Glycemic Control in Diabetic Pregnancies: Effects on Fetal and Maternal Outcome

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Abstract:

Background: Both maternal and fetal complications are increased in diabetic pregnancies. Although hypertensive complications are increased in pregnant women with pregestational diabetes, reports on hypertensive complications in women with gestational diabetes mellitus (GDM) have been contradictory. Congenital malformations and macrosomia are the main fetal complications in Type 1 diabetic pregnancies, whereas fetal macrosomia and birth trauma but not congenital malformations are increased in GDM pregnancies.

Aims: To study the frequency of hypertensive disorders in gestational diabetes mellitus. To evaluate the risk of macrosomia and brachial plexus injury (Erb's palsy) and the ability of the 2-hour glucose tolerance test (OGTT) combined with the 24-hour glucose profile to distinguish between low and high risks of fetal macrosomia among women with GDM.
To evaluate the relationship between glycemic control and the risk of fetal malformations in pregnancies complicated by Type 1 diabetes mellitus. To assess the effect of glycemic control on the occurrence of preeclampsia and pregnancy-induced hypertension in Type 1 diabetic pregnancies.

Subjects: A total of 986 women with GDM and 203 women with borderline glucose intolerance (one abnormal value in the OGTT) with a singleton pregancy, 488 pregnant women with Type 1 diabetes (691 pregnancies and 709 offspring), and 1154 pregnant non-diabetic women (1181 pregnancies and 1187 offspring) were investigated.

Results: In a prospective study on 81 GDM patients the combined frequency of preeclampsia and PIH was higher than in 327 non-diabetic controls (19.8% vs 6.1%, $p<0.001$). On the other hand, in 203 women with only one abnormal value in the OGTT, the rate of hypertensive complications did not differ from that of the controls. Both GDM women and those with only one abnormal value in the OGTT had higher pre-pregnancy weights and BMIs than the controls.

In a retrospective study involving 385 insulin-treated and 520 diet-treated GDM patients, and 805 non-diabetic control pregnant women, fetal macrosomia occurred more often in the insulin-treated GDM pregnancies (18.2%, $p<0.001$) than in the diet-treated GDM pregnancies (4.4%), or the control pregnancies (2.2%). The rate of Erb's palsy in vaginally delivered infants was 2.7% in the insulin-treated group of women and 2.4% in the diet-treated women compared with 0.3% in the controls ($p<0.001$). The cesarean section rate was more than twice as high (42.3% vs 18.6%) in the insulin-treated GDM patients as in the controls.

A major fetal malformation was observed in 30 (4.2%) of the 709 newborn infants in Type 1 diabetic pregnancies and in 10 (1.4%) of the 735 controls (RR 3.1, 95% CI 1.6–6.2). Even women whose levels of HbA_{1c} (normal values less than 5.6%) were only slightly increased in early pregnancy (between 5.6 and 6.8%) had a relative risk of fetal malformation of 3.0 (95% CI 1.2–7.5). Only diabetic patients with a normal HbA_{1c} level (<5.6%) in early pregnancy had the same low risk of fetal malformations as the controls.

Preeclampsia was diagnosed in 12.8% and PIH in 11.4% of the 616 Type 1 diabetic women without diabetic nephropathy. The corresponding frequencies among the 854 control women were 2.7% (OR 5.2; 95% CI 3.3–8.4) for preeclampsia and 5.6% (OR 2.2, 95% CI 1.5–3.1) for PIH. Multiple logistic regression analysis indicated that glycemic control, nulliparity, diabetic retinopathy and duration of diabetes were statistically significant independent predictors of preeclampsia. The adjusted odds ratios for preeclampsia were 1.6 (95% CI 1.3–2.0) for each 1%-unit increment in the HbA_{1c} value during the first trimester and 0.6 (95% CI 0.5–0.8) for each 1%-unit decrement during the first half of pregnancy. In contrast, changes in glycemic control during the second half of pregnancy did not alter the risk of preeclampsia.

Conclusions: In type 1 diabetic pregnancies it is extremely important to achieve optimal glycemic control before pregnancy and maintain it throughout pregnancy in order to decrease the complication rates both in the mother and in her offspring. The rate of fetal macrosomia and birth trauma in GDM pregnancies, especially in the group of insulin-treated women, is still relatively high. New strategies for screening, diagnosing, and treatment of GDM must be developed in order to decrease fetal and neonatal complications.