Comparative frequency of bone sarcomas among different racial groups

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Objective To analyse comparatively the relevant data from bone tumor registries in China, Japan, and the United States.

Methods The data of 38 959 histologically confirmed primary bone tumors collected by the Chinese Bone Tumor Registry 1957-1988, 20 272 collected by the Japanese Bone Tumor Registry 1972-1990, and 11087 diagnosed and treated at Mayo Clinic, USA were used for comparative analysis by race, age, sex and skeletal distribution. For reliability, we used ratios of different tumors to osteosarcoma for frequency analysis. We also included some data from the SEER 1973-1987 as well as from Memorial Sloan-Kettering Cancer Center, USA.

Results The relative frequency of osteosarcoma (OS) is higher in China and Japan than in the United States. There were only limited number of OS patients aged over 50 years in Chinese and Japanese groups, which might be due to the lower incidence of OS subsequent to Paget's disease in Asians. More osteosarcoma occurred in the flat bones in the Americans than in the Chinese and Japanese. The relative frequency of chondrosarcoma (CS) was higher in the American group than in the Asian groups. The average age of CS patient was younger in the Chinese than in the Japanese and the Americans. The data confirmed the previous report that the incidence of Ewing sarcoma was higher in western people than in Asians. The data showed that the comparative frequency of chordoma is higher in the Americans than in the Asians and that the incidence of giant cell tumor of bone is higher in the Chinese and Japanese than in the Americans.

Conclusion The findings from this analysis provide useful information for the epidemiologic study and the clinical diagnosis of bone tumors.

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Sarcomas arising from bone and cartilage account for about 0.5% of all malignant neoplasms in the human. Although tremendous amount of research has been devoted to the diagnosis and therapy, there are only a few epidemiologic studies on bone tumors.[1,2] Oncologic epidemiology is becoming more important than before as genetics develops quickly. It is known that the incidence of Ewing sarcoma is much higher in the white than in the black as well as in the Asians, and chromosome 11 and 22 translocation seems to induce this disease. The question is how this translocation occurs, and why it is liable to happen in the white population. The epidemiologic study in cancer among the different countries or separate racial groups may provide clues to the causation of the cancer. Moreover, the age, skeletal site and frequency distribution data for primary bone tumors have long been used for diagnosis in addition to specific radiographic features of bone tumors.

Little is known about the etiology of bone and cartilage tumors, but the varying incidence patterns suggest that they may arise from different etiologic processes. Bone tumor registry has been providing a unique opportunity to compare the differences in bone tumors among the countries or racial groups, including differences in incidence, age and sex predisposed, skeletal localization and survival rates. The geographic variation of the incidence of bone tumors has been found in some regional cancer centers and cancer registries throughout the world. Larsson[1] reported that the incidence of osteosarcoma was higher in urban than in rural areas, and Song[3] found that there was a higher incidence of giant cell tumor of bone in China than in western countries. The data of SEER 1973-1987[2] confirmed the fact that Ewing sarcoma is extremely rare in the black population. The recent SEER data showed that chordoma is also rare in blacks. This inspired us to make a comparative

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study on the variations of frequency of bone sarcomas among the separate racial groups. In this paper we comparatively analyzed some bone tumor registry data from China, Japan, SEER and Mayo Clinic.

METHODS

The data came from three groups: Chinese Bone Tumor Registry (BTRIC) 1957-1988 which constituted 38 959 histologically confirmed primary bone tumors collected by 40 representative hospitals;[4] Japanese Bone Tumor Registry (BTRIJ) 1972-1990 which consisted of 20 272 histologically confirmed primary bone tumors;[5] and Mayo Clinic which covered 11 087 cases.[6] Some data were also included from the SEER 1973 – 1987 group as well as from Memorial Sloan-Kettering Cancer Center,[7] USA. We compared the data among the groups, and searched for the variation in frequency of various bone tumor in different racial groups. For reliability, the ratios of different tumors to osteosarcoma were used for frequency analysis. We also studied the difference of skeletal localization, age and sex distribution of bone tumors among the groups.

Table. The frequency of bone sarcomas in the Chinese, Japanese and American population

	Ratio to OS in BTRIC (%)	Ratio to OS in BTRIJ (%)	Ratio to OS in Mayo Clinic
Osteosarcoma (OS)	4811 (44%)	2275 (42%)	922 (35%)
Chondrosarcoma	1537 (14.2%)	797 (14.7%)	895 (15.8)
	0.32	0.35	0.54
Ewing' sarcoma	494 (4.6%)	324 (6%)	512 (9.1%)
	0.10	0.14	0.31
Chordoma	412 (3.8%)	168 (3.1%)	356 (6.3%)
	0.09	0.07	0.22
Fibrosarcoma	710 (6.6%)	109 (2%)	255 (4.5%)
	0.15	0.05	0.15
MFH	272 (2.5%)	312 (5.8%)	83 (1.5%)
	0.06	0.14	0.05
GCTs	3996 (18.4%)	1505 (10.1%)	603 (5.4%)
	0.82	0.66	0.34

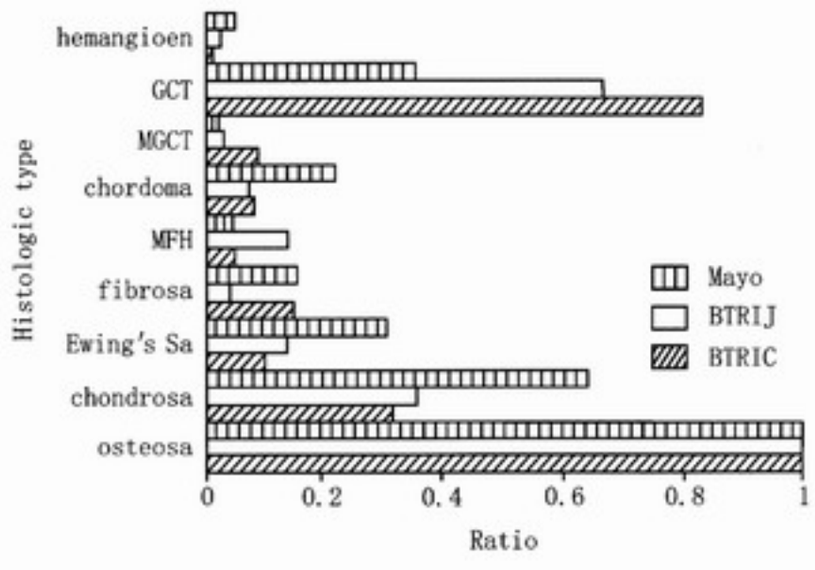

Fig. 1. Ratios of different tumor to osteosarcoma in the Chinese, Japanese and Americans.

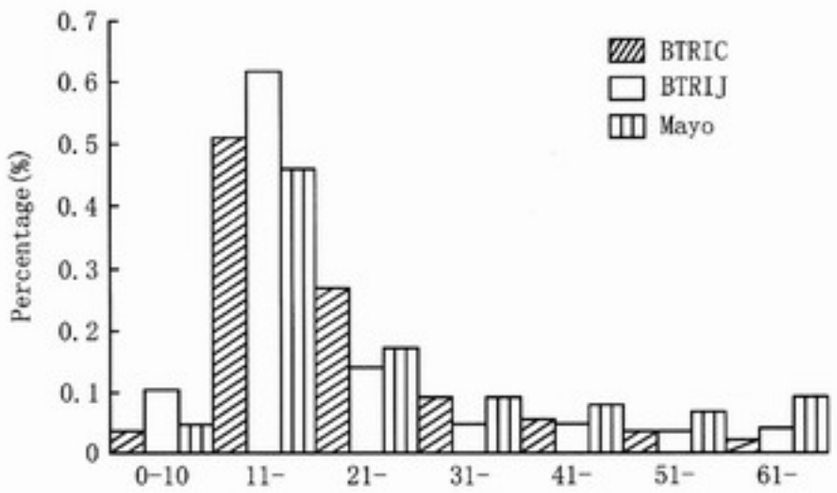

Fig. 2. The age distribution of osteosarcoma in different racial groups.

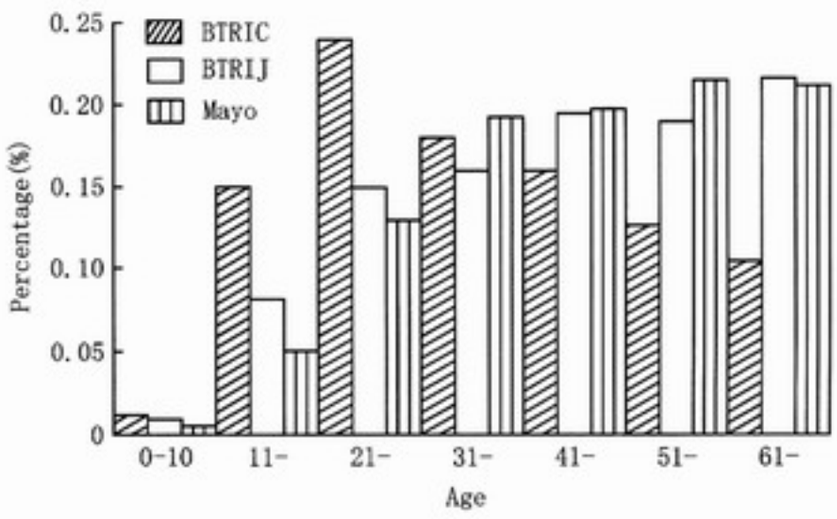

Fig. 3. The age distribution of chondrosarcoma in the Chinese, Japanese and Americans.

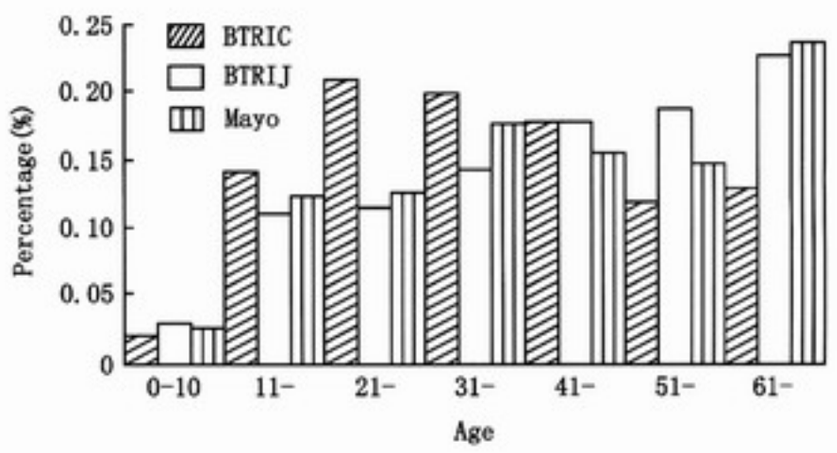

Fig. 4. The age distribution of fibrosarcoma and MFH.

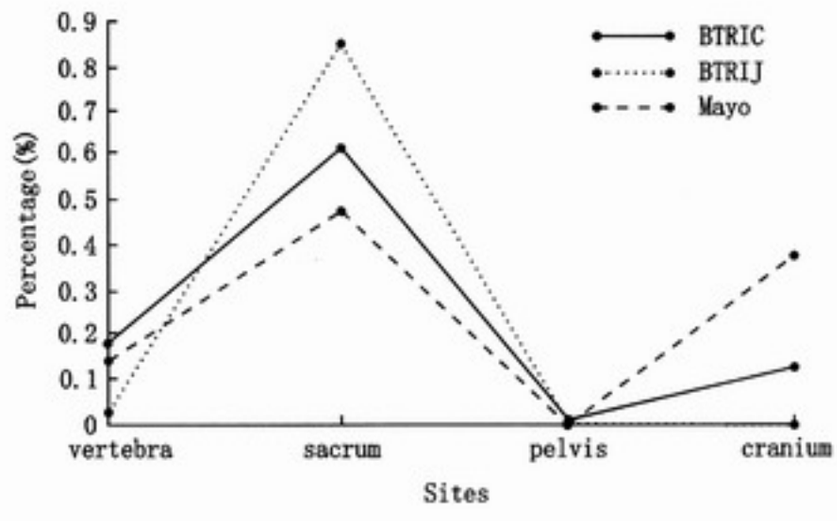

Fig. 5. The bone distribution of chordoma in the different racial groups.

RESULTS AND DISCUSSION

Osteosarcoma

Osteosarcoma is the second common primary malignant bone tumor following myeloma in western countries. Because myeloma is a hematologic malignancy, that can be registered also in other cancer groups in China and Japan, the relative frequency of myeloma in bone tumor registry may not be exact, we excluded myeloma from this study. 4811 osteosarcomas were registered in the BTRIC group, and 2275 osteosarcomas in BTRIJ 1972 - 1990, accounting for 44% and 42% of primary malignant bone tumors respectively. In the SEER group, there were 922 osteosarcomas, which constitute 35% of primary malignant bone tumors. The data showed that the relative frequency of osteosarcoma is higher in China and Japan than in the United States because there are much more Ewing sarcomas and chondrosarcomas in the United States. It has been well-known that osteosarcoma has a bimodal age distribution in western countries. The data of the BTRIC and BTRIJ groups evidently showed few osteosarcoma cases occured at the age over 50 years that as was reported in the American blacks. This may be due to the lower incidence of osteosarcoma subsequent to Paget's disease in the Asians and American blacks. Among 1177 osteogenic sarcomas diagnosed and treated at the Memorial Sloan-Kettering Cancer Center from 1921 through 1981, 65 (5.5%) arose as a complication of Paget's disease of bone. In patients older than 40 years, 27% the osteosarcomas arose in bones affected by Paget's disease. With regard to the skeletal distribution of osteosarcoma, American patients had more lesions in the flat bones such as pelvis, ribs, vertebra, scapula etc. There were more than 25% of osteosarcomas located in these sites in cases of Mayo Clinic, while there were only 9% of such cases in the Chinese and Japanese groups. Paget's sarcoma may also contribute to some extent to this distribution, because Paget's disease often affects flat bone.

Chondrosarcoma

1537 chondrosarcomas collected in the BTRIC group, and 797 chondrosarcomas in the BTRIJ group, accounted for 14.2% and 14.7% of primary malignant bone tumors in China and Japan respectively. In the SEER group, 677 chondrosarcomas were registered, constituting 25.8% of primary malignant bone tumors. We also compared the ratios of chondrosarcoma to osteosarcoma among the groups. The ratio of chondrosarcoma to osteosarcoma was 0.32 in Chinese group, 0.35 in Japanese group, 0.73 in the SEER, group and 0.54 in the Mayo group. It is shown that the relative frequency of chondrosarcoma was much higher in the American groups than that in the Asian groups. With regard to the bone distribution of chondrosarcoma, more cases occurred in ribs and vertebra in the SEER group and Mayo group. Nineteen percent of chondrosarcomas arose from ribs in the SEER group, and 12% arose from ribs in Mayo group, but only 5% and 7% of chondrosarcomas located in ribs in the BTRIC group and BTRIJ group respectively. The same phenomenon happened at the vertebrae between the American and Asian groups. A difference in age distribution was nole among the groups. Fifty five percent of chondrosarcoma occurred at the age of over 40 in the Chinese group, while in the BTRIJ group and Mayo group, less than 40% of chondrosarcoma patients were younger than 40 years. The age distribution of chondrosarcoma in the Chinese group was younger than in the Japanese and American groups. In the data of the SEER group, the median age of chondrosarcoma at diagnosis in the whites people was 53, but in American blacks 40. It is difficult to explain why there was different age distribution in chondrosarcoma patients between the Chinese and Japanese groups.

Ewing sarcoma

494 Ewing sarcomas were registered in the BTRIC group, and 324 in the BTRIJ group, they accounted for 4.6% and 6% of primary malignant bone tumors respectively. Ewing sarcoma constituted 16% of primary malignant bone tumors in the SEER group and 9.1% in the Mayo group. The ratio of Ewing sarcoma to osteosarcoma was 0.1 in the Chinese group, 0.14 in Japanese group, 0.54 in the SEER group and 0.31 in the Mayo group. The data confirmed that the incidence of Ewing sarcoma was higher in western people than in the Asian people. Interestingly incidence of Ewing sarcoma was lower in the American blacks than in the white people in the SEER group. Ewing sarcoma constituted 17.2% and 3.8% of primary malignant bone tumors in the white and black people respectively. A possible explanation for this racial difference is that the genes for controlling osteosarcoma are equally mutable among various races, but those for Ewing sarcoma resist mutation in the black and Asian people. The age distribution of Ewing sarcoma resembles that of osteosarcoma which develops early in life both in the American and Asian population, rarely over 35 years.

Chordoma

412 chordomas of the BTRIC group, and 168 in the BTRIJ group, accounted for 3.8% and 3.1% of primary malignant bone tumors respectively. Chordoma constituted 6.3% of bone sarcomas in the Mayo group, and 8.4% in the SEER group. The ratio of chordoma to osteosarcoma was 0.09 in the Chinese group, 0.07 in the Japanese group, 0.22 in the Mayo group, and 0.24 in the SEER group, Evidently the incidence of chordoma was higher in the Americans than in the Asian people. The data of the SEER group revealed that there was an incidence difference of chordoma existed between the white and black population,

and the latter had a very low incidence of chordoma in the United States. It would be interesting to study the gene alterations in chordoma because they arise from the different gene pathways among the different racial groups. As regard to the site distribution of chordoma, some differences of location also existed among the groups. In the Mayo group, more chordomas (40%) of were located in the cranium. The percentageg cranial chordoma in the Chinese group was 13%, but zero in the Japanese group.

Fibrosarcoma and malignant fibrous histiocytoma (MFH)

710 fibrosarcomas and 272 MFHs were registered in the BTRIC group, accounted for 6.6% and 2.5% of primary malignant bone tumors respectively. In the BTRIJ group, 109 fibrosarcomas and 312 MFHs constituted 2% and 5.8% of primary malignant bone tumors respectively. MFHs constituted 1.5% and fibrosarcoma 4.5% of bone sarcomas in the Mayo group. The ratio of MFH to osteosarcoma was 0.06 inthe Chinese group, 0.14 in the Japanese group, and 0.05 in the Mayo group. The rati o of fibrosarcoma to osteosarcoma was 0.15 in the Chinese group, 0.05 in the Japanese group, and 0.15 in the Mayo group. These data showed that the frequency of MFH was three times of fibrosarcoma in the BTRIJ group to that of the BTRIC group and the Mayo group. This may not be entirely true. The variation of age distribution among the groups was obvious. 35% cases of fibrosarcoma and MFH were found at the age of 30 years or younger in the Chinese group, whereas less than 25% cases of fibrosarcoma and MFH occurred younger than 30 in the Japanese group and Mayo group. The data of the SEER group showed the variation of age predisposition in fibrosarcoma and MFH between the white people and blacks in the USA. The median age of MFH at diagnosis was 61 years in the white people and 47 in blacks. Possibly, the variation was due to the longer lifetime of the white people than in blacks, so that there were less elderly cases registered in blacks. In the Chinese group, there may be a similar reason for a younger age distribution in bone cancer, since patients over 70 years were reluctant to seek medical care some decades ago, especially in the countryside.

Giant cell tumor (GCT) and malignant GCT

There were 3996 giant cell tumors (GCTs) in the BTRIC group and 1505 GCTs in the BTRIJ group. They constituted 18.4% and 10.1% of primary benign bone tumors respectively. The ratio of GCT to osteosarcoma was 0.82 in the BTRIC, 0.66 in the BTRIJ , and 0.34 in the Mayo group. The data reconfirmed the published results that the incidence of GCT was higher in the Chinese than in the western population. The data also showed that the incidence of GCT in the Japanese was higher than in the American people. It would be interesting to study the differences in genetics among the racial groups, which may provide clues to the causes of this cancer. With regard to malignant GCT among the mentioned groups, 9.7% of GCTs were malignant in the BTRIC group, 5% in the BTRIJ, and 2.5% in the Mayo group. The result showed there were more malignant GCTs in the Chinese than the American population and that the Japanese frequency was in between. It would be worthwhile studying the racial difference. The data of the SEER group showed that GCT was rate in blacks, that needs further investigation. Generally the frequency of GCT is considered higher in females. The data of the BTRIC group, also showed that the frequency of GCT in males was higher than in females as seen in other bone cancers.

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