The Bioscan 5 (2) : 255-258, 2010
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES

HAEMATOLOGICAL INDICES IN OSTEOFLUOROSIS IN A TINNY VILLAGE

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KEY WORDS
Dental Fluorosis
Skeletal fluorosis
Creatine kinase
RDW

Received on :
15.03.2010
Accepted on :
19.05.2010

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ABSTRACT
A case study was undertaken among individuals residing in a Fluoride affected area. A total of 50 patients of both sexes in the age group of 02- 80 years were selected from a village Thungapeta of Srikakulam district of AP state, where the levels of Fluoride in drinking water varied from 2.9 to 3.5 mg/L. The patients of Dental fluorosis, skeletal fluorosis were examined for Hematological indices and Biochemical evaluation of Creatine kinase and ∝ Amylase. 72% patients are suffering from Aniscocytosis. 64% are suffering from Eosinophilia, 56% from lymphocytopenia. All parameters revealed that fluoride causes hypochromic Anemia. The present study elaborately deals with increased RDW values and suspected heart problems, liver problems and intestinal disorders. The activity of CK, ∝Amylase showed significantly rise and they alter skeletal and hepatic function.

INTRODUCTION

An estimated 25 million people spread over 15 states of India, where in drinking water is naturally contaminated with fluoride (1 – 40 ppm) are affected by serious health problems. Health complaints have a wide spectrum affecting bones, teeth, muscles, blood vessels, RBC, gastrointestinal mucosa and other soft tissue. (Susheela, 1995).

Fluorosis has no treatment or cure but it can be easily prevented provided the disease is diagnosed at early stages, with the help of warning signals like loss of Appetite, abdominal pain, intermittent diarrhea (Shashi and Kumar, 2009)

In 1992 even though the Bureau of Indian Standards (BIS) prescribed the acceptable level of 1mg / L but that does not mean that 1mg / L limit is safe. Malnourished children can be affected even at fluoride levels below 1mg / L.

Fluorine is the most electro negative element, distributed ubiquitously as fluorides in nature. Water is the major medium of fluoride intake by humans. It can rapidly cross the cell membrane and is distributed in skeletal muscle, cardiac muscle, liver, skin and erythrocytes (Jacyszyn and Marut, 1986).

In India as many as 15 states are affected by endemic fluorosis and an extensive belt of high fluoride in water and soil is reported in south India. A detailed survey for haematological Indices attributable to fluoride toxicity has not been recorded. Hence the present study was undertaken among people living in a fluoride affected area to determine Haematological indices and serum enzymes in patients of fluorosis.

MATERIALS AND METHODS

Thungapeta is a small village with 1100 population in Srikakulam district of A.P. state, where the levels of fluoride in drinking water varied from 2.9 to 3.5 mg/L. The village is about 25 km to Srikakulam town and 50% of the village population is suffering from fluorosis.

A Total of 50 patients of both sex in the age range of 2 – 80 years were selected from the village. Details of physical manifestations, age, sex, economic conditions, duration of the disease, symptoms are collected from them through questioners. Blood samples were collected from them with the help of technicians and samples were sent to Vijaya medical centre Visakhapatnam for estimations of Haematological Indices and Biochemical evaluation for Creatine kinase and ∝ -Amylase.

RESULTS

The results of the present study has been tabulated in Table 1 to Table 4.

The Table 1 revealed the physical manifestation of the patients. We categorized the subjects into 8 groups based on age and two groups based on sex. Among 50 patients 30 are males and 20 females. 25 males and 16 females were suffering from skeletal fluorosis, out of 50, maximum number were children with below 10 years age (14 members).

Table 2 revealed the total counts of RBC, WBC and hemoglobin levels. Total RBC count was increased in males of 31-40 age groups. In the age group of 41-50 also it was at high side. Though the mean values of WBC are in the normal range, the standard deviation was at higher level in 11-20 and 41-50 age group males. Hemoglobin levels were low in 11-20, 51-60, 61-70 and 71-80 age groups.

In the case of females, no variations in RBC count except in 51-60 age group. But WBC standard deviation was more in 21-30 and 41-50 age group. In the 61-70 groups more WBC count was reported. Hemoglobin levels decreased in 21-30, 31-40, and 51-60 age group patients.

Table 3 revealed the data of eosinophils, lymphocytes, MCV, PCV, MCH and MCHC.

All patients of both sexes were suffering from eosinophilia. Lymphocytes exhibit decreased trend in 31-40 to 70-80 age group of males and 21-30 to 61-70 age group of females. PCV values are normal in males and females expect 31-40 age groups of females. Mean values of MCV is also normal but SD variations explains that its values decreases in males of age group of 0-10, 61-70 and 70-80, and in females 21-30, 31-40 age group. Not much variation in MCH and MCHC values in Males. But in female's 31-40 age group patients had lower levels of MCH, MCHC.

Table 4 revealed the evaluation reports of RDW, Creatine kinase and ∝ -Amylase enzymes.

Red cell distribution width was increased in all most all age groups of both males and females. CK activity is more in males of age group 61-70. In females it exhibits a broad variation in the age group of 21-30. Mean values of ∝-Amylase activity normal in all groups except females of age 61-70.

DISCUSSION

There had been a number of studies of fluoride in laboratory animals. Effects on Haematological Indices such as RBC, WBC, Hb, MCV, MCHC on skeleton, such as inhibition of bone mineralization and formation, reduction in collagen synthesis, had been observed in a variety of studies in which rats received fluoride for periods of 2-6 weeks at doses in excess of 5 mg/L (Hanen and Hamadi, 2006; Mehdi and Ridha, 1977; Vijaya Bhaskara Rao and Vidyunmala, 2009).

For humans no data indicating the minimum nutritional requirement are available. To produce signs of acute fluoride intoxication minimums oral doses of at least 1mg of fluoride per Kg of body weight were required (Janssen *et al.*, 1988).

According to WHO document (2002), dental fluorosis was observed at drinking water concentrations between 0.9 and 1.2 mg/L (Dean, 1942). Skeletal fluorosis may be observed when drinking water contains 3-6 mg/L. Present study area reported 2.9 to 3.5 mg/L as per the geological survey records. This correlates the findings that out of 50 subjects 41 are suffering from skeletal fluorosis. Among them 8 are children of below 10 yrs age. All children were suffering from knock knee conditions. Adults were with more manifestation of skeletal fluorosis. The results showed a variation from Dwarakanath and Subburam, 2005 where they reported more dental fluorosis. But the children of below 10 years age 6 are suffering from dental fluorosis.

Fluoride easily accumulates in bones and could conceivably effect the formation of haemotopoietic cells in bone marrow cavity. Hence, alternations were observed in haematological values. The present study revealed the same. Hb levels decreased in 50% of the patients, RBC, WBC levels were elevated in some clearly indicate the fluoride toxicity. When compared to males more number of females are suffering from decreased levels of Hb. Age has influence and more variations were observed between 30-60 years group. This may be due to prolonged consumption of fluoride containing drinking water.

Table 1: Physical status of flourosis disease in thungapeta village of srikakulam district

Age Group (Years)	Males (Total 30) Number	Patients of Dental Flourosis	Patients of Skeletal Flourosis	Females (Total 20) Number	Patients of Dental Flourosis	Patients of Skeletal Flourosis
0-10	08	03	05	06	03	03
11-20	03	01	02	—	—	—
21-30	—	—	—	04	01	03
31-40	01	—	01	01	—	01
41-50	07	01	06	03	—	03
51-60	04	—	04	03	—	03
61-70	04	—	04	03	—	03
71-80	03	—	03	—	—	—

Table 2: Haemotological parameters in flourosis patients

Age Group(Years)	Females TotalRBC	Total WBC	Hb	Males TotalRBC	Total WBC	Hb
0-10	4.24 ± 0.37	9906 ± 2199.2	11.78 ± 1.17	4.60 ± 0.46	9930 ± 1621.54	11.93 ± 0.97
11-20	—	—	—	4.28 ± 0.45	8513 ± 4494	11.83 ± 0.65
21-30	4.54 ± 0.41	7332 ± 3687.7	11.20 ± 1.38	—	—	—
31-40	4.71	9370	9.3	5.58	9380	16.5
41-50	4.45 ± 0.19	7106 ± 3967	12.8 ± 0.72	5.147 ± 0.38	8350 ± 3351	13.47 ± 1.09
51-60	4.025 ± 0.70	9365 ± 784.8	11.3 ± 1.83	4.512 ± 0.457	8074 ± 3351	12.06 ± 2.93
61-70	4.77 ± 0.423	10.560 ± 645.8	12.86 ± 0.83	4.452 ± 0.65	9165 ± 1747.1	11.82 ± 321
71-80	—	—	—	4.263 ± 0.61	8190 ± 2098.7	11.33 ± 4.53

Normal Values

Total RBC	3.90 – 5.10 millions / C		
WBC	5000 – 10000 cells / cmm		
Hb	Males	Below 10 years	11 – 14 g / dL
		20 years – 80 years	13 – 17 g / dL
	Females	Below 10 years	11 – 14 g / dL
		20 years – 70 years	12 – 15 g / dL

Table 3: Haematological parameters in flourosis patients

Age group (Years)	Females eosino-Phils	Lympho-cytes	MCV	PCV	MCH	MCHC	Males eosino-Phils	Lympho-cytes	MCV	PCV	MCH	MCHC
0-10	12.11 ±13.08	35.03 ±7.7	84.13 ±4.05	35.6 ±2.45	8.28 ±1.43	33.63 ±1.48	11.37 ±9.84	37.66 ±6.76	76.97 ±8.91	35.16 ±2.24	26.15 ±3.41	33.39 ±1.01
11-20	—	—	—	—	—	—	13.86 ±11.85	37.63 ±10.89	84.35 ±4.70	35.3 ±2.19	27.8 ±2.05	33.36 ±1.01
21-30	9.45 ±5.25	28.77 ±3.83	75.95 ±9.78	34.27 ±2.79	24.8 ±3.73	32.6 ±1.27	—	—	—	—	—	—
31-40	11.1	26.8	65.4	30.8	19.7	30.2	7.0	33.5	89.1	49.7	29.6	33.2
41-50	8.9 ±6.29	30.05 ±9.38	86.7 ±5.99	38.56 ±0.96	28.8 ±2.80	33.16 ±1.18	17.94 ±11.59	24.7 ±3.69	80.41 ±5.68	41.25 ±2.28	26.22 ±2.19	32.62 ±1.19
51-60	8.75 ±6.01	29.1 ±13.69	85.3 ±2.40	34.25 ±5.02	28.1 ±0.28	32.95 ±0.49	7.88 ±3.67	29.22 ±9.8	81.56 ±11.89	36.84 ±6.54	26.66 ±5.80	32.4 ±2.45
61-70	14.83 ±9.57	26.33 ±4.01	82.1 ±4.67	39.1 ±1.64	27 ±1.55	32.9 ±0.79	6.67 ±7.3	32 ±10.07	78.92 ±10.66	35.3 ±7.79	26.32 ±5.13	33.17 ±2.39
71-80	—	—	—	—	—	—	12.9 ±8.92	26.3 ±6.24	79.83 ±15.43	34.60 ±10.97	25.36 ±7.07	31.36 ±3.2

PCV – 34 – 40 MCH – 24-30 Eosinophils – 0 – 5%
MCV - 75 – 87 MCHC – 31-37 Lymphocytes – 35 – 40%

Normal values

PCV	30 – 40%
MCV	75 – 87 Femotoliters
MCH	24 – 30 Picogram
MCHC	33.6%

Table 4: RDW, CK and ∝ amylase activities

Age group(Years)	Females RDW	CK	Amylase	Males RDW	CK	Amylase
0-10	14.78±1.96	85±10.33	63.16±9.15	16.04±2.05	136±6651.84	85.62±20.16
11-20	—	—	—	13.5±0.34	121.66±20.20	65±13.22
21-30	16.4±2.72	172.75±76.98	62.5±22.35	—	—	—
31-40	18.0	190	62	14.0	65	60
41-50	14.06±0.98	84.66±6.80	88.66±7.09	15.91±2.33	106.5±18.41	69.41±20.53
51-60	15.85±1.34	89.65±4.32	56±15.55	15.46±2.62	164±72.57	70.4±14.58
61-70	16.05±1.48	100.66±6.22	91.33±21.36	16.32±1.81	113.5±15.58	77.5±9.71
71-80	—	—	—	16.23±2.48	207.33±66.00	69±16.37

Normal Values

RDW	11.6 – 14%
CK	20 – 190 I.U/L
μ Amylase	0 – 90 U/L

80% of the patients are suffering from eosinophilia and lymphocytopenia which clearly indicates the pollution states. PCV, MCV, MCH and MCHC exhibit variation in almost all age groups and in both sexes. This shows that fluoride affects the total haemopoisis.

With regard to Red cell distribution width, 72-75% patients were suffering from anisocytosis. RDW is a good indicator of anisocytosis and a good screening index especially for diagnosis of anemia and the thalassemia trait. Subjects of the present study were suffering from low Hb levels, low MCV levels, hence fluoride toxicity leads to RBC fragmentation and iron deficiency anemia. Thalassemia trait needs further investigations. Increased fluoride consumption leads to increased RDW also (www.docstoc.com) correlated with the same during the interaction with the patients, we understood that, all are using painkillers like paracitomol every day for joint pains. Prolonged consumption of paracitomol affects the immune system, and causes RBC fragmentation. Increased RDW, decreased MCV clearly indicates the same.

Creatine kinase is an enzyme which catalyses the conversion of creatine to phosphocreatin, consuming ATP and generating ADP. In tissues that consume ATP rapidly like heart muscle, smooth muscle, phosphocreatines serve as energy reservoir for the rapid regeneration of ATP. Consequently, damage or disease of these tissues result on elevated serum Creatine kinase levels. The present study showed an elevation in the activity of serum CK in the age group 21- 30 in females and 51-60, 71-80 in males. It was known that degeneration of muscle fibers and defects of plasma membrane raise the CK levels in serum (Ebashi *et al.,* 1959). The CK level in the serum was considered an index for assessing the healthy state of the muscle fibre as well as that of muscle membrane. The fluoride toxicity leads to muscle degeneration also.

∝ Amylase is an important marker in the diagnosis of acute pancreatitis where serum ∝ amylase levels may be drastically elevated. In the present study, the activity of serum ∝ Amylase showed non-significant change in the patients of skeletal fluorosis.

CONCLUSION

Fluoride toxicity leads to dentaland skeletal flourosis; fluoride toxicity affects the Hb levels, eosinophils, lymphocytes, RDW,

MCV significantly; RBC count, WBC count exhibits small variations in few patients; PCV, MCH, MCHC showed non-significant changes.

ACKNOWLEDGEMENTS

We extend gratitude to the patients of Thungapeta village for their co-operation. We Express thanks to B.Srinivas for computerization of the findings.

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