THE INCIDENCE OF MOENCKEBERG CALCIFICATIONS IN PATIENTS WITH ENDEMIC FLUOROSIS

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SUMMARY: This study is comprised of 106 male patients over age forty from a high fluoride water (3.5-12.5ppm) area. These patients have been matched by age and sex with 106 patients from a low fluoride water (0.00-0.45 ppm) area.

All patients had radiograms of the chest, pelvis and both femora; 21 in the fluorotic group underwent a skeletal survey. All plain films were examined for skeletal fluorosis changes; pelvis and femur radiograms for Moenckeberg arterial calcifications.

Over age 60, patients in the high-fluoride group showed a significantly higher incidence of Moenckeberg calcifications. A highly significant correlation ($P < 0.001$) was observed between the severity of these calcifications and the severity of skeletal changes within this group.

KEY WORDS: Moenckeberg arterial calcifications; Endemic fluorosis; Turkey, fluorosis in

Introduction

Endemic fluorosis or chronic fluoride intoxication is characterized by mottled enamel, increased density of the skeleton, and ligament calcifications resulting from prolonged ingestion of fluoride in drinking water.

Many of the effects of fluoride on human health are well-known. A review of the literature indicates that, in skeletal fluorosis, arterial calcifications are common (1-10).

The main purpose of this study was to investigate the incidence of Moenckeberg calcifications in patients with fluorosis in Turkey.

Materials and Methods

Radiograms of the chest, pelvis and both femora were taken of 106 male patients over 40 years of age, residing in a high fluoride water area and 106 others in a low fluoride water area, 212 patients in all. Moenckeberg calcifications were investigated in the iliac and femoral arterial area. Skeletal changes of fluorosis were evaluated on the basis of all roentgenograms by the following method:

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1. Moenckeberg calcifications: a) none, b) slight—calcifications seen in only one femoral or iliac artery, and only a small region affected , c) marked— in both arteries with calcifications affecting a large portion of the arteries .

2. Skeletal changes: a) none or slight (normal or slightly increased bone density, but not significant enough by themselves to indicate skeletal fluorosis, b) mild fluorotic changes, c) marked fluorotic changes. Evaluation mainly followed Roholm's calcification, 1937 (11).

Results

I. Moenckeberg calcifications of iliac and femoral arteries (Table 1) were discovered in 28 of the patients with fluorosis(26.4%),17 of which were slight, 11 were marked. Two of the slight cases were under 60 years of age. In the control group, 12 cases of Moenckeberg calcifications (13.3%) were found, 9 of which were slight, 3 were marked.

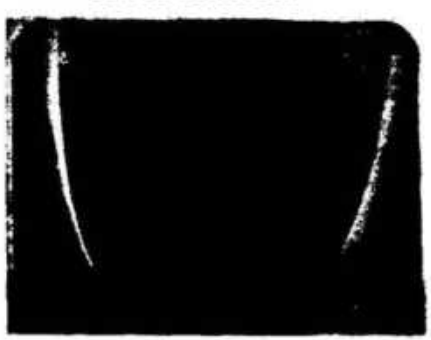
Table 1

Distribution of Moenckeberg Calcifications in Two Groups Based on Age

Age	Number of Cases	Fluorotic		Control	
		Slight	Marked	Slight	Marked
40-59	31	2	-	2	-
60-	75	15	11	7	3

Figure 1

Marked Moenckeberg Calcifications
Severe Fluorosis



II. Table 2 compares Moenckeberg calcifications with skeletal findings in fluorosis patients. Of all patients with fluorosis, 24 (22.6%)showed skeletal findings of fluorosis (15 mild, 9 marked). Only 3 of the 24 patients were under age 60, 21 were older than 60. In five patients with marked skeletal fluorosis, acetabular protrusion, bowing, rough and coarse trabeculations in distal femora were observed. There were "Sandwich vertebrae" appearances in two of them.

Statistical assessment of findings:

1. That Moenckeberg calcifications are more frequent in cases of fluorosis than in the control

Table 2

Comparison of Moenckeberg Calcifications and Skeletal Findings in Fluorotic Group

Moenckeberg Calcifications	Skeletal Changes Marked	Mild	None	Total
Marked	7	3	1	11
Mild	1	4	12	17
None	1	8	69	78
Total	9	15	82	106

Figure 2

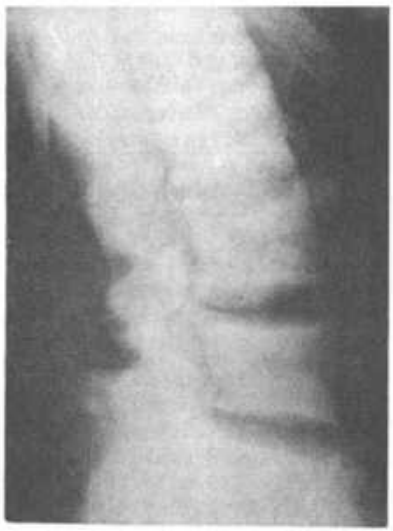
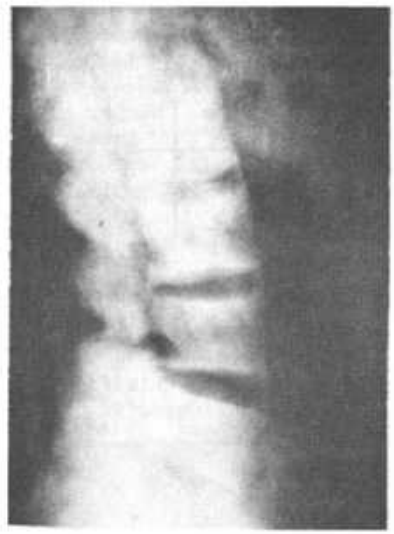


Figure 3



Sandwich Vertebrae Appearances in Severe Fluorosis

group over 60 years of age is statistically significant ($P<0.01$).

2. A close relationship was observed between the distinctness of the findings regarding the skeletal system and the appearance of Moenckeberg calcifications. Moenckeberg calcifications, always found associated with changes in the skeleton, increase in direct relation to the progress of the skeletal changes. This result has a high statistical significance ($P<0.001$).

Discussion

Drinking water in the endemic fluorosis area of DOGU-BE-YAZIT, where our patients were residing, contains 3.5-12.5 ppm fluoride (12-14). In ERZURUM, whence members of the control group came, the concentration of fluoride in drinking water ranged between 0.00-0.45 ppm (12).

All patients were male over 40 years of age. Both skeletal changes of fluorosis and Moenckeberg calcifications were prominent in elderly male patients (15,16). Thus we believe that the conditions of this study were suitable to determine whether Moenckeberg calcifications and skeletal fluorosis are related.

The earliest and most distinct radiological changes of fluorosis were seen in the pelvis, thorax and vertebrae (11,17,18). Moenckeberg calcifications were seen most often in the popliteal and femoral arteries and their appearance in plain radiographs was characteristic (19). They are multiple ring-like calcifications and generally affect a long segment, whereas atheroma calcifications are seen as irregular plaques. Therefore, the radiological study of our patients was sufficient to show skeletal fluorosis changes and Moenckeberg calcifications. According to statistical evaluation of the findings, these calcifications were more frequent in patients with fluorosis over 60 years of age than in the control group, and the degree of calcification and skeletal findings in the patients with fluorosis was closely related.

Speder in 1936 (1) was first to mention involvement of arteries in skeletal fluorosis. Subsequently many others have described the Moenckeberg type of calcification of arteries (2-10). Whereas arteries store more fluoride than any other soft tissue organ, the levels of fluoride and calcium deposition in them are not related (9).

Many studies suggest that parathyroid hyperplasia develops from high fluoride intake (20-22) and that secondary hyperparathyroidism occurs in the skeletal system of patients with fluorosis (23-27). Moenckeberg calcifications and sandwich vertebra appearances are frequently seen in cases of hyperparathyroidism. The high incidence of Moenckeberg calcifications in cases of fluorosis may reflect the development of secondary hyperparathyroidism in these patients. For proof, however, further biochemical, histopathologic and radiographic studies are warranted.

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