

PATHOLOGY OF LEPROUS OSTEOMYELITIS

C. K. JOB, B.Sc., M.D.

*Schieffelin Leprosy Research Sanatorium
North Arcot District, South India*

Bone changes in leprosy due to the direct action of *Mycobacterium leprae* do occur, and their radiographic appearances have been repeatedly described^(2, 3, 5). Leprosy of the bone usually manifests itself as a chronic osteomyelitis displaying clear-cut local areas of bone destruction. The common sites of predilection are the small bones of the hands and feet. Occasionally, these areas are situated in the subarticular region, causing deformities of the joint and the finger. On the other hand, very little is known about the histopathology of these lesions. A description of the histopathology is given in this paper.

MATERIAL AND METHODS

Six of the lepromatous leprosy patients attending the Schieffelin Leprosy Research Centre, Karigiri, who developed destructive lesions of the small bones of the hands were studied. The bacteriologic index was determined according to Cochrane's method⁽¹⁾. Skin biopsies were done to confirm the diagnosis and classification of the disease. X-ray examinations and biopsies of the bone lesions were also done.

In 2 cases, the bone lesion was curetted, and the curetted specimen was used as the biopsy material. In the other 4 cases, a specially-devised trephine was used. A small incision, 0.5 cm. in length, was made at the lateral border of the finger at the site of the lesion detected by x-ray, and deepened to split the periosteum. The trephine was drilled in manually, and a tubular piece of bone about 2 x 5 mm. in size was removed. The tissue was immediately fixed in formalin and decalcified, using formic acid. Sections were cut at 5 microns thickness and stained with hematoxylin and eosin. Acid-fast staining was also done in all cases.

CASE HISTORIES

CASE 1 (S.L.R.S. 501).—A man aged 20 years, with leprosy of 10 years' duration, was admitted on April 12, 1956, exhibiting gross and diffuse lepromatous infiltrations all over the body. The earlobes were nodular. A few nodules were also present on the fingers (Fig. 1). Both hands were swollen and were anesthetic to light touch; but there was no evidence of paralysis. The skin smears showed an index of 3.50. X-ray of the hands showed multiple ill-defined areas of bone destruction and subperiosteal bone formation in a few areas in the phalanges (Fig. 2).

CASE 2 (S.L.R.S. 2430).—A man aged 35 years was admitted on Feb. 6, 1958, with a history of having had leprosy for 5 years. He had diffuse infiltration of the entire skin of the face and extremities. There were nodules and swellings on the fingers. The skin over the hands was anesthetic to light touch; and there was ulnar paralysis of both hands. His bacteriologic index was 1.25.



FIG. 1. Case 1. The hand is swollen, and there are a few lepromatous nodules on the dorsum.

FIG. 2. Radiograph of the hand shown in Fig. 1. Note multiple ill-defined areas of bone destruction in the index, long, and ring fingers.

X-ray of both hands showed multiple areas of bone destruction in the phalanges, most marked in the distal end of the proximal phalanx of the right ring finger. In this area, the subarticular bone on the medial side had collapsed, causing lateral bending deformity of the fingers.

CASE 3 (S.L.R.S. 5199).—A woman aged 17 years reported at our outpatient department on April 13, 1961, with a history of 13 years' duration. There was diffuse infiltration of the skin of the face, trunk and extremities. There were many leprous nodules on the ears, and a few in the fingers. The hands were swollen, anesthetic to light touch, and there was early ulnar palsy of both hands. The bacteriologic index was 3.50.

X-ray of the hands showed generalized osteoporosis. Ill-defined areas of bone destruction were seen in the distal end of the first metacarpal of the left thumb and the distal end of the proximal phalanx of the left little finger.

CASE 4 (S.L.R.S. 3609).—A woman aged 18 years was first seen in the outpatient department on March 30, 1959, with a history of 2 years' duration. There was a fine, diffuse infiltration of the entire skin of the face, trunk, and extremities, and the fingers showed areas of irregular swelling. The hands were anesthetic, and early ulnar paralysis was present in both hands (Fig. 3). Bacteriologic index was 3.12 on admission.

X-ray of both hands showed areas of subperiosteal new-bone formation, with thickening of the cortex in some phalanges. There was also an area of bone destruction with expansion of the cortex in the proximal phalanx of the left little finger (Fig. 4).



FIG. 3. Case 4. Swelling of fingers, and early ulnar paralysis.

FIG. 4. Radiograph of the hand shown in Fig. 3. There is subarticular bone destruction of the proximal phalanx in the little finger. There is also subperiosteal new bone formation, with thickening of cortex in some phalanges.

CASE 5 (S.L.R.S. 2690).—A man aged 24 years, with nodular lepromatous leprosy of 5 years' duration, was admitted on May 16, 1959. Leprous nodules were present over the ears, face, trunk and extremities, and there was slight swelling of the hands and feet. There was no evidence of sensory loss in the hands, or of paralysis. Bacteriologic index on admission was 3.62.

X-ray of the hands showed minimal areas of bone destruction in a few phalanges, and in the distal end of the metacarpal of the right thumb.

CASE 6 (S.L.R.S. 3316).—A man aged 25 was admitted with a history of 7 years' duration. There was diffuse infiltration of the skin over the trunk and extremities; the face was grossly infiltrated; and there were nodules on the ears and hands, which were swollen. Both hands were anesthetic to light touch, but no paralysis was present (Fig. 5). The bacteriologic index was 4.25.

X-ray showed multiple areas of bone destruction in the phalanges. Another x-ray taken 2½ years later showed that all the lesions had

healed, with sclerosis. There was subarticular bone collapse of the middle phalanx of the left ring finger (Fig. 6). At this stage, biopsy of the middle phalanx of the left index finger was done with the trephine.

RESULTS

The biopsy specimens obtained from the bone were yellowish-brown in color. They were not particularly soft, although they felt less hard than normal bone.

The microscopic appearance was essentially similar in all the 6 cases. The bone trabeculae were invaded by inflammatory granulation tissue consisting mostly of macrophages (Fig. 7). Many of these cells had a pink granular cytoplasm with vesicular nuclei, and in some the cytoplasm was vacuolated. There were also scattered collections of lymphocytes and occasional plasma cells. Acid-fast staining showed clumps of *M. leprae* inside the macrophages. The lepromatous granulation tissue extended into the bone as tongue-like processes, and there was fragmentation and necrosis of the bone trabeculae. In some areas, proliferating osteoid tissue was seen with no evidence of calcification. The infiltrate of vacuolated macrophages, plasma cells, and lymphocytes also in-



FIG. 5. Case 6. The hand is swollen, and there is a slight deformity of the terminal phalanx of the ring finger.

FIG. 6. Radiograph of the hand shown in Fig. 5, after antileprosy treatment for 2½ years. Note the sclerosis of the bone around the areas of destruction and the subarticular collapse of the middle phalanx of the index finger.

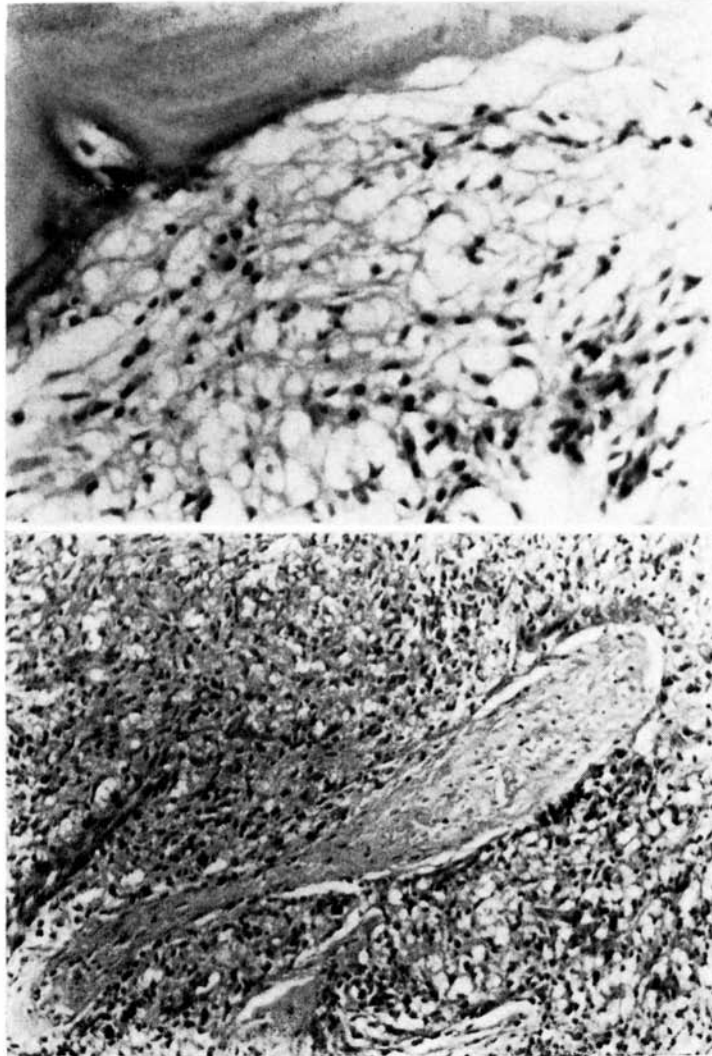


FIG. 7. Photomicrograph of leprosy osteomyelitis. The bone marrow is completely replaced by foamy cells and lymphocytes. (Hematoxylin and eosin, 330 \times .)

FIG. 8. Osteoid tissue infiltrated and surrounded by vacuolated macrophages and a few lymphocytes and plasma cells. (Hematoxylin and eosin, 160 \times .)

vaded and destroyed the osteoid tissue (Fig. 8) In places, fragments of dead bone were seen floating in the midst of bacillus-laden histiocytes, before they were absorbed.

By a combination of the conditions described, namely, active formation of lepromatous granulation tissue and carious absorption and occasional necrosis, much destruction of bone was produced.

In Case 6, in which the biopsy of the bone was performed after 2½ years of treatment, the macrophages had a markedly foamy cytoplasm. The nuclei were small and pushed to one side in the cytoplasm. No

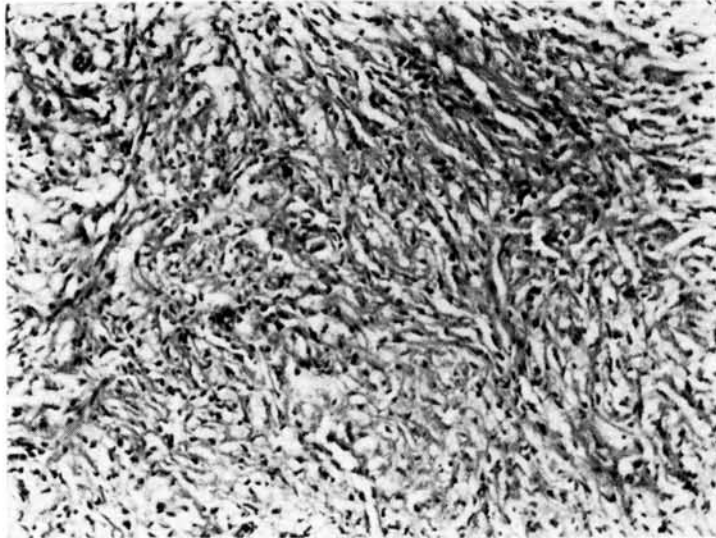


Fig. 9. The leprosy granuloma is mostly replaced by fibrous tissue, which is hyalinized. (Hematoxylin and eosin, 160 \times .)

bacilli were detected in the acid-fast preparation. In many parts of the sections there was proliferating fibrous connective tissue which showed areas of hyalinization (Fig. 9). Scattered infiltration by lymphocytes was also present.

In Case 3, the infiltration was seen to extend into the adjoining joint. The synovial membrane was thrown into papillary folds. There was infiltration of the synovial membrane by many vacuolated cells with a large number of acid-fast bacilli, lymphocytes, and plasma cells. Marked congestion and increased vascularity were also present.

DISCUSSION

All of the 6 cases analyzed in this paper were of the lepromatous type of leprosy, 5 of them very advanced, with high bacteriologic indices. All had swelling of the hands, and 5 of them had also nodules on the fingers. There was sensory loss to light touch in the hands in all except one, and ulnar paralysis in four of them.

The number of cases studied is small, and no definite conclusions can be drawn except to state that bone lesions specifically due to *M. leprae* are usually found in very advanced cases of lepromatous leprosy of long duration and with high bacteriologic indices. Faget and Mayoral⁽³⁾ also found that specific bone lesions are generally a late manifestation of the disease.

In lepromatous leprosy the bacilli invade the reticuloendothelial system, and the bone marrow is one of the important components of this system. Gass and Rishi⁽⁴⁾ reported the finding of bacilli in the bone marrow of 17 out of 21 cases of "mixed" leprosy.

Even though leprosy bacilli may be obtained from the bone marrow of the majority of advanced lepromatous cases, only a very small percentage of them develop destructive bone lesions. Faget and Mayoral⁽³⁾ found bone changes in only 9 out of 160 (5.6%) of such cases, and Paterson⁽⁶⁾ found them in only 128 out of 894 (14.3%) of leprosarium patients in Hong Kong.

Leprous osteomyelitis is a granulomatous process, and in some ways it resembles osteomyelitis of tuberculous origin. The leprous granulation tissue consists of large numbers of macrophages filled with *M. leprae*, and a few lymphocytes and plasm cells. When there is an abundant formation of this granulation tissue, it invades and destroys the bone trabeculae, and there is absorption of bone, or caries. The osteoid tissue that is formed is also destroyed. The lesion is essentially destructive. Healing takes place by fibrosis. The granuloma resolves, and the destroyed bone trabeculae and bone marrow are replaced by dense fibrous tissue.

SUMMARY

The histopathology of bone lesions specifically due to lepra bacilli is discussed. It is found that the lepromatous granulation tissue, consisting of vacuolated macrophages, plasma cells and lymphocytes, gradually invades and destroys the bone trabeculae resulting in bone caries. Healing takes place with fibrosis.

RESUMEN

Se discute la histopatología de las lesiones óseas debidas específicamente a los bacilos leproso. Se observó que el tejido de granulación lepromatosa compuesto de macrófagos vacuolados, plasmocitos y linfocitos, invade y destruye gradualmente las trabéculas óseas, dando por resultado caries ósea. La cicatrización sobreviene con la fibrosis.

RESUMÉ

Dans cette communication, la question de l'histopathologie des lésions osseuses spécifiques dues au bacille de la lèpre est débattue.

Il a été trouvé que le tissu de granulation lépromateux, composé de macrophages vacuolisés, de plasmocytes et de lymphocytes, envahit et détruit progressivement les travées osseuses, entraînant la nécrose de l'os. La réparation fait intervenir un processus de fibrose.

Acknowledgments.—I am grateful to Dr. P. W. Brand, director of orthopedics, The Mission to Lepers, India, for his helpful suggestions; to Dr. D. E. Paterson, professor of radiology, Christian Medical College, Vellore, for his cooperation in interpreting the x-ray pictures; and to Dr. E. W. Gault, professor of pathology, Christian Medical College, Vellore, for his valuable help.

REFERENCES

1. COCHRANE, R. G. A Practical Textbook of Leprosy, First Edition. London: Oxford University Press, 1947, p. 70.

2. ERICKSON, P. T. and JOHANSEN, F. A. Bone changes in leprosy under sulfone therapy. *Internat. J. Leprosy* **16** (1948) 147-156.
3. FAGET, G. H. and MAYORAL, A. Bone changes in leprosy: a clinical and roentgenologic study of 505 cases. *Radiology* **42** (1944) 1-13.
4. GASS, H. H. and RISHI, D. P. Examination of the bone marrow for *M. leprae*. *Leprosy in India* **6** (1934) 8.
5. PATERSON, D. E. Radiographic appearances and bone changes in leprosy. *In Leprosy in Theory and Practice*, R. G. Cochrane, ed. Bristol: John Wright & Sons Ltd., 1959.
6. PATERSON, D. E. Personal communication.