

SKELETAL CHANGES IN INDUSTRIAL AND ENDEMIC FLUOROSIS

by

E. Czerwinski and W. Lankosz
Cracow, Poland

SUMMARY: Fluorotic changes in bones and joints were evaluated in 105 aluminum workers and 20 residents of an endemic fluorosis region in India. The age of the workers averaged 51.2 years, and the duration of their exposure 18.2 years. The skeletal changes in the aluminum workers exhibited the same characteristics as those of endemic fluorosis. In industrial fluorosis the changes were less advanced than in endemic fluorosis. Generalized sclerosis, alterations in the bone structure and periosteal reactions are the most typical features of skeletal fluorosis; ossification of the interosseous membranes and muscle attachments, are less characteristic.

The skeletal changes, an inseparable feature of chronic fluoride intoxication, result from the specific affinity of fluoride for hydroxyapatite, the basic substance of bone tissue (1,2,4-7).

Whereas in endemic fluorosis, the diagnostic value of skeletal changes is incontrovertible, in industrial fluorosis the findings may be modified by other factors. Among the employees of an aluminum factory the basic group studied, these factors include vibrations, mechanical overstrain, marked variations in temperature and humidity, etc.

We attempted to determine whether or not specific diagnostic criteria could be recognized in industrial fluorosis. We therefore compared the skeletal changes in a group of aluminum workers with those in patients from an endemic fluorosis area.

Material and Methods

The 105 aluminum factory workers ranged in age from 37 to 69 (average 51.2). They had been exposed to fluoride for 8-24 years (average 18.2). Ninety-seven (92.4%) of them had been working in the electrolysis department. The 20 patients from the endemic fluorosis area were 18 to 50 years old (average 30.7). Their water supplies contained 8.5 to 25.0 ppm fluoride. The patients were examined in the Department

From the Orthopedic Department, Cracow Academy of Medicine, Poland.

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Orthopedic, radiological and additional examinations were made in all cases, both in the industrial and the endemic fluorosis groups.

Results

The aluminum workers most frequently complained of pains in the lumbar region of the spine, less often of pains in the large joints, forearms and lower legs. On examination various degrees of limitation in the mobility of the spine and joints were found. In the patients

Figure 1
Lumbar Spine in (A) Aluminum Worker (B) Endemic Fluorosis



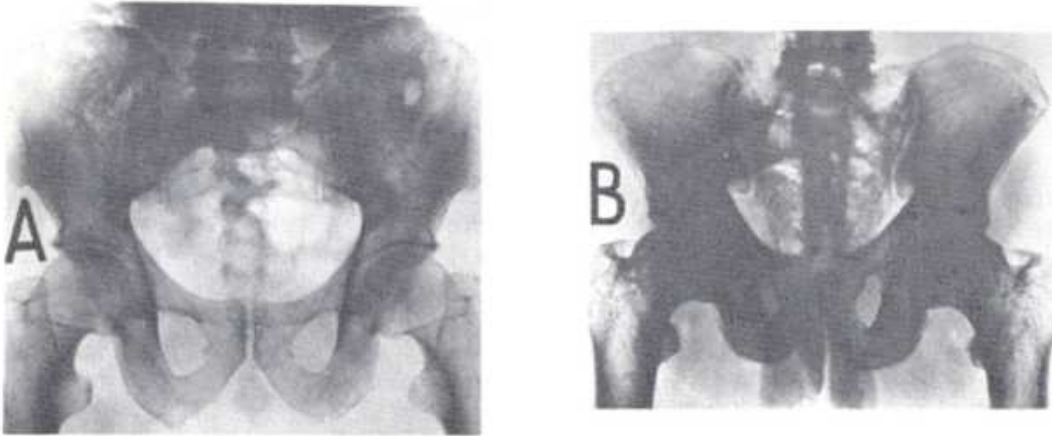
The advanced degenerative changes in the lumbar spine in A are less pronounced than in the generalized osteosclerosis in B.



with endemic fluorosis these changes were of a similar character except that the localization differed since the cervical region of the spine was often affected. On the basis of the clinical symptoms, it is not possible to differentiate fluorotic changes from other bone and joint diseases. Typical fluorotic changes may be evident on radiological examination (4-7).

In the aluminum workers, the most frequent changes in the spine were exostoses and ossification of the ligaments (Fig. 1). These changes did not differ in appearance from those seen in spondylarthritis or vertebral ankylosing hyperostosis. Radiograms of the pelvis very often showed ossification of the muscle attachments to the iliac crest and to the ramus of the ischiac bone. Generalized osteosclerosis and alterations in bone structure were much less common than in the endemic fluorosis group (Fig. 2).

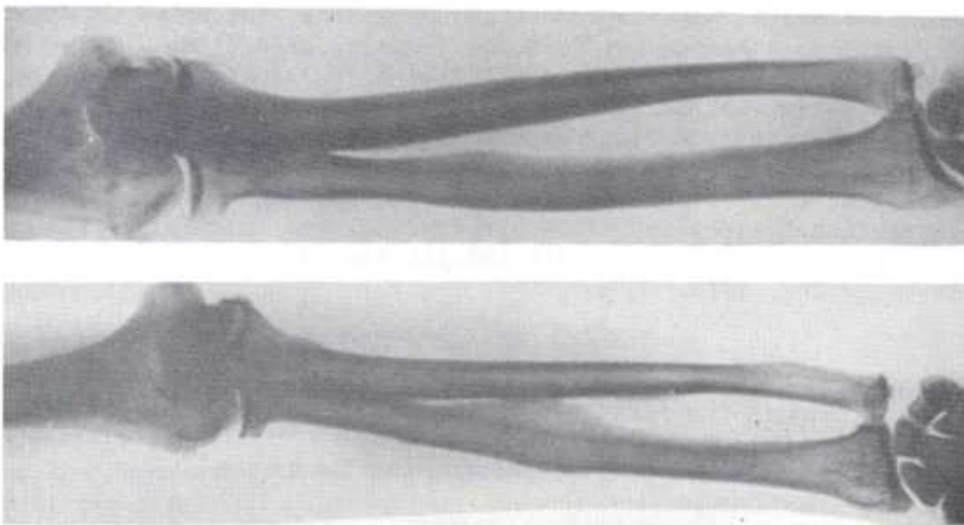
Figure 2
Pelvic Bones in (A) Aluminum Worker (B) Endemic Fluorosis



Ossification of muscle attachments less marked osteosclerosis in (A). Osteosclerosis and increased trabeculation in (B).

The changes most often seen in the long bones of the aluminum workers included ossification of the interosseous membrane, thickening of the cortical bone, and obliteration of the medullary cavity. Periosteal reactions and generalized osteosclerosis were rarely observed. In the endemic group these changes were usually more pronounced, but were absent in some (Fig. 3). It should be emphasized that ossification of the interosseous membrane or of muscle attachments are often found in manual workers who have not been exposed to fluoride compounds. Hence these changes cannot be regarded as typical of industrial fluorosis (3).

Figure 3
Forearm in (A) Aluminum Worker (B) Endemic Fluorosis



Ossification of muscle attachments, thickened cortical bone, obliteration of medullary cavity, patchy condensation in the bone structure in (A). Advanced ossification of interosseous membrane in (B).

Discussion

In evaluating our observations we must consider that the exposure to fluoride in the aluminum workers averaged 18.2 years as compared to 30.7 years for the residents in the endemic area. Furthermore, the exposure of the workers was intermittent whereas the intake of fluoride in the endemic fluorosis cases was continuous. Therefore, one would expect the disease to be farther advanced in the endemic cases. In the aluminum workers, on the other hand, inhalation of fluoride played a major role whereas among the residents of the endemic area the alimentary canal was the main port of entry. How much these factors affected the total amount of fluoride adsorbed and its resulting changes is difficult to assess.

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Discussion

Dr. Teotia: This is the first paper comparing endemic and industrial fluorosis. Osseous calcification develops early in the disease and therefore is its earliest diagnostic feature.
