Acta orthop. Scandinav. *41*, 231–237, 1970

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BONE CHANGES IN PARATHYROID ADENOMA

Report of a Case

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Received 1.iv.69

Primary hyperparathyroidism, often called von Recklinghausen's disease, is caused by hyperplasia, adenoma, or carcinoma of the parathyroid gland. The clinical symptoms are muscular weakness, nausea, polyuria, and bone pains. The disease can lead to renal colic owing to concrements in the urinary tract and to pathologic fractures owing to bone cysts and osteoporosis. A parathyroid tumour containing clear, "wasserhelle" cells or chief cells is a typical microscopic finding (Bernstein & Thorn 1966, Barnhart 1967).

Urinary phosphorus is increased, serum phosphorus decreased, and serum calcium increased in primary hyperparathyroidism. According to more recent publications, the calcium infusion test has less diagnostic value because urinary phosphorus may also be reduced in normal conditions and in cases of renal calculi (Horwith et al. 1966). The hydroxyproline excretion is often elevated (Johnston et al. 1966, Horwith et al. 1966). Serum calcium is rarely decreased in the corticosteroid suppression test (Anderson et al. 1954, Dent 1956) but such a case has been described (Hodges & Waterhouse 1967).

The authors had an opportunity to study bone changes in a case of parathyroid adenoma by oxytetracycline bone labelling and microradiography before and after removal of the adenoma.

CASE REPORT

Patient H.T. 110418, a 48-year-old woman clerk. She had had asthmatic symptoms 16 and 30 years ago and hepatitis 20 years ago. In July 1965, after a slight trauma of the right hand, there was onset of pain and swelling in the fifth metacarpal area. The patient sought treatment because of the cyst and pathologic fracture of the fifth metacarpal. At operation, softened bone was found and a light red tumour

was removed by metacarpal resection. Bone grafting from the iliac crest was performed. The histologic picture resembled a giant cell tumour.

At follow-up the bone graft was united, but bone cysts were seen in the third metacarpal and the first phalanx of fourth finger (Figure 1). The patient was admitted in July 1966 for further study. Her general condition was good. She had a node attached to the left lobe of the thyroid gland. Chest radiograph and ECG were normal. Other radiographic findings in bones were "salt and pepper" changes in the skull and osteoporosis in the spine, an osteoporotic compression fracture in the first lumbar vertebra, and bone cysts on the left humerus and fibula. No renal calculi were visible. Laboratory values: Blood picture and ESR were normal. Serum proteins were 5.4–5.8 per cent, sodium 138–144 mEq/l, potassium 4.1–4.6 mEq/l, creatinine 1.9–2.1–0.8–1.0 mg% calcium 13 mg% = 6.5 mEq/l, phosphorus 1.4 mg%, and alkaline phosphatases 11.0 Bessey-Lowry units. Urinary sediment was normal. There were no traces of proteins, glucose, or Bence-Jones proteins in urine. Excretion of calcium in the urine was 0.18 g/24 h and of phosphorus 0.87 g/24 h. The *Kweim* test was negative.

Figure 1. Bone cysts in the third metacarpal and in the first phalanx of the fourth finger in a case of parathyroid adenoma. A large cyst of the fifth metacarpal was earlier resected and bone grafting performed.

Figure 2. Bone cysts have disappeared one year after removal of parathyroid adenoma.

A corticosteriod suppression test using deltacortisone 40 mg/day during 10 days was done. At first the serum calcium value was 13 mg%, on the fourth day 13.4 mg%, and on the ninth day 13.0 mg%.

Before the operation, 0.5 g of tetracycline was given daily on two days for the bone fluorescence examination. At operation two tumours of the size of a plum were found, one in the thyroid and the other behind it, in separate capsules. The tumours were removed and frozen slices of the parathyroid tumour were made. The histologic examination revealed well-vascularized tumour tissue containing clear "wasserhelle" cells. On the first postoperative day the serum calcium was reduced to 9.8 mg% and on the sixth day to 6.5 mg%. The patient was treated with intramuscular calcium gluconate and dihydrotachysterole (A. T. 10® Bayer, fifteen drops × 3/day). No tetanic convulsions occurred. The serum calcium was followed and dihydrotachysterole was withdrawn after half a year and, later, also the calcium tablets.

The patient was admitted to hospital in July 1967. Most of the bone changes had disappeared (Figure 2), serum calcium was 9.4–9.5 mg%, phosphorus 2.6–4.0 mg%. Urinary excretion of calcium was 0.48 g/24 h, phosphorus 0.43 g/24 h, and hydroxy-

Figure 3. Microradiograph showing eroded and fragmented trabeculae of the iliac crest with low density. × 100.

Figure 4. Microradiograph of iliac crest bone one year after removal of parathyroid adenoma. The margins of trabeculae are clearer, the density is better. Renegerative new mineralized areas are seen in the cancellous spaces. × 100.

Figure 5. Microradiograph of an osteon with wide osteroid before removal of adenoma. × 250.

Figure 6. Microradiograph of a narrower osteoid in the osteon one year after removal of adenoma. × 250.

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proline 14.2 mg/m²/24 h. The patient was given tetracycline before a repeated biopsy of iliac crest bone.

To summarize the case report, the authors describe a case of primary hyperparathyroidism admitted to hospital because of a pathologic fracture. The diagnosis was verified by the clinical picture as well as by elevated serum calcium, positive corticosteroid suppression test, and histologic features of parathyroid adenoma. Iliac crest bone biopsies were taken for study of bone changes before and after removal of the adenoma.

MICRORADIOGRAPHIC AND TETRACYCLINE-FLUORESCENCE EXAMINATIONS

The bone samples were hardened in methylmetacrylate and ground to a thickness of 100 μ. The fluorescence examination was performed with a Leitz microscope. At microradiography the following values were used: 15 mA, 24 kV, 5 min, FSD 15 cm.

In the bone samples taken before removal of the parathyroid adenoma, tetracycline-fluorescence was seen in the margins of trabeculae. In the samples taken one year after operation there was obvious fluorescence in large cancellous areas and also in the cancellous spaces.

In the first microradiographs (Figures 3 and 5) a thin bone network of a low bone density were seen. There was clear fragmentation and the margins of the trabeculae were eroded. In some places the osteons were indistinct.

The second microradiographs taken one year after operation (Figures 4 and 6) showed a less fragmented bone network and less unclear osteons. The trabecular margins were clearer, but also trabeculae with eroded margins were present. In the cancellous spaces new mineralized regenerative areas were visible.

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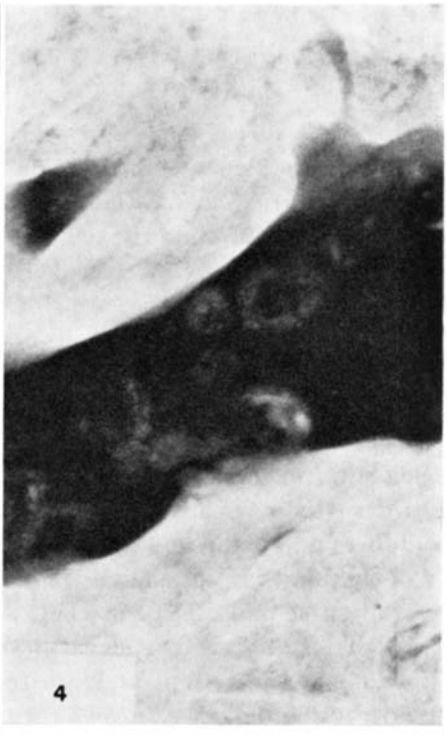

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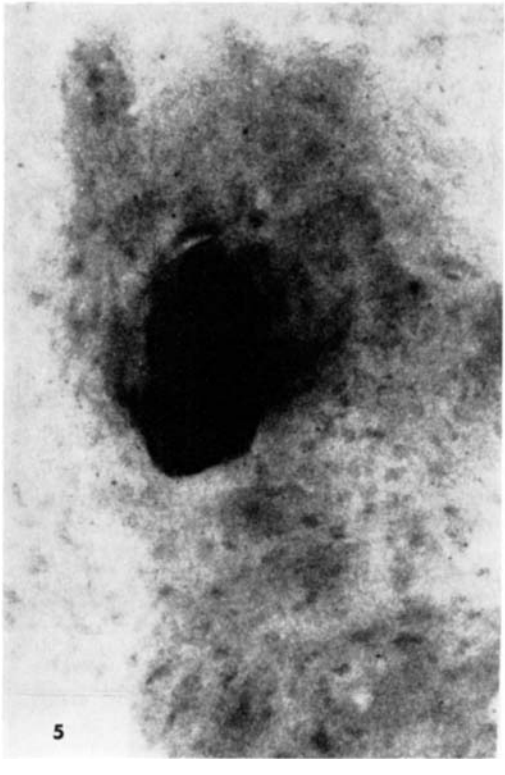

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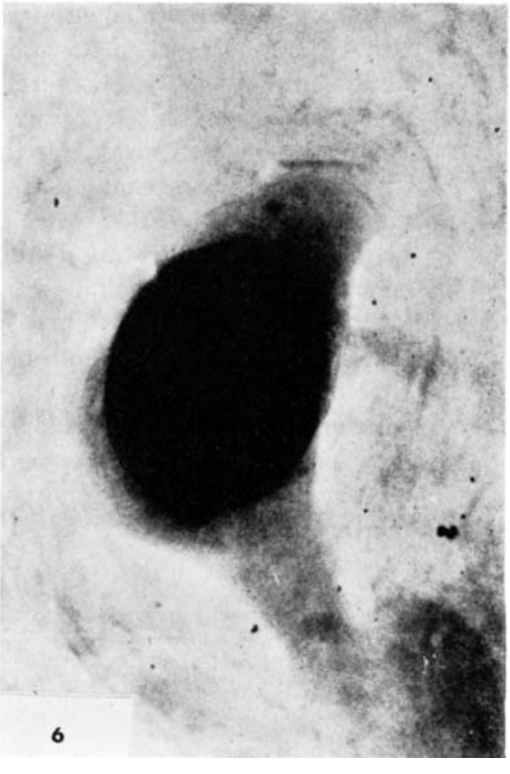

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DISCUSSION

In a case of primary hyperparathyroidism studied with tetracycline-fluorescence, using tetracycline during 7 days before biopsy (Hupe & Horn 1965), clear ossification was found in the margins of the Haversian canals and endosteal bone. In the present study a more obvious uptake of tetracycline seen both at the trabecular margins and in the cancellous spaces one year after the operation than before it, indicating a more active regenerative process.

In the radiocalcium study of Dymling (1965) increased accretion rate and its decrease after removal of parathyroid tumour was found. Another study (Caniggia et al. 1966) shows elevated values of the calcium miscible pool, Ca turnover rate, and accretion and resorption rates. Histologically there was irregularity of the surfaces of the trabeculae and sparse and narrow osteoid seams. Two weeks after removal of a parathyroid adenoma, histological examination showed broad trabeculae and a large osteoid, which was normalized within 45 weeks. At the same time, the elevated values of the Ca miscible pool, Ca turnover rate, accretion, and resorption had decreased. Intestinal hyperabsorption decreased already within 2 weeks. Microradiography (Boyce & Jowsey 1966) revealed an increase in width of osteoid tissue as compared to normal, speaking against the finding by Caniggia et al. (1966). In the present study, regenerative processes were observed both by microradiography and by ordinary X-ray one year after operation.

The present case speaks for the concept that in primary hyperparathyroidism the bone changes are similar to those in osteomalacia: poor mineralization and rich osteoid and, after a one-year observation period, changes indicating a still active regenerative process. The new bone formation in cancellous spaces seen by microradiography one year after removal of the adenoma is an interesting phenomenon. It shows that healing of the bone continues although bone cysts and osteoporosis have disappeared.

Primary hyperparathyroidism is an important, although rare disease. Poor mineralization or bone cysts give reason for the estimation of the serum calcium and phosphorus and for further studies among fracture patients.

SUMMARY

A case of parathyroid adenoma with bone cysts was described. Microradiographic and tetracycline-fluorescence examinations of the iliac

crest biopsy material were performed before and after removal of the parathyroid adenoma. Visible tetracycline-fluorescence was found before and after removal of the tumour. In microradiographs, fragmented trabeculae, eroded margins of a low density, and rich osteoid were seen. One year after removal of the adenoma there were less fragmented trabeculae, better density, less abundant osteoid, and regenerative bone areas.

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