

Takehiko Yamaguchi
Howard D. Dorfman

Radiographic and histologic patterns of calcification in chondromyxoid fibroma

T. Yamaguchi, M.D.
H.D. Dorfman, M.D. (✉)
Section of Orthopaedic Pathology,
Department of Orthopaedic Surgery,
Montefiore Medical Center/
Albert Einstein College of Medicine,
111 East 210th Street, Bronx,
NY 10467–2490, USA

T. Yamaguchi, M.D.
Department of Pathology,
Dokkyo University School of Medicine,
Mibu, Tochigi 321–0293, Japan

Abstract *Objective.* To evaluate the frequency of radiologic and histologic manifestations of matrix calcification in chondromyxoid fibromas. *Patients.* Forty-four cases of chondromyxoid fibroma were reviewed. The age range of the patients was 3–70 years (average 29 years). *Results.* Calcification was found microscopically in 15 cases (34.1%). In five cases (12.5%) it was demonstrated on plain films or CT. The age range of the patients with microscopic evidence of calcified matrix was 14–70 years (mean 46 years), while that of the patients with non-calcified lesions was 3–59 years (average 21 years). All but two of the patients who showed microscopic

calcification in the tumors were over 40 years of age. Four microscopic patterns of calcification were observed: coarse granular, circumscribed, trabecular, and “chicken-wire.”

Conclusions. Calcification in chondromyxoid fibroma was found more frequently than in previously reported studies. There was a tendency for this phenomenon to occur in the tumors of older patients, particularly those over 40 years old, and in chondromyxoid fibromas situated in flat bones, including ribs.

Key words Chondromyxoid fibroma · Calcification · Benign cartilaginous tumor

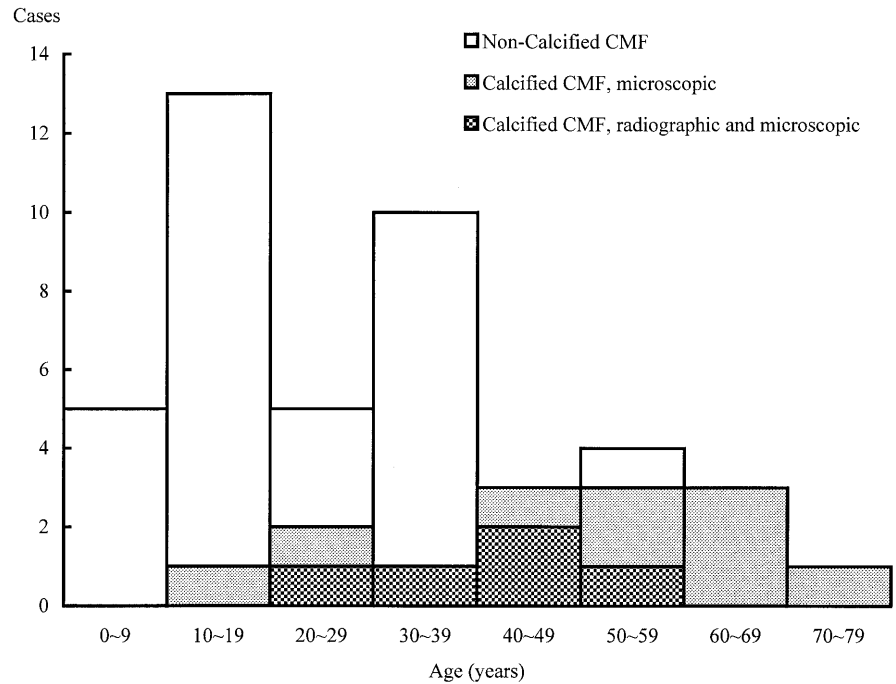
Introduction

Chondromyxoid fibroma (CMF) is a rare, benign cartilaginous tumor that has a predilection for the second and third decades of life [1–4]. The most common sites are the metaphyseal regions of long tubular bones of the lower limb, particularly in the proximal tibiae. The characteristic radiologic feature is a well-defined radiolucent area that is eccentrically located in the metaphysis, occasionally with expansion and thinning of the cortex. The margin is sclerotic with scalloped borders. Microscopically, the tumor consists of lobules of myxomatous, fibrous, and chondroid tissue with varying numbers of multinucleated giant cells.

Unlike other cartilaginous tumors, calcification in CMF has been reported to be unusual [3, 5–10]. However, matrix calcification can occasionally be seen on radiographs [1–3]. Several cases of CMF with conspicuous cal-

cification have been reported [4, 11]. Feldman et al. [5] mentioned that calcification in CMF was recognized in 2.4% of cases radiologically and 6.8% microscopically. Rahimi et al. [6] found 27% of cases in their series to contain microscopic calcification and stated that this condition was more common in the tumors of older patients. Beggs and Stoker [7] found calcification in five of 31 lesions (16%) both radiologically and macroscopically. Gherlinzoni et al. [8] found radiologic evidence of calcification in 3.7% of CMF patients and microscopic evidence in 11.1%. According to Zillmer and Dorfman [9], 14% of cases of CMF contained microscopic calcification and the patients showed a wide range of age. Wilson et al. [10] reported that only 2.5% of CMF patients showed calcification radiographically. Schajowicz [3] mentioned only one case of CMF associated with radiologically and microscopically conspicuous calcification. We retrospectively reviewed our cases of CMF to assess the frequency

Fig. 1 Age distribution of chondromyxoid fibroma (CMF)



and characteristics of radiologic and histologic manifestations of matrix calcification.

Materials and methods

Histologic slides of 44 patients with a diagnosis of CMF were reviewed from the files of one of the authors (H.D.D.). Plain radiographs were available in 39 patients and CT scans in nine. In all but one, clinical data were also available. Twenty-three patients were male and 20 were female; the gender of one was unknown. The age range was 3–70 years with an average of 29 years (Fig. 1). Thirteen cases presented in the tibia, five in the ilium, four in the femur, three each in the fibula and rib, two each in the thoracic vertebra, metatarsal, and phalanx of the foot, and one each in the mandible, clavicle, humerus, ulna, carpal bone, metacarpal, phalanx of the digit, sacrum, pubis, and tarsal bone (Fig. 2). One tumor of the tibia occurred on the surface of the bone, representing a juxtacortical CMF.

Information about patient's symptoms was available in 35 cases. Thirty lesions were symptomatic; pain was present in 18 cases, a mass in seven, pain and swelling in two, swelling in two, limp in one. In 21 of these cases the duration of symptoms ranged from 1 week to 20 years with a mean duration of 20.4 months. The remaining five lesions were asymptomatic and found incidentally during evaluation for other diseases (four cases) or on routine chest radiograph (one case). All but one of these incidentally discovered lesions occurred in flat bones: three in the rib and one in the ilium.

Results

In 15 of 44 lesions (34.1%) matrix calcification was found microscopically (Table 1). Six of these patients were male and eight female; the gender of the remaining patient was unknown. The age of patients with calcified

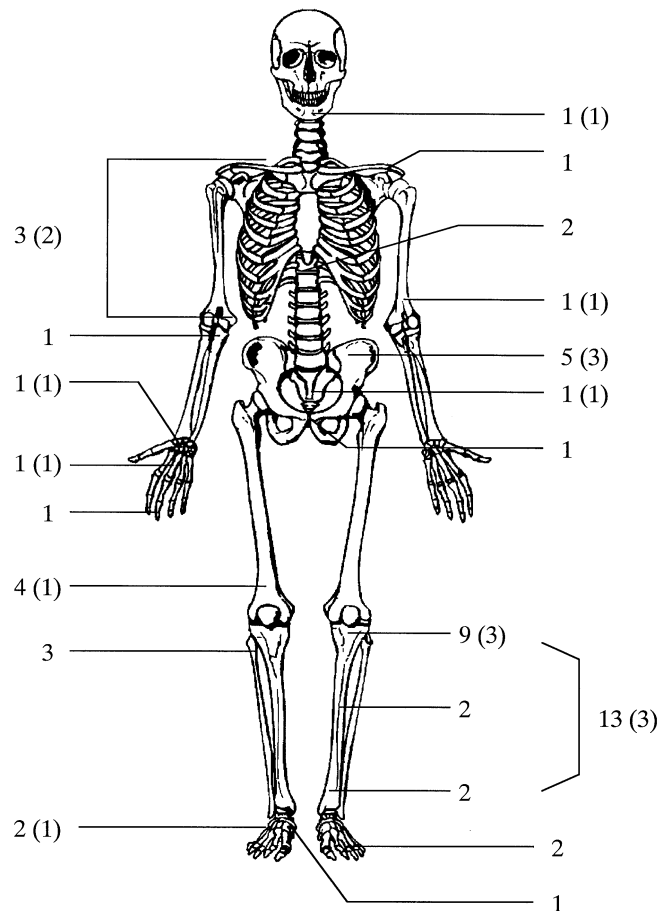


Fig. 2 Skeletal location of cases of chondromyxoid fibroma. Numbers in parentheses are the number of cases with microscopic calcification

Table 1 Clinical, radiographic, and microscopic findings of calcified chondromyxoid fibroma

Case no.	Age (years)	Gender	Location	Symptoms	Duration of symptoms	Calcification		
						Radiograph	CT scan	Microscopic findings
1	14	M	Tibia	Pain	1.5 months	Negative	Negative	“Chicken-wire”
2	20	M	Rib	Asymptomatic	–	–	Identified	Coarse granular and circumscribed
3	23	M	Trapezium	Pain	–	Negative	–	Coarse granular and circumscribed
4	31	F	Rib	Asymptomatic	–	Identified	–	Coarse granular and circumscribed
5	42	F	Tibia, proximal	Progressive pain	24 months	Identified	–	Coarse granular and trabecular
6	48	F	Femur, distal	Mass	–	Negative	–	Coarse granular and circumscribed
7	48	F	Ilium	Intermittent pain	A few months	Negative	Identified	Coarse granular and “chicken-wire”
8	50	M	Metacarpal	Pain	36 months	Negative	–	Coarse granular and “chicken-wire”
9	55	F	Tibia, proximal	–	–	Negative	–	Trabecular and “chicken-wire”
10	55	F	Ilium	Asymptomatic	–	Identified	Identified	Coarse granular and circumscribed
11	60	M	Ilium	Progressive pain	12 months	Negative	–	Trabecular
12	60	F	Sacrum	Low back pain	27 months	Negative	–	Coarse granular
13	65	M	Mandible	Soft tissue mass	–	Negative	–	Coarse granular
14	70	F	Metatarsal	Mass	20 years	Negative	–	Coarse granular
15	(Student)	Not known	Humerus, distal	Small lump	A couple of months	Negative	–	Coarse granular

lesions ranged from 14 to 70 years with a mean age of 46 years, while that of patients with non-calcified lesions ranged from 3 to 59 years with an average of 21 years (Fig. 1). Of the 15 cases, three each presented in the ilium and tibia, two in the rib, and one each in the femur, humerus, metacarpal, metatarsal, trapezium, mandible, and sacrum (Fig. 2). Calcified CMF was often found in the flat bones including ribs (40.0%), while non-calcified CMF involved these sites in 13.8% of cases. Three of 14 calcified lesions (21.4%) were asymptomatic whereas two of 21 non-calcified lesions (9.5%) were discovered incidentally.

The duration of symptoms in patients with calcified CMF was 43.2 months (range 1.5 months to 20 years), compared with 6.4 months (range 10 days to 2 years) in patients with non-calcified CMF. Among all cases with or without calcification, the duration of symptoms in patients older than 40 years of age was 56.9 months (range 2 months to 20 years) and that in patients 39 years of age or younger was 5.8 months (range 10 days to 2 years). In one case (case 10), the lesion was found incidentally during investigation for ovarian carcinoma. The tumor was excised after chemotherapy that included high-dose *cis*-platinum and showed prominent calcification. One patient with CMF (case 14) presented with osteomalacia (oncogenic osteomalacia), which reverted to normal after excision.

Among the lesions with microscopically confirmed calcification, only five (33.3%) showed radiographic evi-

dence of calcification: two each on plain radiography and on CT and one on both. In one case the plain radiographs failed to demonstrate calcification, but it was found on CT scans. The plain radiographs demonstrated evidence of calcification in three of 14 cases (21.4%) and CT scans in three of four cases (75.0%). In the cases for which radiologic imaging studies were available, calcification was found in 7.7% of plain films alone and in 12.5% with CT scans. Calcification was identified as discrete foci of radiodense material within a lytic lesion on plain radio-

Table 2 Incidence of calcification in chondromyxoid fibroma

	Radiographic ^a	Microscopic
Feldman et al. [5]	2.4%	6.8%
Rahimi et al. [6]	–	27%
Beggs and Stoker [7]	16%	16%
		(macroscopic)
Gherlinzoni et al. [8]	3.7%	11.1%
Zillmer and Dorfman [9]	–	14%
Wilson et al. [10]	2.6%	–
Schajowicz [3] ^b	2.1%	2.1%
Present study	12.5%	34.1%
	(7.7% on plain radiograph alone)	

^a Previous reports showing a lower incidence of radiologic calcification (except for Beggs and Stoker [7]) were based on plain radiographs alone or did not specify whether CT scans were available for study

^b Only mentioned conspicuous calcification

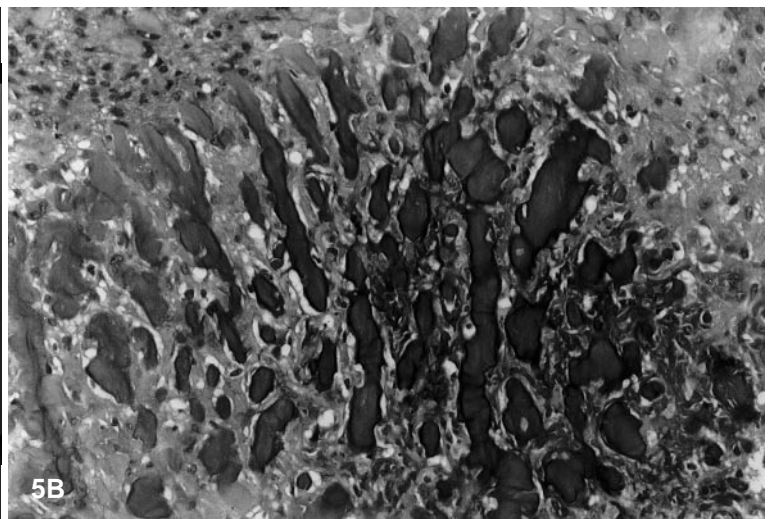
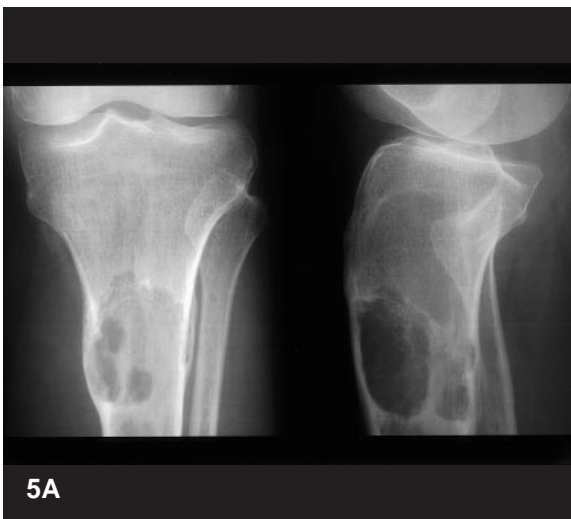
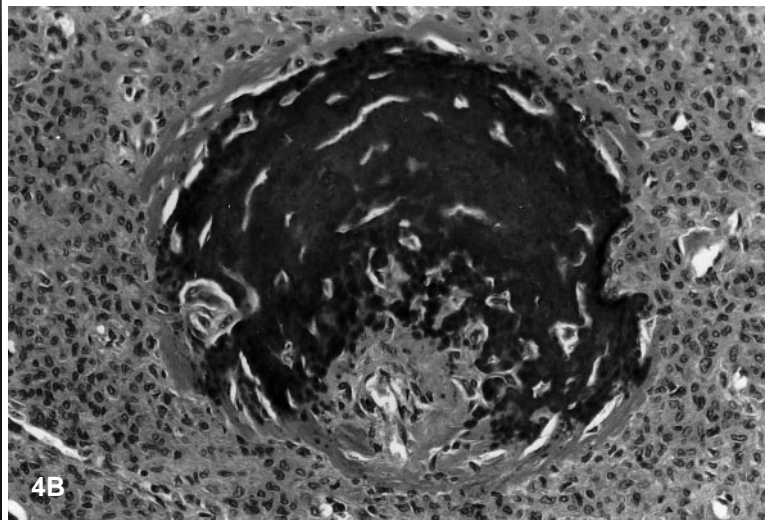
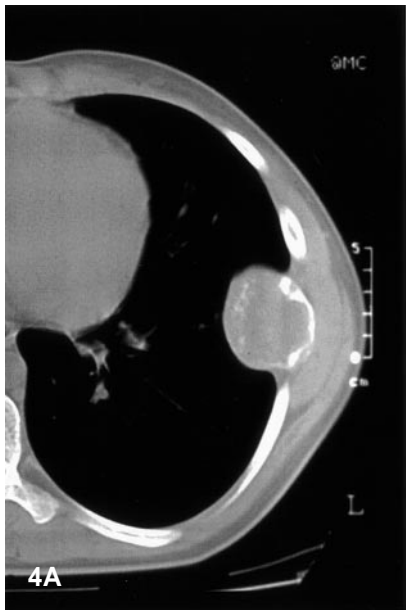
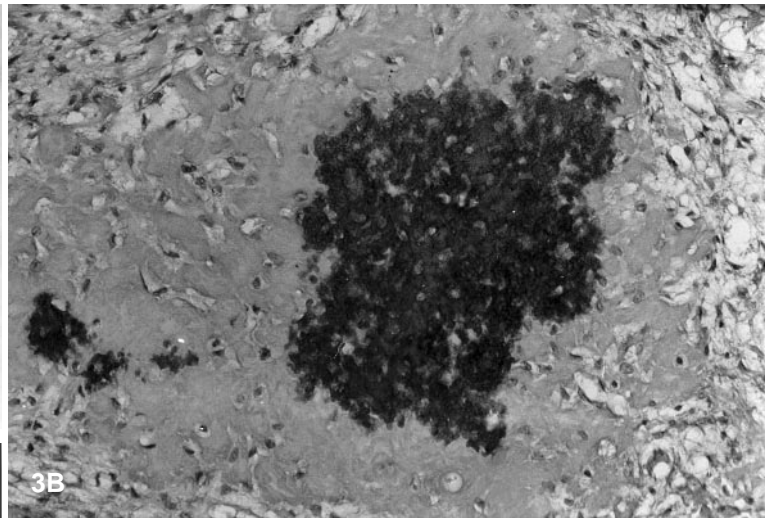
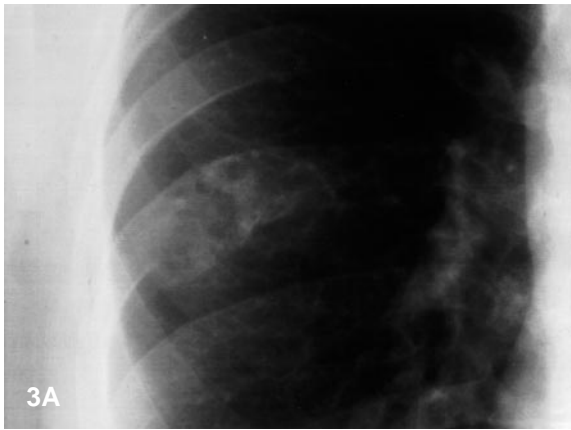
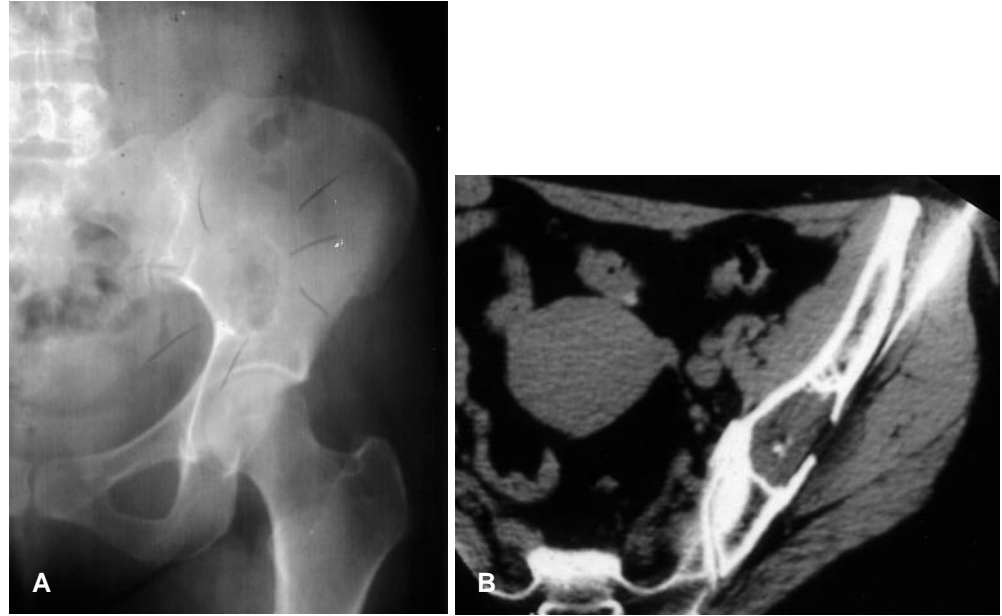
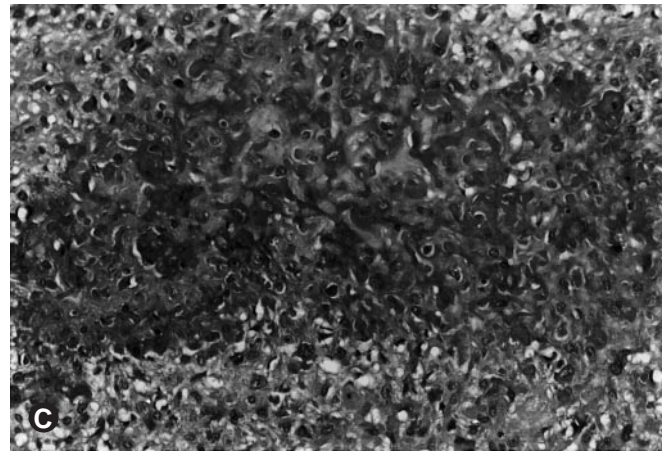


Fig. 6A–C Case 7. **A** Radiograph of a 48-year-old woman revealed a well-demarcated osteolytic lesion with marginal sclerosis in the left ilium. No calcification was recognized in the lesion. **B** CT scan demonstrated calcification in the lesion. **C** Histology showed “chicken-wire” calcification between tumor cells (H&E, original magnification $\times 200$)



graphs and often more conspicuous, dense material on CT scans.

Microscopic calcification was morphologically classified into the following four patterns: coarse granular, circumscribed, trabecular, and “chicken-wire.” The coarse granular pattern showed a granular deposition of calcified material within cartilaginous matrix of low cellularity (Fig. 3). The circumscribed pattern was characterized by localized and well-circumscribed foci of mineral deposition usually seen within a paucicellular chondroid matrix (Fig. 4). The trabecular pattern was characterized by broad trabeculated calcifications deposited within myxoid chondroid matrix (Fig. 5). The “chicken-wire” pattern was composed of a fine meshwork of calcification enclosing individual tumor cells (Fig. 6). Combinations of two different calcification patterns were seen in nine lesions: five cases showed a combination of the coarse granular and circumscribed patterns, two a combination of coarse



granular and “chicken-wire”, and one each combinations of coarse granular and trabecular and trabecular and “chicken-wire” (Table 1).

◀ **Fig. 3A, B** Case 4. **A** Radiograph of a 31-year-old woman revealed an expansile lesion with a thin cortex in the right seventh rib. Discrete calcification was seen in the lesion. **B** Histology showed calcification of coarse granular pattern in the chondroid matrix (H&E, original magnification $\times 200$)

Fig. 4A, B Case 2. **A** CT scan of a 20-year-old man revealed an expansile lesion of the rib that protruded into the thoracic cavity. Conspicuous calcification was recognized within the lesion. **B** Histology showed calcification of circumscribed pattern, which was embedded in sheets of tumor cells (H&E, original magnification $\times 200$)

Fig. 5A, B Case 9. **A** Anteroposterior and lateral radiographs of the left tibia of a 55-year-old woman revealed an expansile osteolytic lesion in the proximal diaphysis. No calcification was identified. **B** Histology showed calcification of trabecular pattern, which was deposited in the myxoid chondroid matrix arranged like a lattice (H&E, original magnification $\times 200$)

Discussion

In this study calcification was found in 12.5% of CMFs radiologically and in 34.1% microscopically. These rates were higher than those previously reported (Table 2) [3, 5–10]. Microscopic calcification was more often seen, the frequency being about 3 times that of radiologic calcification. Plain radiographs demonstrated calcification in 7.5% of cases while radiologic examinations including CT scans showed it in 12.2%. Radiologic study, including the use of CT, leads to a higher rate of recognition of calcification in CMF.

As shown Fig. 1, CMF with calcification had a predilection for middle-aged and older patients. Approximately

90% of CMF in patients over 40 years of age showed microscopic matrix calcification. This observation coincides with the experience of Rahimi et al. [6].

Calcified CMF was found more frequently in the ribs (2/3 cases, 66.6%), and in the ilium (3/5 cases, 60.0%). On the other hand, CMF of the tibia, which was the most common skeletal site, showed microscopic calcification in only 23.1% of cases. Calcified CMF was more often found in unusual locations, particularly in flat bones. These sites tended to be affected in middle-aged and older patients while the tibia was involved in younger individuals. CMF of weight-bearing bones excluding the pelvis may be found earlier than CMF of non-weight bearing bones. The duration of symptoms in patients older than 40 years of age (mean 56.9 months) was much longer than that in patients 39 years of age or younger (mean 5.8 months). Long-standing presence of these tumors is presumed to be related to the finding of calcification in CMF. One patient who underwent chemotherapy for ovar-

ian carcinoma showed prominent matrix calcification in the lesion. In this case, chemotherapy may have played a role in promoting the calcification.

The four calcification patterns found in this study were roughly classified into two categories: one was seen in paucicellular chondroid matrix and another between tumor cells. The former included coarse granular, circumscribed, and trabecular patterns and the latter exhibited the "chicken-wire" pattern. Each calcification pattern existed both alone and in combination. The trabecular pattern seems to be more characteristic for CMF while other patterns are frequently observed in other cartilaginous tumors [1]. Trabecular calcification tended to be deposited in myxoid-chondroid matrix, arranged in the form of a lattice between intervening tumor cells.

This study included a relatively large population of middle-aged and older patients and this presumably explains the higher incidence of calcification in CMF.

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