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Editorial

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Cardiovascular Risk Factors and Obesity in Adolescents

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Cardiovascular diseases (CVDs), including coronary artery disease manifesting as angina and myocardial infarction, are the leading cause of death in developed countries. Cardiovascular risk factors, either alone or in combination, can lead to cardiovascular events in adults. Although CVD is rare in children and adolescents, there is evidence that atherosclerotic changes can begin early in life without symptoms.[1] Cardiovascular risk factors such as body mass index (BMI), high blood pressure (BP), increased total cholesterol, and elevated triglycerides and low-density lipoprotein cholesterol (LDL-C) were associated with the extent of lesions in the Bogalusa Heart Study.[1] Therefore, cardiovascular health guidelines for pediatricians were established by the National Heart, Lung, and Blood Institute.[2] The guidelines consist of the recommendations for those with known risk factors for CVD such as family history, age, sex, nutrition/diet, physical inactivity, tobacco exposure, high BP, elevated lipid levels, overweight/obesity, diabetes mellitus (DM), predisposing conditions, metabolic syndrome, inflammatory markers, and perinatal factors. Several tracking studies have shown a correlation of these risk factors between childhood and adulthood. Obesity in childhood leads to obesity in adult life. The Bogalusa study showed that 84% of children with a BMI ≥95th percentile and those with a BMI ≥99th percentile became obese in adulthood.[3] Tracking the correlation of high cholesterol or BP levels with obesity has been reported, and those with obesity more likely have a tendency to develop hypertension or dyslipidemia as adults.[2]

Overweight/obesity is one of the key factors associated with CVD. Childhood obesity has been increasing worldwide, and in Korea, obesity has increased from 8.7% in 2007 to 15.0% currently.[4] Obesity, characterized by increased adiposity, accelerates the atherosclerotic process and even more powerful when combined with other established risk factors.[1] Consortium data from prospective cohorts demonstrated that a BMI indicative of obesity in children was a strong independent risk factor for arterial vascular abnormalities.[5] An increase in the BMI during childhood increases the risk of adult obesity, metabolic syndrome, hyperglycemia, or type 2 DM, suggesting insulin resistance. In addition, clustering risk factors such as obesity, high triglycerides, and insulin resistance are determinants of adult metabolic syndrome.

BMI has been used to screen obesity because it is simple and well correlated with CVD risk. Compared to children with obesity who had a BMI ≥95th percentile to <120% of the 95th

percentile, children with obesity with ≥140% of the 95th percentile or a BMI ≥40 kg/m^2 had an increased risk of high total cholesterol, low high-density lipoprotein cholesterol (HDL-C), high triglycerides, high systolic BP and diastolic BP, and increased hemoglobin A1c and fasting glucose.[6] However, the BMI classification associated with being overweight and obese has some limitations. The meta-analysis revealed that the BMI had high specificity but low sensitivity to detect high adiposity and failed to detect children with excess body fat percentage, as BMI has limitations in terms of being associated with abdominal fat depots.[7] Additionally, minor adults with obesity defined by BMI are free from metabolic disease.

The waist circumference-to-height ratio or waist circumference is an additional parameter for the assessment of abdominal adiposity. The waist circumference-to-height ratio showed discriminatory power for diabetes, hypertension, and CVD in adults compared with BMI or waist circumference in a meta-analysis by Ashwell et al.,[8] but did not have better screening power in another study.[9] On the other hand, waist circumference is associated with cardiovascular mortality and is recommended as a routine measurement in clinical practice in addition to BMI in adults. Elevated waist circumference is a risk factor for metabolic syndrome in addition to triglyceride level, BP and/or fasting glucose level, and reduced HDL-C. In several studies, the waist circumference-to-height ratio or waist circumference was revealed as a better predictor of CVD in children. Cardiovascular health guidelines define the cutoff point for waist circumference for evaluating children with multiple cardiovascular risk factors as ≥90th to <95th percentile for waist circumference.[2]

Lee's study[10] showed a correlation between waist circumference and the following cardiovascular risk factors: hypertension, high total cholesterol, high triglycerides, high LDL-C, and low HDL-C. This study demonstrated its availability as a routine parameter of obesity by showing a correlation between waist circumference and most of the risk factors for metabolic syndrome. They also tried to evaluate the effect by sex and age stratification, and the results showed that the number of associated risk factors was different according to age group and sex. However, this is a cross-sectional study, and we cannot predict the age effect of each associated risk factor or effect on future CVD. Nonetheless, it is meaningful to demonstrate the utility of waist circumference using nationwide data. We need a prospective study evaluating the clinical usefulness of this parameter of obesity to predict potential CVD.

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