

# Obstetric Management of a Pregnant With Type I Diabetes and Poor Metabolic Control - A Case Report

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## Abstract

Pregnancy in women with type I diabetes is associated with an increased risk of fetal, neonatal and maternal complications.

This increased risk is directly related to the preconception and gestational metabolic control. Poor glycemic control before and throughout pregnancy is associated with adverse outcomes. In preconception period, congenital anomalies and spontaneous abortions occur often. During pregnancy, the mother is at an increased risk for hypoglycemia or diabetic ketoacidosis as well as accelerated retinopathy, renal function deterioration, pregnancy induced hypertension or pre-eclampsia. The fetus is also at increased risk of macrosomia and intrauterine demise.

Appropriate diet counseling, a tight glycemic control and early diagnosis and close monitoring of complications can prevent or minimized adverse effects improving pregnancy outcomes.

We present a case of a pregnant woman with type I diabetes with poor metabolic control.

Clinical optimization and pregnancy monitoring were a challenge for both the pregnant and the health care professionals involved.

**Keywords:** Type I diabetes; pregnancy; Metabolic control

## Introduction

Type I diabetes (T1D) results from the autoimmune destruction of insulin-producing beta cells present in Langerhans's islets of the pancreas [1]. In 2015 the Portuguese prevalence of T1D among young people up to 19 years old was 0.16%. The incidence of type I diabetes has remained constant over the last 10 years and it has been estimated that it complicates 1% to 2% of all pregnancies [1].

The only effective strategy in controlling obstetric risk and improving maternal-fetal outcome in these pregnant women is to obtain and maintain normal blood glucose levels during the preconception and gestation period [2].

## Case Report

A 30 year old gipsy primigesta, diagnosed with T1D at 20 years of age, was poorly controlled despite the prescribed insulin regimen. She was referenced to an obstetric consultation due to a desired but unplanned pregnancy.

At the first appointment, a careful anamnesis showed that she was a woman with a very low educational level, unemployed and living in her gipsy community with scarce economic resources. The inquiry of previous medical reports allowed verifying the absence of diabetes-related complications as renal or cardiac impairment. Her last HbA1c determination of 6 months ago was 11.8%. Clinical examination revealed a normal body mass index (BMI), normal blood pressure and absence of proteinuria in urine dipstick analysis. The ultrasound exam was compatible with a 6 week gestation, inconsistent with her last period. She was informed about obstetrical complications related to uncontrolled diabetes and it was emphasized the importance of compliance with established dietary and insulin regimens during pregnancy.

An articulation with endocrinology, nutrition and social service

was established; however the pregnant woman did not attend the consultations claiming a change of residence.

She returned to the hospital at 23 weeks with capillary glycaemia levels ranging from 200 mg/dl to 500 mg/dl, without fulfilling the therapeutic plan. First trimester screening was not performed and the patient presented a weight increase of 10 kg (BMI=27) and HbA1c level of 11.4% at the time.

Obstetric morphologic ultrasound exam performed in our Prenatal Diagnostic Unit showed a fetus with good vitality, growth in the 99<sup>th</sup> percentile and an overall set of images compatible with hydramnios. No anomalies were detected, especially those involving the heart or central nervous system.

Admission to the obstetric ward was decided for reeducation and optimization of the metabolic control. A multidisciplinary team composed by obstetrics, endocrinology, nutrition and psychology carried out the clinical plan.

Despite the improvement in HbA1c levels from 11.4% to 9.4%, normoglycemic levels were never reached. At 25 weeks the patient requested ward discharge, contrary to medical advice.

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A biweekly surveillance was maintained until 29 weeks in an outpatient basis, keeping up with new deterioration of glycemic control. She accepted rehospitalization for fetal monitoring and to re-attempted metabolic optimization. Therapeutic adjustment every 3 days was made due to constant hyperglycemia and occasional hypoglycemia. HbA1C declined to 7.7%.

Besides the weight increase of 17 Kg during pregnancy, there were no signs of maternal health deterioration or development of early preeclampsia, so that the major obstetric concern was fetal well-being.

The patient performed biophysical profile biweekly and daily fetal monitoring through the perceived moves and cardiotocography. She kept fetal growth in percentile 99.9 and hydramnios. The fetal heart re-evaluation at 31 weeks revealed interventricular septum hypertrophy and cardiomegaly.

Given the high risk of poor perinatal outcome, the termination of pregnancy at 35<sup>+2</sup> weeks was decided by elective cesarean section, after analyzing factors for choice of the delivery route. She started fetal lung maturation at 34<sup>+3</sup> weeks and a close obstetric surveillance.

At 35<sup>+0</sup> weeks she presented a cardiotocogram with a pattern of low variability and absence of fetal moves, constant in a period superior to 1 h. After exclusion of reversible causes, an emergency cesarean section was performed due to a non-reassuring fetal state. The newborn with 4365 g (Percentile 99.9), Apgar Index 8/9/9, showed a permanent spontaneous ventilation pattern, requiring only hypoglycemic treatment in the first hours of life. He was discharged on the 11<sup>th</sup> day of life and referenced to pediatric consultation.

The puerperium was uneventful, with a slight overall improvement in blood glucose levels. The puerpera was referenced to endocrinology consultation and social service.

## Discussion

The hormonal environment of pregnancy induces a diabetogenic state in which postprandial glucose levels are high and insulin sensitivity is reduced [1]. Throughout gestation, the physiological transformation of the hormonal environment causes a decrease in insulin sensitivity, making insulin replacement hard in a pregnant woman with T1D [1].

T1D significantly elevates the risk of maternal, fetal and neonatal adverse outcomes as well as long-term complications in the offspring, which are directly related to metabolic control, indirectly determined by the dosing of HbA1C [3,4]. Close glycemic control and frequent therapeutic readjustments become essential [2,5].

These pregnant women are more likely to have microvascular complications such as gestational hypertension, diabetic retinopathy and progression of renal disease [1]. There is also a greater risk of preeclampsia, hypo and hyperglycemia, including diabetic ketoacidosis, traumatic or surgical delivery [2].

Regarding the adverse fetal effects, the highest rate of spontaneous abortion and congenital malformations are highlighted in the first trimester [3]. In the 2<sup>nd</sup> and 3<sup>rd</sup> trimesters, maternal hyperglycemia increases the risk of macrosomia, hyperinsulinemia, asphyxia and fetal death [6]. In the neonatal period, there is a higher incidence of prematurity, respiratory stress syndrome, hypoglycemia, hyperbilirubinemia, polycythemia, hyperviscosity syndrome, cardiomyopathy and neonatal death. Perinatal mortality is high (3-4%) and the risk increases with HbA1C values between 6 and 6.9% [2,3,7].

Preconception planning is the basis for achieving good results.

However, in unplanned pregnancies, the onset of gestation is the ideal moment for sensitization and education of these women relative to the disease, potential complications and repercussion in pregnancy.

In the absence preconception optimization or the knowledge of the patient health status, additional tests should be performed during the 1<sup>st</sup> trimester, namely, renal function, protein-creatinine ratio in an occasional sample of urine, thyroid function (thyroid dysfunction around 40%), electrocardiogram for screening for ischemic heart disease and ophthalmologic examination to exclude retinopathy [8,9].

A detailed morphological ultrasound is essential to exclude fetal malformations, such as neural tube defects and cardiac defects. The most common cardiac anomalies are conotruncals and defects of the interventricular septum [10]. Usually they are presented in a moderate, asymptomatic and transient form, however, congestive cardiomyopathy may occur. These changes appear more frequently in fetuses of pregnant women with poor metabolic control [10].

In the third trimester, surveillance focuses on continuous monitoring of glucose levels, growth assessment and fetal monitoring to minimize the risk of intrauterine death.

Compared to the non-gravid state, glycemic goals are more restrictive (<90-99 mg/dl in fasting and <120-129 mg/dl 1 h after meals). HbA1C target value ranges from 6 to 7% [8,11].

The hospitalization of pregnant women with poor metabolic control and high risk of fetal death in utero should be considered at any time during gestation. Hospital admission allows adjustment of diet, insulin therapy, monitoring of adherence to the treatment plan and the indirect evaluation of the socioeconomic context in which the pregnant woman is inserted [9].

In this case, despite the great improvement observed in the metabolic control during hospitalization, it was extremely difficult to keep the pregnant woman motivated outside of her familiar and cultural context, revealing a challenge for the professionals.

It is not recommended to initiate insulin perfusion pump therapy during pregnancy due to the risk of diabetic ketoacidosis and metabolic disruption during the adaptation period [1].

Women on previous insulin therapy should maintain it. Approximately 50% of the total insulin dose is administered as fast acting insulin before each meal ( $0.15 \times$  pregnant weight/dose), the remainder is administered as intermediate-acting insulin, divided between the morning and evening hours. Insulin needs may decline after 35 weeks.

Insulin is the main growth hormone regulator. Its receptors have maximum expression between 19-25 weeks. Thus, excessive fetal growth may become apparent for 26-28 weeks, which is why it is recommended to evaluate early growth [10]. The term macrosomia refers to a fetus with a greater than usual weight (fetal weight greater than Pc90) considering gestational age. In the reported case, excessive fetal growth became evident at 23 weeks, mirroring poor metabolic control. However, it is important to note that in this woman with irregular menstrual cycles, this pregnancy was dated at 6 weeks gestation and there is a possibility for an error that is less than 7 days.

There are currently no studies that allow fetal monitoring recommendations in diabetic pregnant women [12]. The American Congress of Obstetricians and Gynecologists (ACOG) suggest monitoring by counting movements perceived by the pregnant woman, biophysical profile and cardiotocography at appropriate gaps starting between 32 and 34 weeks [12]. Other authors recommend evaluation

beginning at 32 weeks, increasing the frequency to biweekly from 36 weeks to delivery [13]. In pregnancies complicated by growth restriction, oligohydramnios, pre-eclampsia or poor metabolic control, monitoring may begin at 26 weeks. Any deterioration of maternal state implies evaluation of fetal status. With this type of monitoring it is estimated that the frequency of intrauterine fetal death is approximately 3 in 1000 pregnancies in women with type 1 diabetes [14]. Intrauterine fetal death is currently a rare complication of diabetes in pregnancy, mainly due to the optimization of metabolic control [15].

In the presence of a non-reassuring fetal state related to a potentially reversible condition, such as hyperglycemia or ketoacidosis, reversal with medical treatment is recommended. When it seems to be attributed to non-reversible causes, gestational age and risk associated with prematurity should be weighed.

When preterm delivery is considered, depending on the degree of fetal compromise, fetal lung maturation should be performed in order to decrease the probability of respiratory distress syndrome in the newborn. This treatment causes transient hyperglycemic effect starting 12 h after the first dose of steroids and lasting up to 5 days, implying an intensification of surveillance and insulin therapy [16].

In pregnancies with good metabolic control, uncomplicated, labor should be induced between 39 and 40 weeks [12]. In the presence of suboptimal metabolic control or non-reassuring maternal or fetal condition, delivery will be scheduled for 37 weeks [17]. In exceptional cases of pregnant women with poor metabolic control, delivery at 34 weeks may be considered [17]. In this exceptional case, the multidisciplinary team decided pregnancy termination at 35<sup>+3</sup> weeks intensifying obstetric surveillance especially in last week, which allowed the early diagnosis of non-reassuring fetal status.

Regarding the route of delivery, the vaginal route is the one indicated [9]. For the decision between the induction of labor or elective cesarean, some factors should be considered such as gestational age, nulliparity, maternal obesity, history of traumatic delivery or macrosomia, Bishop's index, metabolic balance in pregnancy and the presence of changes in fetal growth, namely: Discrepancy between abdominal perimeter and cephalic perimeter greater than 50 mm, abdominal perimeter higher than the 95<sup>th</sup> percentile or fetal weight estimate greater than 4500 g in the term. If some of these conditions happen to be present, an elective cesarean section should be considered, as in the present case [18,19].

During the puerperium, the need for insulin decreases and the dose should be adjusted [9]. This is the best time to start effective contraception. Breastfeeding should be encouraged due to its known beneficial effects not only for the child but also for the mother. Maternal benefits include increased insulin sensitivity and weight loss [9].

T1D without vascular disease are eligible for the use of any contraceptive method [20].

## Conclusion

Women with type 1 diabetes have special requirements during the preconception, pregnancy and postpartum periods. Poor glycemic control during pregnancy is associated with adverse maternal and fetal outcomes.

Preconception counselling is essential to minimize pregnancy risks. The goals of preconception and pregnancy care should be tight glycemic control with a hemoglobin A1c 6-7%, without significant hypoglycaemia, as recommended by American Diabetes Association [8]. This will lower risks of congenital malformations, preeclampsia and perinatal mortality.

It becomes essential a close supervision and multidisciplinary approach that includes nutritionist, endocrinology, obstetric and psychology support in selected patients, allowing early detection of metabolic and obstetric complications.

Towards borderline cases such as those exposed, presenting with poor metabolic control and fetal repercussion, the risks and benefits of pregnancy termination before term should be weighed on an individual basis.

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