Association between preconceptional treatment with insulin pumps and improved metabolic status in early pregnancy in women with type 1 diabetes

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INTRODUCTION
An adverse intrauterine environment in early pregnancy in women with type 1 diabetes is associated with several perinatal complications including spontaneous abortions, fetal congenital defects, and preeclampsia.

OBJECTIVES
We compared metabolic parameters in the first trimester of pregnancy between women with type 1 diabetes treated with continuous subcutaneous insulin infusion (CSII) and those treated with multiple daily injections (MDI).

PATIENTS AND METHODS
A total of 168 women in the first trimester of pregnancy (33 using CSII and 135 using MDI) were enrolled in this cross-sectional single-center study. Anthropometric parameters, fasting serum levels of hemoglobin A1c (HbA1c), lipid profile, and estimated glucose disposal rate (eGDR) were determined.

RESULTS
Patients did not differ in gestational or maternal age, diabetes duration, and the frequency of planned pregnancies. Women using CSII before pregnancy had lower body mass index and waist-to-hip ratio than those using MDI (22.3 vs 23.3 and 0.77 vs 0.79, respectively, P = 0.01). A similar number of women had hypertension; however, the CSII group had lower diastolic blood pressure (P = 0.02). Moreover, the CSII group had a significantly lower insulin requirement (0.54 vs 0.63 units/kg; P = 0.02), significantly higher eGDR (11.3 vs 10.5 mg/kg/min; P = 0.0007), and significantly lower serum triglyceride levels (53.1 vs 61.8 mg/dl; P = 0.004). In a multiple regression analysis, CSII therapy was associated with higher eGDR, lower HbA1c, and lower serum triglyceride levels.

CONCLUSIONS
The use of CSII before pregnancy in patients with type 1 diabetes is associated with better metabolic profile in the first trimester.
Metabolic changes associated with diabetes represent a broad spectrum of abnormalities including hyperglycemia, dyslipidemia, and insulin resistance (IR). The first trimester is considered the most critical period for fetal development, and maternal metabolic status at this time might affect the perinatal outcome. Indeed, studies have correlated the incidence of miscarriage and fetal anomalies with hemoglobin A₁c (HbA₁c) levels in early pregnancy. The HbA₁c level in the first trimester is also predictive of late complications such as preeclampsia and preterm delivery. In addition, another study showed that lipid abnormalities in the first half of pregnancy are associated with fetal macrosomia in nondiabetic women, independent of body mass index (BMI) and gestational weight gain.

Data on the role of IR on the course of pregnancy in women with type 1 diabetes are limited. However, Wolf et al. found that among nulliparous nondiabetic patients, IR was significantly higher in women destined to develop preeclampsia, suggesting that IR may play an important role for perinatal outcomes.

Our objective was to compare metabolic parameters in the first trimester of pregnancy between women with type 1 diabetes using CSII and those using MDI. We aimed to investigate whether women using CSII before pregnancy achieved better metabolic control in early pregnancy.

**PATIENTS AND METHODS** This cross-sectional study was performed at the Department of Obstetrics and Women's Diseases, Gynecologic and Obstetrical University Hospital in Poznań, Poland, between June 2012 and June 2014 in a population of pregnant women with type 1 diabetes. Clinical, anthropometric, and laboratory data for the present study were collected during the first perinatal hospitalization (<12 weeks of gestation). The department is the biggest perinatal center for pregnant women with diabetes in Poland, providing care for patients from the Wielkopolska province.

According to the Polish Diabetes Association (in Polish, Polskie Towarzystwo Diabetologiczne, PTD), clinical recommendations, and our internal hospital standards, all pregnant women with diabetes from the Wielkopolska province are immediately referred to our center once pregnancy is confirmed. This enabled us to investigate an unselected population of patients in the early stages of pregnancy. Women with concurrent diseases unrelated to diabetes that could affect metabolic control of the disease were excluded.

Among 179 pregnant women with type 1 diabetes admitted to our department during the study period, 168 were eligible for the study. Nine patients were excluded because of the following: newly diagnosed type 1 diabetes in early pregnancy (1 patient), diagnosed polycystic kidney disease with coexisting secondary hypertension (1 patient), and newly diagnosed hypothyroidism (7 patients). Two patients refused to participate in the study.

All study participants were Caucasians. They were all treated with functional intensive therapy before pregnancy; 135 patients received MDI and 33—CSII. All CSII users had been using this method of therapy for at least 6 months. A basal-bolus protocol used in patients on MDI involved 3 injections of short-acting insulin analog before meals and 1 or 2 injections of intermediate-acting insulin at bedtime or at bedtime and in the morning. Women on CSII received short-acting insulin analog (continuous basal rate and 3 premeal boluses).

Of all patients, 61 women using MDI and 20 women using CSII received prepregnancy counseling delivered by a diabetologist or an obstetrician with a special interest in diabetic pregnancy. These data were self-reported by participants. The remaining women received standard care for nonpregnant patients with type 1 diabetes delivered by diabetologists as recommended by the PTD. According to the PTD, blood glucose and HbA₁c targets for women planning their pregnancies or already pregnant compared with those nonplanning and nonpregnant were as follows: 3.3–5.0 mmol/l vs 3.9–6.1 mmol/l for fasting glucose levels, <7.5 mmol/l vs <7.8 mmol/l for postprandial glucose levels, and 6.1% (43 mmol/mol) vs (6.5%, 48 mmol/mol) for HbA₁c levels.

Blood samples were collected during the first perinatal hospitalization after overnight fasting and immediately transported to the laboratory for analysis. All measurements were performed in the Central Laboratory of Gynecologic Obstetrical University Hospital in Poznań.

The percentage of HbA₁c in whole blood was estimated using a turbidimetric inhibition immunoassay (TINIA, Tina-quant® Hemoglobin A₁c II test, Roche Diagnostics, Rotkreuz, Switzerland) in a Cobas c311 analyzer. The normal range for this test is between 4.8% and 6.0% (29–42 mmol/mol) for a nonpregnant population.

Total serum cholesterol, high-density lipoprotein (HDL) cholesterol, and triglyceride levels were measured with appropriate reagents (cholesterol CHOD-PAP, HDL-C plus, and triglycerides GPO-PAP, respectively, Roche Diagnostics) in a Cobas c501 analyzer. Low-density lipoprotein (LDL) cholesterol levels were calculated using the following formula: LDL cholesterol = total cholesterol – HDL cholesterol – (triglycerides / 5).

Anthropometric (weight, height, waist circumference, and hip circumference) and blood pressure measurements were performed according to standardized protocols. A detailed medical history, including the course of diabetes, its complications, and comorbidities, was taken from all patients.

All participants were examined by an ophthalmologist in the first trimester of pregnancy.

A 24-hour urine collection test was performed in every patient to assess urinary protein excretion. Diabetic nephropathy was defined as...
the presence of proteinuria exceeding 0.3 g/24 h in the absence of urinary tract infection on admission or as a diagnosis of this disorder documented previously.

A positive family history of type 2 diabetes was defined as the presence of the disease in any of the 3 generations, ie, siblings, parents, and grandparents.

Severe hypoglycemia was defined as any event requiring assistance from another person that occurred during the 6 months before the inclusion to the study.

According to the guidelines, women were tested for thyroid dysfunction (measurement of thyroid-stimulating hormone). Except for the 7 women who were not included into this study because of newly diagnosed hypothyroidism, the remaining women were euthyroid either spontaneously (n = 128) or following levothyroxine treatment (n = 40). There were no patients with hyperthyroidism in the study group.

IR was quantified using the estimated glucose disposal rate (eGDR) (mg/kg/min), calculated using the following equation:

\[ eGDR = 24.31 - 12.22 \times (\text{WHR}) - 3.29 \times (\text{HTN}) - 0.57 \times (\text{HbA}_1c) \]

where WHR is waist-to-hip ratio and HTN is hypertension (0 = no; 1 = yes).

It is worth noting that a decreasing eGDR correlates with increasing IR.23

**Statistical analysis** The statistical analysis was performed using MedCalc for Windows, version 12.1.3.0 (MedCalc Software, Mariakerke, Belgium). The D’Agostino–Pearson test was used to test for normality of data distribution. The t test was used to measure the significance of the difference between 2 continuous variables when data fitted normal distribution, with results expressed as mean ± standard deviation. In case of nonnormally distributed data, comparisons were made using the Mann–Whitney test, with results expressed as median and interquartile range. \( \chi^2 \) and Fisher exact tests were used for the comparison of categorical variables. The Spearman rank correlation coefficient was used to test the relationship between 2 variables when data did not follow normal distribution.

Stepwise multiple regression was used to assess the effect of CSII therapy on maternal HbA1c, eGDR, and lipid profile (total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides). Based on clinical judgment, we included the following confounders into the stepwise models: maternal age (years), diabetes duration (years), nulliparity (yes/no), family history of type 2 diabetes (yes/no), cigarette smoking (yes/no), BMI at baseline (kg/m²), and prepregnancy counseling (yes/no). The models examining the effect of CSII therapy on lipid fractions additionally included HbA1c, and hypertensive status (yes/no) as confounders. According to the stepwise method, variables were entered into the model if their associated P values were lower than 0.05 and then sequentially removed if their associated P values became greater than 0.2. A P value of less than 0.05 was considered statistically significant (2-tailed).

The ethics committee of the Poznan University of Medical Sciences (no. 673/12; June 12, 2012) approved the study protocol, and written informed consent was obtained from every patient before inclusion to the study.

**RESULTS** The clinical characteristics of the study groups are shown in **Table 1**. The groups did not differ in terms of the gestational age at baseline, maternal age at baseline, nulliparity, rates of patients receiving preconception care, age at diagnosis of diabetes, diabetes duration, smoking status, family history of type 2 diabetes, and number of episodes of severe hypoglycemia/ ketoacidosis during the 6 months before pregnancy. A similar number of patients in each group suffered from diabetic vascular complications. Finally, there were no significant differences in the number of patients with chronic hypertension between the groups.

In the CSII group, the mean duration of CSII therapy was 33 months, ranging from 6 to

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>MDI n = 135</th>
<th>CSII n = 33</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>gestational age at baseline, wk</td>
<td>8 (7–10)</td>
<td>8 (6–10)</td>
<td>0.3</td>
</tr>
<tr>
<td>maternal age at baseline, y</td>
<td>29 (26–32)</td>
<td>29 (24–32)</td>
<td>0.5</td>
</tr>
<tr>
<td>primipara</td>
<td>74 (54.8)</td>
<td>21 (63.6)</td>
<td>0.4</td>
</tr>
<tr>
<td>prepregnancy counseling</td>
<td>61 (45.2)</td>
<td>20 (60.6)</td>
<td>0.1</td>
</tr>
<tr>
<td>age at diagnosis of diabetes, y</td>
<td>17 ± 8</td>
<td>15 ± 7</td>
<td>0.1</td>
</tr>
<tr>
<td>duration of diabetes, y</td>
<td>11.8 ± 7.2</td>
<td>12.8 ± 6.6</td>
<td>0.5</td>
</tr>
<tr>
<td>duration of CSII therapy, mo</td>
<td>–</td>
<td>33 ± 32 (6–96)</td>
<td>–</td>
</tr>
<tr>
<td>baseline BMI, kg/m²</td>
<td>23.3</td>
<td>22.3</td>
<td>0.01</td>
</tr>
<tr>
<td>baseline WHR</td>
<td>0.79</td>
<td>0.77</td>
<td>0.01</td>
</tr>
<tr>
<td>(0.76–0.85)</td>
<td>(0.73–0.80)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>systolic blood pressure, mmHg</td>
<td>118 ± 11</td>
<td>112 ± 9</td>
<td>0.06</td>
</tr>
<tr>
<td>diastolic blood pressure, mmHg</td>
<td>72 ± 8</td>
<td>68 ± 6</td>
<td>0.02</td>
</tr>
<tr>
<td>patients with chronic hypertension</td>
<td>12 (8.9)</td>
<td>0 (0)</td>
<td>0.13</td>
</tr>
<tr>
<td>patients with diabetic nephropathy</td>
<td>6 (4.4)</td>
<td>2 (6.1)</td>
<td>0.7</td>
</tr>
<tr>
<td>patients with diabetic retinopathy</td>
<td>28 (20.7)</td>
<td>7 (21.2)</td>
<td>1.0</td>
</tr>
<tr>
<td>cigarette smoking</td>
<td>22 (16.3)</td>
<td>5 (15.1)</td>
<td>0.9</td>
</tr>
<tr>
<td>family history of type 2 diabetes</td>
<td>59 (43.7)</td>
<td>16 (48.5)</td>
<td>0.7</td>
</tr>
<tr>
<td>severe hypoglycemia during the previous 6 months</td>
<td>6 (4.4)</td>
<td>1 (3.03)</td>
<td>1.0</td>
</tr>
<tr>
<td>diabetic ketoacidosis during the previous 6 months</td>
<td>1 (0.74)</td>
<td>0 (0)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Data are presented as mean ± standard deviation, median (interquartile range), or number (percentage).

Abbreviations: BMI, body mass index; CSII, continuous subcutaneous insulin infusion; MDI, multiple daily injection; WHR, waist-to-hip ratio.
96 months. CSII users had lower BMI (P = 0.01), WHR (P = 0.01), and diastolic blood pressure (P = 0.02). There was no significant difference in systolic blood pressure; however, a trend for lower values was noted in the CSII group (P = 0.06).

Laboratory characteristics and IR indexes of the study groups are shown in Table 2. HbA1c was lower in the CSII group compared with the MDI group (6.1% vs 6.8%, 43 vs 51 mmol/mol; P = 0.09), but the difference did not reach statistical significance. In a subsequent analysis using multiple regression, CSII was found to be significantly associated with decreased HbA1c levels after adjustment for maternal age, diabetes duration, nulliparity (yes/no), family history of type 2 diabetes (yes/no), cigarette smoking (yes/no), BMI at baseline, and hypertensive status (coefficient = –0.64 [standard error, 0.29]; P = 0.03). However, the association was no longer present after additional adjustment for prepregnancy counseling (yes/no) (data not shown).

The serum levels of total cholesterol, HDL cholesterol, and LDL cholesterol were not different between the CSII and MDI groups; however, serum triglyceride levels were significantly lower in the CSII group (P = 0.004). There was no difference in daily urinary protein excretion and renal clearance between the groups.

CSII users had lower insulin requirements (units/kg) than MDI users (P = 0.02). eGDR was significantly higher (P = 0.0007) in women using CSII, suggesting that they had lower IR. This group also showed a significant negative correlation between eGDR and triglyceride levels (rho = –0.34; P < 0.0001).

In the multiple regression analysis, CSII treatment was significantly associated with a higher eGDR when adjusted for maternal age, diabetes duration, nulliparity (yes/no), family history of type 2 diabetes (yes/no), cigarette smoking (yes/no), BMI at baseline (model 1 coefficient = 0.79; P = 0.007). The association became weaker after additional adjustment for prepregnancy counseling (yes/no) (model 2 coefficient = 0.66; P = 0.019). The results are shown in Table 3.

The CSII treatment was also associated with the reduction in serum triglyceride levels when adjusted for maternal age, diabetes duration, nulliparity (yes/no), family history of type 2 diabetes (yes/no), cigarette smoking (yes/no), BMI at baseline (model 1 coefficient = –16.36; P = 0.008). This association became weaker after additional adjustment for HbA1c levels (model 2 coefficient = –15.69; P = 0.01) and prepregnancy counseling (yes/no) (model 3 coefficient = –14.23; P = 0.02). The results are shown in Table 4.

The CSII treatment was not associated with changes in the levels of total cholesterol, HDL cholesterol, and LDL cholesterol.

**DISCUSSION**
As numerous obstetric diseases have their origin in the first trimester, we aimed to investigate whether the mode of insulin therapy before pregnancy is associated with any changes in metabolic status in women with type 1 diabetes during early pregnancy.

We demonstrated that the CSII treatment may have several beneficial effects, not only in terms of HbA1c reduction, but also in a broader metabolic context.

Using the multiple regression analysis, we found that the use of CSII before pregnancy was associated with a decreased HbA1c level. This is an important clinical finding because these women had lower mean glycemia during the critical period for fetal development, namely, embryogenesis. These results are in line with previous findings.
TABLE 4 Effect of continuous subcutaneous insulin infusion before pregnancy on maternal serum triglyceride levels after adjustment for confounders

<table>
<thead>
<tr>
<th>model 1</th>
<th>Coefficient (standard error)</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>adjusted for maternal age, diabetes duration, nulliparity (yes/no), family history of type 2 diabetes (yes/no), cigarette smoking (yes/no), BMI at baseline, and hypertensive status (yes/no)</td>
<td>$-16.36 (6.09)$</td>
<td>$0.008$</td>
</tr>
</tbody>
</table>

$R^2$ adjusted = 0.0373

<table>
<thead>
<tr>
<th>model 2</th>
<th>Coefficient (standard error)</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>adjusted for maternal age, diabetes duration, nulliparity (yes/no), family history of type 2 diabetes (yes/no), cigarette smoking (yes/no), BMI at baseline, hypertensive status (yes = 1/no = 0), and HbA$_1c$ at baseline$^a$</td>
<td>$-15.69 (6.14)$</td>
<td>$0.01$</td>
</tr>
</tbody>
</table>

$R^2$ adjusted = 0.0666

<table>
<thead>
<tr>
<th>model 3</th>
<th>Coefficient (standard error)</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>adjusted for maternal age, diabetes duration, nulliparity (yes/no), family history of type 2 diabetes (yes/no), cigarette smoking (yes/no), BMI at baseline, hypertensive status (yes/no), and prepregnancy counseling$^a$ (yes/no)</td>
<td>$-14.23 (6.20)$</td>
<td>$0.02$</td>
</tr>
</tbody>
</table>

$R^2$ adjusted = 0.0547

$^a$ variables that were retained in stepwise multiple regression models

Abbreviations: see TABLES 1 and 2

Observational studies conducted in both pregnant and nonpregnant patients where pump therapy was associated with the reduction of HbA$_1c$ levels. Importantly, lower HbA$_1c$ in the CSII group was achieved without impacting the rate of severe hypoglycemia during the 6 months before the study. However, it should be emphasized that the association between the CSII treatment and lower HbA$_1c$ levels was no longer observed after adjustment for prepregnancy counseling. It further confirms that any therapeutic tool cannot replace preconception care as an integral part of the strategy to achieve optimal metabolic control from the early beginning of pregnancy.

Weight gain is a common metabolic adverse effect of improved glycemic control and is related to hyperinsulinization. In this study, we showed that women treated with CSII had a significantly lower BMI at the beginning of pregnancy. However, the influence of the CSII treatment on gestational weight gain requires further studies as literature yields conflicting results—either no change or larger weight gain in comparison with the use of MDI. We also measured WHR—a useful clinical parameter of fat distribution—and it was also lower in the CSII group. Since WHR has not been examined in previous prospective and retrospective studies comparing CSII and MDI, this is a completely novel finding. It should be also noted that better metabolic control was achieved with lower doses of insulin (units/kg) in the CSII group. One may suggest that beneficial changes in body fat distribution, together with lower insulin requirements observed in women using CSII, might have been attributed to the more physiological method of insulin delivery. Moreover, increased WHR or abnormal fat distribution in the first trimester has been linked with macrosomia and preeclampsia, irrespective of overall adiposity.

IR is a decreased response to normal insulin concentrations and might be observed in both diabetic and nondiabetic individuals. As the gold standard of IR assessment—the clamp technique—cannot be used in pregnancy because of its invasiveness, the eGDR is used as an alternative. It has been found to closely correlate with the clamp technique for measuring IR. eGDR has not been used previously in pregnancy. However, as our study group consisted of patients in the early first trimester, when their WHR has not yet been affected by the enlarging uterus (located below the symphysis pubis until the 12th week of gestation), the eGDR seems to be a good indicator of IR.

We found that treatment with an insulin pump before pregnancy was significantly associated with decreased IR, as indicated by increased eGDR. Importantly, this beneficial effect of the CSII treatment was independent of prepregnancy counseling.

There are some data linking increased IR with pregnancy complications. For example, in patients with polycystic ovary syndrome, higher IR altered the implantation rate after in-vitro fertilization. Similarly, Paretti et al. demonstrated that preeclampsia can be predicted by simple insulin sensitivity indexes measured independently in both early and late pregnancy. Hauth et al. confirmed these findings in a large cohort of patients tested between the 22nd and 26th weeks of gestation. Importantly, these studies have been conducted in nondiabetic patients, and there are no similar reports in a population of women with type 1 diabetes. Nevertheless, bearing in mind the higher incidence of early pregnancy loss and preeclampsia in this group, there is a clear need for further studies on the role of IR in pregnancy complicated by type 1 diabetes, in which the mode of insulin therapy would be considered as a confounder.

Type 1 diabetes predisposes patients to dyslipidemia, which further contributes to increased cardiovascular risk. In pregnancy, there is a physiological elevation of maternal lipid levels to meet the energy needs of the growing fetus. In this study, we showed that CSII used before pregnancy was associated with a significant reduction in maternal triglyceride levels in the first trimester. Moreover, we demonstrated that triglyceride levels are negatively correlated with eGDR, supporting a close association between IR and adipose tissue metabolism. There is strong evidence from recent meta-analyses that maternal hypertriglyceridemia is associated with and precedes the onset of preeclampsia. However, the vast majority of the studies eligible for inclusion to these meta-analyses excluded patients with diabetes as an independent risk group for preeclampsia. Nonetheless, there is an association between diabetes and preeclampsia, as both diseases are associated with oxidative stress and
endothelial dysfunction. Thus, hypertriglyceridemia may represent an additional factor that exacerbates these pathological processes and it should be taken into consideration, especially if present in early pregnancy.

During the Banting Lecture in 1980, Norbert Freinkel suggested that nutrients other than glucose could be linked with excessive fetal growth. Since this hypothesis was formed, several studies have shown that high maternal triglyceride levels are associated with fetal macrosomia in non-diabetic women. Such associations have also been observed in patients with gestational diabetes. However, data on triglyceride levels during pregnancy in women with type 1 diabetes are limited.

There is a paucity of data from human trials exploring the role of CSII on the lipid profile in patients with type 1 diabetes. Available data come from interventional studies carried out on relatively small groups of patients. These studies demonstrated beneficial changes in serum lipids, including a reduction in serum triglyceride and LDL cholesterol levels and an increase in HDL cholesterol levels in patients using CSII. These changes can probably be attributed to a significant improvement in glucose regulation after initiation of pump treatment as was suggested by the available studies.

In our study, we confirmed that a reduction in serum triglyceride levels in patients treated with CSII was independent of HbA1c and BMI. We believe that this is an important clinical finding because lipid abnormalities observed in early pregnancy tend to be accentuated by advancing gestation. However, further studies are required to confirm whether beneficial changes associated with the use of CSII are sustained throughout pregnancy.

Our study is limited by a relatively small sample size. However, its prospective design and the inclusion of the whole population of pregnant women with type 1 diabetes admitted to our department in the first trimester and within a narrow time frame add to the study’s generalizability in this particular population. Nonetheless, this is a “snapshot” study, and further longitudinal studies are needed to explore the mechanisms behind the beneficial effect of the CSII treatment on the metabolic profile in all patients with type 1 diabetes, including pregnant women and children.

In conclusion, we demonstrated that women using CSII before pregnancy achieved better metabolic profile in the first trimester; however, the effect of these beneficial changes on the perinatal outcome requires further research.

**Contribution statement**

PG contributed to study design, data collection, data analysis, data interpretation, and preparation of the manuscript; AZ contributed to data interpretation and reviewed the manuscript; JB reviewed and accepted the final version of the manuscript; EW-O contributed to study design, data analysis, data interpretation, and preparation of the manuscript.

**Acknowledgments**

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**REFERENCES**


Związek między stosowaniem osobistej pompy insulinowej w okresie prekoncepcyjnym a poprawą parametrów metabolicznych we wczesnej ciąży u pacjentek z cukrzycą typu 1

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SŁOWA KLUCZOWE
- ciąży, cukrzyca typu 1, lipidy, oporność na insulinę, systemy infuzji insuliny

STRESZCZENIE

WPROWADZENIE Nieprawidłowe środowisko wewnętrzmaciczne we wczesnej ciąży u pacjentek z cukrzycą typu 1 jest związane z występowaniem takich powikłań położniczych, jak samoistne poronienia, wady wrodzone płodu oraz stan przedrzucawkowy.

CELE Celem badania było porównanie parametrów wyrównania metabolicznego w I trymestrze ciąży między pacjentkami z cukrzycą typu 1 stosującymi w okresie przedciążowym osobistą pompę insuliny (continuous subcutaneous insulin infusion – CSII) a pacjentkami leczonymi metodą wielokrotnych wstrzyknięć (multiple daily injections – MDI).

PACJENKI I METODY 168 kobiet w I trymestrze ciąży (33 stosujące CSII i 135 stosujących MDI) zostało włączonych do jednoośrodkowego badania przekrojowego. Dokonano pomiarów antropometrycznych, a także oznaczono stężenie hemoglobiny A1c (HbA1c) na czczo, profil lipidowy oraz wskaźnik eGDR (estimated glucose disposal rate).

WYNIKI Pacjentki nie różniły się pod względem wieku ciąży, wieku matki, czasu trwania cukrzycy oraz częstotliwości planowania ciąży. Kobiety stosujące CSII przed ciążą miały niższy wskaźnik masy ciała oraz niższy wskaźnik talia–biodro w porównaniu z kobietami stosującymi MDI (odpowiednio: 22,3 vs 23,3; p = 0,01 oraz 0,77 vs 0,79; p = 0,01). Porównywalna liczba pacjentek chorowała na nadciśnienie tętnicze, jednakże u pacjentek stosujących CSII zaobserwowano niższe rozkurczowe ciśnienie tętnicze (p = 0,02). Pacjentki stosujące CSII miały także istotnie mniejsze zapotrzebowanie na insulinę (0,54 vs 0,63 jednostek/kg; p = 0,02), niższą insulinooporność manifestującą się wyższym wskaźnikiem eGDR (11,3 vs 10,5 mg/kg/min; p = 0,0007) oraz niższe stężenie triglicerydów w surowicy (53,1 vs 61,8 mg/dl; p = 0,004). W analizie regresji wielorakiej insulinoterapia związana była z wyższym wskaźnikiem eGDR, niższym stężeniem HbA1c oraz niższym stężeniem triglicerydów w surowicy.

WNIOSKI Stosowanie CSII w okresie przedciążowym u pacjentek z cukrzycą typu 1 ma związek z lepszą kontrolą metaboliczną w I trymestrze.