Gestational diabetes: A practical guide

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Article points

1. Gestational diabetes (GDM) is important to diagnose, not only because treating it reduces maternal and fetal morbidity, but also because it is a modifiable risk factor for mother and baby's risk of developing diabetes in the future.
2. National and international guidelines differ in their advice on screening, diagnosis and management of GDM, so it is important to be familiar with local policies.
3. Management of GDM involves education, home blood glucose monitoring and, potentially, oral medication and/or insulin. Close contact is needed to provide support both during the pregnancy and afterwards.

Key words

- Gestational diabetes
- Guidelines
- Women's health

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Gestational diabetes (GDM) is associated with a range of maternal and fetal complications. Differences in screening, diagnostic and treatment criteria, both globally and within the UK, mean that GDM remains a controversial area. This article provides a broad overview of the topic, with a particular focus on areas of interest to diabetes specialist nurses, as well as examples of ideas that have been implemented in the author's service to improve outcomes.

Gestational diabetes (GDM) can be defined as carbohydrate intolerance of varying severity first recognised during pregnancy (National Diabetes Data Group, 1979). This definition can include women with previously undiagnosed diabetes as well as those who become transiently hyperglycaemic as a result of pregnancy-induced insulin resistance. GDM is associated with a range of maternal and fetal complications, including hypertension, caesarean section, shoulder dystocia and macrosomia (Casey et al, 1997).

Differences in diagnostic and treatment criteria mean that GDM remains a controversial area. This article aims to provide a broad overview of the topic, concentrating on areas that are of interest to diabetes specialist nurses, irrespective of where they practice in the UK. The differences between the NICE and SIGN guidelines (the latter based on World Health Organization [WHO] and International Association of the Diabetes and Pregnancy Study Groups [IADPSG] recommendations) are considered, as well as some innovative ideas designed to provoke thought rather than be prescriptive.

Diagnostic criteria

O'Sullivan and Mahan (1964) defined diagnostic criteria using a 100 g oral glucose tolerance test (OGTT) based on women's risk of developing diabetes. Their criteria are still used in the US today, but more recently the WHO recommended the use of a 75 g OGTT (WHO, 1980).

It is only in the last decade that evidence has been published showing that there is benefit to treating GDM (Crowther et al, 2005; Landon et al, 2009) and an attempt has been made to define the maternal and fetal risks. The HAPO (Hyperglycaemia and Adverse Pregnancy Outcomes) study was a landmark trial in which 75 g OGTTs were conducted in pregnant women to determine the associations of fasting, 1-hour and 2-hour glucose levels with maternal and fetal outcomes such as caesarean section, macrosomia and neonatal hypoglycaemia (HAPO Study Cooperative Research Group, 2008). The authors found a continuous relationship between glucose levels at all three time points and adverse outcomes, even at glucose levels considered to be normal. Thus, the IADPSG Consensus Panel (2010) developed diagnostic criteria based on these findings, setting the following thresholds:

- Fasting glucose: ≥5.1 mmol/L.
- 1-hour glucose: ≥10 mmol/L.
- 2-hour glucose: ≥8.5 mmol/L.

At last there seemed to be a consensus for diagnosing GDM, and the criteria were quickly adopted by WHO. They now form the basis of the SIGN (2010) guidance in Scotland and the Health Service Executive (2010) guidelines in Ireland.

As these criteria came into use in the UK, the potential impact started to become clear, with some units estimating that adopting them would treble the prevalence of GDM (Cundy et al, 2014). Some have also questioned the cost-effectiveness of treating women with only minimally elevated glucose levels. NICE addressed this by undertaking a cost–benefit analysis, which led to the conclusion that diagnostic criteria should be based on a 75 g OGTT, with GDM diagnosed at the following thresholds (NICE, 2015):

- Fasting glucose: ≥5.6 mmol/L.
- 2-hour glucose: ≥7.8 mmol/L.

Both SIGN and NICE agree on screening for GDM at 24–28 weeks' gestation depending on the set of risk factors listed in *Box 1*. At 24–28 weeks, the impact of pregnancy-induced changes in insulin resistance are usually apparent, but there is still sufficient time to treat elevated glucose levels and impact on pregnancy outcomes.

In addition to the differences in diagnostic thresholds, NICE and SIGN differ in their advice on how to screen at a population level in response to glycosuria, and on the early screening of women with a previous history of GDM. These differences are summarised in *Table 1*. In England, many have welcomed the attempt to balance risk with limited resources; however, there is a concern that adopting NICE rather than the IADPSG/WHO criteria will result in a number of at-risk women "falling through the net" (Meek et al, 2015).

As units may choose to adopt different aspects of the guidelines, it is important for clinicians to be familiar with local policies. Irrespective of the criteria used, the number of women with GDM is increasing, and centres will need to design innovative solutions for an increasing workload. With the potential impact on workload and the questions about cost-effectiveness, in Derby we opted to wait for NICE (2015) before implementing new guidance, and we are currently revising our service to take on these recommendations and workload implications. In the discussions regarding management below, I have shared some of our thoughts.

Box 1. Risk factors that should trigger an oral glucose tolerance test for gestational diabetes at 24–28 weeks (SIGN, 2010; NICE, 2015).

- BMI >30 kg/m^2.
- Previous neonate weighing ≥4.5 kg.
- Previous gestational diabetes.
- Family history (first-degree relative) of gestational diabetes.
- Minority ethnic family origin with high prevalence of diabetes.

Management of GDM

Once a woman is diagnosed with GDM, NICE (2015) recommends that she be seen by the specialist diabetes and obstetrics team within a week. This is an intensive period in which the woman receives the following:

- Advice as to the risks of diabetes and pregnancy and the fact that controlling blood glucose can reduce these risks.
- Education about home blood glucose monitoring. She may be asked to check blood glucose before and 1–2 hours after meals, as well as at bedtime: up to seven tests a day. The exact frequency varies between the guidelines and is an example of where an understanding of local practice is needed, and it also needs to be tailored to individual needs. NICE recommends the seven tests above for women on multiple-dose insulin regimens, and fasting and 1-hour postprandial testing for other treatments.
- Advice to improve their understanding of the dietary and lifestyle changes needed to optimise glucose control.

This is an emotional time for the mother, and it is easy to lose sight of this when trying to undertake these consultations in busy diabetes and obstetrics clinics. Some centres have started to use group education sessions to allow women to meet others in similar situations, reduce

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1. NICE and SIGN guidelines both recommend using a 75 g oral glucose tolerance test to screen for gestational diabetes (GDM) at 24–28 weeks in women at risk; however, they differ in their diagnostic criteria.
2. The guidelines also differ in their advice on how to screen at a population level in response to glycosuria, and on the early screening of women with a previous history of GDM.
3. Once diagnosed with GDM, women should receive education on the associated risks, blood glucose monitoring and the diet and lifestyle changes needed.

Table 1. Differences between NICE and SIGN recommendations on population screening, diagnostic thresholds and treatment targets for gestational diabetes.

	Population and early screening	Later screening	Treatment targets
SIGN (2010) (based on WHO/IADPSG)	Fasting glucose or HbA_{1c} test at booking in those at risk, to exclude overt diabetes If intermediate glucose levels at booking, assess need for home glucose monitoring and repeat OGTT at 24–28 weeks' gestation if needed Fasting glucose test in all women at 24–28 weeks	Fasting glucose test in low-risk women at 24–28 weeks OGTT in women with risk factors at 24–28 weeks Diagnosis if any of the following plasma glucose criteria are met: • Fasting: ≥5.1 mmol/L • 1 Hour: ≥10 mmol/L • 2 Hours: ≥8.5 mmol/L	Glucose-lowering therapy should be considered if glucose levels are: • ≥5.5 mmol/L preprandial or ≥7 mmol/L 2 hours postprandial at ≤35 weeks • ≥5.5 mmol/L preprandial or ≥8 mmol/L 2 hours postprandial at >35 weeks • Any postprandial level >9 mmol/L
NICE (2015)	If 1+ glycosuria twice or 2+ once, perform OGTT Women with previous gestational diabetes should be offered glucose monitoring or an OGTT at booking, with a further OGTT at 24–28 weeks if normal at booking	OGTT at 24–28 weeks for any other women with risk factors Diagnose if any of the following plasma glucose criteria are met: • Fasting: ≥5.6 mmol/L • 2 hours: ≥7.8 mmol/L	Aim for the following glucose levels, if they can be achieved without problematic hypoglycaemia: • Fasting: <5.3 mmol/L and • 1 hour postprandial: <7.8 mmol/L or • 2 hours postprandial: <6.4 mmol/L

IADPSG=International Association of the Diabetes and Pregnancy Study Groups; OGTT=75 g oral glucose tolerance test; WHO=World Health Organization.

stress and manage the increasing workload more efficiently. Basingstoke and North Hampshire NHS Foundation Trust, for example, were commended in the Quality in Care (QiC) Diabetes Awards in 2016 for this approach (QiC, 2016a). In our centre, the specialist midwife reviews the antenatal OGTT results and sees women outside the clinic for an initial visit within a week of diagnosis, but from December 2016 we have also begun undertaking twice-weekly group sessions for the majority of women with GDM.

There is large amount of information presented at these visits, and it is important to support this with written information, as well as web-based resources. Two resources our users have found useful are:

- **www.womenwithgestationaldiabetes.com**, which is led by a Belfast team and provides information about GDM through a series of videos supported by clear, written information. This initiative was also recognised at the QiC Diabetes Awards (QiC, 2016b).
- **www.gestationaldiabetes.co.uk**, which was started by a service user and written with the support of healthcare professionals. The site provides practical tips as well as information about GDM.

In our service, the aim of the second visit, which is usually within a week of the midwife-led visit, is not only to review the glucose results but also to allow the woman to spend time with a diabetes specialist dietitian. An understanding of low-glycaemic-index foods and food pairing, such as the use of protein to reduce glucose elevations, is invaluable in supporting women to control postprandial glucose spikes. Women are also encouraged to be active; NICE (2015) recommends 30 minutes of walking after meals.

There is considerable evidence supporting the safety and effectiveness of metformin in GDM (Sivalingam et al, 2014; Kelley et al, 2015), and it is the first-line drug if diet and lifestyle change does not achieve glucose targets (NICE, 2015). Insulin is added as the next step, with the option of glibenclamide for those who refuse insulin or are intolerant of metformin.

Women should be contacted as often as needed, and our practice is to leave it no longer than 2 weeks between contacts, even if the woman is stable. Some women are contacted every few days or weekly at the beginning or when unstable. Provided they are not attending for obstetric care, we undertake non-face-to-face contact, via telephone or with the use of technologies such as Diasend, which allows them to upload their results from home to share with their healthcare professional without physically attending clinic.

In our unit, women are reviewed every 2–4 weeks by the obstetrics team with ultrasound scanning to monitor fetal growth and wellbeing. While the majority are scanned every 4 weeks, the frequency is increased if clinically appropriate; for example, if there is the question of growth restriction, a scan may be undertaken after 2 weeks rather than 4 weeks. While NICE (2015) recommends 4-weekly scanning, it is important to understand that this is a minimum frequency and that the guideline is specifically for diabetes and pregnancy; it does not comment on what to do in the event of obstetric complications, which are covered in dedicated obstetric guidelines.

If delivery is planned before term, two doses of corticosteroids, such as betamethasone, may be needed to reduce the risk of respiratory problems in the neonate. In our unit, women with GDM are admitted, as the steroids are likely to increase blood glucose levels and, even if the woman is being treated with insulin, it is unlikely that she will have gained sufficient skill to manage her diabetes in these circumstances. Usual medication, including insulin, should be continued and variable-dose intravenous insulin may need to be added. The effects of steroids are variable but, typically, the impact starts 12 hours after the first injection and continues for up to 72 hours after the second.

The timing of delivery should be a joint decision by the diabetes and obstetrics team, balancing the risks of prematurity and unsuccessful induction of labour with the risk of stillbirth. NICE (2015) recommends that women with GDM be delivered by 40^{+6} weeks, whereas SIGN (2010) states that delivery should be considered at 38 weeks and "certainly" by 40 weeks.

Good control of glucose is important during delivery to reduce the risk of neonatal hypoglycaemia. NICE (2015) recommends glucose levels of 4–7 mmol/L during labour and delivery to reduce this risk, and variable-dose intravenous insulin may be needed to achieve this. Metformin should be stopped at delivery and no further insulin given. If a woman is on a basal insulin, our practice is to discontinue it once labour is established, as insulin requirements reduce as soon as the placenta is delivered, making the woman vulnerable to hypoglycaemia for several hours if basal insulin has been given in the hours before.

Postnatal management and future diabetes risk

Provided there is no evidence of overt hyperglycaemia in the immediate postnatal period, glucose monitoring can be discontinued. Until recently, most units have recommended an OGTT after 6 weeks, and the SIGN (2010) guidance continues with this advice. However, uptake is poor, with one review finding rates varying from 34% to 73% (Tovar et al, 2011). Women who do not attend are at higher risk of developing type 2 diabetes (Venkataraman et al, 2015). NICE (2015) recommends undertaking a fasting glucose test from 6 weeks postpartum and, if this is not undertaken, an HbA_{1c} test at 13 weeks or beyond. It is hoped that this approach will improve the uptake of postpartum glucose testing. However, a fasting glucose test alone would miss those with impaired glucose tolerance; therefore, in our centre we have opted to conduct an HbA_{1c} test as well.

We give women forms after delivery suggesting that they attend for their blood tests on the same day as their baby's 3-month immunisation. We write to the women with their results, and use it as an opportunity to emphasise the risk of diabetes and how it can be modified. If the test result is not suggestive of diabetes, the woman should be screened annually, as those with a history of GDM have a high risk of developing type 2 diabetes. One Danish study, for example, showed that 40% of women with diet-controlled GDM developed type 2 diabetes after 10 years (Lauenborg et al, 2004), while others have

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1. In women with GDM, frequent contact is needed, and scans are recommended every 4 weeks at a minimum.
2. The timing of delivery should be a joint decision by the diabetes and obstetrics team, balancing the risks of prematurity and unsuccessful induction of labour with the risk of stillbirth.
3. Good control of blood glucose is important during delivery to reduce the risk of neonatal hypoglycaemia.
4. Postnatal screening for diabetes is also recommended, as women with a history of GDM are at increased risk of developing type 2 diabetes.

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1. Women with GDM, especially those subsequently shown to have fasting hyperglycaemia or prediabetes, are at increased risk of type 2 diabetes.
2. Lifestyle interventions and the use of metformin have been shown to reduce this risk.
3. Breastfeeding, in addition to its positive effects on the child, has also been shown to reduce the risk of progression to type 2 diabetes in the mother.

demonstrated rates between 2.5% and 70%, with the greatest risk occurring in the first 5 years (Kim et al, 2002).

The risk of developing type 2 diabetes is higher if the postnatal OGTT shows fasting hyperglycaemia or impaired glucose tolerance (i.e. "prediabetes"). The US DPP (Diabetes Prevention Program) study evaluated a group of people with prediabetes and showed a 58% reduction in the risk of developing diabetes among those who received a lifestyle intervention compared with those who did not (Knowler et al, 2002). A subgroup analysis of women with a history of GDM showed additional benefit from the use of metformin as well as lifestyle (Ratner et al, 2008). These measures would also reduce the woman's risk of GDM in future pregnancies. Obesity is a independent risk factor for adverse outcomes, such as miscarriage, pre-eclampsia and venous thromboembolism. Weight loss not only reduces the risk of GDM but also has the potential to reduce these risks for future pregnancies (Modder and Fitzsimons, 2010).

Finally, there is increasing evidence of *in utero* programming from maternal hyperglycaemia that impacts the offspring's risk of developing metabolic syndrome and diabetes (Dabelea et al, 2000; Dabelea and Pettitt, 2001). Therefore, there is a need to develop effective diabetes prevention strategies that work outside the clinical trial setting. The NHS Diabetes Prevention Programme may provide a way forward and be the start of breaking the vicious circle of mothers' hyperglycaemia impacting the diabetes risk of their offspring.

In addition to diet and lifestyle advice, breastfeeding is to be encouraged. Recent evidence looking at the impact of breastfeeding in 1000 women with previous GDM found that it halved the risk of progression to type 2 diabetes over 2 years (Gunderson et al, 2015).

Conclusion

To conclude, despite evidence from the HAPO study and subsequent consensus adopted by WHO regarding the diagnosis of GDM, a cost-effectiveness analysis by NICE has produced different diagnostic criteria. With different national guidelines in place within the UK, it is important for readers to be familiar with local policies. Irrespective of the criteria used, GDM is important to diagnose, not only because treating it reduces maternal and fetal morbidity, but also because it is a modifiable risk factor for mother and baby's risk of developing diabetes in the future. ■

Online resources for patients

www.womenwithgestationaldiabetes.com is led by a Belfast team and provides information about GDM through a series of videos supported by clear, written information.

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