

CLINICAL INVESTIGATIONS OF SKELETAL FLUOROSIS IN CHILDREN OF MANGA MANDI IN PAKISTAN

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ABSTRACT

In July 2000 about 124 children were detected suffering from skeletal fluorosis at Manga Mandi near Lahore. They were drinking high fluoride (maximum level 29 ppm) containing water. We have studied various biochemical parameters in serum, including alkaline phosphatase, calcium and inorganic phosphorus. These levels were compared with the levels of those children who were the brothers and/or sisters of the patients (patient control) and had a dental fluorosis of varying degree. These levels were also compared with the serum levels of normal children (normal control). Serum samples were analyzed using standard kits of Boring Mannham and Randox. Serum alkaline phosphatase levels of patients, patient control and normal control were 291.68 ± 121.06 (mean $\pm$ SD, n=8), 196.58 ± 45.71 (n=10) and 144.85 ± 39.77 (U/L) respectively. Serum calcium levels of patient, patient control and normal control were 1.44 ± 0.08 , 1.41 ± 0.14 and 1.28 ± 0.13 (m. mol/L) respectively. Serum inorganic phosphorus levels of patient, patient control and normal control were 1.55 ± 0.08 , 1.65 ± 0.09 and 1.69 ± 0.04 (m.mol/L) respectively. These results enable us to conclude that blood calcium and phosphorus may play a major role for the determination of skeletal fluorosis whereas alkaline phosphatase may be having a minor importance.

INTRODUCTION

Skeletal fluorosis is one of the crippling endemic disease which is widely distributed all over the world in high fluoride areas. It is mainly caused by fluoride in drinking water, burning coal and phosphate fertilizers. In July 2000 about 124 children of age group 4-16 years were detected suffering from skeletal fluorosis at Manga Mandi near Lahore. Fluoride content in drinking water of this area was ranging from 0.45 ppm to 29 ppm (Ahmad, 2001). Decreased serum calcium and phosphorus levels have been reported to be responsible for abnormal dental calcification (Zang *et al.*, 1996 and Smith, 1935-1936). Serum total alkaline phosphatase activity and serum inorganic phosphate concentration has been used as a tool for the determination of bone mineral density in preterms (Backstrom *et al.*, 2000). A human tissue non-specific alkaline phosphatase has been detected in bone, liver and kidney (Mornet *et al.*, 2001). High levels of alkaline phosphatase activity are characteristic of bone disease with increased osteoblastic activity and hepatobiliary disease in children (Fuktsu, 2001). However, alkaline phosphatase is an insensitive indicator of bone metastases in renal cell carcinoma (Kriteman and Sanders, 1998). The purpose of the present study was to determine the differential role of alkaline phosphatase serum calcium and inorganic phosphorus in children suffering from skeletal fluorosis at Manga Mandi near Lahore.

MATERIALS AND METHODS

Studies were carried out on three groups of children. First group, age 4 to 16 years, having

skeletal fluorosis (patients). Second group, age 4 to 18 years, having dental fluorosis, but no apparent skeletal fluorosis and were drinking the same high fluoride containing water (patient control). Third group, age 6 to 12 years, having no skeletal fluorosis and were residing in other areas (normal control). 5ml venous blood was taken in test tube and allowed to clot for 30 min. Serum was separated after centrifugation (30min, 4000rpm) and stored at 4°C until analyzed for various biochemical parameters. Samples were analyzed within two days. Serum alkaline phosphatase, calcium and inorganic phosphorus were measured using respective kits of Boring Mannham (Roche, for alkaline phosphatase) and Randox (for calcium and phosphorus).

RESULTS AND DISCUSSION

Mean serum levels of three groups for alkaline phosphatase, calcium and inorganic phosphorus were compared (Table 1).

Table 1
Comparison of various biochemical parameters of serum samples of three groups with or without skeletal fluorosis

Group	Alkaline phosphatase (U/L)	Calcium (m.mol/L)	Inorganic phosphorus (m.mol/L)
Patients (n=8)	291.68 ± 121.06	1.44 ± 0.08	1.55 ± 0.08
Patient Control (n=10)	196.58 ± 45.71	1.41 ± 0.14	1.65 ± 0.09
Normal Control (n=6)	144.85 ± 39.77	1.28 ± 0.13	1.69 ± 0.04

Statistical analysis of these results was carried out to determine the level of significance in various parameters (Table 2).

Table 2
Statistical comparison in various biochemical parameters between three groups (unpaired t-test)

Comparison	Alkaline Phosphatase (U/L)	Calcium (m.mol/L)	Inorganic phosphorus (m.mol/L)
Patients Vs patient control	P=0.03*	P=0.49 ns	P=0.03*
Patient Control Vs normal control	P=0.03*	P=0.14 ns	P=0.42 ns
Patients Vs normal control	P=0.01**	P=0.02*	P=0.04*

*P = significant, **P= highly significant, ns = not significant.

These results indicate that alkaline phosphatase is high in both groups of children whether having skeletal fluorosis or not but drinking the same high fluoride containing water. It is important to note that all the patient control had dental fluorosis of varying degree ranging from chalky white spots on their teeth to severe dental carries. This indicates that other children of that area are still at a risk of skeletal fluorosis. As it has been reported that daily intake of fluoride 10-25 mg for a period of 10 to 20 years is required to cause crippling skeletal fluorosis (Hodge, 1979). The levels of serum alkaline phosphatase of patient were highly significant as compared to normal control. Furthermore, serum calcium levels of patient group were high as compared to normal control group whereas no significant difference was observed in patients and patient control indicating that high fluoride intake in patient control have also affected the bones but to a lesser extent which could not appear as a skeletal fluorosis. Serum inorganic phosphorus levels of patient group were significantly low as compared to normal control group. This indicates that there is an inverse relationship in serum calcium and inorganic phosphorus. Serum calcium levels in patient group were high and inorganic phosphorus was low in patients compared to normal control. Serum alkaline phosphatase of patient group was significantly high whereas inorganic phosphorus was low as compared to patient control. But no significant difference was observed in serum calcium and serum phosphorus between patient control and normal control since alkaline phosphatase was significantly high in patient control compared to normal control. These differences enable us to conclude that blood calcium and phosphorus may play a major role for the determination of skeletal fluorosis whereas alkaline phosphatase may be having a minor importance. It is investigated that alkaline phosphatase is an insensitive indicator of bone metastases (Kriteman and Sanders, 1998).

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