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Pain and internal hypertension in bone lesions

Internal pressures of bone tumors and tumorous conditions were measured in 20 patients. High pressures were frequently found in patients with painful bone lesions while low pressures were common in patients with no pain. Internal hypertension may be a causative factor of aching bone pain at rest.

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Many patients with malignant bone tumors bleed freely at biopsy, and pain at rest is common in these patients (Petrakis 1954). These observations suggest that pressure elevation may be present in these lesions. We investigated whether internal hypertension in bone lesions is associated with pain at rest.

Patients and methods

The clinical material consisted of 20 patients admitted to Gunma University Hospital between 1979 and 1983 because of bone tumors and tumorous conditions. The degree of pain at rest was assessed and the patients were divided into three groups. Six patients complained of severe pain at rest, three patients had mild pain and 11 had no pain (Table 1).

Methods

The patients were examined in the supine position. General anesthesia with intermittent positive pressure breathing was used. The mid-axillary plane at the level of the fourth costal insertion at the sternum corresponding to the heart level was chosen as a level pressure reference. The lesions were identified by an image-intensifier, and a stainless steel cannula (18-gauge) was inserted. The cannula was connected to an electromanometer (P-23ID, Gould Inc., Oxnard, Calif.). Normal bone marrow pressure was measured on the contralateral side in the same manner. The left radial artery was cannulated by a polyethylene cannula (22-gauge), connected to another electromanometer.

The manometric system was filled with heparinized saline and calibrated by a mercury manometer. The readings were made on a four-channel monitor oscilloscope (2G47, San-ei Instrument Co., Tokyo) and on a pen-recorder (Rectigraph-8K, San-ei Instrument Co., Tokyo) for a permanent record. The intra-arterial pressure was recorded synchronously with the internal pressure of the bone lesion.

Results

All the malignant bone tumors were painful, but the lesions with severe pain were not always malignant (Table 1). All simple bone

Table 1. Clinical data

Case	Sex	Location	Histologic diagnosis	Degree of pain
1.	M	humerus	simple bone cyst	none
2.	F	humerus	simple bone cyst	none
3.	M	tibia	simple bone cyst	none
4.	M	femur	simple bone cyst	none
5.	F	calcaneus	simple bone cyst	none
6.	M	tibia	simple bone cyst	none
7.	M	femur	simple bone cyst	none
8.	F	tibia	non-ossifying fibroma	none
9.	F	tibia	non-ossifying fibroma	none
10.	F	tibia	fibrous dysplasia	none
11.	F	tibia	chronic osteomyelitis	none
12.	M	vertebra	benign osteoblastoma	mild
13.	M	humerus	eosinophilic granuloma	mild
14.	F	vertebra	aneurysmal bone cyst	mild
15.	F	tibia	malignant giant cell tumor	severe
16.	F	tibia	giant cell tumor	severe
17.	M	tibia	benign chondroblastoma	severe
18.	M	fibula	metastatic carcinoma	severe
19.	M	femur	chondrosarcoma	severe
20.	M	tibia	giant cell tumor	severe

Table 2. Internal pressure related to pain

Pain	Mean pressure (±S.D.), mmHg		
	Systolic	Diastolic	Pulse
None (11 cases)	28 (±7) (NS)	25(±7) (NS)	3(±2) (NS)
Mild (3 cases)	40 (±8) (NS)	37 (±10) (p<0.02)	3 (±2) (NS)
Severe (6 cases)	74 (±12) (p<0.01)	57 (±7) (p<0.01)	17 (±8) (p<0.02)
Normal bone marrow (7 cases)	27 (±11)	22 (±5)	4 (±6)

p-values were calculated by Student's *t*-test in comparision with normal bone marrow.

cysts were painless (Table 1). The systolic pressures and the pulse pressures in the lesions with severe pain were significantly higher than those in normal bone marrow (Table 2). The systolic pressures in the lesions with severe pain were also higher compared with those in the lesions with mild pain ($p < 0.05$) and the lesions with no pain ($p < 0.01$), whereas the difference between the lesions with mild or no pain was not significant (Table 2). The greatest pulse pressure (24 mmHg) was found in a patient with a malignant giant cell tumor in the tibia (case 15) (Figure 1).

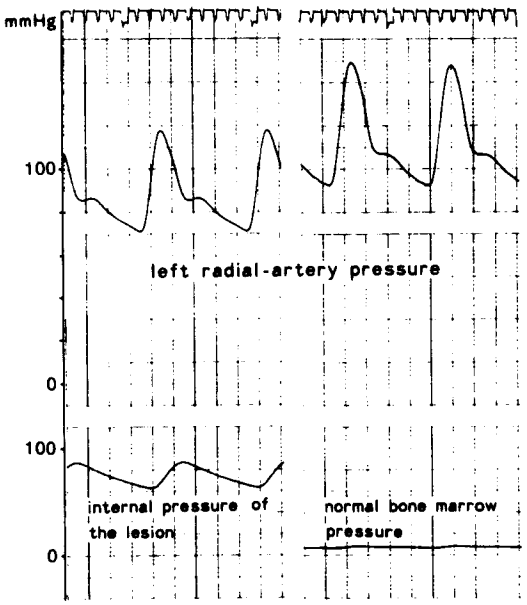

Figure 1. Intra-arterial pressure, internal pressure of a malignant giant cell tumor and normal bone marrow pressure in a patient with severe pain (case 15).

Discussion

A correlation between pain at rest, internal hypertension and venous engorgement in bone marrow has been found in patients with osteoarthritis (Arnoldi 1971, 1972, 1975, Astrom 1975, Phillips 1966, 1967).

However, the relationship between pain and internal hypertension in bone tumors and tumorous conditions has not been clearly demonstrated. High bone marrow pressures in leukemic patients with pain at rest compared to those of patients without pain have been observed (Petrakis 1954). Petrakis did not demonstrate a difference between the internal pressures of painful bone lesions and those of normal bone marrow and painless bone lesions. Our findings indicate that internal hypertension in bone lesions is a causative factor of resting bone pain.

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