

PedsCases Podcast Scripts

This is a text version of a podcast from Pedscases.com on "Type 2 Diabetes." These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedcases.com/podcasts.

Type 2 Diabetes

Developed by Raisa Kanji and Dr. Mary Jetha for PedsCases.com. December 7, 2014.

Hi. My name is Raisa Kanji and I am currently a medical student at the University of Alberta. This podcast was developed in conjunction with Dr. Mary Jetha, a pediatric endocrinologist at the Stollery Children's Hospital in Edmonton, Alberta.

These are the following three objectives of this podcast on Type 2 diabetes in children and adolescents:

- 1) Review the risk factors and screening for Type 2 diabetes in children and adolescents
- 2) Discuss the presentation and diagnosis of Type 2 diabetes in children and adolescents
- 3) Review the management, potential complications, and prevention of Type 2 diabetes in children and adolescents

Let's begin with the risk factors in a child that could lead to the development of Type 2 diabetes.

A child with a BMI at or above the 95th percentile has an increased risk of developing Type 2 Diabetes. Some ethnic populations have a higher risk of Type 2 diabetes. These include Aboriginal, Hispanic, South Asian, Asian and African people. Type 2 diabetes in a first or second-degree relative, and exposure to hyperglycemia in utero, also increase the chance that a child or adolescent develops Type 2 Diabetes. If a child has any signs or symptoms of insulin resistance, such as acanthosis nigricans, his or her risk is increased. Finally, a child is more likely to develop Type 2 Diabetes if he or she has other metabolic or obesity-related conditions, such as hypertension, dyslipidemia, non-alcoholic fatty liver disease (NAFLD), or polycystic ovarian syndrome (PCOS).

Now that we are aware of the risk factors for pediatric Type 2 diabetes, let's talk about the screening process.



Many children with Type 2 diabetes do not present with symptoms, but rather, are diagnosed by chance or by screening tests. *Who should be screened?*

Children with risk factors for Type 2 Diabetes should be screened every two years. Any child with impaired fasting glucose or impaired glucose tolerance, and children treated with atypical antipsychotics should be screened. Prepubertal children should be screened if they have 3 or more, and pubertal children if they have 2 or more of the following risk factors, which we already mentioned: BMI above the 95th percentile, high-risk ethnic group, family history of obesity or exposure to hyperglycemia in utero, or acanthosis nigricans or other metabolic conditions, like hypertension, dyslipidemia, PCOS, and NAFLD.

What screening tools are available?

Screening methods for Type 2 diabetes include measuring the fasting plasma glucose (FPG) or doing an oral glucose tolerance test (OGTT). Measuring the fasting plasma glucose is recommended for routine screening in children because it is easier to obtain. However, the oral glucose tolerance test may be more sensitive, as fasting glucose may be preserved even when post-prandial glucose is in the diabetic range. The OGTT can be used when screening very obese children or children with multiple risk factors. Measurement of the Hemoglobin A1c should not be used as a screening tool in children.

Now that we have discussed the risk factors and appropriate screening for Type 2 diabetes in children and adolescents, let's talk about the various ways Type 2 diabetes can present:

Most kids present with Type 2 diabetes in the teenage years, but about 10% are younger than 10 years old at diagnosis. As mentioned earlier, many children have no signs or symptoms; this makes it imperative to know who should be screened and to screen appropriately. Some children do present with diabetes-specific signs and symptoms - symptoms of hyperglycemia. They are the same symptoms as are seen in Type 1 Diabetes, but are usually less severe because the onset of Type 2 Diabetes is typically more insidious. The most well-known symptoms of diabetes are polydipsia and polyuria. Excess sugar in the bloodstream pulls fluid from the tissues. The fluid is excreted by excess urination, and this causes body fluid depletion and increases thirst. Insulin deficiency prevents the cells from using sugar, which causes energy depletion in cells and tissues, increases hunger, and causes fatigue. Weight loss may occur due to dehydration and due to muscle and fat breakdown for energy needs - however, weight loss is less likely and less severe in the presentation of Type 2 Diabetes than it is in Type 1 Diabetes. Blurred vision results from fluid shifts involving the lenses of the eye. Slow healing of sores and frequent infections of skin or mucous membranes can also occur. If insulin deficiency and the resultant breakdown of muscle and fat is prolonged, acute decompensation and diabetic ketoacidosis (DKA) can occur. This presentation will be mentioned later on when discussing complications of Type 2 diabetes.



How is Type 2 diabetes in children and adolescents diagnosed?

The same definition of diabetes that is used in adults is used in children. It is based on blood glucose measurements. A fasting glucose equal to or greater than 7.0 mmol/L, or an OGTT 2 hr glucose equal to or greater than 11.1 mmol/L are the levels at which diabetes is diagnosed. There is no specific test to determine whether the child has Type 1 or Type 2 diabetes, so it is important to consider whether risk factors for Type 2 Diabetes are present. Additional laboratory findings that are more common in Type 2 Diabetes (but not necessarily diagnostic) are an elevated fasting C-peptide level, and absence of diabetes-related autoantibodies.

We now know the risk factors, screening process, presentation and diagnosis of Type 2 diabetes in children and adolescents. Now, we will look at the management of this disease.

Insulin therapy should be started immediately at diagnosis if the child has a hemoglobin A1c greater than 9%, if they have significant symptoms of hyperglycemia, or if they presented in DKA. Insulin can be weaned if blood glucose normalizes and the child is able to adopt more healthful lifestyle practices.

The first order of business in management for children diagnosed with Type 2 diabetes should be lifestyle modifications. Involving the family in lifestyle behavior change is essential. The child should have an interdisciplinary team of pediatric health care professionals following him or her from the beginning of their diagnosis. Weight loss or weight management should be part of treatment. Healthy eating and physical activity should be emphasized. There is no specific "diabetic eating plan" but rather, kids are encouraged to have portion control and to incorporate all food groups into their diet. Decreasing intake of sugar-sweetened beverages and processed foods can have a dramatic impact on blood glucose. It is important for children with Type 2 diabetes to engage in 60 minutes of moderate to vigorous physical activity each day. Additionally, it is important that they decrease sedentary time and they are recommended to spend no more than two hours in front of a television or computer each day. The pediatric interdisciplinary health team should assess the child for psychological issues like depression or binge eating. Lifestyle management requires a lot of work on the part of the child, the family and the health care team. Assessing the stage of change, motivation and barriers to lifestyle change are essential aspects of treatment. Goal setting, review of progress, and celebrations of small successes can be used effectively.

The hemoglobin A1c target for children with Type 2 Diabetes is 7% or less. If the child's diabetes is not in control after approximately three to six months of lifestyle modification, antihyperglycemic agents can be administered. There is limited information about the safety and efficacy of antihyperglycemics in the pediatric population, but Metformin and Glimepiride can be used. Metformin has been shown to be safe for up to 16 weeks reducing A1C by 1-2%, and it does not cause hypoglycemia. Glimepiride can be used for up to 24 weeks reducing the A1C by 1-2%. However, this antihyperglycemic can result in a 1.3 kg weight gain. For this reason, Metformin is generally preferred. Insulin



can also be used to improve glucose control. There are many types of insulin available including rapid-acting, long-acting and intermediate acting options. A decision of what type of insulin should be used depends on the child's blood sugar levels, lifestyle, eating patterns, and family support. Children with Type 2 diabetes may need to monitor blood glucose levels periodically in order to assess blood glucose control and the effects of foods on blood glucose. Children on insulin should check blood glucose levels at least three times a day and keep a log book so that insulin dosing adjustments can be made.

It is important that children with Type 2 diabetes be screened for complications associated with this disease. Beginning at diagnosis, children should be screened annually for microvascular complications including nephropathy, neuropathy and retinopathy. As well, their fasting lipid profile should be measured at diagnosis and every one to three years after. Hypertension should be screened for at diagnosis and bi-annually. Children should also be screened at diagnosis for comorbid conditions associated with insulin resistance including non-alcoholic fatty liver disease (NAFLD) and polycystic ovarian syndrome (PCOS) in pubertal girls. Additionally, they should be screened for microalbuminuria preferably with a morning urine albumin to creatinine ratio (ACR).

Now that we have talked about how Type 2 diabetes should be managed in children and adolescents, let's discuss some of the short-term complications one should be aware of.

Some of the short-term complications of Type 2 diabetes include hypoglycemia, hyperglycemia with diabetic ketoacidosis, and diabetic hyperosmolar syndrome. These short-term complications must be treated immediately. Hypoglycemia occurs when the child's blood sugar level is below the normal range and normally is a complication when the child is on insulin. This can occur when a meal is skipped, when the child gets more exercise than normal, or if too much insulin is injected. The child may present with sweatiness, shakiness, drowsiness, hunger, headaches, confusion and even loss of consciousness. Episodes of hypoglycemia should be treated with 15 grams of a fastacting source of sugar. If the child has a seizure or loses consciousness, they need emergency/EMS assistance. Another complication that may occur is hyperglycemia leading to diabetic ketoacidosis (DKA). This occurs in situations of relative insulin deficiency, such as when insulin doses are missed, or when there is a concurrent illness which increases insulin resistance. DKA occurs more often in Type 1 diabetes but it can still be a complication in Type 2 diabetes. Insulin deficiency causes the liver to break down glycogen and gluconeogenesis will occur. There will be an elevation of counterregulatory hormones like catecholamines, glucagon, cortisol, and growth hormone. Protein and fat are broken down. The product of fat breakdown is ketones. Ketones accumulate in the bloodstream and are excreted in the urine. Ketosis causes vomiting, lethargy and loss of consciousness if severe. This is a metabolic emergency that requires treatment in a medical facility. The child needs fluid to restore their blood volume, insulin to reverse insulin deficiency, and careful electrolyte assessment and replenishment.



The last complication which may present is diabetic hyperosmolar syndrome. Although it is more commonly seen in adults, it does occur in children and adolescents. It is differentiated from DKA by extreme hyperglycemia, extreme hyperosmolarity, and mild acidosis. It may take days to weeks to develop. Treatment to reverse this condition includes more emphasis on fluid replacement, but also requires insulin to lower the blood sugar levels.

It is important to be aware of these complications, as prompt emergency action must take place to avoid further exacerbation of the situation.

Lastly, we will briefly discuss ways in which Type 2 diabetes may be prevented in children and adolescents.

Firstly, breastfeeding has been shown to reduce the risk of Type 2 diabetes in some populations. Secondly, obesity is the most important major modifiable risk factor for pediatric diabetes. More than 95% of children and youth diagnosed with Type 2 Diabetes are obese. Maintaining a healthy body weight, eating nutritious foods in portions which do not result in excessive weight gain, and engaging in daily moderately vigorous physical activity will help prevent children from developing Type 2 diabetes and other associated conditions.

This brings us to the end of the podcast. We would like to leave you with a summary of the important points:

- Risk factors for a child developing Type 2 diabetes include obesity, being from certain ethnic populations, having a first or second-degree relative with diabetes, exposure to hyperglycemia in utero, having signs and symptoms of insulin resistance, and having any metabolic or obesity-related conditions
- Children with risk factors for Type 2 Diabetes should be screened every 2 years
- Screening methods include a Fasting Plasma Glucose or an Oral Glucose
 Tolerance Test
- Many children will present with no diabetic related signs or symptoms whilst others will present with symptoms of hyperglycemia
- A fasting glucose equal to or greater than 7.0 mmol/L, or an OGTT 2 hr glucose equal to or greater than 11.1 mmol/L are the levels at which diabetes is diagnosed, also paying attention to if the child has the appropriate risk factors
- Management of this disease includes lifestyle modifications with the possibility of the administration of anti-hyperglycemics and insulin
- It is important that the child is screened at diagnosis and continuously for micro and macrovascular complications that can be associated with this disease
- Some of the short-term complications of Type 2 diabetes include hypoglycemia, hyperglycemia with diabetic ketoacidosis, and diabetic hyperosmolar syndrome
- Staying active, eating healthy, and avoiding excessive weight gain can reduce the chance of a child developing Type 2 diabetes



Thank-you for listening to this podcast on Type 2 diabetes in children and adolescents. We hope you have a better understanding of this increasingly prevalent disease.

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