Diabetes mellitus in pregnancy

Diabetes mellitus is a chronic metabolic disease affecting protein, fat and carbohydrate metabolism. In the past, it was a problem to conceive or bear a healthy child with this serious disease. Nowadays, the situation has changed thanks to the introduction of insulin treatment. With proper preconception preparation and pregnancy management, pregnancy and delivery of a healthy baby are possible, but complications of diabetes (retinopathy and nephropathy) may occur during gestation. Perinatal and maternal mortality are comparable to the general population, but the **higher incidence of congenital developmental defects** in diabetic fetuses remains a problem.

Metabolic changes during pregnancy

Metabolism of carbohydrates

- Pregnancy is considered a diabetogenic condition. Gestational diabetes mellitus develops in 5% of pregnant women. Causes of impaired glucose tolerance in pregnancy:
- Increased insulin resistance and decreased pancreatic beta cell reserve (a condition exacerbated in the obese);
- increased production of endogenous glucose in the liver;
- increased production of hormones by the placenta (estrogens, progesterone, cortisol, leptin, tumour-necrosis factor).

Metabolism of fats

Liver glycogen stores are reduced, while the contribution of lipolysis to energy needs increases. Lipolysis produces non-esterified fatty acids, ketone bodies, triacylglycerols and cholesterol.

Transfer of substances through the placenta

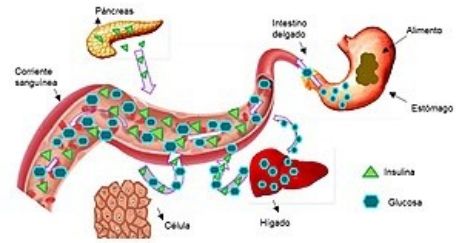
Substrates that ensure the growth and development of the fetus are transported across the placenta. The following processes occur:

- active facilitated glucose transport;
- active transport of amino acids;
- active transport of free fatty acids;
- diffusion of TAG and ketone bodies (ketone bodies can damage the fetus).

Classification of diabetes mellitus in pregnancy

1. Pregestational diabetes mellitus;
   - Type 1 DM;
   - Type 2 DM;
2. gestational diabetes mellitus;
3. other types of diabetes after pancreatic surgery, in endocrinopathies;
4. diabetes mellitus in previous pregnancies.

Risks to the fetus/newborn in maternal diabetes



Model of glucose-insulin interaction

The fetuses/newborns of mothers with diabetes are significantly affected by the level of maternal diabetes control in pregnancy. Neonatal consequences of inadequately compensated DM include:

- macrosomia (maternal hyperglycemia → fetal hyperinsulinemia);
- hypotrophy (small for gestational age, SGA, in renal, retinal and cardiac complications of the mother);
- metabolic disorders: hypoglycaemia in the first hours of life due to high plasma insulin levels, hypocalcaemia in the first days of life, hypomagnesaemia in maternal hypomagnesaemia);
- cardiorespiratory disorders: perinatal asphyxia, respiratory distress syndrome due to delayed lung matriculation and pulmonary surfactant, transient tachypnea of the newborn, hypertrophic cardiomyopathy and septal hypertrophy;
- haematological disorders: hyperbilirubinemia, polycythaemia and hyperviscosity;
- Congenital malformations (when DM is poorly compensated in the first trimester): congenital defects of the heart, kidneys, gastrointestinal tract, CNS and skeleton, abnormal facial appearance and microphthalmos.[1]

Intrauterine complications

- 1st trimester (spontaneous miscarriage, onset of Congenital developmental defects);
- 2nd trimester (disorders of psychomotor development);

- 3rd trimester (disorders of psychomotor development, diabetic fetopathy, IUGR, preterm birth, sudden infant death syndrome).

Postpartum complications

- early complications (manifestations of diabetic fetopathy, impaired psychomotor development);
- late complications (childhood impaired psychomotor development, impaired glucose tolerance, childhood obesity, adult diabetes, metabolic syndrome).

Spontaneous abortion in pregnant women with diabetes

Diabetic women have a higher risk of spontaneous abortion, especially uncompensated diabetes with hyperglycaemia and ketoacidosis preconceptionally and in the early weeks of pregnancy. Delayed growth is diagnosed on ultrasound examination. Silent miscarriage is also common.

VVV in pregnancy in diabetes

The occurrence of congenital developmental defects in fetuses remains the biggest problem in pregnancies of diabetic women. The occurrence of VVV is 2-3 times more frequent in them than in the healthy population and is directly related to poor compensation of diabetes (hyperglycemia, ketoacidosis). The higher the proportion of glycated hemoglobin in the first trimester, the higher the probability of developmental defects in the fetus. The majority of VVV arise and are diagnosed by the 7th week of gestation.

Acceleration of fetal growth

Newborns of diabetic mothers usually have a higher birth weight relative to gestational age compared to the healthy population. This is due to an increased supply of glucose, the amino acids arginine and leucine, IGF (insulin-like growth factor) and other growth factors. Growth acceleration is asymmetrical, with larger acres.

Intrauterine growth retardation (IUGR) of fetuses of diabetic mothers

Up to 20% of diabetic fetuses (3-7% in the healthy population) show growth retardation due to reduced fetal nutrition as a result of impaired blood flow through the placenta. Micro and macroangiopathies affecting, among other things, the placental circulation are to blame. The same etiology is also responsible for the development of pre-eclampsia and hypertension in pregnancy.

More detailed information can be found on the page Newborn of a diabetic mother.

Diabetes mellitus type 1

More detailed information can be found on the Type 1 Diabetes Mellitus page.

Preconception care

Type 1 diabetes affects about one percent of all pregnancies. In order to reduce the risks to the fetus as much as possible, it is advisable to start caring for a diabetic woman already preconceptually. Because of the increased risk of congenital developmental defects, it is necessary to explain to the woman the need for family planning and to recommend pregnancy only after perfect compensation of the internal environment (glycaemia, glycated haemoglobin, ketoacidosis). With good compensation preconceptionally and throughout the pregnancy, the chance of having a healthy baby is 95%. With severe complications of diabetes (for example, macroangiopathy), pregnancy is not recommended.

Symptoms of diabetes mellitus

Diabetes care and therapy in pregnancy in type 1 diabetic women

The following factors contribute to the maintenance of normoglycaemia:

- appropriate dietary regimen, optimization of nutrient intake, stabilization of metabolism;
- treatment with insulin, exclusively human;
- intensified regimen (s.c. administration 4-6 times a day) or insulin pump;
- insulin requirement decreases slightly until week 12-14, then increases until week 32. From then on it is stable until 1-2 weeks before delivery, when it decreases slightly;
- self-monitoring by glucometer;
- fasting glucose 3.5-5.5 mmol/l, glucose 1 hour after meal up to 7.8 mmol/l, HbA1c up to 5.5 mmol/l.

Monitoring type 1 diabetic women in pregnancy

- It is necessary to pay attention to physical activity and proper lifestyle;
- Consultations in the 1st trimester every 3 weeks, then every two weeks, from the 34th week every week with

CTG;
- Hospitalization at 37-38 weeks (always checking BP, urine, maternal weight, edema);
- Repeat ultrasound every 3-4 weeks (biometry, flowmetry);
- early genetic and ultrasound screening at 11-13 weeks; detailed genetic ultrasound at 22 weeks;
- optimally spontaneous delivery at term, but higher risk of SC.

Diabetological monitoring of pregnant women with type 1 DM

- Glycemic profile daily to 1x weekly;
- Glycated haemoglobin every 4-6 weeks;
- renal function and proteinuria at each trimester;
- urine bacteriology at each trimester;
- ocular background examination at least 2 times in pregnancy;
- thyroid examination 1-2 times in pregnancy;
- neurological examination as needed.

Gestational diabetes mellitus

Capillary blood collection

Gestational diabetes mellitus (GDM) is a disorder of glucose metabolism of varying degrees that occurs during pregnancy and resolves spontaneously during the sixth week of life. In addition to GDM, overt diabetes mellitus (also called DM) can be detected in pregnancy, which meets the diagnostic criteria for diabetes in the general population and usually persists after the sixth week. The care of pregnant women with overt diabetes is identical to that of pregnant women with **pregestational diabetes.**[2]

All pregnant women, except those already being treated for diabetes, undergo a **two-stage GDM screening** by an outpatient gynaecologist. In the first trimester of pregnancy (up to 14 weeks), fasting **venous glucose is determined**. If a pregnant woman has a fasting glucose ≥ 5.1 mmol - l-1 repeatedly (i.e. 2 days in a row), she is diagnosed with GDM, no longer needs to undergo oGTT and is referred to a diabetologist. All women with a negative result in the first trimester then undergo a three-point oral glucose tolerance test (oGGT) with a 75 g glucose load between 23 + 1 and 27 + 6 weeks of gestation if their fasting glycaemia is less than 5.1 mmol - l-1. Normal glycaemias on oGTT are < 10.0 mmol - l-1 at minute 60 and < 8.5 mmol - l-1 at minute 120. At higher values, GDM is diagnosed and the woman is referred to diabetology. Diet, metformin or insulin is used to control glycaemia depending on the severity of GDM. [2]

Obstetric care for pregnant women with GDM

- Counseling rooms similar to healthy, at the term of childbirth more often;
- Ultrasound checks with flow measurement (flowmetry) as in healthy at term plus check;
- delivery between 40 and 41 weeks of gestation (induction);
- from 38 weeks of gestation, regular CT scan;
- Diabetes screening (OGGT) required after delivery (but not before the end of the six-week gestation period); possibility of latent type 1 or type 2 diabetes present during pregnancy.

For more detailed information, see Gestational diabetes mellitus.

Links

Used literature

- KREJČÍ, Vratislav. *Patologické stavy v těhotenství* [lecture for subject Předstátnicová stáž z gynekologie a porodnictví, specialization všeob. lékařství, 1. LF UK]. Praha. 2011.

References

1. GOMELLA, TL, et al. *Neonatology : Management, Procedures, On-Call Problems, Diseases, and Drugs.* 7. edition. Lange, 2013. pp. 709-714. ISBN 978-0-07-176801-6.
2. Česká gynekologická a porodnická společnost. Gestační diabetes mellitus. - [online]. 2019, y. -, vol. -, p. - , Available from <http://www.gynultrazvuk.cz/data/clanky/6/dokumenty/2019-05-gestastacni-diabetes-mellitus-dp-cgps-cls-jep-revize.pdf>.