The Australasian Diabetes in Pregnancy Society

Gestational diabetes mellitus -- management guidelines

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Synopsis

- GDM is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy.
- Universal screening is recommended. If selective screening is considered more appropriate (because of limited resources or known low GDM incidence), screening may be reserved for those at higher risk. Risk factors include glycosuria, age over 30 years, obesity, family history of diabetes, past history of GDM or glucose intolerance, previous adverse pregnancy outcome and belonging to a high risk ethnic group.
- The recommended screening test for GDM is performed at 26-28 weeks' gestation and positive results are: 1 hour venous plasma glucose level 7.8 mmol/L after a 50 g glucose load (morning, non-fasting); or 1 hour venous plasma glucose level 8.0 mmol/L after a 75 g glucose load (morning, non-fasting).
- Confirmation of diagnosis after a positive screening test: a 75 g oral glucose tolerance test (fasting) with a venous plasma glucose level at 0 hours of 5.5 mmol/L and/or at 2 hours of 8.0 mmol/L.*
- Patient education is very important and a team approach, if available, is beneficial.
- Dietary therapy is the primary therapeutic strategy, with insulin added where required to achieve the minimum goals for glycaemic control: fasting blood glucose <5.5 mmol/L, 1 hour postprandial <8.0 mmol/L or 2 hour postprandial <7.0 mmol/L.
- Careful antepartum fetal surveillance is essential. Continuation of the pregnancy in uncomplicated GDM *to term* [a] is acceptable provided that indications from fetal monitoring are reassuring.
- Close neonatal monitoring is important, particularly for the detection of hypoglycaemia.
- Maternal follow-up, with an oral glucose tolerance test, should be performed 6-8 weeks postpartum, then at least *every 1-2 years for women with normal glucose tolerance and the potential for further pregnancies, and every 3 years If pregnancy is not possible, and more frequent retesting depending on clinical circumstances, because of the increased risk of developing permanent diabetes.* [b]
- Prospective trials are needed to clarify whether universal screening is justified, and to determine the degree of maternal hyperglycaemia that causes an adverse outcome for the offspring.

The management strategies in this article have been the subject of widespread discussion with the ADIPS membership between 1991 and 2002 at annual scientific meetings, annual general meetings, and in ADIPS newsletters. They represent the majority opinion.

* Cut-off point for Australia; cut-off point in New Zealand 9.0 mmol/L.

Introduction

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy.[1] Women with GDM are a heterogeneous group and may include those with unrecognised pre-existing non-insulin-dependent diabetes (type 2) and also a small number with insulin-dependent diabetes.

The presence of GDM has implications for both the baby and the mother. Although there is no evidence that perinatal mortality is increased in pregnancies with treated GDM, some studies have shown perinatal mortality to be increased in untreated GDM.[2-4] GDM is associated with increased perinatal morbidity, the characteristics of which are the same as for infants of mothers with overt diabetes (eg, macrosomia, neonatal hypoglycaemia, hyperbilirubinaemia, respiratory distress syndrome).[5] In considering longer term outcomes for the baby, evidence is gradually mounting that GDM adds an intrauterine environmental risk factor to an already increased genetic risk for the development of obesity and/or diabetes.[6-8] In one follow-up study insulin therapy for GDM was associated with less adiposity in the offspring.[9] For the mother, GDM is a very strong risk factor for the development of permanent diabetes later in life (49.9% with up to 28 years' follow-up).[10]

Screening

There has been much debate about whether universal or selective screening of pregnant women for GDM is more appropriate.[11-13] Moses and Colagiuri recently estimated that, between 1991 and 1994, 50% of pregnant women in New South Wales were not screened for gestational diabetes.[14]

The Australasian Diabetes in Pregnancy Society (ADIPS) recommends that screening for GDM should be considered in all pregnant women. However, if resources are limited, screening may be reserved for those at highest risk. Risk factors include:

- Glycosuria;
- Age over 30 years;
- Obesity;
- Family history of diabetes;
- Past history of GDM or glucose intolerance;
- Previous adverse pregnancy outcome; and
- Belonging to an ethnic group with a high risk for GDM.

Ethnicity is a particularly important factor determining incidence of GDM (eg, very high risk -- Australian Indigenous, Polynesian and South Asian [Indian] groups; moderate high risk -- Middle Eastern and other Asian groups).[15]

Most Australian centres report a GDM incidence of 5.5%-8.8%.[16-19]

When selective screening is deemed more appropriate because of known low GDM incidence, the ADIPS criteria are similar to those recommended by the American "Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus".[20] A recent article by Naylor et al[21] derived a risk factor scoring system that excluded the need for screening up to a third of pregnant women. However, complex criteria for selective screening may cause difficulties in busy clinical practice.

A summary of the screening and diagnostic procedures recommended by ADIPS is given in the Table.

Procedures for screening and diagnosis of gestational diabetes mellitus (GDM)

Indication	Optimal gestation for testing	Test	Diagnostic criteria — venous plasma glucose level (mmol/L)
Clinical suspicion of GDM	Any time	75 g OGTT (fasting)	0 hours > 5.5 2 hours > 8.0 (Aus) 2 hours > 9.0 (NZ)
Screening	26–28 weeks	50 g glucose load (morning/non-fasting)	1 hour > 7.8
		75 g glucose load (morning/non-fasting)	1 hour > 8.0
Confirmation of diagnosis after a positive screening test	26–30 weeks	75 g OGTT (fasting)	0 hours > 5.5 2 hours > 8.0 (Aus) 2 hours > 9.0 (NZ)

OGTT = oral glucose tolerance test.
Aus = cut-off for Australia; NZ = cut-off for New Zealand (see text).

Diagnosis

The guidelines for diagnosing GDM in Australia are essentially unchanged from those recommended for use in Australasia in 1991.[22] Although there are no uniform international criteria for the diagnosis of GDM, commonly used criteria are those of O'Sullivan and Mahan[23] and the World Health Organization (WHO).[24] One problem with the development of absolute diagnostic criteria is the lack of evidence that perinatal mortality is increased in pregnancies associated with mild degrees of hyperglycaemia. The commonly used diagnostic criteria were not formulated to assess the risk of adverse perinatal outcomes, although this was a factor taken into account in the diagnostic criteria at the Mercy Hospital for Women, Melbourne.[4] The existence of different methods of performing glucose tolerance tests has also hindered the development of uniform diagnostic criteria for GDM.
After consensus, ADIPS has endorsed the diagnostic criteria developed by the working party chaired by Dr F I R Martin in 1991, which are modified WHO criteria.[22] In New Zealand, the 2 hour oral glucose tolerance test (OGTT) cut-off value for a positive diagnosis is a venous plasma glucose level of 9.0 mmol/L. This figure was chosen by a majority decision of specialists at the 1992 meeting of the New Zealand Society for the Study of Diabetes. They chose the higher figure to reduce the worry and inconvenience for women of being given a false positive diagnosis and to reduce the strain on stretched specialist resources in many centres. ADIPS recognises the importance of working towards an Australasian consensus on this issue.

If the clinical suspicion of GDM is high, a diagnostic OGTT is indicated, irrespective of the stage of pregnancy. In such circumstances, if an OGTT gives normal results early in pregnancy the test should be repeated between 26 and 30 weeks' gestation. A 75 g OGTT should use 75 g of anhydrous glucose or the equivalent, and preferably should also be performed after a high carbohydrate diet of at least 150 g of carbohydrate for three days.

Management of GDM

A team approach is ideal for managing women with GDM and, if available, should be used. The team would usually comprise an obstetrician, diabetes physician, a diabetes educator (diabetes midwifery educator), dietitian, midwife and paediatrician. In practice, however, the team

approach is not always possible due to limited resources. In such circumstances, management by an obstetrician or obstetric general practitioner knowledgeable in GDM management, often with the assistance of an appropriately skilled dietitian, diabetes educator or midwife, is acceptable.

Patient education

The importance of educating women with GDM (and their partners) about the condition and its management cannot be overemphasised.
Compliance with the treatment plan depends on the patient's understanding of:

- The implications of GDM for her baby and herself;
- The dietary and exercise recommendations; and
- The how and when as well as the goals of self monitoring of blood glucose level.

Care should be taken to minimise the anxiety of the women.

Glycaemic control

Dietary therapy: Dietary therapy is the primary therapeutic strategy for the achievement of acceptable glycaemic control in GDM. All women should receive nutritional advice, preferably from an appropriately skilled dietitian. However, it is important to avoid a severe calorie-restricted diet, as this can predispose to ketonuria, and also to infants that are small for their gestational age, which carries an increased risk of diabetes in later life.[25]
The diet needs to:

- Conform with the principles of dietary management of diabetes in general;
- Meet the nutritional requirements of pregnancy;
- Be individualised for each patient, depending on maternal weight and body mass index; and
- Be culturally appropriate.

Moderate exercise has recently been recognised as an adjunct therapy, with potential benefits when used together with diet, or diet and insulin therapy, in the management of gestational diabetes in women without a medical or obstetric contraindication.[26]

Monitoring: Glycaemic control needs to be monitored. Self monitoring of blood glucose level is the optimal method and is well tolerated by most women. On commencement of self monitoring, at least one fasting and one 1 or 2 hour postprandial glucose level should be obtained daily. The frequency may be decreased or increased depending on the results of the blood glucose monitoring and the progress of the pregnancy. If self monitoring is not possible, fasting and 1 or 2 hour postprandial laboratory capillary blood or venous plasma glucose levels should be performed regularly (at 1 to 2 weekly intervals). In pregnancies complicated by GDM, the value of self monitoring of blood glucose and appropriate insulin therapy in the prevention of macrosomia and its associated perinatal complications has previously been demonstrated.[27,28]
The minimum goals for glycaemic control are:

- a fasting capillary (venous plasma) blood glucose level <5.5 mmol/L
- a 1 hour postprandial capillary (venous plasma) blood glucose level <8.0 mmol/L
- a 2 hour postprandial capillary (venous plasma) blood glucose level <7.0 mmol/L.

These minimum goals have been set on the basis of informed consensus opinion in Australasia and vary little from those of the American Diabetes Association clinical practice recommendations on gestational diabetes (fasting glucose 5.8 mmol/L and 2 hour postprandial plasma glucose 6.7 mmol/L).[29] The setting of minimal goals for glycaemic control is controversial, however, as some, but not all, studies show benefit from tight glycaemic control in women with GDM.[27,28,30-32] The reasons for the variance in results between studies may relate to

differences in the underlying rates of GDM complications from one study population to another. The recommended fasting glycaemia goal of <5.5 mmol/L is supported by Langer et al, who have shown that rates of large-for-gestational-age (LGA) infants are increased in diet-treated GDM pregnancies if the fasting glucose level is between 5.3 and 5.8 mmol/L (28.6% LGA) compared with 5.3 mmol/L (5.35% LGA).[32] Insulin treatment was shown to reduce the rates of LGA infants to 10.3% in GDM pregnancies with fasting glucose levels between 5.3 and 5.8 mmol/L.[32] In support of the 1 and 2 hour postprandial glycaemic goals of <8.0 and <7.0 mmol/L, respectively, it has been shown that glycohaemoglobin (HbA_{1c}) levels, birth weight, and rates of macrosomia, neonatal hypoglycaemia and caesarean section (for cephalopelvic disproportion) can all be significantly reduced in insulin-treated GDM subjects if insulin therapy is adjusted according to 1 hour postprandial, rather than preprandial, glucose measurements, aiming for <7.8 mmol/L.[27]

HbA_{1c} levels may be used as an ancillary test, as assurance that the self monitored blood glucose results are appropriate. Fructosamine levels are reduced during pregnancy because of the dilutional effect of pregnancy on plasma proteins. HbA_{1c} and fructosamine are not reliable substitutes for self monitoring of blood glucose level.

Insulin therapy: Insulin therapy should be considered if the blood glucose goals are exceeded on two or more occasions within a 1 to 2 week interval, particularly in association with clinical or investigational suspicion of macrosomia. However, the benefit of instituting insulin therapy after 38 weeks' gestation is unproven.
Human insulin should be used. No insulin preparations have a pregnancy category listing, except for the new, rapidly acting insulin analogue lispro, which is Category B2 (Australian medicines in pregnancy category). Two cases of congenital malformations were recently noted in women with insulin-dependent diabetes treated in pregnancy with lispro.[33] The number of women treated with lispro in pregnancy is small to date, but no causative relationship between lispro and teratogenicity has been documented. In general, the insulin preparations and dosage schedules should be tailored to the abnormalities present in the glycaemic profile (eg, postprandial and/or fasting hyperglycaemia) and patient acceptability. The doses may be higher than those required in non-pregnant subjects and should be reviewed frequently so that adequate glycaemic control is achieved rapidly. Care should be taken to minimise the risk of hypoglycaemia, especially nocturnal episodes.
Oral hypoglycaemic agents have no place in treatment of GDM under normal circumstances.

Fetal surveillance

The timing of commencement and the frequency of fetal monitoring in pregnancies complicated by GDM depend on the presence of other pregnancy complications such as pre-eclampsia, hypertension, antepartum haemorrhage and intrauterine growth retardation. The regimen chosen should be dictated by the severity of the obstetric complication. Monitoring may be by either Doppler umbilical bloodflow measurement or cardiotocograph (CTG). Although CTG surveillance is commonly undertaken routinely from around 36 weeks' gestation, there is no objective evidence that fetal monitoring in uncomplicated GDM affects fetal outcome.[34] Common practice in the United States is to commence CTG monitoring after 40 weeks' gestation, while awaiting spontaneous onset of labour in uncomplicated GDM pregnancies,[35] but again there is no evidence-based medicine to support or refute this practice.

Ultrasonography should be considered at around 34 weeks' gestation to detect abnormalities of fetal growth and polyhydramnios. It may be indicated earlier in some women, for example for women unsure of their dates, or those with morbid obesity or suspected undiagnosed non-

insulin-dependent diabetes. Ultrasonography may need to be repeated if any abnormality is detected.

Timing of delivery

The possibility that diagnosis of GDM may lead to increased obstetric intervention, including induction of labour and caesarean section,[36] is a concern. Delivery before full term is not indicated unless there is evidence of macrosomia, polyhydramnios, poor metabolic control or other obstetric indications (eg, pre-eclampsia or intrauterine growth retardation).[37] Continuation of the pregnancy in uncomplicated GDM to ***full term*** [a] is acceptable provided that indications from fetal monitoring are reassuring.

Delivery

During labour, good glycaemic control needs to be maintained while avoiding hypoglycaemia. Lower insulin requirements are common during labour (often no insulin is necessary). Fetal surveillance is needed, as it is for any high risk pregnancy. A paediatrician should be present at the delivery if significant neonatal morbidity is suspected. The maternal blood glucose level should be monitored for 24 hours postpartum and, if indicated, continued for longer.

Neonatal management

The neonates of mothers with GDM are at risk of all the complications of infants born to mothers with overt diabetes, particularly those infants born macrosomic (birth weight >4000 g).[38] The neonates should be observed closely after delivery for respiratory distress. Capillary blood glucose should be monitored at 1 hour of age and before the first four feeds (and for up to 24 hours in high risk neonates). Currently, some amperometric blood glucose meters are acceptable for use in neonates, provided that suitable quality control procedures and operator training are in place. A neonatal blood glucose level <2.0 mmol/L needs to be verified by repeat testing (laboratory verification is preferred but should not delay the initiation of treatment). Levels <2.0 mmol/L should be considered abnormal and treated. If the baby is obviously macrosomic, calcium and magnesium levels should be checked on Day 2. Breastfeeding is actively encouraged.

Maternal follow-up

It is important that women with GDM be counselled with regard to their increased risk of developing permanent diabetes. They should be made aware of the symptoms of hyperglycaemia. Advice should be given about the importance of healthy eating and exercise patterns. Contraceptive advice should be given in the puerperium, and women should be advised to plan future pregnancies and be reviewed medically by their general practitioner before conception (a pre-conception OGTT should be considered).

- *All women with previous GDM to be offered testing for diabetes with a 75 g OGTT 6-8 weeks after delivery;*
- *Repeat testing should be performed every 1-2 years among women with normal glucose tolerance and the potential for further pregnancies;*
- *If pregnancy is not possible, follow-up testing should be performed every 3 years, with more frequent retesting depending on clinical circumstances (eg, ethnicity, past history of insulin treatment in pregnancy, recurrent episodes of GDM).* [b]

Impaired glucose tolerance merits careful follow-up, which should include at least twice-yearly checks for frank diabetes in addition to assessment of other risk factors for macrovascular disease.

The rates of development of permanent diabetes are much higher in several non-European ethnic groups. For example, the prevalence of type 2 diabetes in Polynesian women having a postpartum OGTT has been reported to be 30%.[39] Life-table analysis in a cohort of Latino women shown to have normal glucose tolerance in the postpartum period after pregnancy complicated by GDM revealed a 47% cumulative incidence of type 2 diabetes 5 years after delivery.[40] Similarly, 62% of women in Trinidad have been reported to develop type 2 diabetes after 3.6-6.5 years of follow-up.[41] Follow-up OGTTs, therefore, should be more frequent than every two years in those groups at highest risk.

Directions for future research

ADIPS emphasises that, due to a lack of good quality randomised controlled clinical trials in the area of GDM, these guidelines are based on what is a reasonable consensus of informed opinion in Australasia. They are designed as a guide to practical management rather than a strict protocol. It is expected that the guidelines will not be static but will evolve as the results of clinical trials become available.

Carefully designed, randomised controlled clinical trials are needed in order to determine:

- Whether universal screening programs are warranted;
- The optimal criteria for diagnosis of GDM;
- The costs v. benefits of the team approach;
- Optimal management (eg, clarification of the indications for insulin therapy);
- The role of follow-up programs for affected mothers and babies; and
- Possible interventions to reduce the rates of development of permanent diabetes in the mother.

One such trial is the prospective Australasian Carbohydrate Intolerance Study in Pregnancy (ACHOIS), which aims to clarify what degree of maternal hyperglycaemia results in specific adverse outcome. In the design of these trials consideration needs to be given not only to perinatal outcome, but also to the potential long term benefits of diagnosis and treatment for both the baby and the mother.

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Endnotes

(a) Revision of guidelines for the management of gestational diabetes mellitus, Jeremy J N Oats, H David McIntyre on behalf of the Australasian Diabetes in Pregnancy Society, in conjunction with the Women's Health Committee of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists, February 2003.
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(b) Guidelines for the management of gestational diabetes mellitus revisited by David S Simmons, Barry N J Walters, Peter Wein, N Wah Cheung on behalf of the Australasian Diabetes in Pregnancy Society, December 2002.
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