Early-onset type 2 diabetes: Clinical implications, diagnosis and management

David Morris

There is strong evidence that early-onset type 2 diabetes (commonly defined as that occurring in people under the age of 40 years) is a more aggressive condition than late-onset type 2 diabetes. The longer period of exposure to the risk factors of hyperglycaemia, hypertension and hyperlipidaemia and the more rapid progression of disease itself renders the individual more vulnerable to developing both microvascular and macrovascular complications at an earlier age. Early recognition and management of type 2 diabetes in younger people and public health messaging aimed at prevention of type 2 diabetes will be crucial to dealing with the problem. This article outlines the diagnosis, clinical implications and management of early-onset type 2 diabetes, with a particular focus on younger adults (rather than children and adolescents), in whom the condition is more common, and who are likely to be managed in primary care.

In parallel with rising levels of obesity, the incidence of type 2 diabetes in younger people, including children, adolescents and young adults, has increased substantially over the past 20 years (Zeitler et al, 2018, Misra et al, 2022). The consequences of this trend continuing unchecked are likely to be profound, both in terms of the health of the individuals concerned and socioeconomically for the society in which they live. Early recognition and management of type 2 diabetes in younger people and public health messaging aimed at prevention of type 2 diabetes will be crucial to dealing with the problem.

This article will focus on younger adults (rather than children and adolescents) with early-onset type 2 diabetes. Children and young people with type 2 diabetes should be referred to specialist diabetes paediatric teams for management (Association of Children's Diabetes Clinicians [ACDC], 2021; American Diabetes Association [ADA], 2022a).

Definition of early-onset type 2 diabetes

The definition of early-onset type 2 diabetes varies but is commonly referred to as that occurring in people under the age of 40 years (Misra et al, 2022; Royal Australian College of GPs [RACGP], 2022), with a further division often made between children and adolescents (<18 years) and younger adults (≥18 years). Whilst these are somewhat arbitrary cut-offs, there is no doubt that the population distribution of type 2 diabetes has shifted to include those of a younger age.

The scale of the problem

Between January 2019 and March 2020, a total of 122 780 individuals aged <40 years were diagnosed with type 2 diabetes in England; this comprised 4.6% of the total number of people diagnosed during that period (Misra et al, 2022). The majority of these people were over 18 years of age (*Table 1*). Individuals diagnosed before the age of 40 years were more likely to be obese, female, from a minority ethnic group (particularly South Asian) and to live in a socioeconomically deprived area than those diagnosed above the age of 40 years.

Although the prevalence of type 2 diabetes in those under 40 years of age is low in comparison to those over 40, it is rising rapidly.

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Article points

1. The incidence of early-onset type 2 diabetes is increasing, with important individual health and socioeconomic consequences.
2. Individuals with early-onset type 2 diabetes experience more rapid progression of microvascular and cardiovascular complications than those with type 1 diabetes and those who develop type 2 diabetes in later years.
3. The presence of islet cell autoantibodies is predictive of future insulin requirement and the development of other autoimmune diseases.
4. If there is uncertainty about the type of diabetes in a child or young adult, it is safer to manage as type 1 diabetes and treat with insulin.
5. A holistic approach to early-onset type 2 diabetes is essential. Socioeconomic status and psychological issues need to be taken into account.

Key words

- Children and young people
- Early-onset type 2 diabetes

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Table 1. Age-related prevalence of type 2 diabetes in individuals under 40 years of age in England, January 2019 to March 2020 (Misra et al, 2022).

Age range	Number of people with type 2 diabetes (% of total)
<16 years	650 (0.5%)
16–18 years	910 (0.7%)
19–25 years	8245 (6.7%)
26–39 years	112 975 (92%)

How does glucose intolerance develop in early-onset type 2 diabetes?

The key pathologies in early-onset type 2 diabetes are resistance to insulin-stimulated glucose uptake, which is more pronounced than in later-onset type 2 diabetes, and beta-cell failure, which progresses more rapidly than in later-onset type 2 diabetes (TODAY Study Group, 2013a; Viner et al, 2017). Obesity, and in particular the deposition of abdominal (visceral, rather than subcutaneous) fat, drives insulin resistance, and obese individuals are initially hyperinsulinaemic to compensate for this (Wilmot and Idris, 2014). When insulin production proves inadequate, diabetes develops.

It is noteworthy that early-onset type 2 diabetes may develop following puberty, during which increased levels of growth hormone generate insulin resistance (Arslanian, 2000).

Who is at risk?

Box 1 lists key risk factors for developing early-onset type 2 diabetes. These are very similar to those for type 2 diabetes in older adults and include obesity (in around 90% of cases), family history (again, in nearly 90% of cases – which reflects both genetic predisposition and similar living environment) and ethnicity (Copeland et al, 2011; Wilmot and Idris, 2014). Interestingly, whilst type 2 diabetes is associated with socioeconomic deprivation in the UK, Europe and the US, it is found more commonly amongst affluent children in developing countries such as China and India (Zeitler et al, 2018).

While there is a strong genetic predisposition to type 2 diabetes (e.g. family history, ethnicity), the recent increases in prevalence are too rapid to reflect genetic alteration and indicate the impact of environmental factors, most notably obesity (Reinehr, 2013).

Box 1. Risk factors for development of early-onset type 2 diabetes.

- Obesity
- Physical inactivity
- Strong family history of type 2 diabetes
- Black, Asian and Hispanic ethnicity
- Female sex
- Socioeconomic deprivation
- Personal or maternal history of gestational diabetes
- Polycystic ovarian syndrome

Clinical presentation of early-onset type 2 diabetes

Early-onset type 2 diabetes may present with osmotic symptoms (polyuria, polydipsia, weight loss and recurrent infection: commonly genital fungal infection), but frequently it is asymptomatic and diagnosis may be suggested by the chance finding of glucose on urine dipstick or from screening for hyperglycaemia in an individual with risk factors (Arslanian, 2000). Rarely, the presentation may be with diabetic ketoacidosis or hyperglycaemic hyperosmolar state (Rosenbloom et al, 2008).

In addition to the risk factors listed in *Box 1*, an important finding that would point towards type 2 diabetes would be the finding of acanthosis nigricans, a marker of insulin resistance. Acanthosis nigricans is identified as darkened, velvety patches of skin typically found in the intertriginous areas (skin folds) and is present in the majority of young people with type 2 diabetes.

Certain genetic conditions are associated with type 2 diabetes, including Klinefelter syndrome and Prader–Willi syndrome.

What other types of diabetes need to be considered?

It is important to remember that in the paediatric population (<18 years old), type 1 diabetes is much more common than type 2 diabetes, and presentation with marked osmotic symptoms and diabetic ketoacidosis should be treated as type 1 diabetes. Another type of diabetes to consider is

Table 2. Features of early-onset diabetes.

Clinical feature	Type 2 diabetes	Type 1 diabetes	MODY	LADA
Age of onset	>10 years; increasing incidence with age	Any age from early childhood; commonly young children and adolescents	Commonly 10–30 years	Usually >30 years
Family history	Type 2 diabetes in family very common	Can be type 1 diabetes or other autoimmune disease in family but often absent	Very strong: autosomal dominant inheritance	May be history of autoimmune disease in family
Ethnicity	Increased risk in Black African, African–Caribbean, South Asian, American Hispanic	All ethnicities affected, more common in Caucasians	All ethnicities affected, more common in Caucasians	All ethnicities affected
Obesity	Very common	Uncommon (but increasing)	Uncommon (but increasing)	Uncommon (but increasing)
Gender	Female > Male	Female = Male	Female = Male	Female = Male
Presentation with DKA	Uncommon	Common	Rarely	May occur several years after diagnosis
Islet cell autoantibodies	Uncommon	Common	Uncommon	Common
C-peptide (insulin) levels	Normal	Low	Normal	Lower than type 2 diabetes, greater than type 1 diabetes

DKA=diabetic ketoacidosis; LADA=latent autoimmune disease in adults; MODY= maturity-onset diabetes of the young.

maturity-onset diabetes of the young (MODY; Thanabalasingham and Owen, 2011). The striking feature of this condition is a strong family history affecting multiple generations (autosomal dominant inheritance, with a 50% chance of passing to next generation). Individuals with MODY who are initially diagnosed with type 2 diabetes often respond poorly to metformin and, in contrast, can be very sensitive to sulfonylurea therapy; however, if they receive a diagnosis of type 1 diabetes then they may be treated with insulin unnecessarily. If genetic testing is available, a definitive diagnosis of MODY can be reached (University of Exeter, 2022).

If there is any uncertainty about the type of diabetes, it is better to refer the individual as a same-day emergency, manage as type 1 diabetes and treat with insulin, which ensures safety and allows review of the diagnosis as more evidence becomes available (NICE, 2022a). Type 2 diabetes is very unlikely in a child under the age of 10 years (Reinehr, 2013).

In the adult population (usually over the age of 30 years), a further possible diagnosis is latent autoimmune disease in adults (LADA, or slowly evolving immune-mediated diabetes). Like type 1 diabetes, this is an autoimmune condition with antibodies directed against pancreatic beta-cells. Typically, these individuals are not obese and can initially be managed with oral hypoglycaemics (and so are frequently diagnosed as having type 2 diabetes), though they progress (often over several years, in contrast to type 1 diabetes), to an absolute requirement of insulin, by which time decompensation to diabetic ketoacidosis is a risk (Naik and Palmer, 2003; Buzzetti et al, 2020).

It is important to be aware that, with rising levels of obesity, it is inevitable that a greater proportion of those with types of diabetes other than type 2 diabetes will be overweight/obese at the point of diagnosis. Every new diagnosis of early-onset diabetes requires careful assessment as to the type of diabetes the individual has, as this will determine subsequent education, lifestyle changes and treatments (ADA, 2022b).

Table 2 describes the features of the different types of early-onset diabetes.

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Practical considerations for the management of type 2 diabetes in children and young people, based on the new ACDC guideline.

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Investigations

HbA_{1c} is a valid parameter for diagnosis of diabetes in early-onset diabetes in adults, although it should not be relied on in people under 18 years of age. HbA_{1c} is unreliable in situations where there has been rapid progression to hyperglycaemia and osmotic symptoms, such as in type 1 diabetes, acute pancreatitis, steroid-induced hyperglycaemia, gestational diabetes and during acute illness (NICE, 2022b).

If there is uncertainty about the type of diabetes, testing for diabetes autoantibodies (e.g. GAD, IA-2, ZnT8 antibodies) can be helpful (Zeitler et al, 2018; ADA, 2022a). In those individuals diagnosed with type 2 diabetes (and initially managed without insulin), the presence of pancreatic autoantibodies is predictive of future insulin requirement and the development of other autoimmune diseases (Turner et al, 1997).

For individuals diagnosed with type 1 diabetes (with a picture of osmotic symptoms and ketosis) in whom there is diagnostic uncertainty (e.g. overweight or obese), negative autoantibody testing can be useful in identifying those who may have type 2 diabetes (or indeed MODY) and could possibly be managed in the future without insulin (Zeitler et al, 2018).

Measurement of C-peptide (a surrogate measure of insulin reserve) or insulin itself at initial presentation has been discouraged because the overlap of results between type 1 and type 2 diabetes make interpretation very unreliable (NICE, 2022a). However, the further the time-interval from diagnosis, the greater the predictive power of the C-peptide test, and a low C-peptide result would be expected in type 1 diabetes a year after diagnosis.

How serious is early-onset type 2 diabetes?

There is strong evidence that early-onset type 2 diabetes is a more aggressive condition than the late-onset form. The longer period of exposure to the risk factors of hyperglycaemia, hypertension and hyperlipidaemia, and the more rapid progression of disease itself, render the individual more vulnerable to developing both microvascular and macrovascular (cardiovascular) complications at an earlier age (Hillier and Pedula, 2003; Al-Saeed et al, 2016; Lascar, 2018). Thus, compared to people with later-onset diabetes, those with early-onset type 2 diabetes are four-times more likely to suffer a myocardial infarction and ten-times more likely to have a stroke (Hillier and Pedula, 2003).

Nephropathy is the most frequent early complication in early-onset type 2 diabetes (Benhalima et al, 2011). Retinopathy and neuropathy are further microvascular complications that also occur at an earlier age than in later-onset type 2 diabetes (Wilmot and Idris, 2014; Lascar et al, 2018).

People with early-onset type 2 diabetes suffer reduced quality of life and life expectancy relative to those without diabetes (Lascar et al, 2018; RACGP, 2022).

Obstructive sleep apnoea is a further association with early-onset type 2 diabetes, and can lead to daytime sleepiness and, subsequently, left ventricular hypertrophy and cardiovascular disease (Zeitler et al, 2018). Other sequelae of early-onset type 2 diabetes include non-alcoholic fatty liver disease and polycystic ovary syndrome.

The prevalence of depression, anxiety and eating disorders is raised in those with early-onset type 2 diabetes (Wilmot and Idris, 2014).

The number of women with early-onset type 2 diabetes becoming pregnant is increasing. These pregnancies are associated with poorer outcomes for mother and fetus, including miscarriage, pre-term delivery, macrosomia and birth injury, neonatal hypoglycaemia, congenital malformations and increased perinatal mortality (Wilmot and Idris, 2014). The availability of adequate contraception and pre-pregnancy counselling is of obvious importance.

It is clear that early-onset type 2 diabetes should not be considered a "mild" form of diabetes but rather an aggressive condition leading to accelerated development of complications.

Management plans

The aims of treatment are to reduce the risk of diabetes complications and thereby improve quality of life. Ultimately, prevention of early-onset type 2 diabetes is the aim. This, however, will require broad public health measures directed, in particular, at reversing the tide of increasing obesity.

Consideration should also be given to managing young adults with type 2 diabetes in secondary care,

given the aggressive nature of the condition and its early complications, and specifically to ensure that the correct type of diabetes has been diagnosed. However, in practice, adults with early-onset type 2 diabetes are likely to be treated in primary care, and it is this group that the recommendations below focus on.

Recommendations on management of children and young people with type 2 diabetes have been set out by the ACDC (2021), and summarised in this journal by Soni (2022).

1. Monitoring for glycaemic control and complications

Once stabilised, NICE (2022c) recommends measuring HbA_{1c} levels every 6 months in adults with type 2 diabetes, ideally aiming for an HbA_{1c} of 48 mmol/mol or lower to reduce the risk of long-term complications. However, targets should be realistic and agreed on an individual basis, and any improvement in glycaemic control regarded as a positive step.

Self-monitoring of blood glucose levels may be appropriate, notably if medications that can induce hypoglycaemia are used (insulin, sulfonylureas, meglitinides). For those on complex insulin regimens, intermittently scanned (flash) continuous glucose monitoring or real-time continuous glucose monitoring could be considered (NICE, 2022c; ADA, 2022b).

It is important to screen for cardiovascular risk factors and diabetes-related complications (see *Box 2*) from the time of diagnosis and, subsequently, on at least an annual basis (NICE, 2022c).

When assessing renal function, to minimise the risk of false positive results (orthostatic proteinuria), urinary albumin-creatinine ratio (ACR) should be assessed using the first urine sample of the day. If the ACR is found to be >3 mg/mmol but below 30 mg/mmol, a confirmatory sample is required (NICE, 2021). Renal referral is appropriate if the cause of proteinuria is uncertain.

People with type 2 diabetes are at higher risk of periodontitis, which itself can adversely affect glycaemic control. They should have regular oral health reviews at a frequency advised by their dentist.

2. Education and lifestyle change

All those with early-onset type 2 diabetes (along with family members and carers as appropriate) should be offered referral to a structured education programme following diagnosis. It is crucial that these programmes meet the cultural, linguistic, cognitive and literacy needs of the local population (NICE, 2022c; ADA, 2022a). People with early-onset type 2 diabetes should also be provided with contact details of diabetes support groups and organisations.

As with type 2 diabetes in older adults, lifestyle change is the cornerstone of management of early-onset type 2 diabetes, but the challenges faced in achieving this should not be underestimated (Berkowitz, 2018). To facilitate adherence, the need for lifestyle change should be sensitively explained by the healthcare professional – this should avoid personal criticism or inducing fear, as this may well result in the person becoming demotivated and disengaged. Goals for lifestyle change should be achievable and sustainable, and agreed with the individual concerned. Progress towards these goals should be met with positive feedback and encouragement.

Components of lifestyle advice that may need to be addressed include the following (NICE, 2022c; Zeitler et al, 2018):

- Diet.
- Physical activity and exercise.
- Weight loss.
- Avoidance of smoking (and substance misuse, including alcohol).
- Immunisations (influenza, pneumococcal).
- Contraceptive advice.

Referral to a dietitian with expertise in the management of type 2 diabetes should be offered where available. Key components of dietary advice include avoidance of sugary foods and drinks,

Box 2. Screening for complications in early-onset type 2 diabetes.

- Hypertension (at every visit)
- Dyslipidaemia (annual)
- Diabetic kidney disease – albuminuria (annual)
- Retinopathy (from age of 12 years, annual screening)
- Diabetic foot problems (from age of 12 years, annual screening)
- Dental disease (periodontitis)

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restriction of refined and starchy carbohydrates and fatty foods, switching to wholegrain foods and pulses, and increased fruit and vegetable intake (five or more portions per day; Dyson et al, 2018). To be successful, a family approach to dietary change should be encouraged (Reinehr, 2013; Evert et al, 2019).

Remember that the psychosocial aspects driving eating (e.g. comfort eating, rather than eating to satisfy hunger) may need attention (Nash, 2017). The input of a psychologist, if available, could be very valuable here and also to deal with the mental health issues that particularly affect young adults (Wilmot and Idris, 2014; RACGP, 2022).

NICE and Diabetes UK recommend at least 150 minutes of moderate to vigorous physical activity per week, spread over at least 3 days, for adults (NICE, 2022c; Dyson et al, 2018). An exercise plan needs to be individualised and, again, this should be achievable, sustainable and able to be enjoyed by the individual.

Diet and exercise can improve glycaemic control, reduce cardiovascular risk (by improving hypertension and hyperlipidaemia) and facilitate weight loss. Losing weight improves insulin sensitivity and potentially can lead to remission of diabetes (Lean et al, 2018; Lean et al, 2019).

NICE advises setting an initial body weight loss target of 5–10% for adults with type 2 diabetes who are overweight, although it qualifies this statement by pointing out that lesser degrees of weight loss are still likely to be beneficial (NICE, 2022c). Similarly, Diabetes UK suggests aiming for a weight loss of at least 5% if overweight, by reducing calorie intake and increasing energy expenditure (Dyson et al, 2018). However, if a target weight is not achieved, this should not simply be declared as "failure" but, rather, as an opportunity to learn, change and then move forward (Nash, 2017).

3. Medication for hyperglycaemia

For those with early-onset type 2 diabetes over the age of 18 years, the full range of medications for hyperglycaemia are available. Metformin remains the first-line treatment option (NICE, 2022c; ADA, 2022c). Beyond metformin, the SGLT2 inhibitors and GLP-1 receptor agonists are attractive options; in addition to facilitating weight loss and carrying a low risk of hypoglycaemia, their cardioprotective and renoprotective properties may be particularly valuable given the aggressive nature of early-onset type 2 diabetes and the propensity to develop complications at an early age.

Bear in mind that, at any stage of treatment, marked hyperglycaemia with osmotic symptoms may warrant rescue therapy with insulin or a sulfonylurea, which will quickly lower glucose levels. Once glucose control has stabilised, further adjustment of treatment can be made, including whether or not to continue with these therapies given their association with hypoglycaemia and weight gain (NICE, 2022c).

For those diagnosed with early-onset type 2 diabetes who are managed without insulin, there must always be a discussion about the possibility of sudden deterioration of glucose control (and progression to diabetic ketoacidosis), with the urgent need to initiate insulin treatment.

4. Managing cardiovascular risk factors

Blood pressure

There is strong evidence that hypertension is associated with atherosclerotic cardiovascular disease (myocardial infarction or angina, stroke or transient ischaemic attack, peripheral vascular disease), heart failure and increased mortality (Fox et al, 2015).

For young adults, a blood pressure target of 140/90 mmHg (135/85 mmHg on ambulatory or home blood pressure monitoring) is recommended by NICE (2022d), reduced to <130/80 mmHg for those with chronic kidney disease (CKD) and an ACR of ≥70 mg/mmol (NICE, 2021), with this lower target also to be considered in those with diabetic retinopathy or previous stroke (ADA, 2022d).

Lifestyle changes to improve blood pressure include weight loss, reduced dietary salt intake and increased physical activity. First-line drug therapy are ACE inhibitors or angiotensin receptor blockers (Zeitler et al, 2018; NICE, 2022d; ADA, 2022d); however, bear in mind the need for counselling and contraception in sexually active adolescents and women, and avoid these drugs if contraception is unreliable or in case of pregnancy. If necessary, calcium channel blockers and thiazide-like diuretics can be used as additional therapies (NICE, 2022d; ADA, 2022d), but the combination of ACE inhibitors and ARBs should be avoided (Blowey, 2012; Fried et al, 2013).

Dyslipidaemia

Management of dyslipidaemia is also essential to prevent premature cardiovascular disease in those with early-onset type 2 diabetes. First-line treatment comprises optimisation of glycaemic control, dietary adjustment (reduced fat intake: specifically, less saturated fat), avoidance of excess alcohol, increased physical exercise and weight loss (NICE, 2016; ADA, 2022d). If these measures do not achieve satisfactory lipid control then statin therapy can be considered.

NICE (2016) recommends using QRISK2 as a risk assessment tool in type 2 diabetes to decide whether or not statin therapy should be offered for primary prevention of cardiovascular disease. The threshold for using a statin for primary prevention is set at ≥10% risk of a cardiovascular event over 10 years.

The initial recommended treatment for primary prevention of cardiovascular disease is atorvastatin 20 mg once daily (NICE, 2016; ADA, 2022d). NICE suggests aiming for a reduction of 40% or more in non-HDL cholesterol. The Joint British Societies (2014) recommend a non-HDL cholesterol target of <2.5 mmol/L.

Given the potential for teratogenicity, it is essential to ensure adequate contraception in sexually active females who are prescribed statins.

Because of the amplified risk of cardiovascular disease in people with CKD (eGFR <60 mL/min/1.73 m^2 and/or albuminuria), NICE advises against using QRISK2 in this situation but, rather, routinely offering atorvastatin 20 mg daily. For those adults with type 2 diabetes and established cardiovascular disease, statin therapy (atorvastatin 80 mg once daily) is recommended without formal risk assessment because this population is at increased risk of recurrence of cardiovascular events (NICE, 2016; ADA, 2022d).

Diabetic nephropathy

Control of hyperglycaemia and hypertension are crucial to preventing and slowing the progression of diabetic nephropathy. ACE inhibitors and ARBs are recommended for an ACR persistently over 3 mmol/mol (whether or not individuals have hypertension), owing to their renoprotective properties (NICE, 2021; ADA, 2022e). These treatments should, however, only be used in women of child-bearing age if adequate contraception is in place. Titrate up to the maximum tolerated licensed dose.

Adults with type 2 diabetes and CKD (who are already taking an ACE inhibitor or ARB for renoprotection) should be offered an SGLT2 inhibitor licensed for this indication (irrespective of glycaemic control) if ACR is >30 mg/mmol (NICE, 2021), as they attenuate the progression of CKD (ADA, 2022e). SGLT2 inhibitors will be the agent of choice to improve glycaemic control in those with diabetic nephropathy. Given the high cardiovascular risk of individuals with diabetic nephropathy, the cardiovascular and heart failure benefits of SGLT2 inhibitors are very relevant.

GLP-1 receptor agonists are a useful option in those with diabetic nephropathy, as they offer cardiovascular risk reduction and also because they appear to slow the progression of albuminuria (ADA, 2022e).

Regular measurement of urinary ACR, renal function and electrolytes should be undertaken in those with early-onset type 2 diabetes and diabetic nephropathy.

Bariatric surgery

Randomised controlled trials in obese adults with type 2 diabetes have demonstrated the superiority of various forms of bariatric surgery in improving glycaemic control (including remission of diabetes) compared with intensive medical treatment (Migrone et al, 2012). An estimated 49–73% of excess weight reduction (i.e. weight in excess of a BMI of 25 kg/m^2) following bariatric surgery has been reported (Buchwald et al, 2009).

Whilst the safety and efficacy of bariatric procedures has improved, there are risks and complications associated with surgery, and patient selection is crucial to maximise the possibility of good outcomes.

For people with type 2 diabetes, NICE CG189 recommends bariatric surgery as a treatment option if BMI is 35 kg/m^2 or more after all appropriate non-surgical measures have been tried and clinically beneficial weight loss has not been achieved (NICE, 2022e). It is a requirement that the person receives an intensive weight management programme in a Tier 3 service (a multidisciplinary team comprising a physician [consultant or GP with a

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Case study

Suri, a 32-year-old lady of Asian Indian ethnic origin was diagnosed with type 2 diabetes 3 years previously, following her first pregnancy, during which she was found to have gestational diabetes. She was overweight (BMI 28.7 kg/m^2) and had a strong family history of type 2 diabetes. Suri was planning to try for a second pregnancy and had made an appointment with her GP to discuss her plans.

Subsequent to the finding of diabetes, Suri was diagnosed with hypertension (blood pressure 145/91 mmHg), diabetic nephropathy (ACR 9 mg/mmol, eGFR 71 mL/min/1.73 m^2) and background diabetic retinopathy. She was commenced on ramipril (she reliably used the combined contraceptive pill). Her HbA_{1c} was stabilised at 54 mmol/mol (7.1%) on a combination of metformin and dapagliflozin.

Suri's GP cautioned her over the increased risk of complications in a pregnancy affected by diabetes and the concern of accelerating diabetes complications. Nonetheless, Suri wished to try for a further pregnancy. Suri's GP provided advice on diet, exercise and weight loss. She was a non-smoker and understood the need to avoid alcohol during pregnancy. Her GP prescribed folic acid 5 mg once daily and switched her antihypertensive agent from ramipril to labetalol.

Suri was referred to the hospital diabetes preconception clinic and advised to continue with her current contraception. The importance of entering pregnancy with optimised glucose control was emphasised to Suri and she was advised to continue with her metformin and SGLT2 inhibitor until seen in the hospital clinic. It was explained that the SGLT2 inhibitor would need to be stopped ahead of trying for a pregnancy and that there was a strong likelihood she would need to take insulin.

special interest], specialist nurse, specialist dietitian, psychologist and physiotherapist/physical activity specialist). The individual needs to understand the requirement for long-term follow-up.

In the case of recent-onset type 2 diabetes (<10 years since diagnosis), an expedited assessment for bariatric surgery can be offered and referral can also be considered for those with a BMI of 30–34.9 kg/m^2. An assessment for bariatric surgery for people with an Asian family origin may be requested at a lower BMI (≥27.5 kg/m^2) than other populations (NICE, 2022e).

Surgery should only be considered when lifestyle and medical treatments have been implemented and found to be unsuccessful in achieving desired goals. It is essential that surgery is performed in specialist centres with the support of a multidisciplinary team.

A holistic approach to treatment

The need for a holistic, person-centred approach to treatment has been highlighted both by the ADA and European Association for the Study of Diabetes (Davies et al, 2022) and in NICE guidelines (NICE, 2022c).

An approach to lifestyle management of early-onset type 2 diabetes that accounts for the socioeconomic background of the individual and their family has already been emphasised. Poverty, lack of education, inaccessibility of healthy food and an environment unconducive to physical activity may all conspire against optimal diabetes care.

Psychological issues may also need to be addressed for effective management of diabetes. Individuals should be regularly assessed for depression, anxiety and eating disorders. Referral to mental health services and social workers should follow as necessary. Antidepressants may be employed alongside talking therapies.

The importance of addressing psychosocial factors to improve outcomes in early-onset type 2 diabetes should not be underestimated, and a multidisciplinary approach to individuals and their families is needed (Reinehr, 2013; Wilmot and Idris, 2014).

Conclusions

The incidence of early-onset type 2 diabetes is increasing, driven by rising levels of excess weight and obesity. The consequences are likely to be profound both in terms of the health of the individuals concerned and socioeconomically for the society in which they live. Public health measures aimed at the prevention of early-onset type 2 diabetes should be prioritised.

It is important to appreciate that individuals with early-onset type 2 diabetes suffer a more rapid progression of microvascular and cardiovascular disease than those with type 1 diabetes and those with later-onset type 2 diabetes. They need to be regularly reviewed for these complications and evidence-based preventative and treatment strategies utilised as necessary.

A holistic approach to early-onset type 2 diabetes is essential. Socioeconomic background and psychological issues will need to be taken into account to achieve optimal progress. ■

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"It is important to appreciate that individuals with early-onset type 2 diabetes suffer a more rapid progression of microvascular and cardiovascular disease than those with type 1 diabetes and those with later-onset type 2 diabetes."