SUMMARY

Effects of aging on coronary flow reserve in patients with no evidence of myocardial perfusion abnormality.
(加齢が Coronary Flow Reserve に与える影響)

Erasta Ramandika, Satoshi Kurisu, Kazuhiro Nitta, Takayuki Hidaka, Hiroto Utsunomiya, Ken Ishibashi, Hiroki Ikenaga, Yukihiro Fukuda, Yasuki Kihara, Yukiko Nakano

Coronary flow reserve (CFR) represents the maximal to resting coronary blood flow ratio. Given that coronary blood flow is determined predominantly by resistance vessels in the absence of flow-limiting epicardial coronary artery disease, CFR reflects the functional capacity of microcirculation to adapt to blood demand during increased cardiac work. Previous studies have suggested that hypertension or diabetes mellitus impairs CFR, whereas the effects of aging on CFR remain to be investigated. We tested the hypothesis that aging impacted coronary flow velocities and CFR in patients with no evidence of myocardial perfusion abnormality on single-photon emission computed tomography (SPECT).

Seventy-six patients undergoing transthoracic Doppler echocardiography with no evidence of myocardial perfusion abnormality on SPECT were enrolled in this study. CFR was defined as the ratio of hyperemic to resting peak diastolic coronary flow velocity.

Patients were divided into the three groups based on age: 17 patients aged less than 70 years (Group I), 38 patients aged 70 - 79 years (Group II), and 21 patients aged 80 years or more (Group III). Compared with Group I, CFR was significantly lower in Group II ($p < 0.01$) and Group III ($p < 0.01$). Multivariate analysis showed that female ($\beta = -0.26$, $p = 0.03$), cigarette smoking ($\beta = -0.32$, $p = 0.004$), hemoglobin level ($\beta = -0.40$, $p = 0.001$) and LV mass index ($\beta = 0.24$, $p = 0.03$) were determinants for resting coronary flow velocity. On the other hand, age ($\beta = -0.30$, $p = 0.008$), hemoglobin level ($\beta = -0.47$, $p < 0.001$) and LV mass index ($\beta = 0.24$, $p = 0.04$) were determinants for hyperemic coronary flow velocity. Age was only independent determinant for CFR ($\beta = -0.48$, $p < 0.001$).

In the present study, we showed that: 1) hemoglobin level and LV mass index were determinants for resting coronary flow velocity, but age was not; 2) age, as well as hemoglobin level or LV mass index, was a determinant for hyperemic coronary flow velocity, and was the only determinant for CFR.

Aging is often accompanied by clinical conditions such as hypertension, anemia, or LV hypertrophy. Anemia and LV hypertrophy are major factors determining coronary flow velocity or coronary blood flow. The elderly patients seemed to have an increased resting coronary flow velocity based on their underlying conditions such as anemia or LV hypertrophy.

However, age and hemoglobin level or LV mass index were independent determinants for hyperemia flow velocity. The reduction of functional hyperemia is accompanied by the diminished vasodilatory response of coronary resistance vessels and may contribute

to the development of heart failure. Aging-related loss of vasodilatory function mainly results from increased oxidative stress and endothelial dysfunction.

Aging also alters the structure and function of vascular components such as the endothelium or smooth muscle cells. Chronological age steadily impairs endothelial function. In particular, endothelial dysfunction plays an important role as an early step in the pathogenesis of atherosclerosis and involved in the development of cardiovascular diseases. Hence, it decreased the effect on hyperemic coronary flow velocity rather than resting coronary flow velocity and was further associated with impaired CFR in patients with no evidence of myocardial perfusion abnormality.

(523 words)