CPD Module 6

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Clinical presentations, diagnosis and prevention of diabetes

Philip Evans

Researchers, public health physicians and frontline clinicians, including GPs, are increasingly convinced that we are entering an epidemic (if not a pandemic) of diabetes mellitus. Rates of diabetes prevalence are increasing across the world, particularly in developing countries, and an increasing number of people are being diagnosed in primary care. This article explores the classification and diagnosis of diabetes, focusing on risk factors, pre-diabetes, and management and prevention strategies for type 2 diabetes in primary care.

Learning objectives

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

1. Describe the various forms of diabetes and how they differ.
2. Explain the process of diagnosing diabetes.
3. Define the concept and reasoning behind the term "pre-diabetes".
4. Outline the evidence that exists regarding interventions to prevent or delay the onset of diabetes.

Key words
- Diagnosis
- Pre-diabetes
- Prevention

Philip Evans is a GP in Exeter, Senior Clinical Research Fellow, Peninsula Medical School, Exeter, and Co-Director of the Peninsula Diabetes Local Research Network.

In 2007 it was estimated that 4.82% of the UK population have diabetes (2.45 million people) (Yorkshire and Humber Public Health Observatory, 2007). Data from the author's own practice alone show a trebling in the prevalence of type 2 diabetes in the past 20 years, with a relentless year on year increase (Evans et al, 2008). With the diagnosis of diabetes comes an increased risk of cardiovascular disease (CVD) and three-quarters of people with diabetes will die from cardiovascular causes (Garber, 2003).

Along with this rise in the prevalence of diabetes there is also a growing number of people in the UK with intermediate or borderline hyperglycaemia (often known as "pre-diabetes"). The challenge to primary care is therefore to encourage early diagnosis, intervention and, if possible, prevention of both of these disorders.

The questions, therefore, are: how do we define diabetes and pre-diabetes, and how can we prevent people developing these potentially life-threatening conditions?

Type 1 and type 2 diabetes

Raised blood glucose (hyperglycaemia) has numerous health implications. Diabetes mellitus is "a group of metabolic diseases characterised by hyperglycaemia resulting from defects in insulin secretion, action or both". This definition by the American Diabetes Association (ADA, 2009) illustrates the fact that diabetes is a syndrome with multiple causes.

The vast majority of people with diabetes fall into two main groups: type 1 and type 2 (ADA, 2009). As described in an earlier module in the series, type 1 diabetes is caused by an absolute deficiency of insulin thought to be due to autoimmune destruction of pancreatic islet cells. Type 1 accounts for between 5% and 10% of all cases and is often seen in younger people, usually before the age of 40 (Diabetes UK, 2009). Type 2 diabetes, however, is far

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more common (90% of all cases) and is usually diagnosed in people over 45 years of age who are often obese or physically inactive (Diabetes UK, 2009). It is rapidly increasing in prevalence and is the driver for the current diabetes epidemic.

Type 2 diabetes is strongly dependent on ethnicity and is more common in south Asian or Afro-Caribbean populations. In these populations in the UK, people may develop type 2 diabetes at a younger age and at lower BMI levels than their Caucasian counterparts. Unlike type 1 diabetes, type 2 is characterised by a relative insulin deficiency and is often associated with insulin resistance and features of the so-called metabolic syndrome – an increase in waist circumference and raised blood pressure, low HDL-cholesterol, raised plasma triglycerides or a raised blood glucose (Alberti et al, 2005).

Type 2 diabetes usually develops after a long prodromal period of several years of gradually increasing blood glucose levels (Harris et al, 1992), and most people pass through a period of pre-diabetes before their hyperglycaemia reaches the diabetes threshold. Recent data from the Whitehall II study (Tabák et al, 2009) showed that before diagnosis with type 2 diabetes, study participants had a slow increase in their blood glucose levels over the 13 years of the study, but that blood glucose levels then rose rapidly in the 2–3 years preceding diagnosis.

People with type 2 diabetes often do not need insulin for a period of time after diagnosis (hence the previous term "non-insulin dependent"). In addition, type 2 diabetes is often asymptomatic until blood glucose levels rise (Evans et al, 2003).

Whatever the cause of the hyperglycaemia, however, be it type 1 or 2 diabetes, the symptoms include polyuria, polydipsia, weight loss, tiredness, blurred vision and susceptibility to infections. Long-term complications can be disabling, even fatal, and include neuropathy, retinopathy, CVD, sexual dysfunction and a significant impact on the individual's quality of life and social functioning. However, even at diagnosis of type 2 diabetes, around 25% of people may already have complications (UK Prospective Diabetes Study Group, 1998).

Rarer causes of diabetes

Type 2 diabetes is generally considered to be a polygenic disorder. Monogenic causes of diabetes are seen less frequently (1–2% of all cases) (Murphy et al, 2008), but nevertheless can present to GPs. For example, it is thought that each GP practice has at least one person whose diabetes is due to maturity-onset diabetes of the young (MODY), although this is unlikely to have been recognised as such.

MODY is a monogenic autosomal dominant condition often causing hyperglycaemia in people under the age of 20, and hence is likely to be diagnosed as either type 1 or early type 2 diabetes. The chromosomal defects and functional deficiencies have now been determined, and the most common form involves a mutation in one of the liver transcription factors known as hepatocyte nuclear factor (HNF-1α). People with MODY usually present with early-onset diabetes aged 15–30 years, are not insulin-dependent and usually not obese. There is usually a strong family history of diabetes, often with family members developing the condition before the age of 25.

MODY is important to the primary care team for several reasons, including the need to screen other family members and offer genetic counselling, the need to define the precise sub-type of MODY by genetic testing, and the need for specialist referral to ensure the right diagnosis is made. Treatment options are often dependent on the individual's genetic sub-type (e.g. the use of low-dose sulphonylureas in people with the HNF-1α subtype) (Murphy et al, 2008).

Another monogenic cause of diabetes in middle-aged adults is maternally inherited diabetes and deafness (MIDD). People with the condition have hyperglycaemia and a maternal history of diabetes as well as young-onset bilateral sensori-neural hearing loss. A mitochondrial mutation has been identified (m.3243A>G) (Fischel-Ghodsian, 2001).

When a more unusual form of diabetes is suspected, e.g. younger onset, a strong family history or a lack of the usual insulin resistance features, then discussion with your local specialist about the possibility of monogenic diabetes, the need for genetic testing and possible

Page points

1. Type 2 diabetes usually develops after a long prodromal period of several years of gradually increasing glucose levels (Harris et al, 1992), and most people pass through a period of pre-diabetes before their hyperglycaemia reaches the diabetes threshold.
2. Maturity-onset diabetes of the young (MODY) is a monogenic autosomal dominant condition often causing hyperglycaemia in people under the age of 20, and hence is likely to be diagnosed as either type 1 or early type 2 diabetes.
3. Another monogenic cause of diabetes in middle-aged adults is maternally inherited diabetes and deafness (MIDD). People with the condition have hyperglycaemia and a maternal history of diabetes as well as young-onset bilateral sensori-neural hearing loss.

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1. Currently, both the World Health Organization and International Diabetes Federation (2006) and the American Diabetes Association (2009) recommend that the diagnosis of diabetes (and pre-diabetic states) is based on a blood glucose measurement.
2. Currently, there is also debate regarding the introduction of HbA_{1c} as the diagnostic test for diabetes. HbA_{1c} is the predominant form of glycated haemoglobin, present in red blood cells, which reflects the average plasma glucose concentration over the preceding 2–3 months, and is expressed as a percentage of HbA and hence would give a better overall glycaemic picture.
3. The most important risk factor for type 2 diabetes is obesity.

referral may be helpful. A very practical and educational website is www.diabetesgenes.org.

Diagnosing diabetes

Diabetes can and should be diagnosed in primary care without specialist referral unless the individual's condition is potentially life-threatening, such as diabetic ketoacidosis, or hyperglycaemia is severe and requiring immediate insulin treatment.

Currently, both the World Health Organization and International Diabetes Federation (WHO and IDF, 2006) and the ADA (2009) recommend that the diagnosis of diabetes (and pre-diabetes states) is based on a blood glucose measurement (*Table 1*). Unless people have hyperglycaemic symptoms then this blood glucose estimation should be repeated; either repeated fasting plasma measures (after at least an 8-hour fast) or an oral glucose tolerance test (OGTT) (75 g of anhydrous glucose which equates to 410 ml of Lucozade Energy Original) are commonly used in primary care.

Traditionally, the OGTT has been promoted as the gold standard for the diagnosis of diabetes and has been used extensively in epidemiological studies. However, the recommended use of repeated fasting plasma glucose (FPG) estimations, which are cheap and more convenient for both doctor and patient, may well have moved UK primary care teams away from the OGTT. The use of OGTT is therefore debatable as it is intensive in terms of patient time, nurse time, and has surprisingly poor repeatability. A proportion of general practices do not therefore use it as a diagnostic tool. However, OGTT should be considered in people with impaired fasting glucose (IFG), 30% of whom will have diabetes if challenged with a glucose load (WHO and IDF, 2006).

Currently, there is also debate regarding the introduction of HbA_{1c} as the diagnostic test for diabetes. HbA_{1c} is the predominant form of glycated haemoglobin, present in red blood cells, which reflects the average plasma glucose concentration over the preceding 2–3 months, and is expressed as a percentage of HbA (International Expert Committee [IEC], 2009), and hence would give a better overall glycaemic picture. The new NHS Health Check Programme (2009) advocates the use of HbA_{1c} with a cut-off of >6.5% (>48 mmol/mol) as diagnostic of diabetes. The use of HbA_{1c} may therefore rapidly gain in popularity. It is more convenient (as it does not require a fasting specimen), is reliable and correlates well with long-term complications, hence its use in people once they are diagnosed with diabetes. International recommendations promoting the use of HbA_{1c} in diagnosis were recently published (IEC, 2009), and national bodies across the world are currently considering whether to implement HbA_{1c} as the diagnostic test for diabetes.

It should be noted that the diagnostic cut-offs for the development of diabetes specified in *Table 1* are derived from plasma glucose levels associated with increased risk of retinopathy, as well as the population distribution of plasma glucose (WHO and IDF, 2006).

Table 1. Recommendations for the diagnostic criteria for diabetes and intermediate hyperglycaemia.

Diabetes	**Diagnostic levels**
Fasting plasma glucose	≥7.0 mmol/L
	OR
2-hour plasma glucose*	≥11.1 mmol/L
Impaired glucose tolerance (IGT)	
Fasting plasma glucose	<7.0 mmol/L
	AND
2-hour plasma glucose*	≥7.8 and <11.1 mmol/L
Impaired fasting glucose	
Fasting plasma glucose	6.1–6.9 mmol/L
	AND (if measured)
2-hour plasma glucose*	<7.8 mmol/L

* Venous plasma glucose 2 hours after ingestion of 75 g oral glucose load.

* If 2-hour plasma glucose is not measured, status is uncertain as diabetes or IGT cannot be excluded.

From: World Health Organization and International Diabetes Federation (2006)

Risk factors for diabetes

The most important risk factor for type 2 diabetes is obesity. There are, however, other modifiable and non-modifiable risk factors (*Table 2*). These are used as risk indicators to identify those at higher risk of type 2 diabetes in several clinical settings, for example in risk-screening questionnaires such as

FINDRISC (Finnish Type 2 Diabetes Risk Score; Lindström and Tuomilehto, 2003); in opportunistic screening in GP surgeries (Evans et al, 2008); in risk calculations using routinely collected data held in GP databases such as the QDScore (Hippisley-Cox et al, 2009); and in the new NHS Health Check Programme (2009) to identify those who should have a glucose test.

Pre-diabetes

Another area of debate is the diagnosis of the intermediate hyperglycaemic states collectively known as pre-diabetes. All these conditions have in common the fact that blood glucose levels are raised yet are not above the threshold that is diagnostic of type 2 diabetes. The two most important features of pre-diabetes in primary care are the increased risk of CVD, which is two to three times that of normoglycaemic individuals (Coutinho et al, 1999), and the increased risk of progression to type 2 diabetes. Hence the potential for prevention of both diabetes and CVD in this high-risk group.

The term "pre-diabetes" has been considered by some as being potentially misleading, as a large proportion of people with pre-diabetes do not progress to diabetes. Other terms such as non-diabetic hyperglycaemia, intermediate hyperglycaemia and impaired glucose regulation are therefore gaining popularity. Risk factors for pre-diabetes are generally considered to be the same as those for type 2 diabetes as both conditions share the common pathology of insulin resistance.

The terminology is complicated, but currently two states are recognised: IFG diagnosed on repeated fasting blood glucose (FBG) measurements and impaired glucose tolerance (IGT) diagnosed on an OGTT (*Table 1*). There is some debate, however, about the level of FPG in IFG. The ADA (2009) recommend that IFG includes an FPG of 5.6–6.9 mmol/L rather than the stricter criterion of 6.1–6.9 mmol/L in the WHO and IDF (2006) recommendations. A person may have either IFG or IGT (in isolation) or both (i.e. an FPG of 6.1–6.9 mmol/L and a 2-hour glucose ≥7.8 mmol/L and <11.1 mmol/L), in which case the risk of progression to type 2 diabetes is much greater (Unwin et al, 2002).

Table 2. Modifiable and non-modifiable risk factors for type 2 diabetes.

Modifiable risk factors	Overweight* and obesity† (central and total). Sedentary lifestyle. Previously identified glucose intolerance (IGT and/or IFG). Metabolic syndrome: – Hypertension. – Decreased HDL-cholesterol. – Increased triglycerides. Dietary factors. Intrauterine environment. Inflammation.
Non-modifiable risk factors	Ethnicity. Family history of type 2 diabetes. Age. Gender. History of gestational diabetes. Polycystic ovarian syndrome.

*World Health Organization and International Diabetes Federation (WHO and IDF, 2006) criteria define overweight as BMI ≥25 kg/m^2; †WHO and IDF (2006) criteria define obesity as BMI ≥30 kg/m^2. IFG=Impaired fasting glucose; IGT=Impaired glucose tolerance.

Adapted from: Alberti et al (2007)

People with pre-diabetes are asymptomatic. Nevertheless, some features of the metabolic syndrome may often be present. Also, a number of associated conditions, such as peripheral neuropathy (Singleton et al, 2005) and carpal tunnel syndrome (Gulliford et al, 2006), are increasingly being recognised. Despite these associations, people with pre-diabetes are usually diagnosed by screening.

Both IFG and IGT are increasingly prevalent. For example, it is estimated that 5.1% of the UK population aged 20–79 may have IGT (IDF, 2003). Pre-diabetes carries an increased risk of progression to type 2 diabetes, although this can vary dependent on ethnicity and other factors such as initial level of glycaemia (Unwin et al, 2002). On average, around 5% of people with IGT progress to type 2 diabetes annually (Santaguida et al, 2005). It is widely accepted that people with these conditions are at greater risk of both type 2 diabetes and CVD (Coutinho et al, 1999), and interventions

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1. It should not be forgotten that people with pre-diabetes need appropriate lifestyle advice regarding smoking, alcohol, and possible prescription of lipid-lowering drugs, such as statins, and also blood pressure medication if appropriate.
2. There is now substantial evidence from large-scale randomised trials in various populations across the world that progression to diabetes can be prevented or delayed in high-risk groups both by behavioural and pharmacological interventions.
3. Relatively modest changes in lifestyle, such as a 5% reduction in weight or an increase in moderate physical activity to 4 hours a week, can have important benefits in reducing the risk of diabetes.

designed to prevent diabetes have, in the main, been targeted at this population.

Education of people with pre-diabetes

Previous work in developing a pragmatic screening programme using the GP database identified a large proportion of people with pre-diabetes (Greaves et al, 2004).

Studies had previously shown that individuals and healthcare professionals alike were confused about the implications of the diagnosis of pre-diabetes (Wylie et al, 2002; Whitford et al, 2003; Williams et al, 2004). The author and colleagues therefore developed an educational package for people with pre-diabetes and their healthcare professionals. This package, known as WAKEUP (Ways of Addressing Knowledge Education and Understanding in Prediabetes), was found to be acceptable both to people with pre-diabetes and healthcare professionals (Evans et al, 2006).

Managing pre-diabetes

Although generic guidance was given to GPs and practice nurses, the qualitative data from healthcare professionals in the WAKEUP study revealed a need for robust practice systems to facilitate effective management and follow-up of individuals with pre-diabetes (Evans et al, 2006). Key messages in the WAKEUP study that should be conveyed to people with pre-diabetes were identified (*Table 3*). Similar qualitative work undertaken by Troughton et al (2008) has also shown that this population expected structured follow-up after their diagnosis.

Table 3. Key messages to people with pre-diabetes from the WAKEUP (Ways of Addressing Knowledge Education and Understanding in Prediabetes) study.

- Pre-diabetes is a serious condition, with a high risk of progressing to type 2 diabetes and heart disease.
- The good news is that these risks are often preventable.
- To prevent progression, people need to make lifestyle changes in terms of healthier eating (losing weight) and increased physical activity.

These messages were considered to be as important for clinicians as for people with pre-diabetes.

From: Evans et al (2006)

It should not be forgotten that people with pre-diabetes need appropriate lifestyle advice regarding smoking, alcohol, and possible prescription of lipid-lowering drugs, such as statins, and also blood pressure medication if appropriate. For these reasons an annual review in primary care would seem reasonable with these cardiovascular risk factors being addressed, and also an FBG test (or even OGTT) undertaken to assess any progression towards diabetes.

Primary prevention of type 2 diabetes

As the transition from normoglycaemia through impaired glucose regulation to type 2 diabetes takes several years, it is logical to intervene and aim to prevent or delay the onset of diabetes. This can be at individual or population level. The best evidence regarding prevention exists in high-risk individuals, although several countries such as Finland have a national population programme to prevent diabetes that involves all stakeholders.

There is now substantial evidence from large-scale randomised trials in various populations across the world that progression to diabetes can be prevented or delayed in high-risk groups both by behavioural (Tuomilehto et al, 2001; Knowler et al, 2002; Ramachandran et al, 2006) and pharmacological interventions (Chiasson et al, 2002; Knowler et al, 2002; Lindström and Tuomilehto, 2003; Torgerson et al, 2004; Gerstein et al, 2006).

Lifestyle

A meta-analysis has shown that lifestyle interventions can produce a 50% relative risk reduction in the incidence of type 2 diabetes at 1 year (Yamaoka and Tango, 2005). Typically these interventions are in high-risk individuals, such as those with pre-diabetes (usually IGT), and interventions are targeted at halting or slowing beta-cell dysfunction.

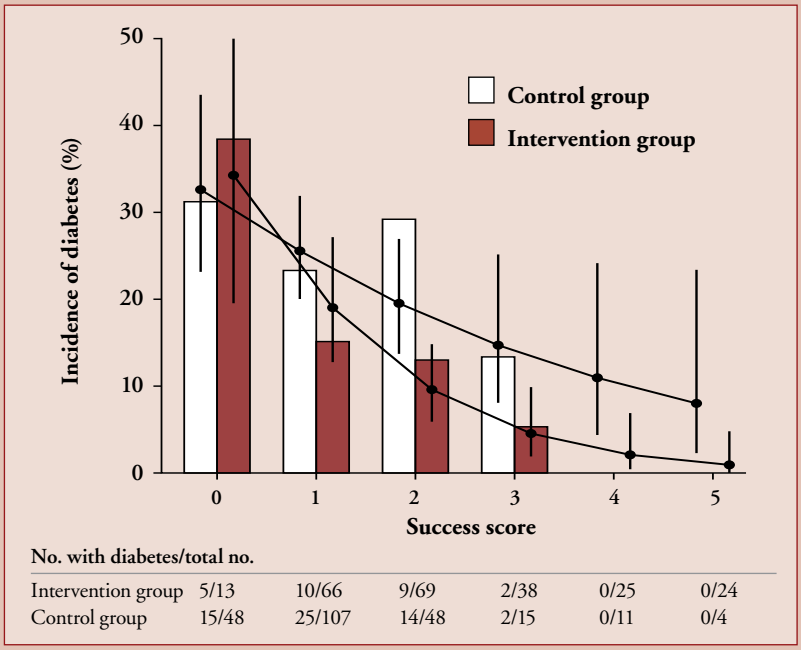
The majority of behavioural interventions are relatively intensive and designed to increase an individual's physical activity levels and encourage weight loss and dietary change. Relatively modest changes in lifestyle, such as a 5% reduction in weight or an increase in moderate physical activity to 4 hours a week, can have important benefits in reducing the risk of diabetes.

In the Finnish Diabetes Prevention Study (DPS; Tuomilehto et al, 2001) a clear "dose–response" curve was observed, such that the greater the number of behavioural changes (the success score), the lower the risk of diabetes in an individual (*Figure 1*). It was also noted that the beneficial effects observed in the Finnish DPS persisted when the participants were followed-up a median of 3 years after the intervention had finished (Lindström et al, 2006).

Lifestyle interventions of course have other general benefits for the individual. However, the majority of these interventions are not feasible or affordable in a resource-limited NHS, and there is therefore a need to develop, pilot and evaluate a pragmatic intervention that could be delivered in primary care or in the community. It is possible that this could be based on motivational interviewing (MI), and early results with MI in promoting weight loss in obese people through lay facilitators are encouraging (Greaves et al, 2008).

The need for a pragmatic intervention is now more urgent as the NHS Health Check Programme begins. A large number of people with pre-diabetes will undoubtedly be identified and will need intervention. These interventions will also need to be culturally sensitive in the light of the large number of people from ethnic communities in the UK with pre-diabetes.

Figure 1. Incidence of diabetes during follow-up, according to the success score. Adapted from Tuomilehto et al (2001). Copyright © [2001] Massachusetts Medical Society. All rights reserved.



No. with diabetes/total no.						
Intervention group	5/13	10/66	9/69	2/38	0/25	0/24
Control group	15/48	25/107	14/48	2/15	0/11	0/4

Pharmacological interventions

As well as lifestyle interventions, drugs have also been shown to reduce progression to type 2 diabetes, including metformin (Knowler et al, 2002; Ramachandran et al, 2006), acarbose (Chiasson et al, 2002), orlistat (Torgerson et al, 2004) as well as troglitazone – although later withdrawn (Azen et al, 1998) – and rosiglitazone (Gerstein et al, 2006).

A meta-analysis by Gillies et al (2008) showed that drug interventions were both less effective and less cost-effective than lifestyle. The IDF (Alberti et al, 2007) recommends drug therapy as second-line after lifestyle intervention for diabetes prevention, yet, unfortunately, no pharmaceutical agent is licensed for diabetes prevention in the UK.

There is also debate about whether these drugs simply mask progression to diabetes by lowering blood glucose, which then rises in the subsequent wash-out period once treatment has finished. On balance, however, it is generally thought that diabetes prevention through lifestyle or drugs is cost-effective and should be actively promoted in clinical practice (Gillies et al, 2008).

Practitioner behaviour

In UK primary care there is a considerable gap between the theory of diabetes prevention and its active implementation. Several qualitative and questionnaire studies have shown that GPs and primary care staff are confused by the whole area of pre-diabetes and its diagnosis and wanted more information and guidance (Wylie et al, 2002; Whitford et al, 2003; Williams et al, 2004). GPs also expressed a variety of attitudes towards pre-diabetes, ranging from enthusiastically embracing its management to diagnostic nihilism (Fearn-Smith et al, 2007).

In the biggest database study to date (Holt et al, 2008), it was demonstrated that GPs were missing opportunities to diagnose both pre-diabetes and diabetes in their registered patients.

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1. Although population screening is not thought to be appropriate (Wareham and Griffin, 2001), targeted or selective screening for both diabetes and pre-diabetes is now considered to be both effective and cost-effective.
2. In the new NHS Health Check Programme, all people aged 40–74 years who are not on a disease register will be called in for a face-to-face check and assessment of their vascular risk.
3. The prevalence of type 2 diabetes is rapidly increasing in the UK, although GPs should be aware of the rarer types of diabetes (e.g. maturity-onset diabetes of the young [MODY] or maternally inherited diabetes and deafness [MIDD]) as well as type 1 diabetes.

For example, borderline blood glucose results were not being followed-up with either a repeat test or OGTT. Better education of healthcare professionals is therefore needed. *Box 1* gives a case study highlighting some common problems encountered in primary care.

Screening for diabetes and pre-diabetes

Although population screening is not thought to be appropriate (Wareham and Griffin, 2001), targeted or selective screening for both diabetes and pre-diabetes is now considered to be both effective and cost-effective (Waugh et al, 2008). Most authorities advise two-stage screening. First, individuals at higher risk of diabetes are identified using GP data or a questionnaire, such as FINDRISC (Lindström and Tuomilehto, 2003), and then a blood glucose test such as an FBG, an OGTT or an HbA_{1c} test is used.

NICE guidance on preventing type 2 diabetes will not be available until June 2011, although European guidance from the IMAGE (Development and Implementation of a European Guideline and Training Standards for Diabetes Prevention) project will be available in early 2010 (http://www.image-project.eu/).

In the new NHS Health Check Programme, all people aged 40–74 years who are not on a disease register will be called in for a face-to-face check and assessment of their vascular risk. Those who are overweight or obese or have a raised blood pressure will also be screened for diabetes. Managing this exercise and its implications will be a major challenge to all practitioners in primary care who wish to prevent type 2 diabetes and its complications.

Box 1. Case study.

Narrative

Mrs C, aged 72, presented to her GP with idiopathic hypertension in 2005. This was well controlled with an angiotensin-converting enzyme (ACE) inhibitor and she had regular annual fasting blood glucose (FBG) measurements as part of her hypertensive care.

Her first annual review revealed an FBG of 6.5 mmol/L; an oral glucose tolerance test (OGTT) was undertaken and this was normal with an FBG at time zero of 6.4 mmol/L. The diagnosis of impaired fasting glucose (IFG) was made and Mrs C was started on a statin (her total serum cholesterol was 6.5 mmol/L) and advice was given about weight loss and exercise. She was referred to an exercise-on-prescription scheme locally and has managed to lose 5 kg (>5% of her weight). Subsequent annual FBG measurements have been in the healthy range.

Discussion

This case illustrates the importance of addressing cardiovascular risk in the context of IFG. It also demonstrates the need for an OGTT to exclude diabetes in people with IFG. It also shows that hyperglycaemia can improve with time and an inexorable progression to type 2 diabetes is not always seen.

Conclusion

The prevalence of type 2 diabetes is rapidly increasing in the UK, although primary care teams should be aware of the rarer types of diabetes (e.g. MODY or MIDD) as well as type 1 diabetes.

The risk factors for type 2 diabetes and pre-diabetes are well recognised and primary care teams are in an ideal position to screen for both conditions (either opportunistically or systematically). Finally, it is now clear that type 2 diabetes can be prevented or delayed by lifestyle or pharmacological interventions in those at highest risk. ■

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"The risk factors for type 2 diabetes and pre-diabetes are well recognised and primary care teams are in an ideal position to screen for both conditions."

CPD module

CPD module

Online CPD activity

Visit www.diabetesandprimarycare.co.uk/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. 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 learned in practice.

1. A person with a BMI of 37 kg/m^2 who has been on oral steroids for the past 9 months presents with polyuria. Which of the following blood tests may be used to screen for type 2 diabetes? Select ONE option only.

A. Oral glucose tolerance test (OGTT).
B. Serum cholesterol.
C. Serum triglyceride.
D. Finger-prick blood glucose test.
E. C-reactive protein.

2. In a person with impaired glucose tolerance (IGT), which one of the following is the most effective intervention to prevent progression to diabetes? Select ONE option only.

A. Genetic counselling.
B. Intensive lifestyle intervention.
C. Metformin.
D. Thiazolidinediones.
E. Acarbose.

3. All but one of the following answers correctly relates to IGT. Which one does not? Select ONE option only.

A. Is diagnosed on repeat fasting blood glucose (FBG) measurements.
B. Carries raised cardiovascular risk.
C. Is diagnosed using an OGTT.
D. May be associated with carpal tunnel syndrome.
E. Increases risk of progression to type 2 diabetes.

4. All but one of the following have been shown to reduce progression to type 2 diabetes. Which one has not? Select ONE option only.

A. Rosiglitazone.
B. Orlistat.
C. Gliclazide.
D. Metformin.
E. Intensive lifestyle interventions.

5. All but one of the following are health-related interventions that people with pre-diabetes may receive. Which type of intervention is not appropriate? Select ONE option only.

A. Bariatric surgery.
B. Smoking cessation advice.
C. Self-monitoring of blood glucose.
D. Blood pressure lowering therapy.
E. Statin therapy.

6. A 27-year-old woman presents with symptomatic hyperglycaemia. Her BMI is 26 kg/m^2 and FBG is 7.4 mmol/L. She reports that her mother and grandmother have type 2 diabetes. Which of the following will help with her diagnosis? Select ONE option only.

A. A second FBG test.
B. An OGTT.
C. A detailed family history.
D. Lipid profile.
E. HbA_{1c} test.

7. A 47 year-old-woman presents for a well-woman check. Her blood pressure is 157/93 mmHg. She has a low HDL-cholesterol (0.8 mmol/L) and raised triglycerides (4.0 mmol/L). Of the following conditions, what is this most likely to be? Select ONE option only.

A. Hypothyroidism.
B. Polycystic ovarian syndrome (PCOS).
C. Metabolic syndrome.
D. Maturity-onset diabetes of the young.
E. Menopause.

8. Mrs Jones, aged 52, is hypertensive and has applied for life insurance. She has a positive family history of diabetes and her insurance form asks if she has any other risk factors for developing type 2 diabetes. Which of the following is another risk factor? Select ONE option only.

A. Multiparity.
B. Anorexia nervosa.
C. Angiotensin-converting enzyme (ACE) inhibitor use.
D. Hormone replacement therapy use.
E. PCOS.

9. An asymptomatic 53-year old woman has a BMI of 40 kg/m^2 and is noted to have an FBG of 7.4 mmol/L and 7.2 mmol/L. What are these blood glucose results diagnostic of? Select ONE option only.

A. IGT.
B. Impaired fasting glucose (IFG).
C. IGT and IFG.
D. Diabetes.
E. Pre-diabetes.

10. A 34-year-old south Asian woman, now living in the UK, attends a GP appointment with flu-like symptoms. You note that her BMI is elevated at 31 kg/m^2, and her father had type 2 diabetes. You want to take this opportunity to consider effective healthcare interventions to prolong her life. She has no diabetes symptoms but accepts your offer of an OGTT. Her FBG is 6.0 mmol/L and her 2-hour glucose is 10.9 mmol/L; her serum cholesterol is 6.0 mmol/L and you diagnose IGT. If you were her GP, what would be your most likely initial course of action? Select ONE option only.

A. Refer to your practice nurse to start metformin.
B. Refer for genetic counselling.
C. Start a statin in light of her high risk of cardiovascular disease.
D. Refer to your practice nurse for dietary advice.
E. Refer to your local diabetologist.