CHRONIC MULTIFOCAL OSTEOMYELITIS

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We describe 22 patients who presented between the ages of 4 and 14 years with gradual onset of malaise and pain at the sites of multiple bone lesions. The symptoms from the bone lesions were sometimes sequential in onset and often relapsing. The radiological findings were typical of osteomyelitis. Radioisotope bone scans identified some clinically silent lesions. Bone biopsies were performed in 20 patients and the changes of osteomyelitis were seen in 17; microbiological culture was positive in only one.

Seven patients had polyarthritis, two had palmoplantar pustulosis and one had psoriasis. Some symptomatic relief was obtained with anti-inflammatory agents and, to a less extent, with antibiotics. No patient had primary immunodeficiency. The mean duration of symptoms from the bone lesions was two years (1 to 4). When arthritis was present the joint symptoms lasted considerably longer (mean 7 years; range 4 to 10). The long-term prognosis was generally good. There was no evidence of altered bone growth or abnormal joint development. One patient developed a progressive kyphosis requiring fusion, but no other surgical intervention was necessary.

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Chronic multifocal osteomyelitis is a rare condition of unknown aetiology. The clinical presentation is of the gradual onset of malaise, with local pain and tenderness at the sites of infection. The bone lesions may occur sequentially and are located predominantly in the metaphyses of long bones, but may involve the medial end of the clavicle, a vertebral body or the sacroiliac joint. The condition was first described by Giedion et al (1972) and since then at least 47 cases have been reported

under a number of headings, most of them as isolated case presentations (Gustavson and Wilbrand 1974; Willert and Enderle 1977; Probst, Björkstén and Gustavson 1978; Girardet et al 1979; Björkstén and Boquist 1980; Blockley 1983; Meller et al 1984; Murray and Kehl 1984; Gamble and Rinsky 1986; Wiener, Newbold and Merten 1986). None of these reports included comprehensive clinical, histopathological, microbiological and immunological investigations.

The bone lesions are frequently relapsing and may be symmetrical but these features are not essential to the diagnosis. Associations have been reported with palmoplantar pustulosis (Björkstén et al 1978; Bergdahl et al 1979; Benhamou, Chamot and Kahn 1988) and with arthritis (Giedion et al 1972; Probst et al 1978; Benhamou et al 1988). Condensing osteitis of the clavicle presents with many similar features (Brower, Sweet and Keats 1974; Appell et al 1983; Mollan, Craig and Biggart 1984; Jones et al 1990) as does sternocostoclavicular hyperostosis, which is also associated with palmoplantar pustulosis and arthritis (Köhler et al 1975; Sonozaki et al 1981; Chigira et al 1986).

We report 22 patients with multifocal osteomyelitis all of whom underwent rigorous investigation and were followed for long periods.

PATIENTS AND METHODS

Between 1975 and 1989 we diagnosed and treated 22 patients with multifocal osteomyelitis at the Royal Children's Hospital in Melbourne (Table I). The diagnosis was based on the presence of multiple bone lesions typical of osteomyelitis and on the clinical picture of insidious onset of malaise and local pain of relapsing nature and prolonged duration, associated with arthritis or palmoplantar pustulosis. No significant past medical or family history was identified. The mean follow-up was 74.8 months (18 to 168).

The response to antibiotics and non-steroidal anti-inflammatory agents was assessed from the speed with which symptoms settled after starting treatment: good, within one week; moderate, within one month; slight, within two months; and none, no discernible effect within three months. The patients were treated with the same combination of intravenous and oral flucloxacillin, chloramphenicol and cephalosporins.

Radiography. Plain radiographs were taken of all symptomatic bones and joints and radioisotope bone scans

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Table I. Clinical details of 22 patients with chronic multifocal osteomyelitis

Case	Sex	Age at onset of symptoms (yr)	Age at last follow-up (yr)	Presenting symptoms	Delay in diagnosis after onset of symptoms (wk)	Time between onset of symptoms in different lesions (wk)	Overall duration of symptoms (yr)			NSAID* response	Present symptoms	Arthritis	Skin rash
							Bone	Joints					
1	M	14.4	18.2	Pallor, tiredness, wrist and ankle pain	36	Simultaneous	1.5	3.8	3		Mild arthritis	Yes	No
2	F	8.8	13.8	Intermittent joint pain	26	Sequential (100)	1.6	5	2		Mild arthritis	Yes	No
3	F	4.8	8.6	Pain and limp	26	Simultaneous	0.9		1		None	No	No
4	M	12.3	19.1	Back pain, gradual onset	156	Simultaneous	2.5	6.7	2		Slt joint pain	Yes	Psoriasis
5	F	10.6	16.1	Malaise, ankle pain	50	Sequential (36)	2.8		0		None	No	No
6	M	13.9	22.6	Pain over clavicles, gradual onset	8	Sequential (4)	3.2		1		None	No	No
7	F	7.8	12.6	Malaise, lethargy, low back pain	24	Simultaneous	1.9		2		None	No	No
8	F	7.6	13.6	Limp, pain and clavicular swelling	1	Simultaneous	1.1		2		None	No	No
9	F	7.3	16.1	Limp, back pain and malaise	5	Simultaneous	2.1		1		None	No	No
10	M	14.9	16.7	Ankle pain, gradual onset	2	Simultaneous	1.5		0		None	No	Plantar pustulosis
11	M	10.2	16.3	Malaise, lethargy, back and knee pain	6	Sequential (18)	2		0		None	No	No
12	M	10.4	15.1	Limp and leg pain	2	Sequential (6)	1.4		0		None	No	No
13	F	4.1	14.6	Leg pain and limp, malaise, lethargy and arthritis	4	Sequential (98)	3.5	10.5	2		Limp, arthralgia	Yes	No
14	F	9.8	16.7	Pain and clavicular swelling, arthritis developing 12 months later	3	Simultaneous	1.1	5.2	2		None	Yes	No
15	M	11.8	21.9	Malaise and arthritis, clavicular pain developing 6 months later	74	Sequential (12)	1.8	4.8	3		None	Yes	No
16	F	6.8	23.6	Lethargy and malaise, pain and knee swelling	6	Sequential (80)	4.1		2		None	No	No
17	F	11.1	27.6	Arthritis and knee and clavicular pain, gradual onset	36	Sequential (35)	3.4	10.1	2		None	Yes	No
18	F	9.6	22.9	Back pain, gradual onset	12	Simultaneous	2.1		2		None	No	Palmar pustulosis
19	F	8.1	19.6	Malaise, ankle and wrist pain	3	Sequential (6)	1.1		1		None	No	No
20	F	11.1	15.3	Ankle and elbow pain, gradual onset, back pain 3 months later	3	Simultaneous	3.2		0		None	No	No
21	F	11.2	14.5	Leg pain and limp, gradual onset	6	Sequential (4)	0.9		0		None	No	No
22	M	13.4	19.2	Painful limp, knee swelling	10	Simultaneous	0.9		2		None	No	No

* NSAID response, non-steroidal anti-inflammatory drug response; 0 = none, 1 = slight, 2 = moderate, 3 = good

† sacroiliac

were done in all cases. If clinically silent lesions were identified on the bone scan further radiographs were taken. Repeat radiography was performed at review. If new symptoms developed repeat bone scans were performed.

Laboratory and immunological investigation. The haemoglobin, ESR, and total and differential WBCs were measured. In patients with arthritis, rheumatoid factor, antinuclear factor and HLA-B27 status were also evaluated.

Immunological assessment was performed on a single peripheral blood sample as described previously (Hosking, Fitzgerald and Shelton 1977; Hosking and Robertson 1981). IgG, IgA, and IgM concentrations were measured by nephelometry and expressed as IU/ml and as age-related centiles against normal values (Shelton et al 1974). IgE concentrations were measured by radioimmunoassay. Mononuclear leucocytes were separated from heparinised blood on Ficoll-hypaque density gradients and cultured in tissue-culture medium and in autologous serum or fetal calf serum in the presence of three different concentrations of purified phytohaemagglutinin (PHA), pokeweed mitogen (PWM) or concanavalin A (con A) (Hosking and Balloch 1983). They were also cultured using pooled irradiated allogeneic stimulator cells in a mixed lymphocyte reaction. Lymphocyte phenotypes were determined for five patients using OKT3, OKT4 and OKT8 antibodies (Ortho Diagnostics, Systems Inc, New Jersey) and fluorescein microscopy or fluorescein-activated flow cytometry. Polymorphonuclear leucocytes (PML) were separated by dextran sedimentation. Metabolic activation of PML in response to stimulation by heat-killed Cowan strain *Staphylococcus aureus* or *Candida albicans* was assessed by ^{125}I incorporation into a neutrophil iodination microassay (Robertson et al 1981). Phagocytosis by PML was measured by yeast particle ingestion and neutrophil chemotaxis by using a Boyden chamber technique. Serum protein electrophoresis was also performed.

Histopathology and microbiology. Bone biopsies were done, at various stages of the disease, in 20 patients and were cultured immediately. Specimens were fixed in 10% buffered formalin, decalcified and processed in the usual way. The sections were stained with haematoxylin and eosin, periodic acid-Schiff, Gram's stain and the Ziehl-Nielsen stain for *Mycobacterium tuberculosis*. Microbiological cultures of the bone biopsies and blood and urine were performed specifically to identify fungi and aerobic and anaerobic bacteria.

RESULTS

Clinical features. The clinical presentation varied but was usually suggestive of chronic osteomyelitis, with insidious onset of constitutional symptoms and pain localised to the site of the bone lesions (Table I). These were often associated with swelling and local erythema. In ten

patients the symptoms were initially localised to one site, and developed at other sites 4 to 100 weeks later. Their mean duration was $2.0 \text{ years} \pm 0.9$ (0.9 to 4.1), often with a relapsing pattern. Symptoms at a particular lesion never disappeared completely between relapses, but two patients had periods of 20 and 18 weeks completely free from symptoms before developing a lesion at a new site.

An association with arthritis was found in seven patients. In one the arthritis preceded the onset of symptoms from the osteomyelitis, but in the remainder it developed at the same time or after the bone symptoms. None of these patients has developed radiological evidence of arthritis and the symptoms have been restricted to mild or moderate pain in the elbows, wrists, knees and ankles. Response to anti-inflammatory medication was good. None of the patients with arthritis had palmoplantar pustulosis but one had psoriasis of the scalp. The mean duration of joint symptoms was $5.9 \text{ years} \pm 2.7$ (3.5 to 10.5) and the mean duration of the symptoms of osteomyelitis in these patients was $2.2 \text{ years} \pm 0.9$ (1.1 to 3.5 years). The mean duration of symptoms from the bone lesions in the whole group was $2.0 \text{ years} \pm 0.9$ (0.9 to 4.1). Of the three patients with involvement of the sacroiliac joint only one had generalised arthritis.

At review only four patients (cases 1, 2, 4 and 13) still complained of symptoms; all had mild joint discomfort particularly after exercise. No patient complained of pain at the sites of bone lesions but some residual swelling of the bone was common, particularly of the clavicle and distal tibia. There was no clinical or radiological evidence of abnormality of bone growth or epiphyseal arrest. One patient developed a progressive kyphotic deformity at the D5 level and required surgical fusion.

Radiography. The distribution of the bone lesions is shown in Table II. Radiographs of the metaphyseal lesions were typical of osteomyelitis with metaphyseal lucency with or without sclerosis, sometimes extending into the epiphysis (Fig. 1). The epiphyseal lesions gradually filled in and disappeared while the epiphysis continued to grow normally. There were no cases of premature growth arrest. The metaphyseal lesions elongated as the physis grew away from the lesion sometimes leaving only a small area of sclerosis adjacent to the plate (Fig. 2). The pattern of healing was not uniform and a number of lesions healed with residual sclerosis and expansion (Fig. 3). The clavicle, if involved, was always affected at its medial end and had both lucent and sclerotic areas often with some associated periosteal reaction (Fig. 4). Vertebral lesions caused collapse of the body and vertebra plana (Fig. 5). One patient with vertebral involvement developed a progressive kyphosis which required fusion. In the three with involvement of the sacroiliac joint the radiological features were of unilateral periarticular sclerosis, predominantly in the ilium (Fig. 6).

Radioisotope bone scans showed increased uptake in all cases. Nine lesions in eight patients were asympto-

Fig. 1a

Fig. 1b

Anteroposterior (a) and lateral (b) radiographs of the knee of a six-year-old girl with a radiolucent lesion with sclerotic margins in the proximal metaphysis of the tibia. It extends into the epiphysis.

Fig. 1c

Fig. 1d

Anteroposterior (c) and lateral (d) radiographs of the same knee ten years later. A healed metaphyseal lesion is present with residual sclerosis and slight bone expansion. The epiphysis is normal and the growth plate has closed. No evidence of abnormal bone growth was found.

Figure 2a – Lateral radiograph of the ankle of a ten-year-old girl showing a lucent metaphyseal lesion with a fine sclerotic margin. Figure 2b – The same ankle two years later. The epiphysis has grown normally, away from the lesion. There are lines of growth arrest around the healed lesion, which had been asymptomatic for 12 months.

Fig. 2a

Fig. 2b

Fig. 3a

Fig. 3b

Figure 3a – Lateral radiograph of the ankle of a ten-year-old girl showing a lucent metaphyseal lesion anteriorly. Figure 3b – The same ankle two years later. The lesion has increased in size and become sclerotic. There is extension into the epiphysis but epiphyseal growth is normal. There was some bone expansion on clinical examination but no tenderness. The lesion had been asymptomatic for six months.

Fig. 4

The left clavicle of a 15-year-old boy, showing sclerotic expansion of the medial end and some periosteal reaction.

Fig. 5

Lateral radiograph of the thoracic spine of a nine-year-old girl with vertebra plana deformity of the fifth thoracic vertebra (arrow).

Fig. 6

Radiograph of the pelvis of a 13-year-old girl. The sacroiliac joint is wide and there is periarticular sclerosis.

matic at the time of bone scan and detection of silent lesions in this way may hasten the diagnosis. In one case, no abnormality was evident on the initial plain radiographs and the diagnosis was made only after bone scintigraphy; subsequent plain radiographs showed pathological changes.

Laboratory and immunological investigation. The ESR was elevated in most patients and the total and differential WBCs were normal (Table III). No patient had a

Table II. Radiological features of 22 patients with chronic multifocal osteomyelitis

Case	Interval from onset of symptoms (wk)	Site of bone lesions	Radiological	
			Features	Outcome
1	36	Bilateral radii	Metaphyseal lucency	Normal
2	20	D8 to 10, multiple ribs, proximal tibia (L)*, sacrum	Metaphyseal lucency and surrounding sclerosis, vertebra plana	Vertebral wedging and kyphosis
3	21	Sacrum*, patella (R), distal femur (L)	Sacral sclerosis, lucent lesion in the proximal pole of the patella	Lesion healed with sclerosis
4	156	Distal tibia (L)*, D11, SI† joint (R)	Metaphyseal lucency and surrounding sclerosis	Lesion healed with sclerosis
5	50	Distal tibia (L), clavicle (L)	Expanded lytic lesion in clavicle (medial), metaphyseal lucency	Healed lesions, clavicular expansion
6	8	Clavicle (L), fibula (L)*, metatarsal (L)*	Expanded lytic lesions in clavicles (medial) with periosteal reaction	Clavicular expansion
7	24	Sacrum, pubic ramus (L), tibia (L)*	Metaphyseal lucency with surrounding sclerosis, sclerosis sacrum	Normal
8	1	Clavicle (L), SI joint*, C7, greater trochanter (R)	Lytic lesions in clavicle (medial) and greater trochanter	Mild clavicular expansion
9	5	D11-12, acetabulum (L)	Vertebral collapse, pelvic sclerosis	Pelvic sclerosis, mild vertebral body wedging
10	2	Metatarsal (R)*, distal fibula and proximal tibia (L)	Periosteal reaction	Normal
11	6	Distal tibia (L), D5, D8, D9	Metaphyseal lucency, vertebral collapse	Lesion healed with sclerosis, vertebral wedging
12	2	Bilateral tibiae (distal)	Metaphyseal lucency with surrounding sclerosis	Healed with some sclerosis
13	4	Distal fibula (L), calcaneum, metatarsal	Lucent lesions	Normal
14	3	Clavicle (L), sternum*	Ill-defined expanded lucent lesion in clavicle (medial), metaphyseal lucency	Mild clavicular expansion
15	74	Bilateral clavicles	Lytic lesion in clavicle (medial) with periosteal reaction	Lesion healed, mild expansion of bone
16	6	Proximal tibia (L), SI joint (R)	Metaphyseal lucency, sclerotic lesion around SI joint	Normal
17	12	Proximal tibia (L), clavicle (R)	Metaphyseal lucency, expanded lytic lesion in clavicle (medial)	Normal
18	12	Multiple thoracic and lumbar vertebral bodies	Vertebral collapse	Progressive kyphosis requiring surgical correction
19	3	Distal tibia, distal radius	Metaphyseal lucency	Normal
20	3	Distal tibia (L), distal humerus (R), SI joint (R)*	Metaphyseal lucency with surrounding sclerosis	Lesions healed with sclerosis
21	4	Proximal and distal tibia (R)	Metaphyseal lucency with surrounding sclerosis	Lesions healed with sclerosis
22	10	Proximal femur (R) and tibia (R)	Metaphyseal lucency with surrounding sclerosis	Lesions healed with sclerosis

* initially asymptomatic

† sacroiliac

deficiency of any immunoglobulin isotype. Three had IgM concentrations above the 95th centile for their age; four had IgA and one had IgG concentrations above this range. The IgE concentrations were all within the normal range.

There were no significant abnormalities of the responses of separated mononuclear cells in culture to the mitogens PHA, PWM or con A, or to pooled allogeneic cells. One patient had a deficient mononuclear cell response to all three mitogens but normal responses to allogeneic cells. All responses, however, were normal

on subsequent testing. Polymorphonuclear leucocyte iodination assays with *Staphylococcus aureus* and *Candida albicans* did not reveal any abnormalities of oxidative metabolism of phagocytic cells. Neutrophil chemotaxis was marginally low in one patient on initial testing but was normal subsequently. The median chemotaxis result, expressed as a percentage of normal control neutrophils, was 108. Polymorphonuclear leucocyte phagocytosis was normal (median 3.1 yeast particles/cell).

No patient was lymphopenic at the time of testing; the median lymphocyte count was 2465/ μ l (2010 to 3168).

Table III. Laboratory and immunological findings

Case	Interval from onset of symptoms (wk)	ESR (mm/hr)	ASOT*	White cell count	Immunoglobulins† (IU/ml)
1	36	130	120	10300	IgA (343), IgG (398)
2	36	55	30	5400	IgA (303), IgM (237)
3	28	66	15	4300	Normal‡
4	156	32		7900	
5	50	39	240	9300	IgM (184)
6	26		60	8500	IgA (201)
7	16	42	30	9000	Normal
8	4	44	<15	6600	Normal
9	5	53	<15	5200	Normal
10	4	91	40	5800	
11	6	88	260	10000	
12	2	6		4700	IgM (168)
13	17	34	120	7000	IgA (177)
14	20	26	60	5200	Normal
15	74	80		7800	
16	6	73	30	7300	Normal
17	12	29		8700	Normal
18	12	53	30	5600	Normal
19	12	14		6400	Normal
20	12	19	40	3800	
21	10	44	30	4500	
22	10	20	40	7200	

* antistreptolysin O titre

† the 95th centiles were 190 for IgA, 167 for IgM and 230 for IgG for children over 9 years of age. The 95th centile for IgA for ages 4 to 6 years was 155 IU/ml

‡ within 5th to 95th centile range

No patient was neutropenic. In the five patients in whom lymphocyte phenotyping had been performed, the absolute numbers (and ranges) of CD3, CD4 and CD8 positive cells respectively were 1722/ μ l (369 to 2194), 798/ μ l (335 to 1354) and 743/ μ l (34 to 861). The median CD4 to CD8 ratio was 1.4. Serum protein electrophoresis showed no significant changes. None of the nine patients tested were HLA-B27 positive nor did they have a positive antinuclear or rheumatoid factor.

Histopathology. In 17 of the 20 cases biopsied, histopathological examination showed changes suggestive or diagnostic of osteomyelitis (Table IV). In three the bone was normal, or showed only mild non-specific changes, including focal fibrosis, woven bone, or periosteal new bone formation. Inflammatory infiltration was not seen. In the four cases suggestive of osteomyelitis there were small foci of fibrosis associated with moderate numbers of plasma cells. Although consistent with osteomyelitis such changes are not infrequently seen adjacent to non-

infective lesions, such as osteoid osteoma. In all four cases, synovium biopsied at the same time showed synovitis. In one this was initially suppurative, but chronic villous synovitis was present on rebiopsy two years later. In the other two chronic villous synovitis was seen. In the biopsies considered to be diagnostic of osteomyelitis there was extensive fibrosis with intense focal infiltration by plasma cells, often with variable numbers of lymphocytes and histiocytes. In addition, necrotic bone, granulomas and suppurative or marked PML infiltration in various combinations were seen in many cases. The granulomas were often tuberculoid, particularly around dead bone. Caseation and acid-fast bacilli were not seen.

Microbiology. Microbiological investigation produced only one positive culture from a bone biopsy with moderate growth of *Staphylococcus aureus* (Table IV). The remaining bone cultures and all the blood and urine cultures for bacteria, fungi and mycobacteria were

negative. The single patient with a positive culture was similar, in other respects, to the rest of the group with gradual onset of symptoms and multifocal lesions.

The response to antibiotics in this patient was moderate and her symptoms settled completely ten months after their onset and have not recurred. In one case repeated flare-ups of symptoms from a proximal tibial lesion appeared to respond to the administration of flucloxacillin. In the remainder the response to antibiotics was slight or none.

DISCUSSION

The term chronic multifocal osteomyelitis seems most appropriate to describe this heterogeneous group of signs and symptoms for which no cause is known. The lesions can be symmetrical and relapsing but these features are not essential to the diagnosis. The condition has also

been described as recurrent but this was not true of this series of patients. It is slightly more common in girls than boys as in chronic unifocal osteomyelitis (Cole 1991), but in contrast to acute osteomyelitis, which most commonly affects boys. We did not find the marked female preponderance described by other authors (Pelkonen et al 1988).

A spectrum of presenting features is possible, ranging from bone lesions alone or combined with arthritis, palmoplantar pustulosis or psoriasis. It seems unlikely that the varying combinations represent a single clinical entity with a common aetiology. The skin lesions do appear to follow the same relapsing course shown by the bone lesions but the significance of the association with palmoplantar pustulosis is unclear. The arthritis seen in this condition is not entirely typical of juvenile rheumatoid arthritis; morning stiffness is not a feature and there is no radiological evidence of joint abnormality

Table IV. Histological and microbiological findings of bone biopsies

Case	Interval from onset of symptoms (wk)	Histology*						Microbiology†			Antibiotic response‡
		A	B	C1	C2	C3	C4	Bone	Blood	Urine	
1	38			*				0	0	0	0
2	20			*	*		*	0	0	0	0
3	28	*						0	0	0	1
4	156			not done				not done	0	0	0
5	54		*					0	0	0	1
6	12			*	*	*	*	0	0	0	1
7	56	*						0	0	0	0
8	5			*	*	*	*	0	0	0	0
9	9		*					0	0	0	0
10	11			*		*	*	0	0	0	1
11	3			not done				not done	0	0	2
12	56			*			*	0	0	0	1
13	7		*					0	0	0	0
14	3			*	*	*	*	0	0	0	0
15	74			*	*	*	*	0	0	0	0
16	44		*					0	0	0	0
17	20	*						0	0	0	0
18	16						*	0	0	0	0
19	12			*		*	*	0	0	0	0
20	12					*	*	0	0	0	1
21	4			*	*		*	2 (<i>S. aureus</i>)	0	0	1
22	12				*	*	*	0	0	0	1

* A = Bone normal or changes minimal. B = Suggestive of osteomyelitis; fibrosis with mild to moderate round cell infiltration. C = Diagnostic of osteomyelitis. C1 = Numerous neutrophils. C2 = Granulomas. C3 = Necrotic bone. C4 = Fibrosis with intense round cell infiltration.

† 0 = No growth, 1 = Slight, 2 = Moderate, and 3 = Heavy growth.

‡ 0 = none, 1 = slight, 2 = moderate, and 3 = good.

either at presentation or at long-term follow-up. Nor are there any serological changes to suggest an autoimmune process.

We investigated 15 patients rigorously for evidence of immunodeficiency but did not find a primary abnormality. Six had some elevation of immunoglobulin levels consistent with an inflammatory response. Björkstén et al (1978) did not find any immunological abnormality in four patients.

Although the radiological and histological appearances were invariably typical of osteomyelitis, microbiological investigation produced a positive culture in only one case. This patient presented with a typical picture of two distinct bone lesions and *Staphylococcus aureus* was cultured from bone biopsy.

At the other end of the spectrum one patient presented with arthritis and only developed symptoms from bone lesions six months later. With such a diversity of presentation it is not surprising that delays in diagnosis still occur and we outline below guidelines for the diagnosis, treatment and prognosis of the disorder.

Diagnosis. The presentation is invariably gradual; local pain, tenderness, swelling and erythema often accompany the bone lesions but may be absent if the spine or pelvis is involved. Plain radiographs usually reveal features suggestive of osteomyelitis but these may be difficult to detect in the spine or pelvis. The diagnosis of multifocal osteomyelitis can be made only when more than one lesion has occurred and the sequential nature of some lesions can produce a delay in diagnosis. Radioisotope bone scans assist in establishing the diagnosis and in identifying lesions that are initially clinically silent. The diagnosis should be suspected, even if only one bone lesion is present, in the presence of palmoplantar pustulosis, psoriasis or arthritis. Morning stiffness is not a typical feature and the joint pains are often worse at night or after exertion. Histological examination of biopsy tissue is important to exclude other diagnoses, such as tumours or histiocytosis. Although the histology in most cases was typical of osteomyelitis a positive culture was obtained from only one bone biopsy. Failure to identify an organism is not uncommon in cases of chronic osteomyelitis (Cole 1991). Two other cases with positive cultures have been reported. In one *Propionibacterium* (Le Goff et al 1985) and in the other *Mycobacterium* (Hummell et al 1987) were identified; these findings emphasise the importance of obtaining a biopsy to exclude an identifiable and treatable infection. It may be appropriate also to look for the presence of atypical mycobacteria and to determine HIV antibody status in some patients. Chronic multifocal osteomyelitis predominantly affects children, whereas sternocostoclavicular hyperostosis, which has many similarities, affects an older age group and may represent the adult form of the disorder.

Treatment. The basis of treatment is expectant. Non-steroidal anti-inflammatory agents may provide some

symptomatic relief, particularly for patients with joint involvement and painful bone symptoms. Antibiotics can also be beneficial but their effect is less predictable. A therapeutic trial may be of value; if symptoms persist unchanged after two weeks of treatment then relief is unlikely with further therapy. We have not used steroids as some authors have suggested (Björkstén et al 1978). Surgical removal of both clavicles has been performed for the treatment of pain in sternocostoclavicular hyperostosis, but the hyperostosis recurred in several of these patients (Sonozaki et al 1981; Abe et al 1984). In chronic multifocal osteomyelitis surgical treatment is rarely necessary.

Prognosis. The symptoms from the bone lesions are often prolonged and relapsing, lasting up to five years. If they settle completely for three months or more, they are unlikely to recur. New lesions, however, can develop up to two years after the onset of symptoms. The prognosis is generally good with residual bone swelling being the commonest sequel, but progressive kyphosis and premature epiphyseal growth arrest are possible (Pelkonen et al 1988). Angular deformities of long bones have also been described but these result from sclerosing lesions of the diaphysis and not from the metaphyseal lesions typical of this condition (Blockey 1983). Joint symptoms tend to be more prolonged and may be present for ten or more years. The arthritis is not associated with clinical or radiological evidence of joint destruction and once the joint symptoms have settled function is normal.

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