Question: 21

During your examination of a 7-year-old boy at his health supervision visit, conducted with a pediatric resident, you determine that his weight is greater than the 97th percentile for age. His mother is obese, his father has type 2 diabetes mellitus, and one grandfather died of a myocardial infarction at 51 years of age. You counsel the family about improvements they can make in the boy’s diet and level of exercise.

Of the following, you are MOST likely to advise the resident that this child’s risk of developing metabolic syndrome

A. can be predicted by a determination of hemoglobin A1c values

B. is close to that of the general population because there is no family history of hyperlipidemia or systemic hypertension

C. is reduced if he begins to develop a healthy lifestyle as a child

D. is the same as the general population if cholesterol-lowering agents are started, even without lifestyle changes

E. is the same as the general population if his fasting lipid profile is currently normal
The findings on physical examination combined with the family history for the boy described in the vignette suggest that he is at risk of metabolic syndrome, a combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes. Metabolic syndrome affects one in five people, the prevalence increases with age, and some studies estimate the prevalence in the United States to be up to 25% of the population. Metabolic syndrome also is known as metabolic syndrome X, syndrome X, and insulin resistance syndrome. The term "metabolic syndrome" dates back to at least the late 1950s but came into common usage in the late 1970s to describe various associations of risk factors with diabetes. The term "metabolic syndrome" for associations of obesity, diabetes mellitus, hyperlipoproteinemia, and hyperuricemia describes the additive effects of risk factors on atherosclerosis. The terms "metabolic syndrome," "insulin resistance syndrome," and "syndrome X" now are used specifically to define a constellation of abnormalities that is associated with increased risk for the development of type 2 diabetes and atherosclerotic vascular disease (eg, heart disease and stroke).

Very little is known about the development of metabolic syndrome in children, and the term is not used in pediatrics. However, clinicians are becoming increasingly cognizant of the risk factors in the pediatric population, which include obesity, family predisposition to early cardiovascular disease, systemic hypertension, type 2 diabetes, and an unhealthy dietary and exercise-related lifestyle. Criteria have been determined for treating childhood hyperlipidemia, with the first line of therapy being diet modification and exercise programs. Adoption of such lifestyle changes in childhood can reduce the risk of developing metabolic syndrome. Cholesterol-lowering agents never are used in the absence of concomitant recommendations for institution of lifestyle changes. Although an elevated hemoglobin A1c value does predict diabetes, data are insufficient in the pediatric population to make predictions regarding the use of this value alone to predict risk for the eventual development of the metabolic syndrome. The same holds for fasting lipid profiles: an abnormal panel predicts the development of hyperlipidemia during adulthood but does not predict the development of the metabolic syndrome. A normal fasting lipid profile does not reduce this risk. The risk for the development of metabolic syndrome does not require the presence of all components of the definition. The absence of several risk factors (ie, family history of hyperlipidemia/hypertension) does not reduce this child’s risk to that of the normal population because of the presence of other risk factors.

The exact mechanisms of the complex pathways of metabolic syndrome are not yet completely known. Most patients are older, obese, sedentary, and have a degree of insulin resistance. Stress also can be a contributing factor. The most important factors are: obesity, genetic predisposition, aging, and sedentary lifestyle (ie, low physical activity and excess caloric intake).

There is debate regarding whether obesity or insulin resistance is the cause of the metabolic syndrome or if they are consequences of a more far-reaching metabolic derangement. A number of markers of systemic inflammation, including C-reactive protein, often are increased, as are fibrinogen, interleukin-6, tumor necrosis factor-alpha, and others. Central adiposity is a key feature of the syndrome. However, despite the importance of obesity, patients who are of normal weight also may be insulin-resistant and have the syndrome. The metabolic syndrome
affects 44% of the United States population older than age 50, and a greater percentage of women older than age 50 have the syndrome than do men. It is estimated that 75% of patients who have type 2 diabetes have the metabolic syndrome. With appropriate cardiac rehabilitation and changes in lifestyle (eg, nutrition, physical activity, weight reduction, and, in some cases, medications), the prevalence of the syndrome can be reduced.

The International Diabetes Federation consensus worldwide definition of the metabolic syndrome (2006) includes central obesity (defined by waist circumference), AND any two of the following:
- Elevated triglycerides
- Low high-density lipoprotein (HDL) cholesterol
- Hypertension
- Elevated fasting plasma glucose

Various strategies have been proposed to prevent the development of metabolic syndrome, including increased physical activity (such as walking 30 minutes every day) and a healthy, reduced-calorie diet. However, these measures are effective in only a minority of people, primarily due to a lack of compliance. Drug treatment frequently is required. Diuretics and angiotensin-converting enzyme inhibitors may be used to treat hypertension. Cholesterol drugs may be used to lower low-density lipoprotein cholesterol and triglyceride concentrations, if they are elevated, and to raise HDL concentrations, if they are low. Use of drugs that decrease insulin resistance such as metformin is controversial; this treatment is not approved by the United States Food and Drug Administration. Cardiovascular exercise has been shown to be therapeutic in approximately 30% of cases. The most probable benefit is reduction in triglyceride concentrations, but fasting plasma glucose and insulin resistance in most patients did not improve.

Suggested reading:

