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COMPARISON OF ARTERIOSCLEROSIS OBLITERANS OF LOWER LIMBS BETWEEN CHINA AND JAPAN

BY

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ABSTRACT

Clinical data on 50 patients with arteriosclerosis obliterans (ASO) in China (Guoup A) and Japan (Group B) respectively were studied for better understanding of these changing trends.

The results showed that the incidence of ASO peaked in Group A in the 50 to 69 age range (88%) and in Group B in the 55 to 74 age range (78%). Group A had a lower ratio of smokers and cases of diabetes mellitus than Group B but a higher ratio of hypertension and a higher total cholesterol level. Angiography showed that the prevalence of atherosclerotic lesions in the lower extremities as a whole was similar for both groups. They were different in location, extent and severity of the arteries involved between the two groups. We believe that this study has shown various differences between the two groups but that the causes are probably multifactorial.

Key words: ASO in China, ASO in Japan, ASO and age, Atherosclerogen, Fontaine's classification, Angiographic results.

INTRODUCTION

The incidence of ASO as reported in China and Japan was lower than in the Western countries but has been increasing during the past 2–3 decades[1–5]. In the Monica project survey, it was predicted that this increasing trend would continue in the following decades[1]. Mishima[5] in 1980 indicated that the prevalence of Buerger's disease (thromboangiitis obliterans or TAO) had dropped considerably and the prevalence of ASO had increased markedly during the past 15 years. In the 1st Department of Surgery, Tokyo Medical and Dental University, the data suggested that the number of ASO patients who had undergone reconstructive surgery had increased yearly from 9 per annum in 1978 to 31 in 1989. No recent reports are available about the comparison of ASO in our two countries. This study is based on 50 consecutive cases in China and Japan respectively in the three years taken to present a comparative analysis of the clinical data.

MATERIALS AND METHODS

a) Patients

Group A: (Department of Surgery of Shanghai Ninth People's Hospital affiliated Shanghai Second Medical University, China) 50 patients (100 limbs) ranged in age from 45 to 81 years, a means age of

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61.7±7.15, males 44, females 6, male: female ratio of 7.3:1. Surgical treatment 24 (Table 1), conservative treatment 26. The patients came to the outpatient department or were admitted as inpatients during the period from September 1986 to August 1989.

Group B: (1st Department of Surgery of Tokyo Medical and Dental University, Japan) 50 patients (100 limbs) ranged in age from 40 to 85 years, a mean age of 66.5±9.3, males 41, females 9, male: female ratio of 4.6:1. All 50 patients were admitted as inpatients and received surgical treatment (Table 1) during the period from January 1987 to May 1989.

b) Clinical symptoms and classification

The diagnosis of the ASO patients in both groups was based on the following criteria: Age at onset of disease, usually accompanied by symptoms including fatiguableness, claudication, rest pain, and ischemic symptoms and signs in the lower extremities. Buerger's disease was ruled out in all eligible patients in both groups.

The patients in both groups were classified into three groups according to Fontaine's classification: There were 9 patients at stage I, 29 at stage II and 12 at stage III+IV in Group A, with 8 at stage I, 37 at II and 5 at III+IV in Group B.

c) Atherosclerogen

The main risk factors studied in both groups were as follows: smoker, 25; hypertension, 24; total hypercholesterol, 17; and diabetes mellitus (DM), 6 in Group A, smoker, 45; hypertension, 19; total hypercholesterol, 7; and DM, 14 in Group B.

Table 1. Surgical Procedure in Both Groups

Kind of surgical treatment	Group A* Number of patients (limbs)	Group B* Number of patients (limbs)
Aorto-bifemoral bypass	2 (2)	17 (17)
Axillo-bifemoral bypass	0	2 (2)
Ilio-bifemoral bypass	0	2 (2)
Ilio-femoral bypass	0	4 (4)
Ilio-popliteal bypass	1 (1)	0
Femoro-femoral bypass	4 (4)	9 (9)
Femoro-popliteal bypass	1 (1)	12 (14)
Femoro-crural bypass	2 (2)	1 (1)
Arteriovenous reversal	6 (6)	0
Amputation (near the ankle)	6 (6)	0
Percutaneous transluminal angioplasty	4 (4)	2 (2)

Note: Adjunctive treatment are profundaplasty, sympathectomy, endarterectomy and thrombectomy.

* Patient received one or over two kinds of surgical treatment.

d) Angiography

All symptomatic patients (total 200 limbs) of both groups underwent angiography for limb disease using Seldinger's technique of percutaneous transfemoral angiograph and/or digital subtraction angiograph (DSA).

Results

Age and sex: A statistically significant difference in age ($p<0.01$) and no difference in sex ($p>0.05$) were demonstrated between Group A and Group B. Patients in Group A were generally younger than in Group B, with a slightly lower ratio of female patients. Figure 1 shows that patients of Group A demonstrated an earlier onset of the disease than those of Group B. Prevalence of ASO in Group A peaked at ages between 50 to 69 years (88%) and in Group B between 55 to 74 (78%). The prevalence of ASO was about ten years later in Group B.

Fontaine's classification: No significant difference in statistical analysis could be found between the two groups ($p>0.05$).

Atherosclerogen: Concerning the atherosclerotic risk factors, there were less smokers and patients with DM in Group A, but higher total cholesterol levels than those in Group B, the statistical analysis showing a significant difference of $p<0.01$, $p<0.05$ and $p<0.05$, respectively. There were more female smokers in Group B than in Group A (9/9 vs. 0/6). There was no significant difference concerning hypertension between the groups ($p>0.05$). The relation of the risk factors and Fontaine's classification is summarized in Table 2. The incidence of DM in patients at the ischemic limb stage III+IV of both groups was higher than that at stages II and I, but no difference in statistical analysis could be found except for Group A, where the difference between stage III+IV and stage II in the DM patients showed a value of $p<0.01$.

Angiographic results: The involved arteries were classified according to the morphologic changes as seen on the angiograms, namely: filling defect of the arterial lumen; stenosis or complete occlusion; irregular intima of the arterial lumen; tortuous and dilatated artery. Table 3 shows the results of aortic angiography from the infrarenal aorta to the bifurca-

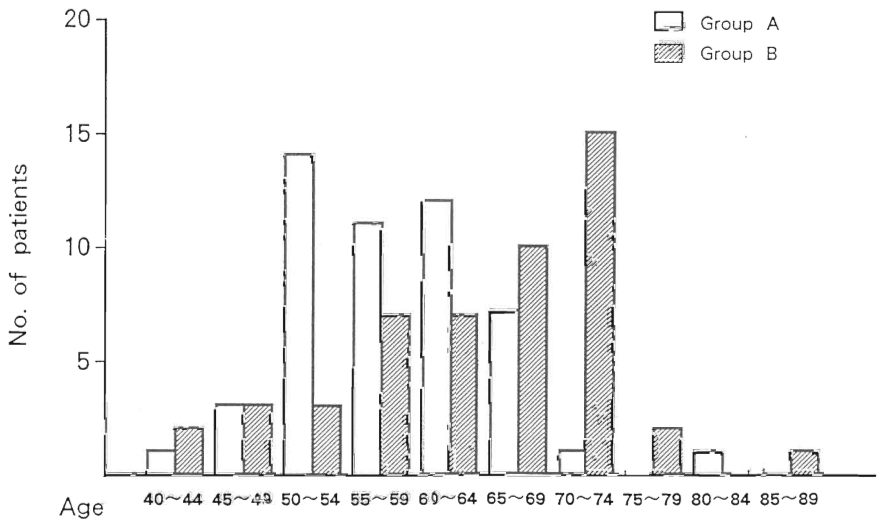

Fig. 1. Age at Onset of Symptoms

Table 2. Relation Between Stages 1, 2 and 3+4 and Smoking, Hypertension, Total Hypercholesterol and Diabetes Mellitus

Fontaine's classification	Grup A 9/50(18%) Stage 1.	Group B 8/50(16%) Stage 1.	Group A 29/50(58%) Stage 2.	Group B 37/50(74%) Stage 2.
Smoking	6/9(66.6%)	7/8(87.5%)	15/29(51.7%)	34/37(91.9%)
Hypertension	5/9(55.5%)	3/8(37.5%)	16/29(55.2%)	16/37(43.2%)
Total hyper-cholesterol	3/9(33.3%)	2/8(25 %)	11/29(37.9%)	5/37(13.5%)
Diabetes mellitus	1/9(11.1%)	2/8(25 %)	1/29(3.4%)**	9/37(24.3%)

Fontaine's classification	Group A 12/50(24%) Stage 3+4.	Group B 5/50(10%) Stage 3+4.	Total number of patients Group A	Total number of patients Group B
Smoking	4/12(33.3%)	4/5(80%)	25(50%)**	45(90%)**
Hypertension	3/12(25 %)	0/5	24(48%)***	19(38%)***
Total hyper-cholesterol	3/12(25 %)	0/5	17(34%)*	7(14%)*
Diabetes mellitus	4/12(33.3%)**	3/5(60%)	6(12%)*	14(28%)*

Statistical analysis by fourfold table
* $p<0.05$
** $p<0.01$
*** $p>0.05$

Table 3. Results of Angiography of Infrarenal Aorta

Infrarenal aorta	Group A 50 patients	Group A %	Group B 50 patients	Group B %
Aneurysm or aneurysmal change	2	4%	9	18%
Complete occlusion	0		2	4%
More than 50% luminal stenosis	0		3	6%
Atherosclerosis	29	58%	27	54%
Normal	19	38%	9	18%
Total	50	100%	50	100%

tion of the aorta. Thirty-one patients (62%) in Group A demonstrated atherosclerotic lesions, compared with 41 patients (82%) in Group B, showing a significant statistical difference between the two groups ($p<0.05$).

In Group A, of the 31 patients with aortic atherosclerotic lesions, 2 patients had aneurysms, one of which was an aortic dissecting aneurysm. Of the 41 patients in Group B, 9 patients had an aneurysm or aneurysmal change, ranging from 3×3 cm to 8×10 cm in size. Judging from the angiographic morpholgic changes, the aortic atherosclerotic lesions in Group A were less severe than in Group B.

Table 4 shows the difference in character, extent and severity of the diseased arteries of the lower extremities in both groups, showing that the incidence of atherosclerotic lesions of the lower extremity was similar for the two groups, 90 limbs

Table 4. Arterial Involvement of Lower Extremities

Total number	100 limbs in Group A			100 limbs in Group B		
Category	Arterial lumen occlusion	Atherosclerosis and/or luminal stenosis	Normal appearance	Arterial lumen occlusion	Atherosclerosis and/or luminal stenosis	Normal appearance
Bilateral	34			16		
One and another	19	19		21	21	
One and another	10		10	8		8
Bilateral		8			24	
One and another					1	1
Total number	63*	27**	10	45*	46**	9

Statistical analysis by fourfold table
*P<0.05
**P<0.01

(90%) in Group A and 91 limbs (91%) in Group B. Comparing the arterial lumen occlusion and atherosclerosis in the two groups, Group A had significantly a higher degree of occlusion ($p<0.05$), while Group B had a higher degree of atherosclerosis ($p<0.01$). Group A demonstrated a greater extent of bilateral arterial lumen occlusion, whereas Group B showed a higher occurrence of bilateral atherosclerosis.

In Table 5, the distribution of arterial lumen occlusion or atherosclerosis in the specific arterial segments is shown. The Group A patients had a lower percentage of involved arteries proximal to the femoral artery, for both occlusion and atherosclerotic stenosis, as compared with the patients in Group B. However, for the lesions in and distal to the femoral artery, the findings showed the opposite. Furthermore, in femoral arterial lumen occlusion, 3/31 patients (9.7%) of Group A and 11/25 patients (44%) of Group B had less than 1/3 length of the arterial lumen occlusion.

Table 6 shows the unilateral multiple segment arterial lumen occlusion; the percentage occurring proximal to the femoral artery was lower for Group A, in and distal to the femoral artery higher for Group A, as compared to Group B.

In the bilateral symmetrical atherosclerotic lesions of the lower limbs, 2/50 patients were observed in Group A. One patient had a total superficial femoral arterial lumen occlusion with common femoral arterial atherosclerosis and the other had a multiple segment atherosclerosis, luminal stenosis and luminal occlusion from the common femoral artery to the proximal sural arteries. Five per 50 patients were observed in Group B. From the 5 patients, one had a total luminal occlusion from the infrarenal aorta to the bilateral common iliac artery; one had superficial femoral arterial lumen occlusion localized above the adductor hiatus; one had atherosclerosis from the external iliac artery to the common femoral artery; and the remaining two had a luminal occlusion from the common iliac artery to the proximal superficial femoral artery.

Discussion

Arterial lumen stenosis, occlusion or arterial disease of the lower limbs are almost always due to atherosclerosis in the peripheral arterial disease in the older

Table 5. Comparison of Incidence in Specific Arterial Segments

Specific arterial segment***	Group A 90 limbs (50 patients)					
	Arterial lumen occlusion	%	Atherosclerosis and/or luminal stenosis	%	Total	%
CIA	9	10 %	45(7)**	50 %	54	60 %
IIA	9	10 %	36	40 %	45	50 %
EIA	9	10 %	33(5)**	36.7%	42	46.7%
CFA	7	7.8%	22	24.4%	29	32.2%
DFA	0		5	5.5%	5	5.5%
SFA	31(3)*	34.4%	39(14)**	42.9%	70	77.7%
PA	17	18.9%	41(12)**	45.6%	58	64.4%
ATA	27(5)*	30 %	10	20 %	37	41.1%
TPeA	1	1.1%	6	6.6%	7	7.8%
PTA	20(3)*	22.2%	3	3.3%	23	25.6%
PeA	6(1)*	6.6%	4	4.4%	10	11.1%

Specific arterial segment***	Group B 91 limbs (50 patients)					
	Arterial lumen occlusion	%	Atherosclerosis and/or luminal stenosis	%	Total	%
CIA	20	22 %	58(16)**	63.7%	78	85.7%
IIA	16	17.6%	48(6)**	52.7%	64	70.3%
EIA	21	23.1%	51(10)**	56 %	72	79.1%
CFA	19	20.9%	22(1)**	24.2%	41	45.1%
DFA	4	4.4%	3	3.3%	7	7.7%
SFA	25(11)*	27.5%	10(2)**	11 %	35	38.5%
PA	1(1)*	1.1%	4	4.4%	5	5.5%
ATA	3(3)*	3.3%	3	3.3%	6	6.6%
TPeA	1(1)*	1.1%	3	3.3%	4	4.4%
PTA	1(1)*	1.1%	2	2.2%	3	3.3%
PeA	1(1)*	1.1%	2	2.2%	3	3.3%

* Less than 1/3 length of occlusion of the specific arterial lumen segment
** More than 50% stenosis of the arterial lumen
*** Common iliac artery (CIA), internal iliac artery (IIA), external iliac artery (EIA), common femoral artery (CFA), deep femoral artery (DFA), superficial femoral artery (SFA), popliteal artery (PA), anterior tibialis artery (ATA), tibioperoneal artery (TPeA), posterior tibialis artery (PTA), peroneal artery (PeA)

patient. Arterial lumen occlusion of the limbs is also a manifestation of a local disease related to the general arterial degenerative changes. The connection between the various risk factors and the atherosclerotic process is caused by various interactive mechanisms at the cellular level, and we can say that atherosclerosis is multifactorially-influenced[7,8].

Detailed Japanese studies have shown that in the Okinawan Japanese compared to the immigrants coming to the Okinawa islands who had lived in Hawaii for some years with changes in both the environ-

Table 6. Frequency of Unilateral Multisegmental Arterial Lumen Occlusion in Lower Extremities

Arterial segment*	Group A 63 limbs (46 patients)	%	Group B 45 limbs (37 patients)	%
CIA EIA IIA	2 (2)	3.2%	4 (4)	8.9%
CIA EIA	4 (4)	6.4%	15 (12)	33.3%
CIA EIA CFA	1 (1)	1.6%	11 (8)	24.4%
CIA EIA CFA SFA	1 (1)	1.6%	7 (5)	15.6%
EIA CFA	5 (5)	7.9%	14 (11)	31.1%
EIA CFA SFA	2 (2)	3.2%	8 (6)	17.8%
CFA SFA	4 (4)	1.3%	10 (8)	22.2%
SFA PA SA	13 (11)	20.6%	2 (2)	4.4%

* Common iliac artery (CIA), external iliac artery (EIA), internal iliac artery (IIA), common femoral artery (CFA), superficial femoral artery (SFA), popliteal artery (PA), sural arteries (SA)

ment and diet, the incidence of atherosclerosis was higher in the former than in the latter[9]. In the Chinese studies, the people who lived in the city had a higher risk factor of occurrence than those living in the rural areas, and the hypertension rate was comparatively higher in the northern and northeastern provinces than in the southern and southwestern provinces of China[10]. Geographic and dietary differences were emphasized in the development and progress of atherosclerosis[11,12].

Although our patient population is small in both groups in the present study, our data demonstrate that patients in Group B tend to be older than those in Group A ($p<0.01$). The female patient in Group B demonstrated a higher cigarette smoking rate (9/9 in Group B vs. 0/6 in Group A) at the time of the onset of symptoms, and cigarette use in general was heavy. The male: female ratio is 4.6:1 in Group B and 7.3:1 in Group A: we have surmised that the higher incidence of artery disease in women in Group B may be accounted for by the greater tobacco consumption. Wald[13] in 1973 indicated that smoking was an important factor in the development of atherosclerotic cardiovascular diseases, especially heavy ciagrette smoking. The sex ratio may be changing in favour of the female owing to the increased use of cigarettes by women[14].

It is concluded that the prevalence of hypertension and total cholesterol level is higher in Group A than in Group B; But the statistical analysis shows a difference in hypertension ($p>0.05$) and difference in total cholesterol level ($p<0.05$) between the two groups. This may account for the higher occurrence of distal limb atherosclerosis. There is a significant difference in the incidence of DM between the two grups ($p<0.05$). The percentage of DM in the patients at stage III+IV for both groups is also higher than those in the patients at stage I and stage II, although there is no statistically significant difference ($p>0.05$) except for Group A between stage II and stage III+IV ($p<0.01$). The risk factors interacted with the development and progress of atherosclerosis. Sato[15] in 1983 suggested that atherosclerosis is enhanced in DM, especially in the arteries where the cholesterol content is low. The risk factors are additionally affected by environmental and dietary factors.[10–12].

Our angiographic results indicate that the ASO patients in Group A have a trend toward the femoral artery and involvement of its distal arteries with wider-ranging and severer atherosclerotic lesions compared to the patients in Group B, and for the proximal femoral artery involvement, the results turn out to be contrary between the two groups. Further studies will be needed to define the causes of this trend. No particular distribution of the diseased arteries on the angiographic films could be found in the present study, as in the type of isolated bilateral common femoral artery occlusion in one patient reported by Cohen[16]. The percentage of symmetrical atherosclerotic lesion of the lower limbs in our data was lower than what Walden[17] reported.

These findings indicate that the causes of arterial diseases are probably multifactorial, however, the differences in the environment, dietary composition, age, smoking, total cholesterol level and DM between the two groups may be some of the more important factors. Further comparative studies between wider-spread geographical groups may reveal a more definite correlation.

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