

The comparison of the safety and effectiveness of multiple insulin injections and insulin pump therapy in treating gestational diabetes.

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Abstract

Objectives: To observe and compare the treatment effect of multiple insulin injections and insulin pump therapy on pregnant women with gestational diabetes.

Methods: From January, 2015 to May, 2017, 90 pregnant women with gestational diabetes enrolled in Linyi Chinese Medicine Hospital were collected and randomly divided into research group and reference group. In the research group, 45 patients were treated with insulin pump therapy. All 45 patients in the reference group were treated with multiple insulin injections therapy. General treatment effect of these two groups was then observed and compared.

Results: After treatment, in research group, patients' fasting blood-glucose level was 5.2 ± 0.6 mmol/L, 2 h post-meal blood sugar level was 7.3 ± 1.2 mmol/L and the blood-glucose standard time was 2.5 ± 0.8 d; However, in the reference group, the fasting blood-glucose level was 6.8 ± 0.6 mmol/L, 2 h post-meal blood sugar level was 8.8 ± 1.2 mmol/L and the blood-glucose standard time was 6.9 ± 1.4 d, $P < 0.05$. When comparing the changes of peripheral blood sugar between the 2 groups after treatment, in research group, the peripheral blood sugar level was 4.8 ± 0.7 mmol/L before breakfast, 5.3 ± 1.2 mmol/L after breakfast, 5.8 ± 1.2 mmol/L before lunch, 5.4 ± 1.2 mmol/L after lunch, 5.2 ± 1.0 mmol/L before dinner, 6.3 ± 1.1 mmol/L after dinner, 6.7 ± 1.4 mmol/L before sleep, while in reference group, the peripheral blood sugar level was 3.6 ± 0.8 mmol/L before breakfast, 6.5 ± 2.3 mmol/L after breakfast, 6.6 ± 1.5 mmol/L before lunch, 7.3 ± 1.5 mmol/L after lunch, 5.8 ± 1.2 mmol/L before dinner, 8.6 ± 1.7 mmol/L after dinner, 7.3 ± 1.3 mmol/L before sleep, $P < 0.05$. Hypoglycemia occurred more frequently in reference group than in the research group after calculation and observation.

Conclusion: Compared with multiple insulin injections therapy, the project of treating gestational diabetes patients with insulin pump therapy has more precise effect. Additionally, it has great safety and reliability, along with huge application value.

Keywords: Multiple insulin injections, Insulin pump, Gestational diabetes, Effectiveness, Safety.

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Introduction

During pregnancy, if blood glucose is not controlled reasonably, bad pregnancy outcomes will occur. At present, the effective drug which treats gestational diabetes is still insulin. After a clear diagnosis of Gestational Diabetes Mellitus (GDM), scientific diet management and exercise management should be carried out on patients immediately [1].

If the result of blood-glucose monitoring is not satisfactory, then insulin treatment project should be immediately put into effect. Subcutaneous injection can be applied, for example, insulin pump infusion (CSII) can simulate insulin physiological secretion patterns to the greatest extent [2]. Because of the emergence of long-acting insulin and the insulin drugs that have already been basic treatment for

gestational diabetes women, the insulin pump therapy is facing a treatment challenge of insulin detemir combining Multiple Daily Injections (MDI) of short-term effect insulin analog [3,4] before three daily meals. Through detailed analysis and several researches on the effectiveness and safety of multiple insulin injections and insulin pump therapy in treating gestational diabetes, this study develops the following report.

Materials and Methods

General information

90 pregnant women with gestational diabetes who have received treatment in Linyi Chinese Medicine Hospital during the period from January, 2015 to May, 2017 were selected as

research objects of the study. The diagnosis of all patients met the criteria for gestational diabetes which was made by American Diabetes Association in 2011 and excluded cardiac-liver-kidney dysfunction patients, infected patients, diabetic ketoacidosis and patients who have drug contraindications or mental disorders. All patients in the research were guaranteed the right to know their treatment measures and signed hospital's informed consent before any specific treatment. Patients were randomly divided into research group and reference group. Each group had 45 patients. In research group, the average age was 30.8 ± 2.6 , ranging from 23-36, and the average pregnant periods were 26.9 ± 1.8 w, ranging from 23 to 32 w. In reference group, the average age was 31.5 ± 2.4 , ranging from 22-35, and the average pregnant periods were 25.3 ± 1.6 w, ranging from 22 to 33 w. Comparing related materials of these two groups, the author found out comparability, the P value was above 0.05.

Methods

All patients of research group and reference group were asked to strictly observe the standard weight and pregnancy guide to control diet. Required amount of nutrition and calories should be met by daily food consumption in patients' pregnancy. In addition, patients' blood sugar cannot be raised and adequate exercise guidance should be given to patients [5-8]. On this basis, patients in research group were treated with insulin pump (made by Medtronic) which can also be called insulin aspart intensive treatment while in reference group, patients were treated with a collaborative treatment of insulin aspart injections before daily meals and insulin detemir therapy. The insulin amount in patients' initial period should be accurate and reasonable according to their fasting blood-glucose level, pregnant weeks, age and obesity degree [9,10]. The control dose was $0.4 \text{ IU}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$ - $0.7 \text{ IU}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$. The amount of insulin detemir took up approximately 40% in the total insulin

amount in reference group. Patients in research group were given 24 h continuous basic insulin injection which was controlled at a percentage of approximately 50% of the total insulin amount.

Observational index

After adopting different treatment programs, the fasting blood-glucose, 2 h post-meal blood sugar, blood-glucose standard time, peripheral blood-glucose before and after treatment and the frequency of hypoglycemia in two groups were all respectively observed and calculated.

Statistical method

Statistical software SPSS21.0 was applied in analyzing related data. The count data were presented in the form of percentage and examined by chi-square. The measurement data were presented in the form of Mean \pm SD and examined by t. only if $P < 0.05$ can discrepancy exist in statistics.

Results

The comparison of fasting blood-glucose, 2 h post-meal blood sugar and blood-glucose standard time of the two groups

As shown in Table 1, after treatment, patients' fasting blood-glucose level in research group was 5.2 ± 0.6 mmol/L, 2 h post-meal blood sugar level was 7.3 ± 1.2 mmol/L and the blood-glucose standard time was (2.5 ± 0.8 d). In reference group, the fasting blood-glucose level was 6.8 ± 0.6 mmol/L, 2 h post-meal blood sugar level was 8.8 ± 1.2 mmol/L and the blood-glucose standard time was 6.9 ± 1.4 d. Compared with reference group, the advantages of all indicators in the research group were more significant, $P < 0.05$.

Table 1. The comparison of fasting blood-glucose, 2 h post-meal blood sugar and blood-glucose standard time of the two groups.

Group	Number of patients	Fasting blood sugar	2 h post-meal blood sugar	Blood sugar standard time
Research group	45	5.2 ± 0.6	7.3 ± 1.2	2.5 ± 0.8
Reference group	45	6.8 ± 0.6	8.8 ± 1.2	6.9 ± 1.4
P value		$P < 0.05$	$P < 0.05$	$P < 0.05$

The comparison of peripheral blood-glucose changes before and after treatment of the two groups

As shown in Table 2, a comparison of peripheral blood-glucose level of the two groups was made before treatment (before breakfast, after breakfast, before lunch, after lunch, before dinner, after dinner, before sleep), and no apparent discrepancy was found in results, $P > 0.05$. However, after treatment, the results of research group showed more advantages compared to reference group in terms of peripheral blood-glucose level

before breakfast, after breakfast, before lunch, after lunch, before dinner, after dinner and before sleep.

The comparison of hypoglycemia incidence in the two groups

As shown in Table 3, by comparing the incidence of hypoglycemia in the two groups, the author found out the incidence of hypoglycemia in the research group was obviously smaller than that in the reference group, $P < 0.05$,

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indicating that the program of insulin pump treatment enjoyed better safety and reliability.

Table 2. The comparison of peripheral blood-glucose changes before and after treatment of the two groups.

Group	Time	Before breakfast	After breakfast	Before lunch	After lunch	Before dinner	After dinner	Before sleep
Research group	Before treatment	8.8 ± 1.6	11.4 ± 2.6	8.8 ± 1.4	12.5 ± 2.8	8.4 ± 2.5	13.8 ± 3.2	11.5 ± 2.1
	After treatment	4.8 ± 0.7	5.3 ± 1.2	5.8 ± 1.2	5.4 ± 1.2	5.2 ± 1.0	6.3 ± 1.1	6.7 ± 1.4
Reference group	Before treatment	8.9 ± 1.6	10.6 ± 2.7	9.3 ± 2.4	13.3 ± 2.2	8.9 ± 1.6	13.5 ± 3.0	10.9 ± 2.7
	After treatment	3.6 ± 0.8	6.5 ± 2.3	6.6 ± 1.5	7.3 ± 1.5	5.8 ± 1.2	8.6 ± 1.7	7.3 ± 1.3

Table 3. The comparison of hypoglycemia incidence in the two groups.

Group	Number of patients	Incidence of hypoglycemia
Research group	45	2 (4.44)
Reference group	45	10 (22.22)
P value		<0.05

Discussion

During pregnancy, because of the probable factors such as the significantly increased secretion volume of placental growth hormone, placental lactogen, progesterone and glucocorticoid, antagonistic effect on insulin would appear. In most cases, the compensation of pancreatic β -cell [11,12] is conducive to the increase of insulin and keep blood-glucose in a normal range. As for gestational diabetes patients, when their insulin secretion increases, insulin receptor being damaged and relatively decreased Insulin Receptor-1 (IRS-1) tyrosine phosphatases being acidized, their serine phosphorus acidification would be strengthened and thus resulting in gestation IR and increased blood-glucose [13-15]. The results of this study suggest that after treatment, comparing to the reference group, the test results of fasting blood-glucose, 2 h post-meal blood sugar and blood-glucose standard time of patients in research group have more advantages, $P < 0.05$; Comparing the peripheral blood-glucose changes of the two groups, the author finds out that the results of research group is better than that of reference group, $P < 0.05$, however, when observing and calculating the hypoglycemia incidence of the two groups, the author discovers the frequency in reference group is larger than that in research group, $P < 0.05$, indicating the insulin pump treatment therapy has a better effect than multiple insulin injections. Being different from the traditional intensive multiple insulin subcutaneous injections, insulin pump therapy can better simulate physiological insulin secretion, meanwhile, its greater pharmacokinetics and smaller absorption fluctuations can obviously decrease hypoglycemia incidence to help patients acquire better life quality, bringing greater safety and reliability to treatment effect [16]. In addition, in the initial period of pregnancy, gestational diabetes patients' hypoglycemia usually occurs at night because of their increased metabolism, fetal consumption, increased glomerular filtration and so on. In the meantime, the increased female

hormone, progesterone and human placental lactogen in the middle and late stages can also lead to blood-glucose elevation [17,18]. Especially when blood-glucose raises before dawn because of the effect of glucocorticoid, the blood-glucose can be easily affected and become hard to control. If patients are received insulin pump continuous subcutaneous injections, the injection patterns in corresponding time period can be managed flexibly to avoid the above unfavorable situations and better control blood-glucose level [19,20]. Additionally, pregnant women will have to eat frequent and small meals during pregnancy, therefore, patients in insulin pump therapy can separate the required insulin amount before meals into small doses of insulin and add them into daily frequent meals to avoid the pain that would be caused by multiple subcutaneous injections.

Conclusion

To sum up, compared with multiple insulin injection treatment, the program of insulin pump therapy has better effect on gestational diabetes patients, along with great safety and reliability, being very helpful in improving patients' life quality. Therefore, promoting and applying insulin pump treatment is of great value.

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