

Comparative Pathological Study of Coronary Arteriosclerosis in Okinawa, Nagasaki and Akita Prefectures

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SUMMARY: In order to clarify the degree of coronary arteriosclerosis in Okinawa, we carried out comparative histological study of coronary arteriosclerosis in 418 autopsy cases, ranging from 50 to 79 of age, which were autopsied between 1983 and 1988 in Okinawa, Nagasaki and Akita districts. Coronary artery samples were collected from cases which had arteriosclerosis-related diseases such as ischemic heart diseases, cerebrovascular diseases, diabetes mellitus, renal diseases, and collagen diseases. Arteriosclerotic lesions were prevalently seen in the following order: main trunk of the left coronary artery, right coronary artery and left circumflex artery. Degree of coronary arteriosclerosis was more severe in Akita than in Nagasaki and Okinawa. There was no significant difference in the degree of coronary arteriosclerosis in Okinawa and Nagasaki.

Key words: Coronary arteriosclerosis, Okinawa, Nagasaki, Akita.

INTRODUCTION

Geographic variations have long been recognized in prevalence and mortality rate of cardiovascular diseases^{1, 2, 3}. Mild coronary arteriosclerosis is expected in Okinawa because Okinawa belongs to subtropical area. However, no pathological information of coronary arteriosclerosis in Okinawa is available because autopsy rate is extremely low in Okinawa compared with that in the other areas in Japan. In this study, we performed the comparative histopathological study of coronary arteriosclerosis in Okinawa, Nagasaki and Akita prefectures.

MATERIALS AND METHODS

We compared the frequency of causes of death from 1983 to 1988 in the University Hospital and the Chubu Hospital in Okinawa (**Table 1**). As seen in **Table 1**, frequency of malignant tumor cases ranged from 54% to 67% and that of cerebro- and cardio-vascular disorder ranged from 0% to 15% in the University Hospital. On the other hand, in the Chubu Hospital, the frequency of malignant tumor cases ranged from 18% to 31% and that of cerebro- and cardio-vascular disorder ranged from 15% to 28%. Thus, it is clear that the frequency of a circulatory disorder in the autopsy cases is quite different in the different institutes. In order to

Table 1-A Cause of death in autopsy cases in University Hospital, University of the Ryukyus

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|----------------------------------|------------|------------|------------|------------|------------|------------|
| Malignancies | 23 (55) | 14 (54) | 14 (54) | 36 (64) | 24 (59) | 40 (67) |
| Infectious diseases | 2 (5) | 2 (8) | 0 (0) | 3 (5) | 3 (7) | 3 (5) |
| Collagen diseases | 2 (5) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (2) |
| Arteriosclerosis-related disease | 4 (10) | 2 (8) | 4 (15) | 0 (0) | 3 (7) | 3 (5) |
| Violent death | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| Others | 13 (31) | 8 (31) | 8 (31) | 17 (30) | 11 (27) | 13 (22) |
| Total | 42 | 26 | 26 | 56 | 41 | 60 |

Parenthesis indicates percentage

Table 1-B Cause of death in autopsy cases in Chubu Hospital

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|----------------------------------|------------|------------|------------|------------|------------|------------|
| Malignancies | 13 (24) | 8 (18) | 17 (31) | 13 (25) | 9 (22) | 15 (31) |
| Infectious diseases | 13 (24) | 10 (23) | 9 (17) | 10 (19) | 6 (15) | 4 (8) |
| Collagen diseases | 0 (0) | 2 (5) | 1 (2) | 1 (2) | 1 (2) | 1 (2) |
| Arteriosclerosis-related disease | 10 (18) | 9 (20) | 15 (28) | 8 (15) | 9 (22) | 12 (25) |
| Violent death | 2 (4) | 1 (2) | 0 (0) | 1 (2) | 3 (7) | 0 (0) |
| Others | 17 (31) | 14 (32) | 14 (26) | 20 (38) | 13 (32) | 16 (33) |
| Total | 55 | 44 | 54 | 53 | 41 | 48 |

Parenthesis indicates percentage

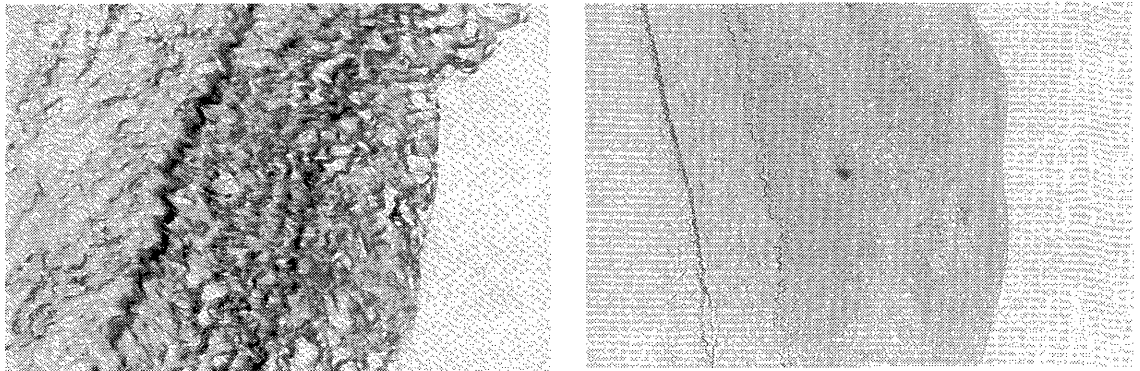
Table 2. Number of the examined cases in each age group

| District | | Age | | | Total |
|----------|--------|-------|-------|-------|-------|
| | | 50-59 | 60-69 | 70-79 | |
| Okinawa | Male | 16 | 25 | 23 | 129 |
| | Female | 19 | 21 | 25 | |
| Nagasaki | Male | 19 | 26 | 24 | 137 |
| | Female | 17 | 22 | 29 | |
| Akita | Male | 25 | 27 | 26 | 152 |
| | Female | 21 | 30 | 23 | |

obtain accurate geographical difference in the degree of coronary arteriosclerosis, we decided to examine the degree of coronary arteriosclerosis in specific cases except for the cases which has arteriosclerosis-related diseases such as circulatory disorders, diabetes mellitus, chronic renal diseases and collagen diseases. **Table 2** shows the number of the examined cases in Okinawa, Nagasaki, and Akita prefectures, respectively. Histopathological examination was carried out on the autopsy cases over a 6-year period of 1983 to 1988. Coronary artery samples were obtained from 126 cases in Okinawa (Chubu Hospital, University Hospital, University of the Ryukyus), 135 cases in Nagasaki (Nagasaki City Hospital, University Hospital), and 157 cases in Akita (Nakadori Hospital). Three representative samples were collected from the three main arteries; trunk of the left coronary artery, left circumflex artery and right coronary artery. Samples of left circumflex and right coronary arteries were collected from the sites of margo obtutus and margo acutus of the formalin fixed heart, respectively. Collected samples were embedded into paraffin and cut into 4 micrometer thickness. These sectioned specimens were stained with hematoxylin and eosin (HE), and elastica van Gieson (EV) to examine intimal arteriosclerotic lesions. Arteriosclerosis includes three types of arterial intimal lesions such as atherosclerosis, fibrocellular intimal thickening and Menkeberg's medial sclerosis. Since the degree of the atherosclerotic lesion and lesion of fibrocellular intimal thickening is considered to correlate with clinical symptom, these two lesions were histologically examined and the maximal thickness of arterial intima was measured on sections stained with elastica van Gieson using ocular micrometer.

RESULTS

Microscopic findings: Almost all cases histologically showed some fibrocellular intimal thickening in their coronary arteries (**Fig. 1**). These results support the idea that fibrocellular intimal thickening is related to physiological factors such as aging and hemodynamic stress⁴⁾. Coronary arteries with atherosclerotic change



A: fibrocellular intimal thickening (×670)

B: atherosclerotic lesion (×130)

Fig. 1. Coronary arterial lesions (EV stain)

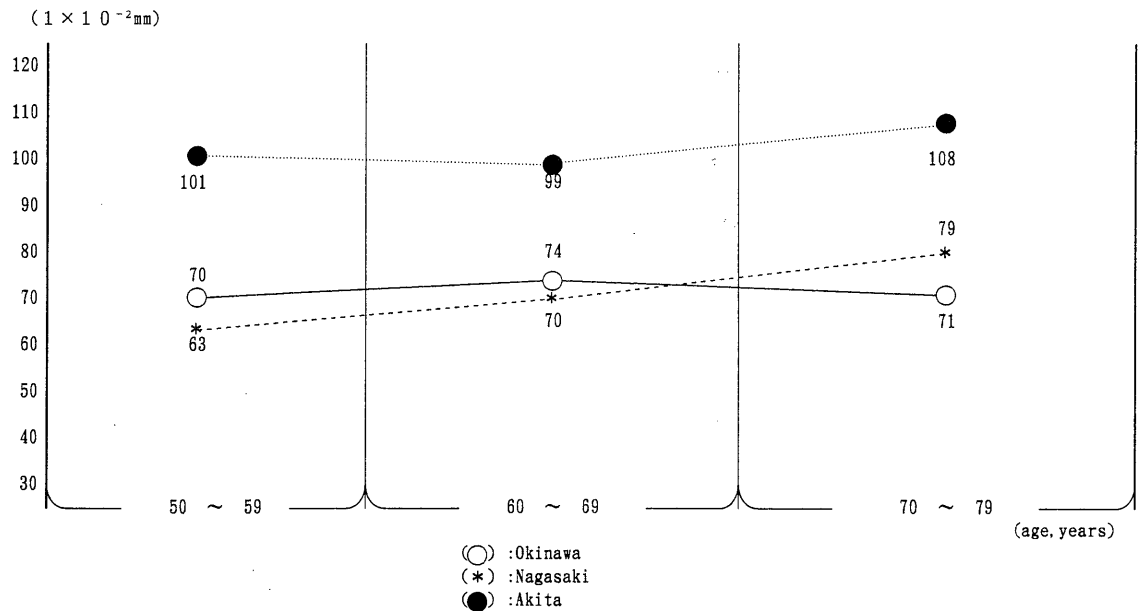


Fig. 2. Average degree of arteriosclerosis in main trunk of the left coronary artery in males

had more narrow lumen than those with fibrocellular intimal thickening (Fig. 1). As suggested by previous studies, males had more severe arteriosclerosis than females, and most predilection site of arteriosclerosis was the main trunk of the left coronary artery and the least preferable site of arteriosclerosis was the left circumflex artery.

Histometric findings: Figure 2 shows the severity of arteriosclerosis of main trunk of the left coronary artery in male autopsy cases in each group. The degree of arteriosclerosis was

highest in Akita. The degree of arteriosclerosis was higher in Okinawa than in Nagasaki over 6th to 7th decades, but that was reversed in 8th decade. Average grades were somewhat lesser for females than for males from the 6th to the 8th decades. Figure 3 represents the average degree of arteriosclerosis in main trunk of the left coronary artery in females in each group. Over 6th to 7th decades, there was no difference of arteriosclerosis among these three districts. However, over 7th decades, the difference in the degree of arteriosclerosis became remarkable;

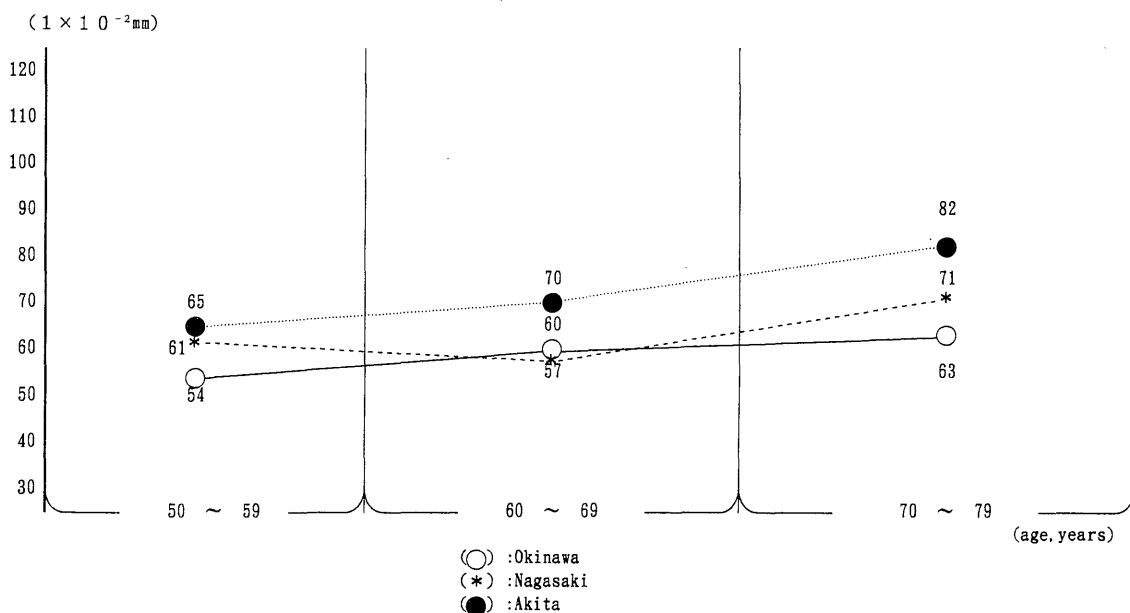


Fig. 3. Average degree of arteriosclerosis in main trunk of the left coronary artery in females

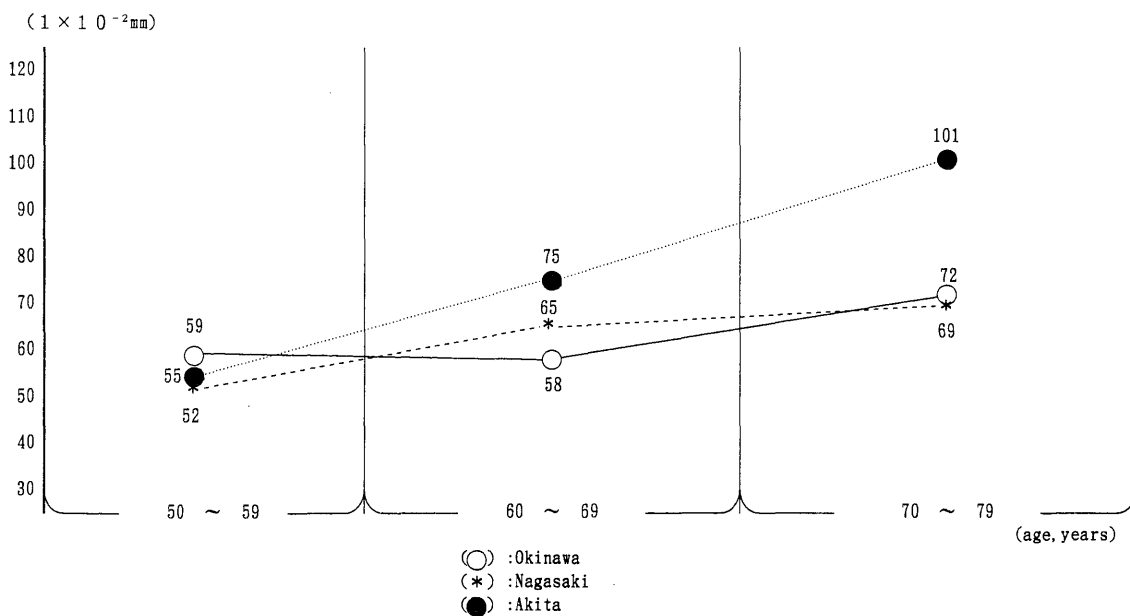


Fig. 4. Average degree of arteriosclerosis in the right coronary artery in males

The severity of arteriosclerosis was highest in Akita and it was lowest in Okinawa. **Figure 4** shows the average degree of arteriosclerosis in the right coronary artery in males in each age group. Arteriosclerosis of the right coronary

artery also tended to increase in average grades with age. Akita showed the highest severity in the degree of arteriosclerosis. On the other hand, Okinawa and Nagasaki showed almost parallel increase in the severity of arteriosclerosis

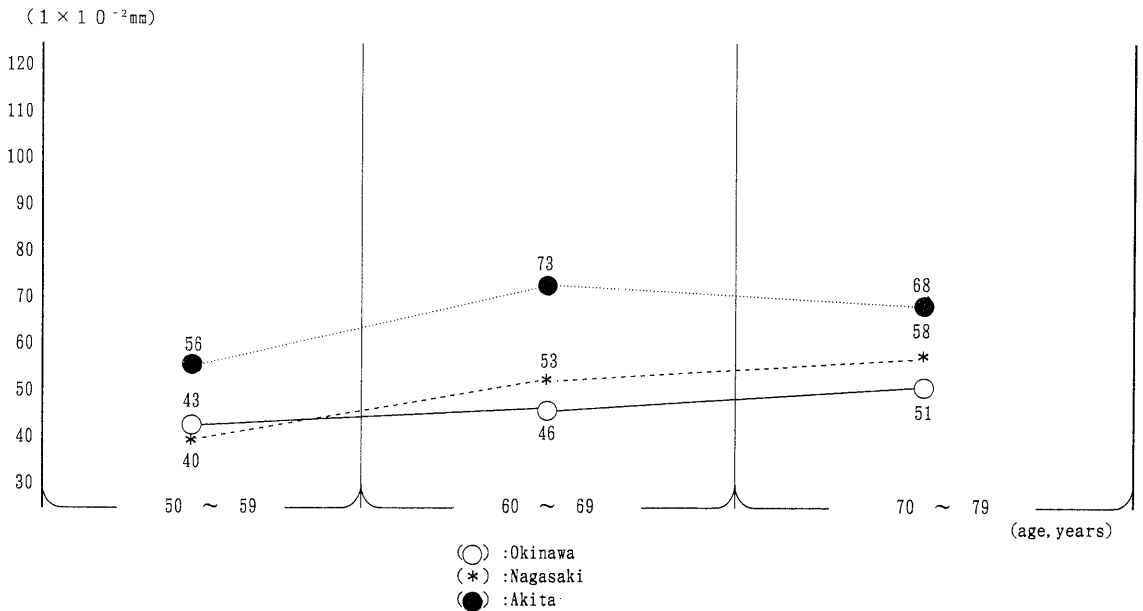


Fig. 5. Average degree of arteriosclerosis in the right coronary artery in females

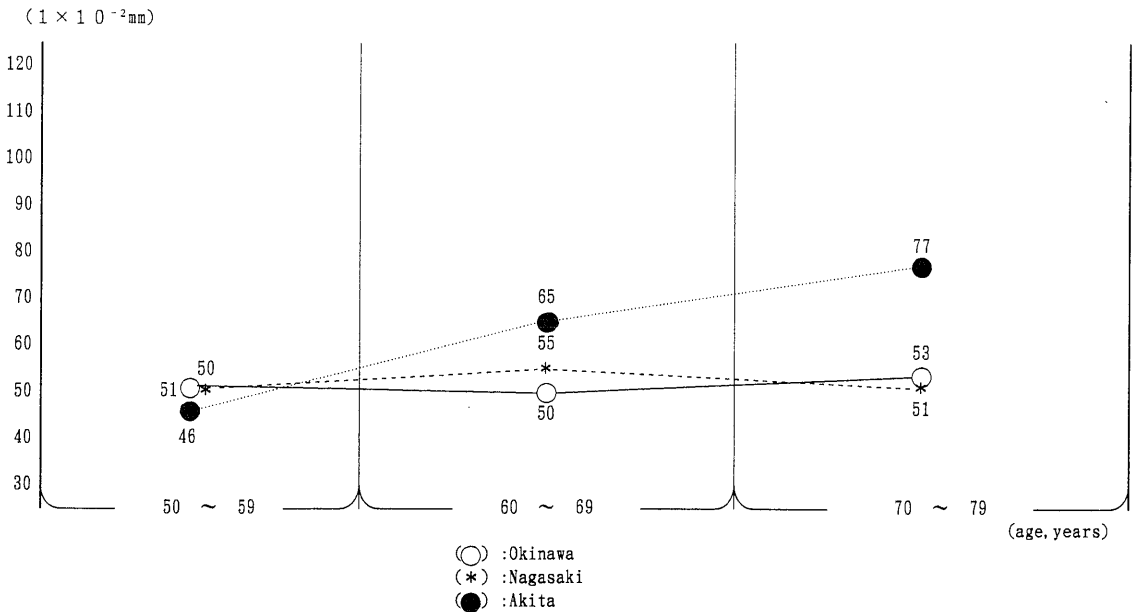


Fig. 6. Average degree of arteriosclerosis in the left circumflex artery in males

with age. **Figure 5** presents average degree of arteriosclerosis in the right coronary artery in females in each age group. Arteriosclerosis advanced with age and the degree of arteriosclerosis was also most severe in Akita.

Figure 6 indicates the average degree of arteriosclerosis in the left circumflex artery in males in each age group. Severity of arteriosclerosis increased with age. In 7th and 8th decades, Akita showed highest degree of coro-

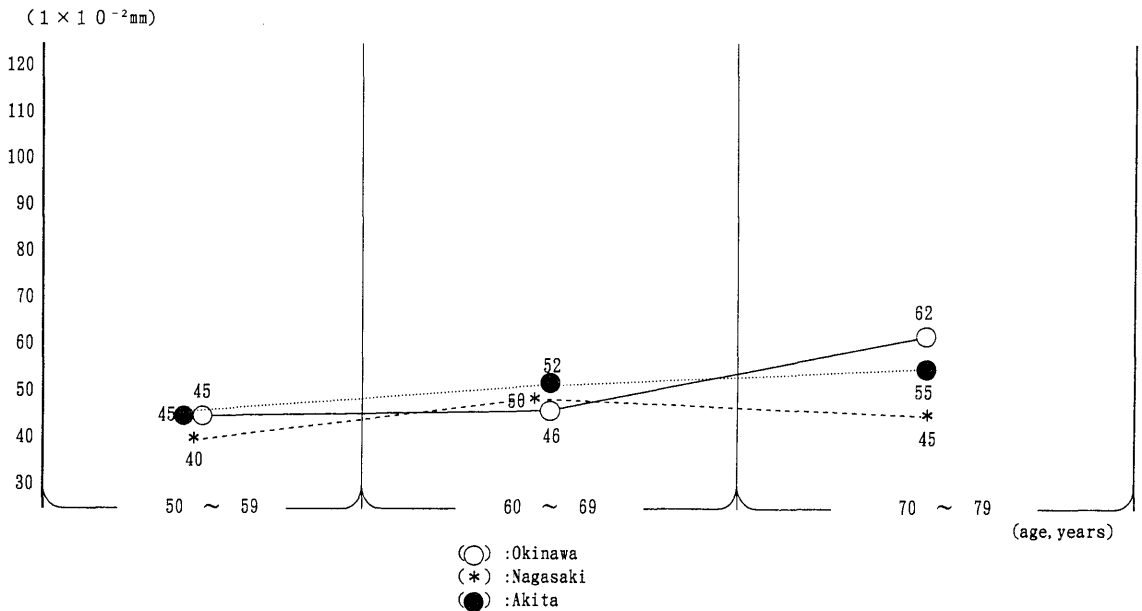


Fig. 7. Average degree of arteriosclerosis in the left circumflex artery in females

nary arteriosclerosis among three prefectures. **Figure 7** shows the average degree of arteriosclerosis in the left circumflex artery in females in each age group. Arteriosclerosis in this portion of the coronary artery was less severe than the other portion of the coronary artery. The difference of the severity of arteriosclerosis in this portion was not significant in these three districts.

DISCUSSION

The pathogenesis of atherosclerosis and its complications is complex and involves dietary, blood coagulation, hemodynamic, metabolic, hormonal and other factors. One or more of these factors may affect directly and/or indirectly the pattern of distribution of atherosclerosis in individual arterial trees. The topographical distribution and severity of coronary arterial sclerosis has been known to be different, and the anterior descending branch of the left coronary artery is involved by atherosclerosis earlier and more severely than the right coronary artery^{5, 6}. In accordance with the results of these reports, the present study also demonstrated severity of coronary arterioscle-

rosis in the following order: the main trunk of the left coronary artery, right coronary artery, and the left circumflex artery. Therefore, we observed no clear difference in the severity of the arteriosclerosis in the left circumflex artery. It has been recognized that the incidence of ischemic heart disease is lower in females than in males. The present study also indicates that coronary arteriosclerosis is greater in males than in females. Dietary factor is one of the important risk factors of arteriosclerosis. The relationship between hypertension and coronary atherosclerosis has been considered by many investigators^{7, 8}. The severity of coronary arteriosclerosis was highest in Akita district where consumption of dietary salt is large and the frequency of hypertensive cerebral hemorrhage is reportedly highest in Japan. Initially, we expected that the degree of coronary arteriosclerosis is lowest in Okinawa because Okinawa locates in subtropical area and there are many old people with longevity. Unexpectedly we found that the severity of coronary arteriosclerosis in Okinawa was almost same to that in Nagasaki. Goto⁹ reported that serum lipid levels of normal Japanese have been increasing probably by the westernized dietary habits and

suggested that hyperlipidemia will accelerate the increase in the incidence of atherosclerotic ischemic heart disease. Mimura *et al.*¹⁰⁾ reported that serum cholesterol level is higher in Okinawa than the other districts in Mainland Japan. Furthermore, they carried out comparative study of the amount of the dietary fat intake and serum lipid levels between Okinawa and Taiwan and they found no significant difference as for the serum levels of cholesterol and triglycerides, and the amount of the dietary fat intake between these two areas¹¹⁾. Further follow-up studies are required to elucidate the promotive risk factors of coronary atherosclerosis in Okinawa.

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