

## X-RAY ANALYSIS OF 80 PATIENTS WITH SEVERE ENDEMIC FLUOROSIS CAUSED BY COAL BURNING

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**SUMMARY:** Radiographs of 80 patients with severe endemic fluorosis of coal-burning type [CBEF] - 49 males and 31 females aged 30 to 70 years - were analysed to examine the changes to the bone substance, peripheral structure of bone, and joints. The changes to bone substance were: 1) osteosclerosis type, 62 cases (77.5%); 2) mixed type, 16 cases (21.25%); 3) osteoporosis type, one case (1.25%); 4) osteomalacia type, one case (1.25%). The changes to the joints were: articular lesions were found in the hips and elbows in 79 cases (98.75%), and in the knees in 75 cases (93.75%). When combinations of the above three changes occur, the classification of the disease is according to the most severe one of the three. Our findings can increase the accuracy of X-ray diagnosis, making it more consistent with clinical diagnosis, thus improving prevention and treatment of CBEF.

Key words: fluoride; fluorosis; endemic X-ray diagnosis.

### Introduction

CBEF is the type of endemic fluorosis caused by air and food contaminated by coal smoke, and occurs in certain mountainous regions in Sichuan, Guizhou, Hubei and Yunnan Provinces of China. To improve our knowledge of CBEF, and to improve prevention and treatment to this disease, we analysed radiographs of 80 patients with severe CBEF, examining the changes to the bone substance, the peripheral structure of the bones and joints. Relations between X-ray changes and the stages and classification of the disease were also discussed.

### Materials and Methods

Radiographs were taken of 450 patients with CBEF, in the CBEF regions of Sichuan Province, China, during 1989 to 1992, and included: frontal view in pelvis and right forearm containing the elbow, and frontal and lateral views in the right tibia and fibula containing the knee. Eighty cases with severe CBEF (49 male and 31 females aged 30 to 70 years), selected from the 450, were radiographically analysed. X-ray diagnoses were according to criteria described in *The Hand Book for Prevention and Treatment of Endemic Fluorosis*.<sup>1</sup> With combinations of changes to bone substance, peripheral structure of bones, and joints, the classification of the disease was according to the most severe of the three changes observed.

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## Results

### *Changes to bone substance and type:*

1) Osteosclerosis type of CBEF occurred in 62 cases (77.25%). The density of the bone in the pelvis increased, fine and compact bone striae with fusion occurred in four cases. In 46 of 58 cases, the density of the bone was lower in the extremities than in the pelvis. Compact osteosclerosis in both the pelvis and the extremities were observed in 16 cases, of whom 8 presented the eburnated appearance in the forearms and legs, and 11 had mild to moderate changes to the joints. The clinical diagnosis of them was: moderate degree. Their age averaged 44.4 years.

2) Mixed type of CBEF occurred in 16 cases (21.25%). The pelvis all manifested compact bone sclerosis, obliteration of trabeculae, and bone transference resulting in woven bone formation. Eight of the 16 cases presented gross bone change with thin cortex. Osteoporosis of the bone cortex and sclerosis of the cancellous bone occurred in 8 cases. In 12 of 16 cases, the changes of the joints were of the severe degree, corresponding to the clinical diagnosis. Their age averaged 54.4 years.

(3) Osteoporosis type of CBEF occurred in one case (1.25%). The pelvis and extremities demonstrated obvious osteoporosis, narrowed spaces in elbows, and deformed ends of the bones. The tendons and ligaments were ossified. The lower rims of both hips showed hyperostosis embracing the femoral heads. The knees presented hyperostosis, gross ends of the bones, with calcified interosseal membranes and parietes of the blood vessels.

4) Osteomalacia type of CBEF occurred in one case (1.25%). There were multiple pseudofractures in the left tibia and fibula. Radiographs after 18 months showed that the fracture lines were clearer, with margins of osteosclerosis. Although there was a little callus, the fractures were not healed because of osteomalacia. The pelvis showed compact osteosclerosis, with trabeculae obliterated as osteosclerotic osteomalacia.

### *Changes to the peripheral structure of the bones:*

Interosseal membranes in the forearms and/or legs were ossified in 79 cases (98.75%). Intertransverse ligaments were ossified in 59 cases (74.25%). Supraspinal ligaments were ossified in 58 (72.50%), and iliolumbal ligaments in 38 (47.50%). Twenty-nine cases (36.25%) were graded as severe according to the changes of the peripheral structures of the bones.

### *Changes to the joints:*

In all our cases, there were articular lesions in various degree, the most common site being the hips in 80 (100%) cases, main findings included: hyperostosis of the upper and lower rims of the acetabulum, embracing the femoral heads; lesions of the elbows in 79 (98.75%) manifested in ossified extensor and flexor tendons and narrowed spaces of the joints. Forty one of 80 cases were graded as severe according to the changes to the joints.

### Discussion

- 1) Changes of bone structure of CBEF: The increase of bone density is the main roentgen finding. In 79 among 80, the pelves showed increase of bone density, and compact osteosclerosis. In 63 of these, the degree of osteosclerosis decreased from the trunk to the extremities, as described in the literatures.<sup>2</sup> However, in 16 cases the pelves, forearms and legs all showed compact osteosclerosis. In 8 of the 16, the articular changes were mild to moderate, consistent with the clinical diagnosis. The patients were younger and their ability to work remained. It is apparent that osteosclerosis is not parallel to the articular changes and the clinical stages. So osteosclerosis does not represent the severity of CBEF.
- 2) Clinical diagnosis of CBEF is based on the degree of motion of the joints. In our cases, the ossifications of the peripheral structures of the bones occurred in 98.75%. Besides the tendons and ligaments in the extremities, there were multiple ossifications of the spinal ligaments, so that the vertebral column was limited in motion, resulting in kyphosis, a stiff and rigid spine.
- 3) Lesions of the joints of CBEF.<sup>3</sup> Articular lesions in the elbows and hips occurred in 98.75% of the cases, and in the knees in 93.75%. The patients were unable to flex the knees and to squat. In 12 of 16 cases with mixed type CBEF, the articular lesions were severe, consistent with the clinical diagnosis. Their age averaged 54.4 years and they were disabled. The lesions of the peripheral structure of the bones and of the joints are closely related with the clinical symptoms and signs, and are positively related to the patient's age.
- 4) CBEF may cause necrosis of the articular cartilage, similar to degenerative arthropathy, from which it should be differentiated. Ossifications and osteophytes of the articular synovial, tendons and ligaments are characteristics of CBEF.<sup>4</sup> The main roentgen findings of CBEF are the changes to the bone substance, to the peripheral structure of the bones, and to joints. We suggest that criteria for X-ray diagnosis of CBEF should include the articular changes. Classification of the disease depends upon the most severe of the above three changes. The above considerations can make X-ray diagnosis more consistent with clinical diagnosis.

### References

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