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Case Report
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High Blood Sugar in a Child: A Case Report

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Abstract

High blood sugar in children is always associated with type 1 diabetes mellitus. However, it also can be due to type 2 diabetes mellitus or Maturity Onset of Diabetes in Young (MODY). MODY is the commonest monogenic form of diabetes and the term arises from mutation of the gene. Generally, diabetes is classified into 4 subtypes; Type 1 diabetes mellitus, type 2 diabetes mellitus, gestational diabetes mellitus and Diabetes Mellitus (DM) due to specific causes other than above. Diabetes is seen not just in adults but also in children and the numbers are increasing in view of transition of lifestyle and behavior. We present a case of high blood sugar in a child which we suspect type 1 diabetes mellitus but turn out to be most probably a MODY type of diabetes mellitus.

Keywords: Maturity onset of diabetes in young; Type 2 diabetes mellitus; Gene mutation

Case Report

A 12 years old Chinese boy presented with a decent referral letter from one of the general practitioners, emphasizing on the random capillary sugar recorded which was 22.1 mmol/l during their encounter.

His mother Madam E also had noticed that her son fluid intake was increasing in trend and it was accompanied by increasing frequency of maturation for 8 to 10 times per day since one month ago. She perceived it as normal in view of growing kids as he was active in extra curriculum and due to the hot weather. He also loses his weight from 69 kg to 49 kg within 3 months.

Otherwise, there were no other associated symptoms suggestive of diabetes mellitus such as poor wound healing and recurrent infection. He denied symptoms pertaining to microvascular and macrovascular complications such as blurring of vision, chest pain, peripheral numbness or body weakness.

His food intake generally consisted of poor dietary choices such as fast food, high-level carbohydrate with carbonated drinks. His mother reminded him constantly however, he ignored his mother. The food normally was prepared by his mother and occasionally they had meal outside the home during festivals or school holidays. He had a lack of exercise prior to this visit as he blamed his previous weight hindering him from playing sports.

Family History

He is the second out of 4 siblings. His other siblings were tested for capillary sugar and the readings were below 5mmol/L. Madam E who is currently working as a clerk has diabetes mellitus and hypertension diagnosed at the age of 33 and on oral medications. His maternal aunt has been having it for the past 10 years, on regular insulin diagnosed at the age of 26. His maternal grandmother had passed away 10 years ago due to diabetic complications and stroke. As for other siblings, they had no medical illness and living healthily (Figure 1).

He had no underlying medical illness, surgical intervention and no history of allergies to medication or food. He was born term and delivered *via* spontaneous vaginal delivery with birth weight of 3.1 kg. No complications were seen during the antenatal period and postnatally. He had completed his vaccination up to date.

On general inspection, he was a fair body build, conscious, comfortable and alert. His blood pressure was 112/74 mmHg, pulse rate is 73/min and afebrile. His weight is 49 kg (on 50th centile) and his height is 159 cm (above 50th centile). His Body Mass Index (BMI): 19.4 kg/m^2 (above 50th centile). His conjunctiva was pink and no jaundice. The skin appeared to be normal and no acanthosis nigricans. There was also no bilateral leg oedema.

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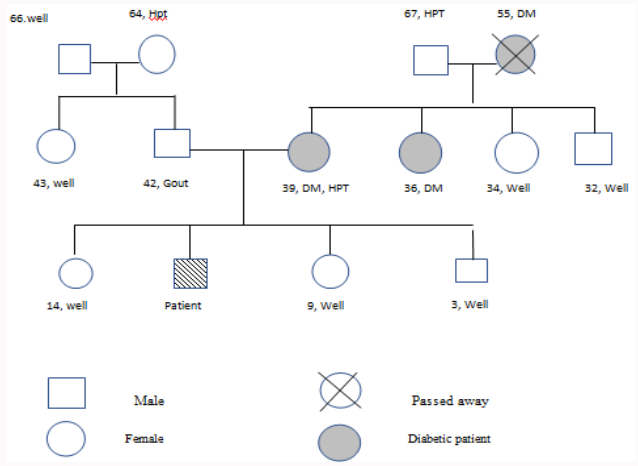

Figure 1:

Blood investigation was done and the result was normal for full blood count, renal function test, liver function test and fasting lipid. His HbA1c was 15.6% and his fasting venous glucose 12.5 mmol/L (<6.1 mmol/L). His serum C-peptide was 0.68 nmol/L (normal value 0.37-1.47 nmol/L), Anti-GAD 3.06 u/mL (<5.0 u/ml), Islet Cell autoantibody 0.24 binary index (<0.71 binary index). All are in the normal range.

Urine examination reveals negative for protein. His funds examination was normal as well as his electrocardiograph.

Discussion

Patient with MODY normally presented with atypical symptoms of type 1 and 2 diabetes mellitus such as fatigue, excessive thirst, polyuria, frequent infections, slow healing wounds especially patients with HNF1A and HNF4A. Sometimes the symptoms are very mild, and the condition may be unnoticed. Patients with the subtype of Glucokinase (GCK) are often being diagnosed incidentally during routine blood glucose investigation. On examination, the patient will have lack of sign of insulin resistance and complications of diabetes are obvious during the later stage. An absence of pancreatic islet auto antibodies and measurable C-peptide in the presence of hyperglycaemia highly suggestive that it was unlikely due type 1 DM [1,2].

As a growing adolescent, the main objective was to prevent any sort of acute or chronic complications. MODY carries risks of both microvascular and macrovascular diabetic complications [3,4]. Prevention of complication will be attained by gaining control of his sugar level. There are multiple types of MODY discovered. However, 99% with known a etiologies are caused by mutations in hepatocyte nuclear factor such as HNF1-alpha, HNF4-alpha, HNF1-beta and GCK [5]. The importances of identifying the subtypes are for research purposes and part of the management. Based on studies, MODY accounts for 1 to 2.4 percent of Pediatric diabetes cases [6-8].

Most of the MODY patients have been diagnosed either with type 1 or 2 diabetes mellitus due to the rareness of the disease [5]. This monogenic diabetes runs in families and all children of an affected parent will have 50% chance of having the affected gene as it is autosomal dominant inheritance. Another form of monogenic diabetes is Neonatal Diabetes Mellitus (NDM) occurs in new-born or young infants especially seen in the first 6 months of life.

The classical clinical criteria for MODY are being diagnosed with diabetes under the age of 25, having a parent with diabetes, with diabetes in two or more generation and not necessarily needing insulin in view of preserved beta cell function [9]. A strong autosomal dominant pattern of inheritance may provide vital information to differentiate between MODY and type 1 DM.

Genetic testing cost for genes associated with MODY was recorded to be as high as $2,580 USD. There are limited studies in Malaysia pertaining to MODY. This is most probably due to the cost of running the genetic study and the rareness of the disease. The nearest center that would perform this test is in Singapore. McDonald, Shields et al., revealed that C-Reactive Protein (CRP) has a role of detecting HNF1A- MODY but not for other subtypes [5].

There is no official consensus in regard to MODY guideline in Malaysia. Basic investigation like fasting plasma glucose, HbA1c, lipids, renal and liver profile and urinalysis for albumin are mandatory for baseline and follow up purposes. The latest International Society for Paediatric and Adolescent Diabetes 2018 recommended proceeding with genetic studies if diabetes presenting before 6 months of age, family history of diabetes in either one parent or other first relatives affected, absent of islet autoantibodies and detectable C-peptide indicating preserved beta cell function. Type 2 DM diagnosis may not be correct in children who are not obese or from a diabetic family with normal weight, absence of Acanthosis nigricans and ethnic with lower prevalence of type 2 DM.

As for the treatment, the aim is to improve the quality of life by adhering to short term and long-term strategies, reduce complication and also preventing premature death. These goals can only be achieved through a team approach and patient centeredness. Even though it is a challenging task especially in dealing with adolescents, the reward will be promising and life-changing for both directions. Glycaemic control can be optimised by recommending a well-balanced meal plan according to the patient's profile and based on medical nutrition therapy. It is an essential component of diabetes management which consists of energy balance and intake, nutritional care and education and also nutritional management of physical activities. The goals are to provide adequate energy intake and nutrients for optimal growth and developmental, archiving optimum glycaemic control by maintaining balance food intake, to prevent and treat acute complication such as hypoglycaemia. Sulfonylurea works wonder on most of the subtype, nevertheless there are certain types which are highly efficacious using insulin.

Physical activity is an essential component of managing diabetes as they are predisposed with cardiovascular and other complications. Physical activity can be divided into 2 common types, aerobic (low-intensity physical activity) and anaerobic exercise (high-intensity physical activity). The benefits of physical activity mainly targeting on HbA1c level and also BMI. It helps to promote muscle strength and increases stamina.

In a large systemic study of MODY among paediatric age group, they were usually misdiagnosed and wrongly treated with insulin [10]. Most patients will need pharmacological treatment at one point in time. HNF4A and HNF1A MODY are highly sensitive to sulfonylureas [11] in comparison to insulin [12]. In literatures did mention that MODY patient can be on low-dose sulfonylureas for years as long as they have no adverse effects [13,14].

As conclusion, MODY is a rare monogenic disease caused by the

genetic mutation. As a family medicine specialist, there is an urge to update our knowledge especially pertaining to chronic diseases. The impact of diabetes and its complications can be devastated especially to a growing adolescent and during their adulthood. Managing MODY especially in adolescent requires their trust and rapport simultaneously so that they will comply with the mutual treatment regime. As for targets for MODY, it does not differ from any other types of diabetes mellitus. The main goal for MODY is to improve one's quality of life by having optimal glycaemic control so that complications can be prevented.

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