The collagen components of human middle size arteries

Motoyama, I., Aoki, M. and Murata, K.
(Department of Medicine and Physical Therapy, University of Tokyo School of Medicine)

Summary: Collagen components in normal and atherosclerotic parts of human arterial trees were quantitatively studied on both the aorta and smaller size arteries. Type I, III and V collagens increased reflecting the enhanced total collagen with the affected parts. In addition the main type V collagens (αA and αB), the αC collagen was first detected in the human aorta.

Several studies showed that the normal and affected aorta contained type I, III and V collagens. No attempt, however, were made to study the collagen type of the smaller arteries such as iliac, coronary and renal arteries. The exact study of the collagen type of the normal aortic intima is still a few. The present study was an attempt to ascertain whether collagen type differed in the various size-arteries and in atherosclerosis (Fig. 1).

Human arterial trees of normal and atherosclerotic parts were obtained within 7 h after death. Collagen was repeatedly extracted by suspension in 0.5 M acetic acid at 4°C for 48 h by constant agitation and digested with pepsin (1 mg/ml) in 0.5 M acetic acid for 24 h and then separated by centrifugation. Collagen types were determined with the pepsin-solubilized collagen extracted several times based on the salt differentiated fractionation and SDS-polyacrylamide gel electrophoresis. The collagen content of all extracts and the final residue were determined as hydroxyproline. SDS-polyacrylamide gel electrophoresis was carried out according to a modification of the method of Weber and Osborn.

The hydroxyproline contents of the human artery were 40–100 mg/g dry tissue. Type I collagen was prominent in the intima and adventitia and tended to increase in the affected parts. Type III collagen was rich in the medial parts. The ratio of type I to type III were over 1.0 in almost all arteries studied here but the ratio increased with the advancing of atherosclerosis. The most striking finding is the increase of type V collagen with the advancing atherosclerosis. In the aorta, the ratios of αB to α2 (I) of the normal and atherosclerotic parts and adventitia part were 0.24, 0.39 and 0.14, respectively whereas those in the iliac artery were respectively 0.51, 1.03 and 0.44. The ratio of αB to α2 (I) was greater in the smaller size arteries than the aorta at the normal and affected parts (Fig. 2). The ratios of renal and coronary arteries were 0.38 and 0.44, respectively. It was also interesting to note that the αC collagen was detected at the various condition of the human aorta but not in the smaller arteries (Fig. 3). The occurrence of αC collagen seemed to be related the arterial size as well as the degree of the disease.

References
Fig. 1. The appearance of type I, III and V collagens in various smaller size of human arteries by SDS-PAGE: IN= normal intima, IS=sclerotic intima, Ad. =adventitia and Cor.=coronary arteries.

Fig. 2. The ratio of $\alpha_B$ to $\alpha_2$ (I) of the aorta and middle-size arteries. The numbers in parentheses are sample number. N=normal, S=atherosclerosis.

Fig. 3. The detection of $\alpha_C$ band between $\alpha_B$ and $\alpha_A$ bands in human thoracic and abdominal aorta.