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COMMENT

Atherosclerosis and arteriosclerosis

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Dyslipidemia is an important problem, even in children, because of the risk of future cardiovascular disease. However, evaluating the influence of dyslipidemia on vessels is difficult. In children, the short exposure time to various risk factors is challenging. Cruz's paper nicely demonstrates the clinical problems of dyslipidemia in children [1]. In this paper, the authors evaluated the carotid-femoral pulse wave velocity (cfPWV), one of the standard tools for evaluating arterial stiffness. The term arterial stiffness usually means arteriosclerosis; however, it can be sometimes used for atherosclerosis. They are different conditions but can overlap and are frequently confused.

Atherosclerosis is the result of a pathological process that starts with a local lesion in the intima of middle to large arteries. Lipid is then deposited in the intima, causing inflammation. Atherosclerosis results in occlusive disease. For example, atherosclerosis of the coronary artery causes coronary artery stenosis, which can induce angina. Rupture of the coronary atheroma plaque leads to myocardial infarction.

Arteriosclerosis is more of an aging process. One of the important features of arteriosclerosis is the increase in the stiffness of elastic arteries, including the aorta. The pathological characteristics of arteriosclerosis include elastin fracture, an increase in collagen fibers, and calcium deposition. In contrast to atherosclerosis, one of the morphological features of arteriosclerosis is dilation. It is well-known that the aorta gradually dilates with age. Elastin fracture depends on strain and the number of cardiac cycles experienced, hence, the strong impact of age on elastin fracture. Practically, Ohmori et al. reported no significant difference in PWV between groups with and without a history of atherosclerotic disease [2]. Recently, the concept of early vascular aging, which means acceleration of the aging process of the elastic arteries, appears to be a promising indicator that can provide clinical guidance for treating individuals at an increased risk of cardiovascular disease [3]. Early vascular aging is defined as PWV values higher than the 95th percentile for age and sex.

Dyslipidemia is an important risk factor for cardiovascular disease. Although it is logical that dyslipidemia would contribute to atherosclerosis, there are conflicting reports regarding the relationship between dyslipidemia and arteriosclerosis. Although some studies have found no relationship between brachial-ankle PWV (baPWV) and total cholesterol level [4], it has been reported that the estimated aortic PWV correlates positively with low-density lipoprotein (LDL) cholesterol levels [5]. Vallee et al. found that total cholesterol, LDL cholesterol, and nonhigh-density lipoprotein (HDL) cholesterol levels were significantly correlated with the PWV index [6]. We have previously reported that early vascular aging was common in adult patients with congenital heart disease. In this report, the significant determinants of early vascular aging were LDL cholesterol, triglycerides, fasting blood sugar, and hemoglobin A1c levels [7]. Ojima et al. reported that atherosclerosis, which was diagnosed by plaque score, was associated with impaired fasting glucose and dyslipidemia. On the other hand, a high baPWV was significantly correlated with impaired fasting glucose [8]. Cecelja et al. published a systematic review concerning the relationship between cfPWV and cardiovascular disease risk factors and concluded that most studies found no independent association between cfPWV and total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides [9]. Sougawa et al. reported that triglyceride levels, low HDL cholesterol, and impaired fasting glycemia significantly increased with increases in the standardized baPWV z-score [10]. Ohnishi

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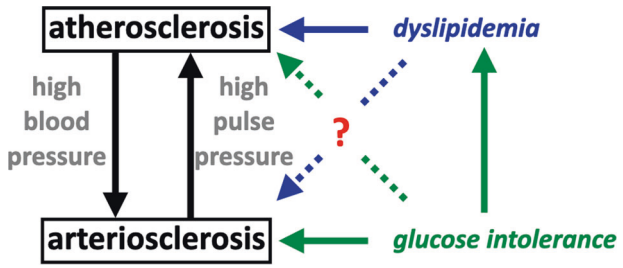

Fig. 1 Relationship between atherosclerosis and arteriosclerosis

et al. reported a close relationship between blood sugar level and baPWV [11].

It has been suggested that there is a nonenzymatic reaction between blood sugar and collagen in the arterial wall. The formation of advanced glycation endproducts on the vascular wall causes crosslinking of collagen molecules, thereby increasing arterial stiffness. The high glucose concentration and chronic exposure promote the glycation. Therefore, besides blood sugar and hemoglobin A1c levels, triglyceride levels can also be determinants of PWV, although some papers have reported no significant association [12].

Regarding the influence of therapeutic interventions for dyslipidemia on arterial stiffness, it was reported that treatment with statins was associated with a reduced PWV [13, 14]. However, the reduction was not necessarily caused by the change in lipid profile [13]. The effect may be one of the so-called pleiotropic effects of statins.

The relationship between dyslipidemia, which can cause atherosclerosis, and arterial stiffness is complicated, especially in the elderly [15] (Fig. 1). Arteriosclerosis and atherosclerosis are just concepts, and both conditions are common and frequently coincide in aged people. High blood pressure accelerates PWV, which is one of the most used biomarkers for arteriosclerosis, and wide pulse pressure, which is one of the features of arteriosclerosis, accelerates atherosclerosis. The relationship probably involves glucose metabolism, and time may also play a large role. Data regarding atherosclerosis, arteriosclerosis, dyslipidemia, and glucose intolerance in children can play an important role in elucidating the relationship of these factors. I hope that research into vascular biology, especially in the young, will continue to progress.

Compliance with ethical standards

Conflict of interest The author declares that they have no conflict of interest.

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