

Dyslipidemia and type 2 diabetes mellitus

History:

A 17-year-old Hispanic female patient is seen for a routine clinic follow-up visit. She was diagnosed with type 2 diabetes 6 months ago. Her hemoglobin A1c upon diagnosis was 10.4 percent. She was started on metformin and insulin therapy. At her clinic visit today her hemoglobin A1c has decreased to 7.9 percent.

There is a family history of type 2 diabetes in the mother and in three grandparents. The maternal grandmother had a myocardial infarction at age 53.

Physical examination:

- Height 163 cm (50th percentile)
- Weight 108 kg (>95th percentile)
- Body mass index (BMI) 40.6 (99th percentile)
- Blood pressure 139/83

The exam is significant for acanthosis nigricans noted at multiple locations and abdominal obesity.

Laboratory studies:

Lipid profile: Total cholesterol: 185 mg/dL

- Triglycerides: 169 mg/dL
- HDL cholesterol: 34 mg/dL
- LDL cholesterol: 122 mg/dL

Questions:

1. Which of the following statements is most accurate regarding the risk of cardiovascular disease in patients with type 2 diabetes?

- a. Individuals diagnosed with type 2 diabetes as adolescents have a high risk of myocardial infarction before 20 years of age.
- b. The presence of type 2 diabetes is an independent risk factor for cardiovascular disease.
- c. The high risk of cardiovascular disease in patients with type 2 diabetes is due to the frequent occurrence of co-morbid conditions such as hypertension and dyslipidemia, not due to diabetes itself.
- d. Dyslipidemia is rarely seen in adolescents with type 2 diabetes; therefore, lipid screening is not recommended until 20 years of age.

Answer: b. The presence of type 2 diabetes is an independent risk factor for cardiovascular disease.

Discussion: In the past, type 2 diabetes was considered exclusively a disease of adulthood. Over the past 2 decades, increasingly more adolescents have been diagnosed with the disorder. The rise in childhood type 2 diabetes has coincided with the rise in childhood obesity. Recent studies have reported that between 8 and 50 percent of newly diagnosed adolescent diabetic patients have type 2 diabetes. Because type 2 diabetes is a relatively new disorder in the adolescent population, limited prospective data exist. Therefore, clinical guidelines regarding the treatment of dyslipidemia in adolescents with type 2 diabetes are largely based on adult literature.

Cardiovascular disease is the main cause of morbidity and mortality of patients with diabetes. Hypertension and dyslipidemia are common co-morbidities of type 2 diabetes and are definite risk factors for cardiovascular disease, but the presence of type 2 diabetes alone confers independent risk. Hyperglycemia and insulin resistance are thought to lead to endothelial dysfunction and contribute to the development of dyslipidemia.

2. Which of the following is not among the lifestyle modifications recommended to improve the lipid profile in patients with type 2 diabetes?

- a. Increase omega-3 fatty acid intake.
- b. Increase soluble fiber intake.
- c. Increase fruit juice intake.
- d. Decrease trans-fat.

Answer: c. Increase fruit juice intake.

Discussion: Therapeutic lifestyle modifications are recommended in patients with type 2 diabetes with dyslipidemia, regardless of whether medical therapy is indicated. Examples of lifestyle modifications include decreasing intakes of saturated fat, trans fat and cholesterol; increasing intakes of omega-3 fatty acids, soluble fiber and plant stanols or sterols; increasing physical activity; and implementing weight loss (if overweight). In those with poor glycemic control, improved control can also improve the lipid profile.

Foods high in saturated fat come primarily from animal products, such as meats and dairy. Saturated fats are also found in some plant foods, such as palm oil and coconut oil. Trans fats are found in trace amounts in natural food but can occur in significant amounts in processed foods. Trans fats are added to processed foods because they increase shelf life, limit refrigeration requirements and offer a low-cost alternative to other oils.

Foods high in soluble fiber include legumes, many fruits and vegetables, whole grains and nuts. Omega-3 fatty acids are found in some types of fish, plants and nuts. Plant sterol and stanol esters are a group of naturally occurring compounds found in plant cell membranes. They are naturally present in small quantities in vegetable oil, nuts, legumes, whole grains, fruits and vegetables. Most people do not naturally consume quantities of plant sterols or stanols sufficient to lower cholesterol. Some foods are now fortified with plant sterols or stanols, and they can also be consumed in the form of supplements.

3. What is the most common dyslipidemic pattern found in patients with type 2 diabetes?

- a. Low levels of HDL cholesterol and elevated triglyceride levels.
- b. Isolated elevated LDL cholesterol levels.
- c. Elevated HDL and LDL cholesterol levels.
- d. Low HDL and LDL cholesterol levels.

Answer: a. Low levels of HDL cholesterol and elevated triglyceride levels.

Discussion: A combination of low levels of HDL cholesterol and elevated triglyceride levels is the most common lipid pattern seen in individuals with type 2 diabetes. The medical literature indicates that treatment with statins reduces morbidity and mortality due to cardiovascular disease in patients with type 2 diabetes. Statins target primarily LDL levels, as opposed to HDL and triglyceride levels. The medical literature contains less evidence that therapies targeting HDL and triglyceride levels reduce morbidity and mortality in diabetic populations.

Key points:

- 1. Type 2 diabetes is an increasingly common diagnosis in obese adolescents, especially those with other risk factors, such as a positive family history, ethnicity and the presence of acanthosis nigricans.
- 2. Individuals with type 2 diabetes have an increased prevalence of lipid abnormalities and hypertension, which contributes to their high risk of cardiovascular disease.
- 3. Cardiovascular disease is the leading cause of morbidity and mortality in individuals with diabetes.
- 4. Clinical trials have demonstrated significant positive effects of pharmacologic therapy on cardiovascular disease outcomes in diabetic populations. The medical literature has focused primarily on adult populations, and long-term prospective data on young patients with type 2 diabetes are limited.

References/suggested reading:

1. Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents: Summary Report. *Pediatrics*. 2011 Dec; 128 Suppl 5:S213–56.
2. Standards of Medical Care in Diabetes – 2012. American Diabetes Association. *Diabetes Care*. 2012 Jan; Vol 35, Supplement 1.
3. Kavey RW, Allada V, Daniels SR, Hayman LL, McCrindle BW, Newburger JW, Parekh RS, Steinberger J. Cardiovascular Risk Reduction in High-Risk Pediatric Patients. *Circulation*. 2006; 114:2710–2738.