ORIGINAL CONTRIBUTION

Trends in Prevalence Rates of Asymptomatic Aortic Aneurysms in Japan Based on Autopsy Series

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A considerable portion of patients with aortic aneurysms is asymptomatic. In order to know the prevalence rates of asymptomatic aortic aneurysms, the cases of aortic aneurysms found incidentally in an autopsy series from 1960 to 1989 were reviewed. In the Annual of the Pathological Autopsy Cases in Japan, 1,469 (971 male and 498 female) cases were found. The overall age-adjusted prevalence rates of asymptomatic aortic aneurysms increased from 2.08 to 2.48 for males, and from 1.26 to 1.85 for females, per 1,000 autopsy cases, respectively, during the period. Abdominal aortic aneurysms were the most frequent in males but dissecting ones were the leading type in females. The prevalence rates of abdominal and dissecting aortic aneurysms increased in both sexes, and the rate of thoracic aortic aneurysms decreased in females. J Epidemiol, 1995; 5 : 159-163.

SUBJECTS AND METHODS

The Annual of the Pathological Autopsy Cases in Japan has been published by the Japan Pathological Society since 1960 every year. In the annuals, we can find the following information on all autopsy cases in university hospitals and 95% hospitals of large ones (500 beds or over) in Japan: address, age, sex, occupation, clinical and pathological diagnoses of the autopsy cases. Approximately 26,000 autopsy cases have been reported recent every year. Out of them we are able to find about 400 autopsy cases with aortic aneurysms in each annual.

In this study, we reviewed the Annual of the Pathological Autopsy Cases in Japan in 1960, 1965, 1970, 1975, 1980, 1985 and 1989. There were 188,715 autopsy cases (115,643 for males and 73,072 for females) in the annuals in total. We excluded aortic aneurysms associated with syphilis in the study. The number of all autopsy cases with aortic aneurysms was 2,861 (1,985 for males and 876 for females), but we excluded 1,392 (48.7%) autopsy cases with clinical diagnosis of aortic aneurysms from this study. We
Table 1. Number of autopsy cases with aortic aneurysms found incidentally in Japan in 1960, 1965, 1970, 1975, 1980, 1985 and 1989.

| Type     | Males       | Female     | Total       |
|----------|-------------|------------|-------------|
| Thoracic | 148(15.2)   | 112(22.5)  | 260(17.7)   |
| Abdominal| 341(35.1)   | 131(26.3)  | 472(32.1)   |
| Dissecting| 282(29.1)  | 180(36.1)  | 462(31.5)   |
| Other    | 200(20.6)   | 75(15.1)   | 275(18.7)   |
| Total    | 971(100.0)  | 498(100.0) | 1469(100.0) |

Figures in parentheses show the percent.

defined in the present study that remaining 1,469 cases (971 for males and 498 for females), namely, cases with clinically undiagnosed aortic aneurysms were found incidentally in autopsy. We also call them asymptomatic aortic aneurysms. They comprised thoracic aortic aneurysms, abdominal aortic aneurysms, dissecting aortic aneurysms and aortic aneurysms with ill-defined region and observed in multiple sites. Dissecting aortic aneurysms were not further divided because of the limit of records in the Annual of Pathological Autopsy Cases in Japan. The prevalence rates were calculated to be the number of autopsy cases with asymptomatic aortic aneurysms divided by the number of all autopsy cases for each sex or age group. To know the trends in the prevalence rates, the rates were standardized to the world population.

To know the prevalence rates of asymptomatic aortic aneurysms by urbanization and type, we divided all autopsy cases appeared in the pages of odd number in the Annual of the Pathological Autopsy Cases in 1965 and 1989 into four categories according to the record of address; i.e., large cities (Tokyo, Sapporo, Sendai, Yokohama, Kawasaki, Nagasaki, Kyoto, Osaka, Kobe, Hiroshima, Kitakyushu, and Fukuoka) and local cities (other cities), rural areas (towns and villages), and others or unknown. The prevalence rate for each category was calculated by the method of indirect standardization (Standard=all Japan).

RESULTS

Table 1 shows that the dominant type of the aortic aneurysms found incidentally is abdominal aortic ones in males (35.1%) and dissecting aortic ones in females (36.1%) as far as we counted the numbers.

The age-adjusted prevalence rates of asymptomatic aortic aneurysms were higher in males (2.71 per 1,000 autopsy cases) than in females (1.91 per 1,000 autopsy cases).

Table 2. Number of Autopsy Cases, the Age-adjusted Prevalence Rates* and 95 Percent Confidence Intervals (95%CI) of Asymptomatic Aortic Aneurysms in Japan, 1960-1989.

| Year | No. | Rate  | 95% CI     | No. | Rate  | 95% CI     | No. | Rate  | 95% CI    |
|------|-----|-------|------------|-----|-------|------------|-----|-------|------------|
| Male |     |       |            |     |       |            |     |       |            |
| 1960 | 52  | 4.22  | 3.03–5.41  | 13  | 1.10  | 0.49–1.71  | 1   | 0.06  | 0.00–0.12  |
| 1965 | 48  | 2.08  | 0.86–3.30  | 5   | 0.24  | 0.08–0.40  | 13  | 0.40  | 0.07–0.73  |
| 1970 | 72  | 2.51  | 1.14–3.88  | 9   | 0.33  | 0.12–0.54  | 21  | 0.47  | 0.23–0.71  |
| 1975 | 97  | 3.00  | 1.38–4.62  | 16  | 0.60  | 0.13–1.07  | 30  | 0.65  | 0.12–1.18  |
| 1980 | 206 | 2.14  | 0.69–3.59  | 36  | 0.26  | 0.05–0.47  | 80  | 0.75  | 0.32–1.18  |
| 1985 | 213 | 2.60  | 0.77–4.43  | 35  | 0.22  | 0.01–0.43  | 75  | 0.62  | 0.26–0.98  |
| 1989 | 283 | 2.48  | 0.81–4.15  | 34  | 0.29  | 0.02–0.56  | 121 | 0.72  | 0.29–1.15  |
| Total| 971 | 2.71  | 1.86–3.36  | 148 | 0.40  | 0.10–0.70  | 341 | 0.60  | 0.25–0.95  |

| Year | No. | Rate  | 95% CI     |
|------|-----|-------|------------|
| 1960 | 23  | 5.07  | 4.14–6.00  |
| 1965 | 23  | 1.26  | 0.93–1.59  |
| 1970 | 46  | 1.83  | 1.07–2.59  |
| 1975 | 47  | 1.99  | 1.13–2.85  |
| 1980 | 108 | 2.43  | 1.10–3.76  |
| 1985 | 110 | 1.39  | 0.51–2.27  |
| 1989 | 131 | 1.85  | 0.87–2.83  |
| Total| 498 | 2.03  | 1.22–3.04  |

*per 1,000 autopsy cases. The rates were standardized to the world population.
Aortic Aneurysms in Autopsy Series, Japan

Figure 1. Age-adjusted prevalence rates* of asymptomatic aortic aneurysms for males in Japan, 1960, 1965, 1970, 1975, 1980, 1985 and 1989. *per 1,000 autopsy cases. Standardized to the world population.

Figure 2. Age-adjusted prevalence rates* of asymptomatic aortic aneurysms for females in Japan, 1960, 1965, 1970, 1975, 1980, 1985 and 1989. *per 1,000 autopsy cases. Standardized to the world population.

cases) than in females (2.03 per 1,000 autopsy cases) in the period combined, and the rates slightly increased from 1965 to 1989 in both sexes (Table 2). Only the prevalence rates of thoracic aortic aneurysms were higher in females (0.50 per 1,000 autopsy cases) than in males (0.40 per 1,000 autopsy cases), although the rate for females decreased during the period. The prevalence rate of dissecting aortic aneurysms increased especially for females, and the rate for females showed the similar level as that for males in recent years.

Age specific prevalence rates of each type were very low before 50 years old and gradually increased with age for both sexes (Fig. 1 and Fig. 2). The rates of dissecting aortic aneurysms were higher than those of abdominal and thoracic ones at almost any age groups for females. For males the prevalence rates of abdominal aortic aneurysms are almost 2-fold the rates of dissecting and thoracic aortic aneurysms at 70 years old or over.

Table 3 shows that the prevalence rates of abdominal aortic aneurysms were obviously higher in males than in females at any ages. But thoracic aortic aneurysms are higher in females than in males except for 70-79 years old. The prevalence rate of dissecting aortic aneurysms increased with age more remarkably in females than in males (Fig. 1 and Fig. 2), and it led the sex ratio to be less than 1.0 in the age groups of 70 years old or over.

Number of autopsy cases increased from 8,956 in 1965 to 19,578 in 1989, and the proportion of the cases in large cities decreased from 42.4% to 30.0% in males and from 41.4% to 30.6% in females.

The prevalence rates of overall aortic aneurysms increased for both sexes in both urban and rural areas from 1965 to 1989 (Table 4). In large cities abdominal aortic aneurysms increased for males and females. In rural areas thoracic aortic aneurysms markedly increased for males, and abdominal aortic aneurysms increased for females.

**DISCUSSION**

We estimated the prevalence rates of asymptomatic aortic aneurysms found incidentally in Japan to be about 2.5 per 1,000 males and about 1.9 per 1,000 females in recent years. The exceptionally high rates observed in 1960 may be due to the following reasons: a) Some of thoracic aortic aneurysms had no descriptions of history of syphilis in their histories of the disease. Carlsson, et al reported that syphilis is given as the commonest cause of aortic aneurysms far into the 20th century and as late as
1940 about 90% of all aortic aneurysms were due to syphilis. They also described that the ratio between atherosclerosis and syphilis as a cause of aortic aneurysms has changed since 1950s. In 1950s 2 or 3 times and in 1957-1961 10 times as many aneurysms were due to atherosclerosis as to syphilis.

b) The autopsy cases who died from rupture of aortic aneurysms without clinical diagnosis were also included because ultrasonic techniques were first applied to the abdominal aorta in 1966.

According to the study by Carlsson and Sternby, the total number of atherosclerotic aortic aneurysms was 102 in 5,386 autopsy cases in Malmo, Sweden from 1957-61. Out of them 25 patients were in the thoracic aorta and 77 in the abdominal aorta. The proportion who had the diagnosis of aortic aneurysms before death was 20%. Therefore, the prevalence rate of asymptomatic atherosclerotic aortic aneurysms in thoracic aorta was 3.7 per 1,000 (=25×0.8/5,386) and that in abdominal aortic aneurysms was 11.4 per 1,000 (=77×0.8/5,386). These are approximately 15-fold and 28-fold the rates of 0.24 and 0.40 per 1,000 for thoracic and abdominal aortic aneurysms for Japanese males, and about 6-fold and 38-fold the rates of 0.58 and 0.30 per 1,000 for these aortic aneurysms for Japanese females in 1965 (we did not use the Japanese data in 1960 for the comparison because of the abnormal figures described previously in this section). The rates in Sweden were obtained based on population, although they were not age-adjusted.

There were 1,335 and 1,205 deaths from dissecting and abdominal aortic aneurysms, respectively, in Japan in 1989. It was reported that the ratio of unruptured to ruptured abdominal aortic aneurysms was 84/16. One-year survival rates of the patients with dissecting, unruptured, and ruptured abdominal aortic aneurysms were about 57%, 95% and 56%, respectively. From these figures, we can roughly estimate that there are about 3,105 (=1,335/0.43) incidences of clinical or manifested dissecting aortic aneurysms and 20,682 (=1,205×0.84/0.05 for unruptured+1,205×0.16/0.44 for ruptured) incidences of clinical abdominal aortic aneurysms in Japan in 1989.

The prevalence rate of abdominal aortic aneurysms sharply increased, whereas the prevalence rate of dissecting aortic aneurysms markedly decreased in recent years in the United Kingdom, United States and Western Australia based on the data of routine mortality statistics or hospital in-patient statistics. In the present study, the prevalence rate of abdominal aortic aneurysms increased for both sexes in both urban and rural areas from 1965 to 1989 and that of thoracic aortic aneurysms decreased for females in urban areas. These findings may be explained by the decline in the incidence of syphilis and hypertension, and the increase in atherosclerosis in recent decades in Japan. However, the prevalence rate of dissecting aortic aneurysms was also increased in both sexes during the period. The reason for different prevalence ratio of abdominal aortic aneurysms to dissecting aortic aneurysms between Japan and the United Kingdom or the United States may involve the differences in race and lifestyle.

The age-adjusted mortality rates of aortic aneurysms markedly increased from 1955-90 based on the Vital Statistics in Japan (0.43 to 10.98 per 100,000 for males and 0.23 to 4.54 per 100,000 for females). The most predominant type was abdominal aortic aneurysms followed by dissecting and thoracic aortic aneurysms, although the latter two types showed the larger increasing ratios than the abdominal ones. However, in the present study the overall prevalence rates of asymptomatic aortic aneurysms did not show the similar increase during the same period, and thoracic aortic aneurysms decreased in females. One of the reasons for the increase in mortality rate may be due to
the high fatality rate of the patients with aortic aneurysms in advanced age, especially above 70 years old, who are often unable to be operated because of other diseases or complication. On the other hand, it is likely that asymptomatic aortic aneurysms have been precisely diagnosed recent years being accompanied by the advance of diagnostic techniques, such as ultrasound and computed tomography, and the change has affected the prevalence rates. However, it is difficult to explain the different changing trends in the prevalence rates of asymptomatic aortic aneurysms by type. The inconsistency between the trends in the prevalence and mortality rates also suggests that some risk factors may accelerate the growing and rupture of aortic aneurysms.

Atherosclerosis as one of the important causes of aortic aneurysms increases with age and it can be accelerated by high fatty diet14. There is also a strong dose-response relationship between smoking and aortic aneurysms, suggesting that smoking may induce aortic aneurysms to grow and rupture. The proportion of smokers among Japanese males is twice that among males in western industrialized countries, although the consumption of fat is still low in Japan compared with these countries. The different trends in dissecting aortic aneurysms between Japan and United Kingdom or United States should be further discussed considering these lifestyles.

Changes of medical diagnostic capability could have an impact on the perceived prevalence trends. There are also several critical limitations for the use of the autopsy series, although they can give us many informations. For example, the subjects with autopsy are usually highly selected and not representative of the population. In this study, however, we analyzed the autopsy cases with clinically undiagnosed aortic aneurysms. Unless asymptomatic aortic aneurysms are closely associated with some diseases like malignant and benignent neoplasms which often lead the patients to autopsy, our data are not far from representative.

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