the observation group after nursing were significantly lower than those in the control group. This is due to weight gain from fetal growth pregnant and women's own fat accumulation during pregnancy. Besides, the increase of fat is associated with abnormal secretion and insulin resistance in patients [13]. With services from nurses of obstetrics, endocrinology and nutrition departments and close assistance from family members, patients in the observation group developed the awareness of the dangers of gestational diabetes and strengthen compliance of orders and cooperation of treatments, and thus, contributing to the effective control of blood glucose and body weight of pregnant women through diet, medication and so on. Furthermore, incidences of cesarean delivery, polyhydramnios, pregnancy-induced hypertension and postpartum hemorrhage in the observation group were significantly lower than those in the control group. This result was due to the fact that gestational diabetes had less impact on pregnant women under TSCS with fluctuation of blood glucose within the normal range and less organ pathology. In addition, incidences of macrosomia, hyperbilirubinemia, fetal distress, stillbirth and teratogeny in the observation group were also significantly lower than those in the control group. This could be due to the fact that fetal weight is positively correlated with pregnant women's weight, and that abdominal fat will affect the abdominal muscle contractility during labor. Besides, difficulty in delivering the head of the fetus would occur, which could lead to fetal distress and even dead fetus owing to reasons like thick pelvic floor tissue and the accumulation of vulva fat.

In conclusion, the application of TSCS with MDT in patients with gestational diabetes helps to keep the appropriate weight gain, control blood glucose by improving glycemic indexes, and significantly reduce the incidences of maternal, perinatal and neonatal complications, and thus improving pregnancy outcomes, with further clinical application value.

Disclosure of conflict of interest

None.

Address correspondence to: Wei-Lin Ke, Department of Obstetrics, Shenzhen Second People's Hospital, No. 3002, West Sungang Road, Shenzhen, Guangdong, China. Tel: +86-755-83366388; Fax: +86-755-83216006; E-mail: szkeweihengd@126.com

References

[1] Coustan DR. Gestational diabetes mellitus. Clin Chem 2013; 59: 1310-1321.

[2] Lambrinoudaki I, Vlachou SA and Creatsas G. Genetics in gestational diabetes mellitus: association with incidence, severity, pregnancy outcome and response to treatment. Curr Diabetes Rev 2010; 6: 393-399.

[3] Mai C, Wang B, Wen J, Lin X and Niu J. Lipoprotein-associated phospholipase A2 and AGEs are associated with cardiovascular risk factors in women with history of gestational diabetes mellitus. Gynecol Endocrinol 2014; 30: 241-244.

[4] Panpitpat P, Thipaporn T, Somprasit C, Tanprasertkul C and Suwannarurk K. The effects of systematic management on maternal and neonatal complications in gestational diabetes subjects. J Med Assoc Thai 2015; 98: 451-456.

[5] Shek NW, Ngai CS, Lee CP, Chan JY and Lao TT. Lifestyle modifications in the development of diabetes mellitus and metabolic syndrome in Chinese women who had gestational diabetes mellitus: a randomized interventional trial. Arch Gynecol Obstet 2014; 289: 319-327.

[6] Yan J and Yang H. Gestational diabetes mellitus, programing and epigenetics. J Matern Fetal Neonatal Med 2014; 27: 1266-1269.

[7] Rono K, Stach-Lempinen B, Klemetti MM, Kaaja RJ, Poyhonen-Alho M, Eriksson JG and Koivusalo SB. Prevention of gestational diabetes through lifestyle intervention: study design and methods of a Finnish randomized controlled multicenter trial (RADIEL). BMC Pregnancy Childbirth 2014; 14: 70.

[8] Poolsup N, Suksomboon N and Amin M. Effect of treatment of gestational diabetes mellitus: a systematic review and meta-analysis. PLoS One 2014; 9: e92485.

[9] Dornhorst A, Nicholls JS, Probst F, Paterson CM, Hollier KL, Elkeles RS and Beard RW. Calorie restriction for treatment of gestational diabetes. Diabetes 1991; 40 Suppl 2: 161-164.

[10] Baeten JM, Bukusi EA and Lambe M. Pregnancy complications and outcomes among overweight and obese nulliparous women. Am J Public Health 2001; 91: 436-440.

[11] Yogev Y, Xenakis EM and Langer O. The association between preeclampsia and the severity of gestational diabetes: the impact of glycemic control. Am J Obstet Gynecol 2004; 191: 1655-1660.

[12] Alberti KG and Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabet Med 1998; 15: 539-553.

[13] Buckley BS, Harreiter J, Damm P, Corcoy R, Chico A, Simmons D, Vellinga A and Dunne F. Gestational diabetes mellitus in Europe: prevalence, current screening practice and barriers to screening. A review. Diabet Med 2012; 29: 844-854.