

MEDICAL MANAGEMENT OF DIABETIC PREGNANCY

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The main factor in the progressively improving results of diabetic pregnancies is the stricter control of the maternal blood glucose, but advances in obstetric and paediatric care have also been important. In the study by Goldman and colleagues (1981) in Israel the main improvement in perinatal mortality and morbidity followed the introduction of self monitoring of blood glucose. There was still, however, an excess incidence of fetal malformations in diabetic pregnancies, e.g. 5.7% in 664 such pregnancies versus 1.8% in 224 gestational diabetic pregnancies (British Survey of Diabetic Pregnancies-Beard and Lowy 1982), presumably because the diabetic control was not optimal during the first ten weeks or so of pregnancy. *Self monitoring* of blood glucose means that diabetic control can be very good without the need for prolonged admission to hospital giving considerable financial and social benefits. The glucose oxidase test strips for blood glucose measurement can be read visually or in photoelectric meters, the former offering simplicity, portability and economy and the latter greater accuracy. The visual method may be made much less costly by cutting each strip longitudinally into two or three. In Aberdeen BM-test Glycaemia 20-800 strips are used two or three times a day when planning a pregnancy, three or four times a day during its early stages and four or five times a day in the last trimester. Meters are used if the patient finds objective recording of the visual reading difficult. The results are recorded graphically on special charts with the desirable range of preprandial blood glucose levels shaded in at 3-7 mmol/l. The patient's accuracy of self monitoring is checked occasionally by comparing their results with those of a Beckman glucose analyser on the same sample of blood. The patient is trained how to make minor *adjustment in her insulin dose* on a basis of her results. The urine is tested only for ketones if the blood glucose rises above 10 mmol/l or in the presence of any infection or stress. A significantly positive result usually warrants early admission to hospital, as *the fetus tolerates maternal ketosis* poorly but hypoglycaemia well. The patient and her husband are instructed how to treat and prevent hypoglycaemia while the diabetic control is so tight.

Careful adjustment of insulin dose can be effective only if the patient is correspondingly well educated about her diet. A well controlled diabetic woman of normal weight needs only some extra 60 kcal a day in the first two trimesters of pregnancy, increasing to nearly 300 kcal a day in the last trimester. Just as in the non-pregnant, the high fibre content of the diet should be planned and a low proportion of saturated to unsaturated fat. Even the obese should take at least 1800 kcal a day and about 70 g of protein a day in the last half of pregnancy. *Complications* of diabetes are best sought before the patient becomes pregnant or in early pregnancy, remembering that the levels of serum urea and creatinine are normally lower in the pregnant than in the non-pregnant state. Renal impairment noted in the first trimester is the main indication for the therapeutic abortion in the diabetic mother who would not be expected to survive long enough to care for her child over the normal period of dependency on her. The optic fundi are carefully examined for retinopathy and retinitis proliferans in particular, since *pregnancy carries an increased risk of intraocular haemorrhage*. Photocoagulation should be given where indicated early in pregnancy.

The aim of *treatment of diabetic patients having insulin* is to achieve near normal blood glucose levels throughout each 24 hour period by methods which avoid building up high levels of insulin antibodies. *Congenital malformations* occur mainly in pregnancies where the diabetes has been poorly controlled from the time of conception and for the following 7 or 8 weeks. This can be inferred by the retrospection of two months or so provided by the measurement of levels of glycosylated haemoglobin (HbA1). Meticulous control of the diabetes starting before pregnancy has been shown by Fuhrmann and coworkers (1983) to have reduced the rate of congenital anomalies from 7.5% in 292 pregnancies where strict control started after the eighth week of gestation to only 0.8% in 128 pregnancies with excellent control antedating conception. Several centres have now established pre-pregnancy clinics for diabetic women to extend this advance.

Serial measurements of HbA1 or HbA1C are valuable to check the reliability of self-monitored blood glucose values and are not expensive if a colorimetric method is used.

Insulin treatment for the pregnant diabetic woman should be with only the less antigenic preparations (purified porcine or human), since, although there is no appreciable transfer of insulin across the placenta, *IgG insulin* antibodies are freely transferred. Furthermore there is evidence that high levels of insulin antibodies can stress the fetal pancreas and increase the morbidity of the infants. Since insulin antibodies can persist for many months or even years it is desirable to use insulins of low immunogenicity for all women of childbearing age. A refinement of insulin administration is to use continuous subcutaneous insulin infusion (CSII) and it can certainly produce excellent control of the blood glucose at the cost of less frequent self-monitoring than would be required for equally good control to be obtained by conventional methods. CSII may induce unexpected hypoglycaemia and is relatively expensive, not only for the supply of the pump but for the period of initial stabilisation in hospital. Fail-safe procedures are needed to prevent unexpected escape from diabetic control. Roversi has used a very inexpensive method. He finds the maximum tolerated dose of insulin for each pregnant diabetic patient, that is the dose which just produces hypoglycaemic symptoms, and then reduces the dose to be used to just below that level. The maximum tolerated dose increases in the third trimester so needs to be reassessed from time to time. It is worth remembering that the times of delivery can also be judged inexpensively by using the relatively *simple "shake"* test (Clements et al. 1972) on amniotic fluid after about the 36th week of gestation.

The management of diabetes during labour involves using an infusion of glucose (preferably 5%) at a rate of about 200 ml/hour with soluble (preferably pure porcine or human) insulin given by infusion pump at a rate of 1-4 units/hour although frequent subcutaneous injections can be used if no pump is available. The blood glucose is measured every hour or so by a glucose oxidase strip and the rate of glucose infusion adjusted to maintain blood levels of 4-6 mmol/l. The exertions of labour reduce requirement of insulin, but there is always a sudden further fall after the separation of the placenta with a return to near the pre-pregnancy dose. An advantage of the combined glucose and low dose insulin infusion system is that it is appropriate also if a decision is later made to perform a Caesarean section.

The control of diabetes may be very difficult if special measures are taken to postpone or treat pre-term labour. These may include the intravenous use of sympathomimetic drugs, such as Ritodrine or Salbutamol to inhibit the onset of labour and the administration of high doses of carbohydrate-active steroids to facilitate the formation of surfactant in the premature infant. Both manoeuvres tend to raise the blood glucose level sharply and may be used simultaneously. Then insulin may be needed in doses of up to 32 u/hour by continuous IV infusion.

The outcome of pregnancy depends on the combined efforts of the physician, obstetrician and paediatrician and in large teaching centres in Europe the perinatal mortality has been much reduced in the last 40 years to less than 30 per 1,000. In short the care of a diabetic pregnancy offers great advantages from motivation and education of the patient from even before the time of conception and from close co-operation between an interested physician and obstetrician during gestation before handing over the baby to the care of a well-informed paediatrician. The complications of diabetic pregnancy are many and yet they can largely be prevented by a first-class care over a period of about ten months. This fact gives hope that good control can be equally effective over longer periods for the prevention of the classical complications of diabetes.