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Learning objectives

After reading this article, the participant should be able to:

1. Identify the risk factors for the development of gestational diabetes.
2. Describe the ideal prepregnancy clinic and the optimum care that a pregnant woman with pre-existing diabetes should receive.
3. Outline the appropriate diabetes treatments for pregnant women with either gestational, type 1 or type 2 diabetes.
4. Describe the obstetric management of a pregnancy complicated by diabetes.

Key words

- Gestational diabetes
- Pregestational diabetes
- Prepregnancy care

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A practical guide to pregnancy complicated by diabetes

Eoin Noctor, Fidelma Dunne

As the prevalence of diabetes is increasing, so the number of pregnancies complicated by pre-existing diabetes or gestational diabetes is also rising. This presents a challenge to healthcare services in the UK to prevent adverse outcomes in babies born to mothers with diabetes. Clinicians in primary care have an important role to play, particularly in delivering pre-conception care for women with these conditions. This article discusses the pathophysiology and treatment of both gestational and pre-existing diabetes during pregnancy and outlines the ideal pre-conception care pathway, as well as antenatal and obstetric care.

Diabetes prevalence is increasing in pregnancy, with pregestational diabetes (type 1 and 2 diabetes) affecting 1.3% of pregnancies (Lawrence et al, 2008). Gestational diabetes, however, accounts for the majority of cases, and prevalence varies widely depending on the criteria used, affecting up to one in four pregnancies in some cohorts (Hartling et al, 2012). As such, a comprehensive understanding of the challenges faced in such pregnancies is vital.

Gestational diabetes

Gestational diabetes (GDM) was for many years defined as the onset or first recognition of abnormal glucose tolerance during pregnancy (American Diabetes Association [ADA], 1980), with diagnostic thresholds reflecting the mother's future risk of developing diabetes rather than pregnancy outcomes. However, more recently, the International Association of Diabetes and Pregnancy Study Groups (IADPSG; IADPSG Consensus Panel et al, 2010) took a different approach, redefining classification into two groups: overt diabetes and GDM (see the first version of this module [Noctor and Dunne, 2011] for further information). These guidelines were subsequently adopted by the ADA (2011) and, more recently, the World Health Organization

(WHO; WHO, 2013). NICE guidance (National Collaborating Centre for Women's and Children's Health [NCCWCH], 2008) currently recommends diagnosing GDM using the 1999 WHO diagnostic criteria (*Table 1*); however, it should be noted that these recommendations were issued prior to the availability of data from the HAPO (Hyperglycaemia and Adverse Pregnancy Outcomes) Study Cooperative Research Group et al (2008).

The new IADPSG criteria were based heavily, although not exclusively, on the results from the multicentre HAPO trial (HAPO Study Cooperative Research Group et al, 2008). This involved 25 505 pregnant women worldwide and showed a continuous relationship between maternal blood glucose levels and adverse pregnancy outcomes of large for gestational age, pre-eclampsia and caesarean section. This landmark study showed that there was no cut-off value above which the risk of complications rose abruptly; rather, the risk rose steadily even with mean blood glucose values previously considered to be in the normal range. As a result, the IADPSG criteria were developed (diagnostic cut-offs reflect mean blood glucose levels at which the odds ratio for adverse outcome was 1.75) to allow intervention in women who would previously have been categorised as having normal glucose tolerance, but who are at

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increased risk of an adverse pregnancy outcome. The lower fasting and 1-hour glucose thresholds, and the requirement for only a single abnormal value, have predictably resulted in an increase in the number of women diagnosed with GDM.

Using the new IADPSG criteria, a GDM prevalence of 12.4% was found in the Irish ATLANTIC DIP (Diabetes in Pregnancy) study (O'Sullivan et al, 2011), which employed universal screening at 24–28 weeks using a 75-g oral glucose tolerance test (OGTT). Also, applying the IADPSG criteria retrospectively to the HAPO study population yielded an overall GDM prevalence of 18%, although it was as high as 25% in some centres (Sacks et al, 2012).

Risk factors for the development of GDM have been well established (Solomon et al, 1997; NCCWCH, 2008):

- Family history of diabetes in a first-degree relative.
- BMI ≥ 30 kg/m².
- Maternal age ≥ 30 years.
- Previous unexplained perinatal death.
- Previous GDM.
- Current glycosuria.
- Long-term steroid use.
- Previous delivery of a baby weighing ≥ 4.5 kg.
- Polycystic ovarian syndrome.
- Polyhydramnios or macrosomia in existing pregnancy.
- Ethnicity associated with a high prevalence of diabetes (African, south or east Asian, Pacific islanders, Hispanic, Middle Eastern or Caribbean).

Individuals with the above risk factors should undergo blood glucose testing (random or fasting plasma glucose, with or without HbA_{1c} measurement) at their booking visit to exclude undiagnosed diabetes. A subsequent 2-hour 75-g OGTT between 24 and 28 weeks should be carried out if diabetes is not diagnosed. Universal screening at 24–28 weeks is desirable, as per IADPSG guidelines, and has also recently been recommended by the US Preventive Services Task Force (Moyer, 2014). This still varies according to local policies, and it is not currently recommended by NICE (NCCWCH, 2008). In the absence of universal screening, high-risk criteria based on the above risk factors should be used to guide selective screening.

Pathophysiology of GDM

During normal pregnancy, insulin sensitivity decreases with advancing gestation (Catalano et al, 1991). Placental hormones such as human placental lactogen and human chorionic somatotropin, combined with the visceral adiposity of pregnancy, lead to increased insulin resistance. Indeed, by the end of pregnancy in non-obese women without diabetes, insulin sensitivity is 40% of its prepregnancy value. The normal pancreas responds via beta-cell hyperplasia, resulting in increased insulin production. In spite of these changes in insulin regulation, blood glucose levels are lower than in the non-pregnant state owing to increased glucose use (including fetal consumption), increased glycogen storage and decreased hepatic glucose output. Women who develop GDM also increase insulin secretion to compensate for the demands of pregnancy. However, in the majority of cases, there is a pre-existing relative beta-cell insufficiency (usually due to obesity and increased insulin resistance [Buchanan et al, 2012]). Therefore, the compensation is inadequate to meet the demands of the increased insulin resistance seen as gestation progresses, and hyperglycaemia ensues.

Rationale for treatment

Persistent maternal hyperglycaemia leads to compensatory fetal hyperinsulinaemia, which also has growth effects. This may cause macrosomia, which increases the risk of serious obstetric complications – shoulder dystocia, brachial plexus injury and clavicular fracture. The high levels of fetal insulin may also result in neonatal hypoglycaemia. In addition to these complications, infants of mothers with GDM are also at risk of hypocalcaemia, jaundice and respiratory distress, resulting in more admissions

Page points

1. During normal pregnancy, insulin sensitivity decreases with advancing gestation.
2. Women who develop gestational diabetes also increase insulin secretion to compensate for the demands of pregnancy.
3. However, in the majority of cases, there is a pre-existing relative beta-cell insufficiency.

Table 1. Diagnostic criteria for gestational diabetes recommended by NICE (National Collaborating Centre for Women's and Children's Health, 2008).

The 2-hour 75-g oral glucose tolerance test should be used to test for gestational diabetes and diagnosis made using the criteria defined by the World Health Organization (WHO) in 1999*

Test	Threshold
Fasting plasma glucose	≥ 7.0 mmol/L
2-hour plasma glucose	≥ 7.8 mmol/L

*The WHO has since updated its criteria in line with International Association of Diabetes and Pregnancy Study Groups criteria

Page points

1. Despite improvements in glycaemic control over recent decades, rates of adverse pregnancy outcome in women with pre-existing type 1 and type 2 diabetes remain significantly elevated compared with the background population.
2. A key principle of management of women with type 1 or type 2 diabetes is prepregnancy care (PPC).
3. Structured PPC takes the form of a dedicated hospital clinic, delivered by a combination of diabetes nurse specialists, midwife specialists, dietitians, endocrinologists or obstetricians.

to the neonatal unit. The risk of pre-eclamptic toxæmia, pregnancy-induced hypertension and polyhydramnios is increased in mothers affected by GDM, and delivery by caesarean section is more frequent (O’Sullivan et al, 2011).

The ACHOIS (Australian Carbohydrate Intolerance Study in Pregnancy; Crowther et al, 2005) demonstrated that children of mothers with “mild” GDM (fasting blood glucose <5.3 mmol/L; $n=1000$) who were treated with diet, exercise, blood glucose monitoring and insulin where indicated, were less likely (relative risk, 0.33) to have a serious adverse perinatal outcome (composite outcome of stillbirth, shoulder dystocia, fracture or nerve injury) than those given routine care. Similar results were seen in an American study of 958 women randomised to either usual antenatal care or treatment, which showed a significant reduction in shoulder dystocia, fetal overgrowth, caesarean section and hypertensive disorders (Landon et al, 2009).

GDM treatment is based initially on lifestyle modification, and women should be managed in a combined obstetric–diabetes antenatal clinic. Women with GDM should be educated on the benefits of good glycaemic control during pregnancy for their own health and that of their baby. Weight should be monitored throughout pregnancy to ensure appropriate weight gain.

Women with GDM are advised to check capillary blood glucose measurements regularly – fasting, pre-meals, 1-hour post-meals and at bedtime. Little high-quality evidence exists, however, regarding targets in pregnancy (Prutsky et al, 2013). Targets are a blood glucose level of <5 mmol/L pre-meals and fasting, and <7 mmol/L 1-hour postprandially. These targets are based on our clinical practice (Health Service Executive, 2010) and are more stringent than the NICE guidelines (NCCWCH, 2008). As mentioned previously, however, the HAPO trial results were not published at the time of the NICE recommendations.

If women fail to meet these targets (i.e. are above target on three or more occasions, despite medical nutritional therapy for 2 weeks), insulin therapy is generally prescribed. Oral antihyperglycaemic agents are less widely used, but both NICE and the American College of Obstetricians and Gynecologists (ACOG) allow for their use. Their use in pregnancy is covered in more detail later in this module.

Prepregnancy care

Despite improvements in glycaemic control over recent decades, rates of adverse pregnancy outcome in women with pre-existing type 1 and type 2 diabetes, although greatly improved, remain significantly elevated compared with the background population. Perinatal mortality and congenital malformations remain more common in women with diabetes than in the general population (Evers et al, 2004; Dunne et al, 2009), as does pre-eclampsia. Adverse pregnancy outcome is related to periconception HbA_{1c} (Jensen et al, 2009; Owens et al, 2012). Therefore, a key principle of management of women with type 1 or type 2 diabetes is prepregnancy care (PPC).

Structured PPC takes the form of a dedicated hospital clinic, delivered by a combination of diabetes nurse specialists, midwife specialists, dietitians, endocrinologists or obstetricians. A standardised approach to providing PPC, and discussing relevant medical issues (as outlined further below), may be aided by the use of a standardised proforma and a “checklist” style approach. Clinic sizes tend to be smaller than general diabetes clinics, enabling more frequent recall and less waiting time for new referrals. Primary care providers are well placed also to increase the proportion of women availing themselves of PPC, and to help with this every diabetes consultation in women of child-bearing age, both in the hospital and in the community, should include a brief but thorough evaluation of plans for pregnancy, potential risks, need for strict glycaemic control and current method of contraception. In particular, return visits for updated contraceptive prescriptions could prompt such a discussion.

In a recent UK study of 680 women with either type 1 or type 2 diabetes, PPC was associated with a decrease in adverse outcomes (stillbirth, neonatal death and congenital malformations) to 1.3% in attendees compared with 7.8% in non-attendees (Murphy et al, 2010). A dedicated prepregnancy clinic is the gold standard of care but, despite this, the UK Confidential Enquiry into Maternal and Child Health (2005) report showed that only 17% of UK maternity centres offer such a service. PPC offers the opportunity to optimise diabetes care as early as possible – ideally at least 3–6 months prior to attempting to conceive – aiming

to achieve an HbA_{1c} level as close to normal as possible while avoiding hypoglycaemia. Fasting and pre-meal blood glucose targets to help achieve this are a fasting level of <5 mmol/L and 1-hour postprandial levels of <7 mmol/L. However, not all women can achieve this target safely, particularly those with hypoglycaemia unawareness, and in these individuals the HbA_{1c} target should be higher.

Other aspects of pre-pregnancy care

Optimal glycaemic control as described above is only one aspect of PPC. PPC also offers the opportunity to optimise overall diabetes care. Medications that have known or potential teratogenic effects – particularly angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers and statins (van Gelder et al, 2010) – need to be discontinued. If blood pressure lowering is necessary, methyldopa or labetalol may be used. Advice should also be given with regard to smoking cessation and avoiding alcohol intake.

If individuals avail themselves of PPC, there is time to discontinue oral agents and initiate insulin or change regimens. There is also time to re-educate women on the recognition and risks of hypoglycaemia, especially in relation to driving. The woman and her partner can be educated on the appropriate use of glucagon. Education with regard to the potential effects of pregnancy on diabetes management also needs to be discussed, for example the management of hyperemesis gravidarum and signs of diabetic ketoacidosis (DKA). In particular, it should be noted that DKA may occur at lower blood glucose levels than in a non-pregnant woman. All people with type 1 diabetes should know how to self-monitor serum ketones. *Table 2* summarises medication-related and general advice for women with type 1 or type 2 diabetes.

Neural tube defects are more common (odds ratio between 1.7 and 8.4; Correa et al, 2012) in infants of mothers with diabetes, and all women with pre-existing diabetes should take high-dose (prescription-only) folic acid 5 mg once daily for at least 3 months prior to pregnancy, and up until 12 weeks' gestational age (Medical Research Council Vitamin Study Research Group, 1991; Macintosh et al, 2006). Increasingly, vitamin D is being shown to be deficient in Irish women (O'Riordan et al, 2008). Deficiency is greater in overweight and

obese women (Kayaniyil et al, 2010). Vitamin D deficiency is associated with increasing insulin resistance (Holick, 2007), which may make blood glucose management more difficult. Consequently, vitamin D should be measured and supplemented if required.

Many women with pregestational diabetes will be overweight or obese. Obesity is independently associated with adverse pregnancy outcomes for both the mother and the infant and is an independent risk factor for congenital malformations (Owens et al, 2009, 2012; Denny et al, 2012; Egan et al, 2014). In the ATLANTIC DIP cohort of women with both type 1 and type 2 diabetes, only 37% had a normal BMI while 18% were obese (defined as a BMI >30 kg/m²; Dunne et al, 2009). PPC with attention to diet and exercise should focus on reducing, and where possible normalising, BMI prior to conception. This may also help with fertility, which is a potential problem. In these women, exercise will have an additional beneficial effect on diabetes control, improving insulin resistance (Brewer et al, 2010).

Medical nutritional therapy is a key component of achieving glycaemic control, with a focus on regulating carbohydrate intake and also opting for low-glycaemic-index carbohydrates. Contraception should be continued until the HbA_{1c} level is at target. In the absence of overt vascular disease (in the presence of which the combined oral contraceptive pill should not be prescribed), contraception choices remain the same as in the general population, subject to the usual cautions and contraindications.

Page points

1. Optimal glycaemic control as described above is only one aspect of pre-pregnancy care (PPC); it also offers the opportunity to optimise overall diabetes care.
2. If individuals avail themselves of PPC, there is time to discontinue oral agents and initiate insulin or change regimens.
3. There is also time to re-educate women on the recognition and risks of hypoglycaemia, especially in relation to driving.

Table 2. Medication and advice for pregnant women with pre-existing diabetes.

Aspect	Type 1	Type 2	Common to type 1 and type 2
Glycaemic control	Change to MDI regimen if appropriate	Stop oral agents* Change to MDI regimen if appropriate	Change to MDI regimen if appropriate
Hypoglycaemia	Education Glucagon	Education	Education
DKA	Educate regarding ketone monitoring	Glucagon	
Hyperemesis	Insulin management Ketone monitoring	Educate regarding ketone monitoring	Insulin management

*NICE guidelines (National Collaborating Centre for Women's and Children's Health, 2008) allow for the use of oral agents in some patients. DKA=diabetic ketoacidosis; MDI=multiple daily injections.

Page points

1. Women with type 2 diabetes will generally need to change to insulin in the prepregnancy period if receiving prepregnancy care (PPC), or as soon as pregnancy is reported if not.
2. Despite the proven benefits of PPC, uptake remains poor.
3. All healthcare providers, both in primary and in secondary care, need to be aware of the adverse outcomes observed in pregnancies complicated by diabetes and the vast potential for reducing these adverse events through structured PPC.

Insulin therapy in the prepregnancy period

During the prepregnancy period, our view is that women with type 1 diabetes are best managed on a multiple daily injection (basal–bolus) regimen, with three pre-meal injections of rapid-acting insulin analogue and one or more injections of intermediate- or long-acting human insulin or insulin analogue, in preparedness for the pregnancy.

In a randomised controlled trial (RCT), the short-acting insulin analogues aspart and lispro were shown to be effective and well tolerated during pregnancy and have been associated with a significant reduction in hypoglycaemia compared with human short-acting insulin (Mathiesen et al, 2007). The choice of basal insulin varies from person to person. Insulin detemir appears safe and effective in pregnancy and is increasingly used (Mathiesen et al, 2012). Although insulin glargine has not yet completed RCTs in pregnancy, anecdotal evidence from a large number of pregnancies does not raise any cause for concern. Intermediate-acting insulin (for example, neutral protamine Hagedorn [NPH]) remains the basal insulin with the most clinical experience in pregnant women with either type 1 or type 2 diabetes. Women on continuous subcutaneous insulin infusion (insulin pump therapy) may continue. Women trained in structured carbohydrate counting (such as DAFNE [Dose Adjustment For Normal Eating]) may also continue. As pregnancy is associated with changes in insulin resistance, insulin doses will undergo significant changes. Patients should be advised of this.

Non-insulin therapies in prepregnancy

Women with type 2 diabetes will generally need to change to insulin in the prepregnancy period if receiving PPC, or as soon as pregnancy is reported if not. The use of oral agents in pregnancy is, however, a widely discussed topic. Metformin has been evaluated in an RCT in women with GDM (Rowan et al, 2008) and no safety issues have emerged from that study, or from a follow-up study of infants up to 2 years after index pregnancy (Rowan et al, 2011). It is listed as an option for treatment in NICE guidelines (NCCWCH, 2008), and by ACOG (2013) for use in women with GDM. It should be noted, however, that high supplemental use (44%) was needed to maintain glycaemic control in the MiG (Metformin in Gestational diabetes) study (Barrett et al, 2013).

Glibenclamide showed effectiveness in GDM, with no evidence of excess risk, in small trials (Langer et al, 2000), and is also listed as an option for treatment of GDM by ACOG (2013). Glibenclamide is less likely to provide adequate glycaemic control, however, in older than in younger women, and in those with higher versus lower fasting glucose levels (Kahn et al, 2006). Both metformin and glibenclamide have shown placental transfer (although studies have been conflicting in glibenclamide [Langer et al, 2000; Hebert et al, 2009]). Therefore, the risks and benefits of these treatments should be discussed fully with patients prior to commencing therapy. Other sulphonylureas, and other classes of antidiabetes medication (e.g. acarbose, dipeptidyl peptidase-4 inhibitors, glucagon-like peptide-1 receptor agonists, meglitinides, sodium–glucose cotransporter 2 inhibitors and thiazolidinediones), are not approved for use during pregnancy.

Uptake of pre-conception care

Despite the proven benefits of PPC, uptake remains poor. A recent UK study found that only 27% of people availed themselves of PPC (Murphy et al, 2010). Our local data show that women with pre-existing diabetes remain unprepared for pregnancy, with 49% conceiving with an HbA_{1c} level of >53 mmol/mol (>7%) while only 43% were on folic acid pre-conception (Dunne et al, 2009). Follow-up from this cohort has demonstrated that introducing specialist-led care improved the proportion of women attending for PPC (from 28% to 52%). An improvement in glycaemic control, and a decrease in the perinatal mortality rate, was also noted (Owens et al, 2012). All healthcare providers, both in primary and in secondary care, need to be aware of the adverse outcomes observed in pregnancies complicated by diabetes and the vast potential for reducing these adverse events through structured PPC.

Diabetes-related complications

Retinopathy, nephropathy, neuropathy, thyroid disease and cardiovascular disease are considered in the module's first version (Noctor and Dunne, 2011).

Antenatal care Glycaemic control

As stated above, insulin is the pharmacological treatment of choice in women with diabetes during

pregnancy. Insulin is uptitrated weekly to reach the desired glycaemic targets mentioned earlier, and it should be emphasised that insulin doses need to rise progressively as a consequence of increasing insulin resistance. In addition to self-monitoring of blood glucose, HbA_{1c} levels are tested on a 2- to 4-weekly basis. In interpreting these, however, it should be noted that trimester-specific ranges are more appropriate, as HbA_{1c} levels are lower in the general population during pregnancy than in a non-pregnant woman with diabetes. Some published trimester-specific HbA_{1c} reference ranges for women without diabetes are: first trimester, 28–37 mmol/mol (4.8–5.5%); second trimester, 24–36 mmol/mol (4.4–5.4%); third trimester, 27–39 mmol/mol (4.7–5.7%); O'Connor et al, 2010). Peripartum insulin infusion will be required for people on insulin.

When resuming therapy, women on insulin pre-conception can return to their normal doses. Breastfeeding women, however, require either more carbohydrate or a 25% reduction in the pre-pregnancy regimen. Women with GDM can stop insulin on delivery of the placenta, with blood glucose monitoring being recommended for 24 hours afterwards. All plans for delivery should be clearly documented prior to delivery in the patient record.

Obstetric management

Antenatal

Obstetric management for the diabetic pregnancy, while similar to that for other higher-risk pregnancies (i.e. increased fetal ultrasound monitoring including second-trimester anomaly scan, third-trimester scans for fetal well-being and growth, and frequent antenatal clinic visits), differs in some respects. Particular attention is paid to blood pressure and urinalysis, given the increased incidence of pre-eclampsia in women with diabetes, and the possibility of a presentation of DKA with near-normal blood glucose levels. If antenatal steroids are indicated for fetal lung maturation (usually prior to 34 weeks), they may be given, but hospital admission for strict glycaemic control with intravenous insulin is necessary.

Delivery

Planning of the timing and mode of delivery is important in women with diabetes. The standard practice of early induction of labour for all

pregnancies complicated by diabetes at 38–39 weeks is no longer the case. This was done to minimise the risks of spontaneous labour with a macrosomic fetus – shoulder dystocia, birth trauma and emergency caesarian section – and to avoid the increasing risk of stillbirth at 39–40 weeks. The approach to delivery is now, however, individualised, and the obstetrician and medical team work together, considering factors such as estimated fetal weight, glycaemic control, and medical and obstetric history to determine the optimal mode and timing of delivery.

Advice from an anaesthetist is advisable if significant medical complications are apparent. Tocolytic agents may cause hyperglycaemia (Neilson et al, 2014) and should only be given after consultant-level discussion between the obstetric and diabetes team involved in the woman's care. Caesarean section rates remain high, however, occurring in 43% of women with diabetes compared with 27% of controls in the ATLANTIC DIP cohort, this difference being explained by higher rates of emergency section in those with diabetes (Dunne et al, 2009).

Postpartum care

Women with GDM have a significantly increased lifetime risk of diabetes. A recent meta-analysis shows a relative risk of 7.43 for development of diabetes in women with a history of GDM (Bellamy et al, 2009). Significant risk factors for the development of type 2 diabetes after GDM include high glucose levels during pregnancy, family history of diabetes, higher BMI and insulin use in pregnancy. Our practice, in line with International Diabetes Federation (2009) recommendations, is to assess for persistent glucose intolerance 6–12 weeks postpartum with a standard 75-g OGTT, using the standard criteria for diagnosis of diabetes in the non-pregnant population, in line with ADA criteria (ADA, 2014). In addition to early postpartum screening, as a high-risk group these women should be screened for diabetes at least every 1–3 years.

Current NICE guidance (NCCWCH, 2008) differs somewhat, however, in recommending fasting blood glucose alone for postpartum follow-up. This is, however, less sensitive than the 75-g OGTT and may miss up to 26% of women with diabetes (Kakad et al, 2010). Although the initial postpartum screen is carried out in hospital, subsequent routine testing is usually carried out in primary care, which

Page points

1. Planning of the timing and mode of delivery is important in women with diabetes and should follow the principles of individualised care.
2. Advice from an anaesthetist is advisable if significant medical complications are apparent.
3. Women with gestational diabetes have a significantly increased lifetime risk of diabetes.

“Knowledge of the specific problems faced in the pregnancy complicated by diabetes is essential and will become an ever more important skill to master over the coming years.”

has the advantage of frequently caring for the child also, allowing an extra opportunity to target the mother for screening that may otherwise be missed.

If further pregnancy is planned, women should be counselled that the risk of GDM recurring is up to 41% (Getahun et al, 2010), and that pre-conception care is desirable. A random blood glucose test should be carried out when women with a history of GDM are booked in. Breastfeeding appears to confer some protection against progression to type 2 diabetes, at least in the short term (O’Reilly et al, 2011), and should be encouraged.

Complications in the child

Complications in the child are presented in the first version of this module (Noctor and Dunne, 2011).

Conclusions

The management of a pregnancy complicated by diabetes is an intensive process, involving very frequent direct patient contact with multiple disciplines, a strict regimen of dietary and exercise measures, and very frequent blood glucose monitoring.

Women with diabetes during pregnancy also require more hospital visits for review by members of the multidisciplinary team. This has wider implications – time taken from work, childcare arrangements and transport arrangements all place a significant emotional and financial burden on the individual and her family, complicating what can be a stressful time even in the uncomplicated pregnancy. This should be borne in mind from a practical perspective, and scheduling appointments together where possible, as well as maintaining regular telephone contact outside of hospital visits, may go some way towards alleviating stress.

Given the ongoing rise in the number of pregnancies complicated by diabetes (mainly GDM or type 2 diabetes), it is inevitable that primary care practitioners will see an increasing number of these women, and play a significant role in coordinating their overall care. Primary care practitioners are also ideally placed to help increase the proportion of women with diabetes availing themselves of pre-conception care. Knowledge of the specific problems faced in the pregnancy complicated by diabetes is therefore essential and will become an ever more important skill to master over the coming years. ■

Case examples

Two relevant case reports are presented in the first version of this module (Noctor and Dunne, 2011).

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Online CPD activity

Visit www.diabetesonthenet.com/cpd to record your answers and gain a certificate of participation

Participants should read the preceding article before answering the multiple choice questions below. There is ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. A short explanation of the correct answer is provided. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learnt in practice. The new CPD centre keeps a record of your CPD activities and provides the option to add items to an action plan, which will help you to collate evidence for your annual appraisal.

- Pre-gestational diabetes mellitus affects which approximate PERCENTAGE of pregnancies? Select ONE option only.
 - <1%
 - 1%
 - 2.5%
 - 5%
 - 10%
- Which ONE of the following was a key finding from the HAPO trial with regard to maternal blood glucose levels and risk of adverse pregnancy outcomes?
 - The risk rose steadily, even for values previously considered normal
 - There was a cut-off value above which the risk of complications rose abruptly
 - There was no increased risk of complications linked to glucose levels
 - None of the above
- Which ONE of the following is NOT a recognised risk factor for the development of GDM? Select ONE option only.
 - BMI of 35 kg/m²
 - Maternal age of 30
 - Polycystic ovarian syndrome
 - Polyhydramnios in current pregnancy
 - Previous delivery of a baby weighing 4 kg
- Which of the following is the MOST appropriate statement concerning insulin sensitivity in non-obese women without diabetes and with normal pregnancies? Select ONE option only.
 - Decreases in the first trimester
 - Decreases throughout pregnancy
 - No significant change
 - Increases in the first trimester
 - Increases throughout pregnancy
- A 22-year-old primigravida is diagnosed with mild GDM (fasting blood glucose <5.3 mmol/L) and is initially advised about lifestyle modification. Which is the MOST appropriate advice regarding the MINIMUM FREQUENCY of capillary blood glucose monitoring? Choose ONE option only.
 - Not currently necessary
 - Once daily
 - Twice daily
 - Three times daily
 - Four times daily
- A 43-year-old woman is currently 6 weeks pregnant. She has a past medical history that includes pernicious anaemia, hypertension and hyperlipidaemia. Which of her medications, if any, should she now STOP? Choose ONE option only.
 - Aspirin 75 mg daily
 - Hydroxocobalamin 1 mg 3-monthly
 - Labetalol 200 mg twice daily
 - Simvastatin 20 mg daily
 - None of the above
- A 36-year-old woman is 24 weeks pregnant and has type 2 diabetes mellitus managed by lifestyle modification pre-pregnancy. She accepts that treatment is now necessary as her fasting blood glucose measurements are rising, but she declines insulin. Which of the following antidiabetes agents, if any, are SAFE to recommend? Choose ONE option only.
 - Acarbose
 - A dipeptidyl peptidase-4 inhibitor
 - A glucagon-like peptide-1 receptor agonist
 - All of the above
 - None of the above
- A 27-year-old woman has just started insulin to control her GDM. Which of the following is the MOST appropriate interval (in weeks) between HbA_{1c} blood monitoring checks? Select ONE option only.
 - 1
 - 3
 - 6
 - 8
 - 12
- A 31-year-old previously fit and healthy woman has been treated with insulin for GDM and just had a normal vaginal delivery of a healthy infant weighing 3.7 kg. Which is the MOST appropriate advice about STOPPING insulin? Select ONE option only.
 - After delivery of the placenta
 - After 24 hours
 - After 1 week
 - Once blood glucose returns to less than 5.3 mmol/L
 - Once HbA_{1c} is less than 42 mmol/mol (6.0%)
- According to NICE guidelines, which of the following represents the diagnostic threshold ABOVE which a glucose tolerance test confirms GDM? Select ONE option only.

	Fasting plasma glucose	2-hour blood glucose
A.	≥5.1 mmol/L	≥8.6 mmol/L
B.	≥5.1 mmol/L	≥10.2 mmol/L
C.	≥5.1 mmol/L	≥11.2 mmol/L
D.	≥7.0 mmol/L	≥7.8 mmol/L
E.	≥7.0 mmol/L	≥11.2 mmol/L