



### Matthew A Sabin

MBBS, MRCPCH(UK), PhD, is Clinical Research Fellow, Department of Endocrinology and Diabetes, Royal Children's Hospital, Melbourne, Victoria. matt.sabin@rch.org.au

### Fergus J Cameron

BMedSci, MBBS, DipRACOG, FRACP, MD, is Director of Diabetes, Department of Endocrinology and Diabetes, Royal Children's Hospital, Melbourne, Victoria.

### George A Werther

MD, BS, FRACP, MSc(Qxon), is Director, Department of Endocrinology and Diabetes, Royal Children's Hospital, Melbourne, Victoria.

# Type 1 diabetes

## Still the commonest form of diabetes in children

Obesity is rife within the community, and associated conditions such as type 2 diabetes and cardiovascular disease threaten the future health of our children. While type 2 diabetes has been the focus of much media attention, type 1 diabetes mellitus remains the commonest form of newly diagnosed diabetes in childhood. This case study acts to remind practitioners that all young people (even those with established obesity) who present with symptoms, and/or biochemical derangements compatible with diabetes, should be managed acutely in order to avoid a delayed diagnosis of type 1 diabetes.

■ **A significant number of children in developed countries are now either overweight or obese, placing them at increased risk of diseases such as type 2 diabetes mellitus (T2DM), hypertension, dyslipidaemia, and nonalcoholic fatty liver disease.<sup>1</sup>**

The emergence of T2DM within the paediatric population (and the high prevalence of T2DM in adults) has been the focus of much publicity over the past few years and, with 6–8% of all Australian children now obese,<sup>2</sup> most practitioners are likely to be aware of the need for screening and treating youth for this problem.<sup>3</sup>

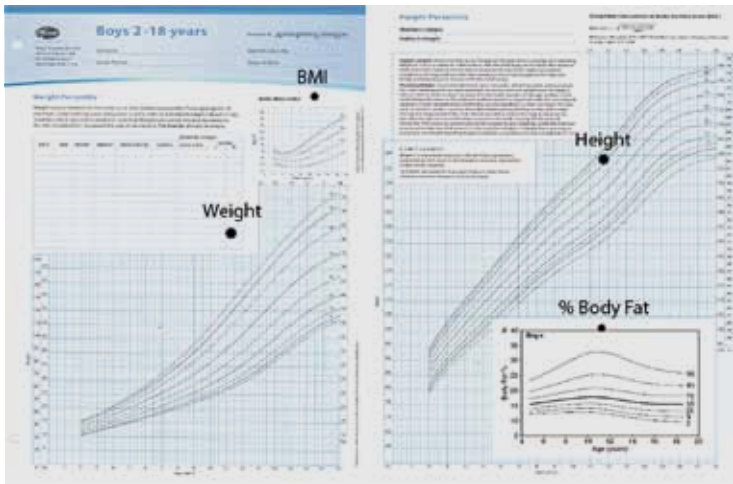
We present the case of an obese boy, 11 years of age, who developed polyuria and polydipsia, leading to an initial diagnosis of T2DM. In fact he, like most of his peers developing diabetes at this age, had developed type 1 diabetes mellitus (T1DM) – a misdiagnosis that may have led to serious consequences due to acute insulin deficiency. Missed cases and delayed diagnosis of T1DM are the most likely reasons for children with newly diagnosed diabetes presenting in diabetic ketoacidosis<sup>4</sup> – the leading cause of acute morbidity and mortality in children with T1DM.<sup>5</sup> This case highlights that careful consideration should be given to the more common condition of T1DM when an obese child presents with polyuria and polydipsia and a raised blood glucose level.

### Case study

A Lebanese boy, 11 years of age, was referred to the Weight Management Service (WMS) at the Royal Children's Hospital (Melbourne, Victoria) following a 4 year history of excessive weight gain. His medical history was unremarkable, he was not taking any medication, his development had been normal and he was progressing well in school. A maternal grandmother and paternal grandfather had been diagnosed with type 2 diabetes mellitus (T2DM) in middle/late life.

Auxology is shown in *Figure 1*. His weight was 82.6 kg (>97<sup>th</sup> centile) and height 1.58 m (90<sup>th</sup> centile), generating a body mass index (BMI) of 33.1 kg/m<sup>2</sup> and a BMI standard deviation score (based on 1990 UK growth data) of +3.33. His waist circumference was 96 cm and bio-impedance analysis (using a Tanita BC-418MA Segmental Body Composition Analyser) showed an overall

Figure 1. Composite figure demonstrating weight, height, BMI and percentage body fat on centile charts



Note: Height, weight and BMI are shown on a standard Australian boy's growth chart (produced by Pfizer using data from the US Centres for Disease Control and Prevention – [www.cdc.gov](http://www.cdc.gov)). Percentage body fat is shown on a figure of normal ranges (derived from McCarthy et al<sup>6</sup>)

percentage body fat of 40.1% (50<sup>th</sup> centile for age and gender = 17.7%; 98<sup>th</sup> centile = 32.9%).<sup>6</sup>

Otherwise clinical examination was unremarkable. He was pre-pubertal, his blood pressure was normal for age and gender, and there was no acanthosis nigricans suggestive of underlying insulin resistance.

A thorough dietary and physical activity review identified several factors that, over time, could account for his continuing weight gain. This boy had undergone several investigations before his attendance at the WMS. An oral glucose tolerance test was normal (fasting glucose 5.2 mmol/L; 120 minute glucose 5.9 mmol/L), as was liver function and a standard lipid profile. A circulating insulin concentration was uninterpretable as the sample had not been taken after a period of fasting.

Standard lifestyle related information was delivered by a paediatrician and dietician, and review was organised for 3 months.<sup>7</sup> The family cancelled an appointment and came back for review 8 months later. The boy stated he had been 'working hard' to reduce his weight – managing to reduce portion sizes and carbonated drinks, as well as generally being more active. He was pleased that his weight had reduced to 78.4 kg, which (with a normal increase in height to 162 cm) was associated with a BMI of 29.9 kg/m<sup>2</sup> and a BMI SDS of +2.94. During this consultation, his mother reported that over the preceding 4 weeks he had been drinking more than usual and had been getting up frequently at night to urinate. She stated that their primary care provider had suggested a diagnosis of T2DM 3 weeks earlier – in view of his weight problems and an elevated fasting plasma glucose (19.3 mmol/L) and HbA1c concentration (11.6%). At that time, it had been suggested that this was best discussed at his forthcoming WMS appointment, as weight control is central to T2DM management.

In the WMS clinic, urinalysis revealed large amounts of glucose and ketones and he was urgently admitted to hospital with a provisional diagnosis of type 1 diabetes mellitus (T1DM). On admission, his circulating glucose concentration was 25.5 mmol/L and pH was 7.37. Over 5 days, he was stabilised on subcutaneous insulin and received appropriate diabetes related education.

He has since remained well on a basal-bolus subcutaneous insulin regimen (1.15 units/kg/day). Glutamic acid decarboxylase antibodies returned as strongly positive which, along with other features such as ketonuria, recent weight loss, and pre-pubertal presentation, confirm the most likely diagnosis to be T1DM.

## Discussion

Type 1 diabetes mellitus is a common paediatric condition, and although the incidence varies globally from 0.1–40.9 per 100 000/year, around 14–19 cases are diagnosed per 100 000/year in Australia.<sup>8,9</sup> This compares with a reported incidence of 2.5 cases of T2DM per 100 000/year in those aged 10–18 years.<sup>10</sup> Therefore, despite the appropriate increased media coverage of the emerging epidemic of T2DM, T1DM remains the commonest form of newly diagnosed diabetes in youth. As such, children and adolescents presenting with elevated plasma glucose levels require immediate assessment and management to avoid the life threatening complications of acute insulin deficiency.

Table 1. Factors that help in the differentiation (but do not categorically classify) between type 1 and type 2 diabetes mellitus in youth

	T1DM	T2DM
Age range	Any age – often young children	More often seen in peri- and post-pubertal youth
Ethnic distribution	All groups	Increased in certain groups, eg. Hispanic, Micronesian, Polynesian, Aboriginal and Torres Strait Islander, Indian and Chinese
Gender distribution	Females = males	Females > males
Symptom duration	Days or weeks	Weeks or months – may be asymptomatic
Obesity	As in population	Generally present in >80%
Family history of diabetes	Present in ~3–5%	Present in ~75–100%
Acanthosis nigricans	Unusual unless incidentally obese	Common
Circulating insulin concentration	Usually low	Usually elevated
Ketosis at presentation	More likely (but can be absent)	Less likely (but can be present)
Islet autoimmunity	Often positive	Generally negative

Adapted from: Rosenbloom AL, Silverstein JH. Type 2 diabetes in children and adolescents. London: Taylor & Francis Books Ltd, 2003

Type 2 diabetes mellitus can be a challenging diagnosis to make, especially in younger individuals, and often requires a comprehensive review of clinical features and biochemical parameters over time.<sup>11</sup> Furthermore, the clinical distinction between T1DM and T2DM is not always clear, as shown by intermediate diabetes states such as latent autoimmune diabetes in youth,<sup>12</sup> as well as the introduction of controversial concepts such as the 'accelerator hypothesis'.<sup>13</sup> This proposes that T1DM and T2DM are the same disorder of insulin resistance set against different genetic backgrounds – a view that is not universally accepted.<sup>14</sup> Factors that help in the differentiation between T1DM and T2DM are outlined in *Table 1*, and details relating to the later diagnostic approach for evaluation of the child with possible T2DM are available through the International Society for Paediatric and Adolescent Diabetes.<sup>15</sup> In some instances, definitive diabetes subclassification can only be performed long after the diagnosis of diabetes has been made and it is therefore imperative that new onset diabetes in youth is acutely assessed as T1DM, until proven otherwise.

This case is a timely reminder that 'common things are common'. All young people, obese or not, presenting with clinical and/or biochemical features of diabetes should be assessed acutely and presumed to have T1DM until proven otherwise.

### Summary of important points

- Obesity is associated with numerous comorbidities and practitioners should remain alert for other underlying conditions.
- Type 1 diabetes remains the commonest form of newly diagnosed diabetes in youth.
- Regardless of body weight, all children with elevated plasma glucose concentrations require immediate assessment.

Conflict of interest: none declared.

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