Bone and joint tuberculosis: a continuing problem

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Although tuberculous disease of bones and joints is becoming uncommon, it still occurs and may cause devastating sequelae. It is frequently not diagnosed prior to the onset of permanent damage to the joints or spine; the most important reason for this delay may be the fact that it is not considered in the differential diagnosis of monoarthritis or back pain. Most persons with the disease have other evidence of tuberculosis. Not infrequently an aggressive approach (including synovial biopsy or surgical exploration of the back) is needed to confirm the diagnosis when there are no other clues.

Bien que la tuberculose des os et des articulations devienne rare, elle se voit encore et peut laisser des séquelles dévastatrices. Souvent elle n'est pas diagnostiquée avant que ne se soient installés des dommages permanents aux os ou à la colonne vertébrale; la plus importante raison de ce retard peut être le fait que la tuberculose n'est pas prise en considération dans le diagnostic différentiel de la monoarthrite ou du mal de dos. La plupart des personnes souffrant de cette maladie présentent d'autres signes de tuberculose. Il n'est pas rare qu'une démarche agressive (comprenant une biopsie synoviale ou une exploration chirurgicale du dos) soit nécessaire pour confirmer le diagnostic en l'absence d'autres indices.

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Tuberculosis has been a scourge of mankind since earliest times. Archeologic evidence shows that deformity of joints and the spine due to this disease occurred in ancient Egypt.

In the past, tuberculous disease of bones and joints accounted for a very high proportion of admissions to facilities for the physically handicapped; this situation still prevails in areas of the world where tuberculosis is common. Fortunately in our society this disease is much less common than it was a century ago.

With this condition there have been two modes of infection: airborne and by ingestion. The latter was more common for the bovine tubercle bacillus, *Mycobacterium bovis,* which used to cause about 20% of all cases of bone and joint tuberculosis, particularly in children.[1] This source of infection has been almost entirely eradicated from our society. However, *M. tuberculosis,* the bacillus pathogenic for humans, continues to cause disease of bones and joints. We recently encountered several patients in whom the complications of this disease had devastating effects. It seemed that the main reason for these sequelae was a delay between the time symptoms first appeared and the time the diagnosis was made. This prompted us to review the subject of bone and joint tuberculosis to identify factors that might aid in the diagnosis of this condition before complications ensue.

Methods

Through the kindness of Statistics Canada and with the permission of the provincial directors of tuberculosis control, we obtained for review the notification records of all cases of active tuberculosis notified in Canada from 1970 through 1974. From these we identified 555 cases of bone and joint tuberculosis.

Included in the records were place of residence and of birth, year of arrival in Canada if foreign-born, ethnic origin (specifically, whether the individual was a registered Indian or Inuit) and site and type of disease. However, much of the information was insufficient for detailed analysis, and the period under consideration was too short to clearly show trends in the incidence of the disease.

To obtain a clearer picture of the disease, particularly the method of diagnosis, symptoms, exact site of disease, treatment and outcome, we reviewed all notifications of active tuberculosis in British Columbia from 1967 through 1976. Of the 100 cases of active bone and joint tuberculosis identified, 1 was excluded from the study because the causative agent was *M. xenopi*; records of the other 99 cases were studied thoroughly.

Results

Incidence

From 1970 through 1974 in Canada 21 483 active cases of tubercu-

Table I—Incidence (per 100 000 population) of various forms of tuberculosis, British Columbia, 1967 through 1976

Year	Form of tuberculosis: Bone and joint — No. of cases	Bone and joint — Incidence	Bone and joint — Log incidence	Pulmonary (adult-type) — No. of cases	Pulmonary (adult-type) — Incidence	Pulmonary (adult-type) — Log incidence
1967	13	0.60	−0.51	400	20.57	3.02
1968	12	0.59	−0.53	390	19.43	2.97
1969	10	0.48	−0.73	402	19.43	2.97
1970	13	0.60	−0.51	361	16.87	2.82
1971	9	0.41	−0.89	351	16.07	2.78
1972	13	0.58	−0.54	409	18.35	2.91
1973	7	0.30	−1.20	352	15.48	2.74
1974	11	0.47	−0.76	336	14.50	2.67
1975	8	0.33	−1.11	310	13.13	2.57
1976	3	0.12	−2.12	261	10.85	2.38
Total	99			3572		

losis were notified. The 555 cases of bone and joint tuberculosis, the fourth most common form of extrapulmonary tuberculosis, constituted 2.6% of the total. There were 1516 cases of genitourinary tuberculosis, 1083 cases of tuberculous lymphadenitis and 934 cases of tuberculous pleurisy.

The mean annual incidence of bone and joint tuberculosis in Canada during this period was 0.5 cases per 100 000 population. There was a steady downward trend in incidence during this period, as there was between 1967 and 1976 in British Columbia (Table I). This trend was not significantly different from that for adult-type pulmonary tuberculosis in British Columbia (Fig. 1).

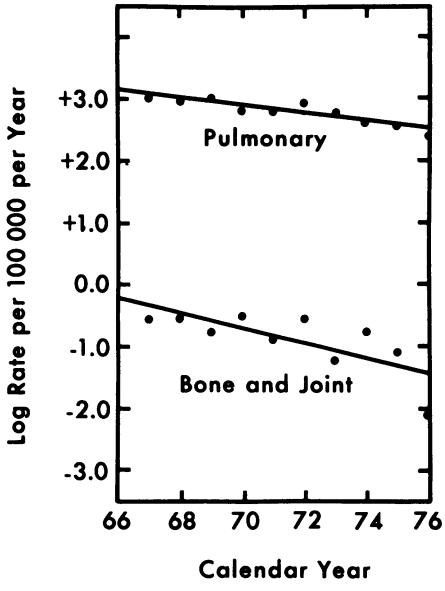

FIG. 1—Incidence of pulmonary and bone and joint tuberculosis, British Columbia, 1967 through 1976.

Further analysis of Canadian data

Most (457; 82.3%) of the cases of bone and joint tuberculosis in Canada were notified as instances of new active disease; the remainder (98; 17.7%) were reported as cases of reactivated disease. In contrast to most other forms of tuberculosis, disease of bones and joints was almost as common among females as among males in Canada: 256 of the 555 cases from 1970 to 1974 were in females and 299 in males. The mean age of the patients was 48 years (range less than 1 year to 92 years, with a symmetric distribution). The variation of incidence with age was striking (Table II).

Table II—Mean annual incidence (per 100 000 population) of bone and joint tuberculosis according to age and sex, Canada, 1970 through 1974

Age (yr)	Sex: Male	Sex: Female
0-14	0.14	0.12
15-24	0.18	0.20
25-34	0.25	0.43
35-44	0.63	0.43
45-54	1.00	0.75
55-64	1.30	1.02
65+	1.60	1.40

Table III shows that, whereas the incidence of bone and joint tuberculosis varied 15-fold (from 0.4 to 5.8 per 100 000) among various population groups in Canada, the proportion of cases of this disease among all forms of active tuberculosis varied less (1.8% to 3.6%). The higher incidence of bone and joint tuberculosis in certain groups reflected the higher incidence of all forms of tuberculosis in these people (particularly the Asian-born) rather than a racial predisposition to this form of disease. Indians and Inuit had the lowest proportion of bone and joint disease.

Further analysis of British Columbia data

In British Columbia, among the 99 cases of bone and joint tuberculosis the proportion notified as instances of reactivated disease (34.3%) was higher than that for all of Canada. In seven cases in which tuberculosis had not previously been diagnosed, apical scarring was noted on chest roentgenograms and recorded as evidence of "presumed pulmonary tuberculosis, inactive" or as a "fibrotic lesion". In only 38 cases was there no evidence of tuberculosis (previous or concurrent) at other sites (Table IV).

As Table V shows, the mean interval from the diagnosis of pulmonary tuberculosis to the diagnosis of bone and joint tuberculosis for cases in which this was known was

Table III—Rates of bone and joint tuberculosis in various groups, Canada, 1970 through 1974

Birthplace	Form of tuberculosis: All forms, no. of cases	Bone and joint: No. of cases	Bone and joint: % of total	Bone and joint: Mean annual incidence per 100 000 population
Canada				
Indians and Inuit	2 433	43	1.8	3.1
Others	14 233	368	2.6	0.4
Europe	2 996	80	2.7	0.6
Asia	1 334	48	3.6	5.8
Other	487	16	3.3	0.6
Total	21 483	555	2.6	0.5

17 years (range 1 to 42 years), the mean interval from the diagnosis of pleurisy to the diagnosis of bone and joint disease was 10 years (range 2 to 20 years) and the mean interval from the first diagnosis to the diagnosis of reactivation of bone and joint disease at the same site was 35 years (range 14 to 76 years).

Reactivation of bone and joint tuberculosis at the same site was most frequent in those with hip disease, who accounted for 7 of the 14 such cases of reactivation, and reactivation was very common at the hip, occurring in 7 of 16 cases of hip tuberculosis.

The site of bone and joint disease is shown in Table VI. Of the 99 cases 59 were of arthritis, 37 of spondylitis and 9 of osteomyelitis; in 6 cases there was disease at two sites. In tuberculous arthritis the larger joints of the legs were most frequently involved: there were 16 cases of tuberculosis of the hip and 12 of the knee, whereas the wrist was affected in 8 cases, the elbow in 7 and the shoulder in 5. Of the 37 persons with spondylitis 17 had disease in one disc space, 10 in two spaces, 5 in three spaces, 2 in four spaces and 1 in five spaces. Most persons (32) had disease in contiguous disc spaces, but a few (5) had disease in two areas of the spine separated by normal disc spaces. The second, third and fourth lumbar discs were the most commonly affected (in eight cases each). The pelvis was the most common site of osteomyelitis; there were four such cases.

The presenting symptoms and signs of bone and joint tuberculosis varied (Table VII). Persons with arthritis usually complained of pain (in 40 cases), which was often accompanied by swelling (in 27 cases) and a draining sinus (in 10 cases). Pain was also the most frequent presenting complaint of patients with spondylitis (it was the only complaint in 20), and was often associated with radiation along the distribution of a nerve root. Five individuals complained of weakness of the legs in association with pain at the time of presentation. A small group presented with other forms of tuberculosis (three with lymphadenitis and one with genitourinary disease) and were found to have involvement of bone and joints as well. In five of the nine women of child-bearing age who had spondylitis the first symptoms developed during pregnancy.

In 30 of the 99 cases there was a history of trauma to the affected area prior to the onset of symptoms, and seven individuals had been treated with intra-articular injections of corticosteroids prior to the diagnosis of tuberculosis.

Symptoms were present, on the average, for 16 months prior to diagnosis; there was little variation in this

Table IV—Activity of disease at time of notification of cases of bone and joint tuberculosis, British Columbia, 1967 through 1976

Status of disease	Form of tuberculosis; no. of cases of active disease					
	Bone and joint		Pulmonary as well		Other extrapulmonary as well	
New active		58		15		5
Reactivated from						
Pulmonary disease	10		1		1	
Pleurisy	10		5		0	
Disease at same site	10		2		0	
Adenitis	2		1		0	
Other bone and joint disease	2		0		0	
Subtotal		34		9		1
Apical pulmonary fibrosis*		7		0		0
Total		99		24		6

*Termed "presumed pulmonary tuberculosis, inactive" or "fibrotic lesion".

Table VI—Sites of tuberculous involvement of bones and joints in 99 cases,* British Columbia, 1967 through 1976

Site	No. of cases	Site	No. of cases†
Joint	59	Spine	37
Wrist	8	C4-5	1
Elbow	7	C5-6	3
Shoulder	5	C6-7	1
Costosternal	1	T5-6	1
Sternoclavicular	1	T6-7	2
Sacroiliac	4	T7-8	2
Hip	16	T8-9	4
Knee	12	T9-10	3
Ankle	2	T10-11	5
Foot	3	T11-12	4
Bone	9		
(osteomyelitis)		T12-L1	3
Finger	1	L1-2	6
Sternum	1	L2-3	8
Rib	1	L3-4	8
Pelvis	4	L4-5	5
Fibula	1	L5-S1	6
Calcaneus	1	Unknown	2

*In six cases there was tuberculous disease at two sites.
†The numbers in the left-hand column indicate the frequency of involvement of an individual site; the solitary number to the right is the total no. of cases.

Table V—Interval from previous diagnosis to current diagnosis in cases of bone and joint tuberculosis, British Columbia, 1967 through 1976

Previous diagnosis	Mean (yr)	Actual values (yr)									
Pulmonary disease											
Age at time of previous diagnosis	23.1	40	32	35	10	7	15	7	29	41	15
Age at time of current diagnosis	46.3	48	51	52	30	29	37	32	55	72	57
Interval	23.2	8	19	17	20	22	22	25	26	31	42
Pleurisy											
Age at time of previous diagnosis	30.3	66	48	47	33	19	29	21	14	17	9
Age at time of current diagnosis	52.4	68	53	58	52	39	59	51	47	50	47
Interval	22.1	2	5	11	19	20	30	30	33	33	38
Bone and joint disease at same site											
Age at time of previous diagnosis	12.8	15	28	11	17	13	22	2	6	5	9
Age at time of current diagnosis	54.6	34	51	37	56	54	64	46	56	63	85
Interval	41.8	19	23	26	39	41	42	44	50	58	76

Table VII—Presenting problems in the 99 cases of bone and joint tuberculosis

Problem	Type of tuberculous disease; no. of cases		
	Arthritis	Spondylitis	Osteomyelitis
Pain alone	11	20	2
Pain and swelling	17	3	2
Pain, swelling and draining sinus	10	1	0
Swelling only	3	0	2
Swelling and draining sinus	1	0	0
Draining sinus only	3	0	1
Pain and draining sinus	2	1	0
Pain and paralysis	0	5	0
None (disease diagnosed post mortem)	0	1	0
Tuberculous arthritis	—	5	0
Tuberculous lymphadenitis	2	1	0
Genitourinary tuberculosis	1	0	0
Unknown	9	0	2
Total	59	37	9

Table VIII—Duration of symptoms prior to diagnosis of bone and joint tuberculosis in the 99 cases

Duration (mo)	Type of tuberculous disease; no. of cases				
	Arthritis		Spondylitis		
	New active	Reactivated	New active	Reactivated	Osteomyelitis
0-6	7	1	5	6	3
7-12	10	5	8	4	4
13-18	1	0	0	0	1
19-24	6	2	0	2	0
25-36	2	2	1	1	0
37-72	0	0	1	1	0
73-84	0	0	1	0	0
Unknown	16	7	5	2	1
Total	42	17	21	16	9
Mean	14.4	18.2	18.9	15.8	8.6

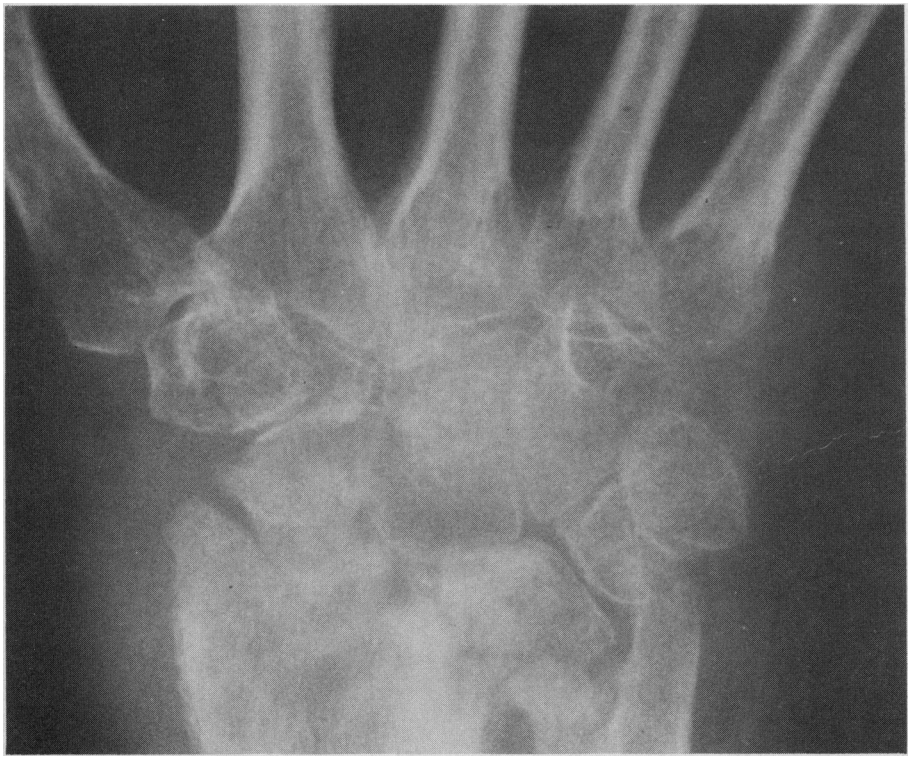

FIG. 2—Advanced tuberculosis of wrist, with destruction of joint and osteoporosis of surrounding bone.

period between the diagnostic groups (Table VIII).

M. tuberculosis was isolated from the skeletal lesions in 59 of the 99 cases. In 11 cases the diagnosis was made after the organism was discovered at another site. The diagnosis in 17 cases was made on the basis of histologic findings only, and in another 8 cases was made because of reactivation of previously diagnosed disease. In two cases characteristic changes in spine roentgenograms were accompanied by resolution of symptoms with chemotherapy. In the remaining two cases the records were insufficient for the means of diagnosis to be determined.

Skin tests with 5 tuberculin units of purified protein derivative of tuberculin were negative in 3 of 66 cases. Bacteriologic examination of material from the skeletal lesions in 65 of these cases failed to demonstrate *M. tuberculosis* in 6.

Roentgenograms of the affected area were available for review in 75 cases. The abnormalities in the 42 cases of tuberculous arthritis included destruction of periarticular bone (in 29 cases), narrowing of the joint space (in 23 cases) and osteoporosis (in 23 cases), as in Fig. 2. In the 31 cases of spondylitis, narrowing of the disc spaces (in 29 cases), vertebral destruction adjacent to the space (in 27 cases) and evidence of paravertebral abscess (in 8 cases) was noted, as in Figs. 3 and 4.

Myelograms done in six cases showed extradural defects due to abscess formation. At subsequent operation the abscesses were drained.

Chest roentgenograms made at the time of presentation were abnormal in 47 cases, showing changes consistent with pulmonary tuberculosis in 45 and pleural changes alone in 2.

Chemotherapy was used in 97 cases. In one other case the diagnosis was made only after death, and one patient refused treatment. Records were inadequate for assessment in nine cases. In the remaining 88 cases triple drug therapy was given initially for 2 months in 79; the daily dose of isoniazid was 300 mg. Therapy

was continued with two drugs (including isoniazid) for at least 18 months in 69 cases. It was terminated by death in two cases and by emigration in one.

Arthrodesis was performed in 15 of the 59 cases of tuberculous arthritis, and spinal fusion in 16 of the 37 cases of tuberculous spondylitis.

Eight of the persons with spondylitis suffered traumatic myelopathy, in five instances before the diagnosis was made. Four of the eight had paraparesis, three paraplegia and one quadriplegia. Six patients died — four of unrelated problems, one prior to diagnosis of tuberculosis and one after pleurectomy.

Case reports

The following case reports illustrate some of our observations.

Case 1

A 68-year-old Chinese woman was admitted to hospital with pleuritic chest pain. A chest roentgenogram showed a small right-sided pleural effusion, and a diagnosis of carcinoma of the lung was considered. The effusion spontaneously resolved and she was discharged a week after admission.

She was readmitted to hospital 11 days later with back pain and weight loss. A chest roentgenogram was normal but a roentgenogram of the spine revealed a destructive lesion at the 11th dorsal interspace, with surrounding soft tissue swelling. This was thought to represent carcinomatous metastases. A month later, when signs of myelopathy developed, needle aspiration of the lesion yielded pus that was positive on smear and culture for *M. tuberculosis*. Therapy with streptomycin, isoniazid and ethambutol in standard dosage was begun immediately. After spinal fusion 4 months later, the myelopathy gradually resolved, and chemotherapy was completed after 2 years.

Comment: The failure to consider tuberculosis as the cause of the pleural effusion and spondylitis with paravertebral abscess in this elderly Asian woman permitted traumatic myelopathy to develop.

Case 2

A 41-year-old Caucasian woman presented to her doctor with complaints of pain and stiffness of the right shoulder of 1 year's duration. Although a roentgenogram of the joint revealed narrowing of the joint space with some destruction of both humerus and scapula, she was treated with an intra-articular injection of cortisone. When she returned 2

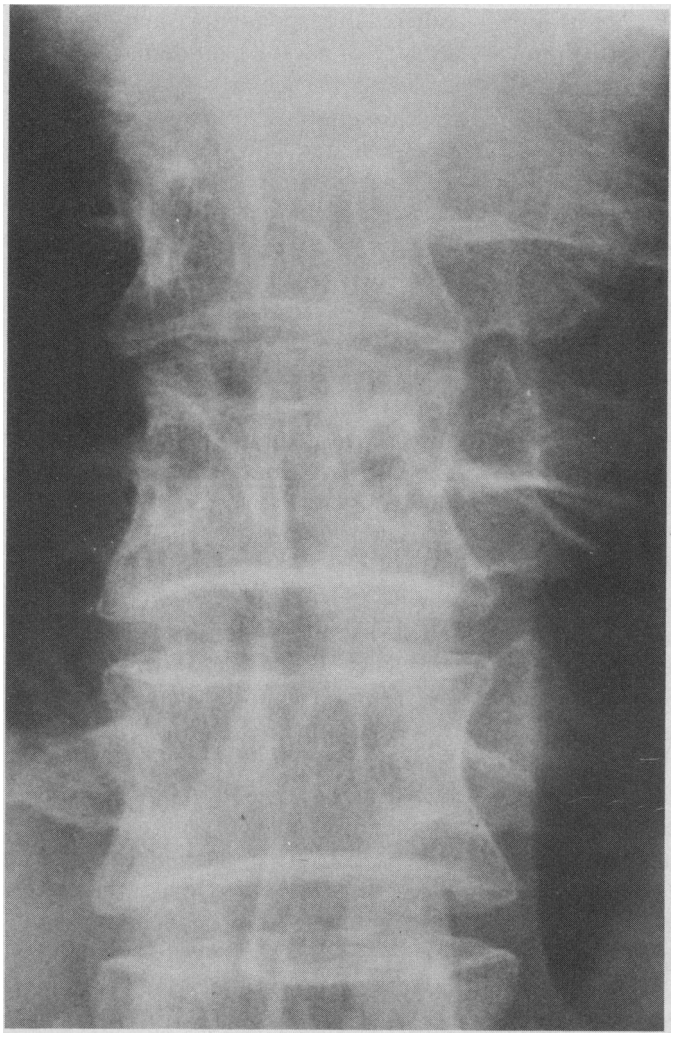

FIG. 3—Disc space narrowing at ninth dorsal interspace due to tuberculous spondylitis.

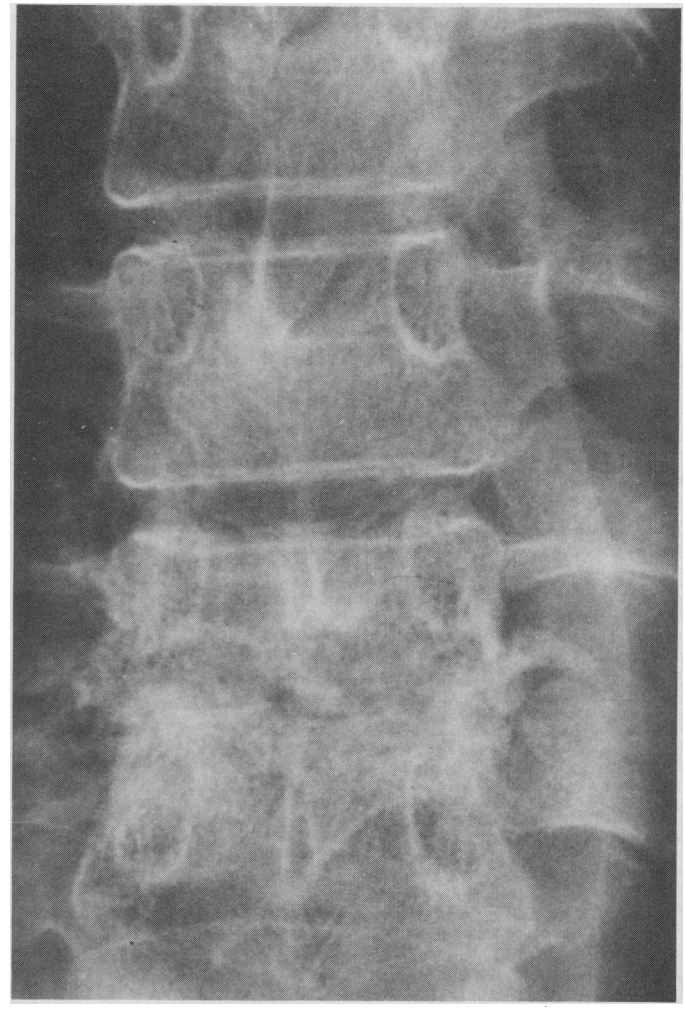

FIG. 4—Extensive destruction of first lumbar interspace and adjacent bone due to tuberculous spondylitis, and paravertebral abscess.

weeks later with swelling and redness around the joint she was referred to an orthopedist. The possibility of an infection causing this lesion was raised, and aspiration of the joint was performed. The smear was negative for acid-fast bacilli and a culture was not done. However, when she returned 2 weeks later with a draining sinus, cultures of the drainage were done; when the culture results were reported 8 weeks later treatment was begun with streptomycin, 1 g/d, isoniazid, 100 mg three times a day and para-aminosalicylic acid, 4 g three times a day. This treatment was continued for 2 years, but function of the joint was severely impaired.

Comment: Monoarthritis, particularly with evidence of periarticular destruction, must raise the possibility of an infectious cause. Urgent investigation, including synovial biopsy if necessary, is needed to prevent further destruction. The use of intra-articular injection of corticosteroids prior to diagnosis is to be deplored.

Discussion

The incidence of bone and joint tuberculosis is low and is declining. Accompanying this decline is a decrease in awareness of tuberculosis as a diagnostic possibility.[2,3] The recent trend away from specialized institutions for tuberculosis treatment (and consequent decline in reliability of statistical reporting) makes a review of the subject appropriate now.

In Canada bone and joint tuberculosis accounts for less than 3% of all cases of active tuberculosis, a higher proportion than has been reported in some areas.[4,5] This may reflect more complete notification of cases in our country.

Tuberculosis of bones and joints, as with most forms of tuberculosis, affects predominantly the elderly. Hald[6] in Norway has demonstrated that this is a recent development, related to the fact that the decline in tuberculosis morbidity has been most striking in young people. Tuberculosis of bones and joints seems to affect both sexes equally,[3] in contrast to pulmonary tuberculosis, which largely affects males. There is a marked variation in incidence of bone and joint tuberculosis among various ethnic groups in Canada, as has also been noted in Britain[7] and the United States.[5] However, this variation is mainly due to differences in total incidence of tuberculosis in these groups rather than a demonstrable predisposition of certain groups for this form of the disease.

The proportion of cases of bone and joint tuberculosis in our series that resulted from reactivation of previous disease was high, particularly for hip disease. This indicates a need for additional attention in the follow-up of such cases to ensure that the disease is arrested by treatment and that its recurrence is recognized early.

Our study underscores our initial impression of the contribution of the delay in diagnosis to the harmful sequelae of the disease. The strong association of spinal cord injury with tuberculous spondylitis, and the frequency of severe joint damage are of concern, particularly since this disease, in contrast to many of the bone diseases frequently encountered, is completely curable.

What is the cause of this delay in diagnosis? We have shown that roughly two thirds of patients with bone and joint tuberculosis have other evidence of tuberculosis, and nearly one half have chest roentgenograms with changes suggestive of the disease. In addition, the interval from the onset of symptoms to the time of diagnosis does not differ between cases of new active and reactivated disease. Walker[3] has observed that the delay is frequently avoidable, and Hunt[2] has suggested that the declining incidence of bone and joint tuberculosis is one of the causes for the delay in diagnosis. It is possible that, in spite of clues to the diagnosis, tuberculosis is often not considered in the differential diagnosis.

Tuberculous disease of the joints, as with other infectious arthritides, is characteristically a monoarthritis.[8] In contrast to the more common acute pyogenic infections, however, it may present with chronic joint pain and only minimal signs of inflammation; as such, it may be mis-

taken for other more common forms of inflammatory joint disease. The frequency in our series with which intra-articular injections of steroids had been given (7% of cases) is disturbing. Aspiration of joint fluid for direct examination of a smear and bacteriologic culture prior to the institution of palliative therapy is important. But even this is frequently insufficient to make the diagnosis and, in the presence of monoarthritis, synovial biopsy should be seriously considered to ensure that what is thought to be noninfectious inflammatory arthritis is not, indeed, chronic granulomatous infection. Certainly the diagnosis of tuberculous arthritis should be made before a draining sinus demands its consideration.

Tuberculous spondylitis must frequently be differentiated from other causes of disc disease. Early changes associated with this disease fail to identify the cause, and frequently the patients are thought to have degenerative disc disease. In these cases other evidence of tuberculosis should lead the practitioner to consider tuberculosis as the cause of the back symptoms. Certainly by the time there is evidence of bone destruction in the area adjacent to the disc space an infectious cause should be considered. However, tuberculous spondylitis cannot be differentiated from other infectious spondylitides solely on the basis of roentgenographic features; surgical exploration is necessary to obtain material for bacteriologic examination. Tuberculosis, nevertheless, remains one of the most frequent infectious causes of spondylitis.[9] The difference between tuberculosis, which is primarily a condition involving the disc space, and malignant disease, which involves the vertebrae, is usually readily apparent.

Conclusion

The information we have presented emphasizes the need for continued awareness of the possibility of tuberculosis as the cause of bone and joint disorders. Diligent search for other clues to the diagnosis, however minimal, is an important component of investigation of such cases. In the absence of these clues, early bacteriologic and histologic examinations in possible cases will do much to avoid the regrettable sequelae that are often seen.

We thank Statistics Canada for making available the notifications of active tuberculosis in Canada from 1970 through 1974; Dr. F.D. Mackenzie and staff, division of tuberculosis control, Ministry of Health, British Columbia, for making their records available to us; Dr. M. Schulzer for advice on statistical analysis; and Miss E. Dorken, PHN, for considerable technical assistance.

This study was supported by a grant from the Muskoka Hospital memorial research fund, National Sanatorium Association. Dr. Enarson is a George Saxton memorial fellow, British Columbia Lung Association.

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