Fluorosis-induced hyperparathyroidism mimicking a giant-cell tumour of the femur

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Endemic fluorosis is a public-health problem in several parts of the world and is characterized by abnormalities of the bones and teeth. Typical descriptions of skeletal radiology in endemic fluorosis have emphasized the presence of osteosclerosis, membranous and ligamentous calcification and exostoses. Other reported radiological features include osteomalacia and osteoporosis. We report the case of a young woman with secondary manifestations of fluorosis.

Case report

A 28-year-old woman presented in May 1997 with insidious, progressive pain in the right hip and difficulty in walking. Initially, she had been treated elsewhere and a radiograph (Fig. 1) had revealed an osteolytic lesion in the right proximal femur. CT showed features suggestive of a giant-cell tumour. By the time she presented to us she had sustained a pathological fracture of the neck of the femur (Fig. 2). CT-guided fine-needle aspiration cytology was inconclusive. A clinicoradiological diagnosis of a giant-cell tumour of the femur with a pathological fracture was made and a cemented, modular, bipolar hemiarthroplasty was performed in June 1997.

We report the case of a young woman who, over a period of five years was diagnosed and treated for a giant-cell tumour of bone, osteomalacia and fluorosis. A review of the literature revealed a correlation between these three diagnoses, the primary pathology being fluorosis and the remaining symptoms being secondary manifestations. It is important to be aware of this association, especially in regions with endemic skeletal fluorosis.

Discussion

Classical teaching in medicine suggests that all signs and symptoms in a patient should be explained by one diagnosis. In our patient, over a period of five

References


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doi:10.1302/0301-620X.86B4.14944 $2.00
Received 10 September 2003; Accepted 27 October 2003

THE JOURNAL OF BONE AND JOINT SURGERY
years, three different diagnoses were made, namely giant-cell tumour, osteomalacia and fluorosis. We have attempted to find a correlation between these three diagnoses.

A search of the literature showed that, although the classical appearance of skeletal fluorosis is osteosclerosis, it can also present as osteoporosis or osteomalacia. Wang et al\(^2\) found that of 127 patients with clinically-proven endemic fluorosis, osteosclerosis was seen in 54 (43%) and osteopenia in 51 (40%). Of the patients with osteopenia, a pattern of osteoporosis was seen in 28 (22%) and of osteomalacia in 23 (18.1%).
The radiological picture is one of osteopenia.

Factors can lead to secondary hyperparathyroidism. The radiological picture is one of osteosclerosis. In those with a poor intake of calcium, marked change in ionised serum calcium occurs and the radiological picture is one of osteomalacia. Three patients had subperiosteal resorption of the phalanges.

In a study on 65 subjects on the radiological spectrum of endemic fluorosis, Mithal et al reported a predominant osteopenia in 12%. Three patients had features resembling rickets, in the form of metaphyseal fraying and apparent widening of the epiphyseal cartilage. Three also had subperiosteal resorption of the phalanges.

Christie, in a study on the spectrum of radiological bone changes in children with fluorosis in Tanzania, reported a combination of osteomalacia, osteoporosis and osteosclerosis. Similar findings were also reported by Krishnamachari. He explained the reasons why two different radiological pictures may occur, on the basis of calcium intake, as follows.

In patients with an adequate calcium intake calcium fluorapatite is deposited in bone and leads to an increased bone density. No marked change in ionised serum calcium occurs and the radiological picture is one of osteosclerosis. In those with a poor intake of calcium, calcium fluorapatite formed in the blood leads to a decrease in the level of serum calcium. In addition, fluoride stimulates the parathyroid glands directly or indirectly. Both of these factors can lead to secondary hyperparathyroidism. The radiological picture is one of osteopenia.

In the light of Krishnamachari’s work, we were reasonably certain that fluorosis was the primary pathology which led to secondary osteomalacia in our patient. The question arose as to whether the giant-cell tumour was an incidental occurrence or a feature of hyperparathyroidism manifesting as a brown tumour and mimicking a giant-cell tumour. A review of the literature showed that various authors have documented the radiological manifestations of secondary hyperparathyroidism caused by fluorosis, such as subperiosteal resorption, generalised osteopenia, loss of the lamina dura and the presence of Looser zones and resorptive cavities.

Prolonged stimulation of the parathyroid gland because of secondary hyperparathyroidism which has been caused by fluorosis may cause formation of an adenoma de novo (tertiary hyperparathyroidism).

A review of the initial skeletal survey in our patient revealed a multilocular lytic lesion with a homogenous matrix but without any expansion of the cortex. The lesion had a narrow zone of transition with well-defined margins. The pre-operative CT scan (Fig. 2) showed a pathological fracture and a minimal soft-tissue shadow. The Hounsfield value within the head of femur was 77, which suggested the presence of blood.

The patient’s chest radiograph, previously reported as normal, revealed a Looser zone in the left first rib (Fig. 4). Her mandibular radiograph showed a partial loss of the lamina dura. There was also subcortical and intracortical resorption of the phalanges and metacarpals. In view of these radiological features of secondary hyperparathyroidism the radiologist considered that a brown tumour could not be excluded.

With this revised clinicoradiological assessment, we requested a review of the histopathological sections. These were still found to be inconclusive in distinguishing between a giant-cell tumour and a brown tumour.

We believe that the primary pathology in our patient was fluorosis. This led to secondary hyperparathyroidism manifesting as osteomalacia and, ultimately, a resorptive cavity in the head and neck of the femur. Awareness of such an association, especially in a region with endemic fluorosis, is essential.

No benefits in any form have been received or will be received from any commercial party related directly or indirectly to the subject of this article.

References