CASE REPORT

Fluorosis… causing paraplegia… mutilating life…

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Abstract

Fluorosis is thought to be rare in Pakistan but endemic in various parts of the world, especially in India and China. In Pakistan only a few cases have been reported from Thar, Sibbi and Manga Mandi, with probability of fluorosis on MRI findings, supported by high drinking waterfluoride content. Neurological manifestations of skeletal fluorosis may vary from radiculo-myelopathy to neuropathy. A case of 26 years old female from Thul, Sindh, who presented with paraplegia, is reported here. Her MRI showed extensive classical degenerative changes throughout the spine, consistent with fluorosis, leading to cord compression at multiple levels. No such case with confirmed fluorosis has been previously reported from Pakistan.

Keywords: Fluorosis, Paraplegia.

Introduction

Fluorosis results from chronic exposure to excessive fluoride, mostly through drinking well/tube well water or via dust, fumes, tea, toothpaste, drugs or supplements.[1-3] Though endemic in many countries across the globe, especially in India and China, it is thought to be rare in Pakistan. However, there is some emerging evidence contrary to this assumption.[4]

Case Report

We report a case of a 26 years old female from Thul, Sindh. She presented with pain in the back and legs for 3 years and progressive weakness of legs which had made her completely bed bound for the last 3 months. There was no bowel or bladder dysfunction and no other co-morbid condition.

On examination she was alert and fully oriented but unable to walk. She had brown stained teeth (Figure-1). Lower limbs examination showed no muscle wasting, increased tone, power 0/5, reflexes were brisk and ankle clonus was present, along with bilateral up going plantars. She had diminished sensations (touch, pain, temperature, vibration, proprioception and two point discrimination) with a sensory level at T11. Neurological

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Figure-1: Dental fluorosis: Brown staining of teeth.

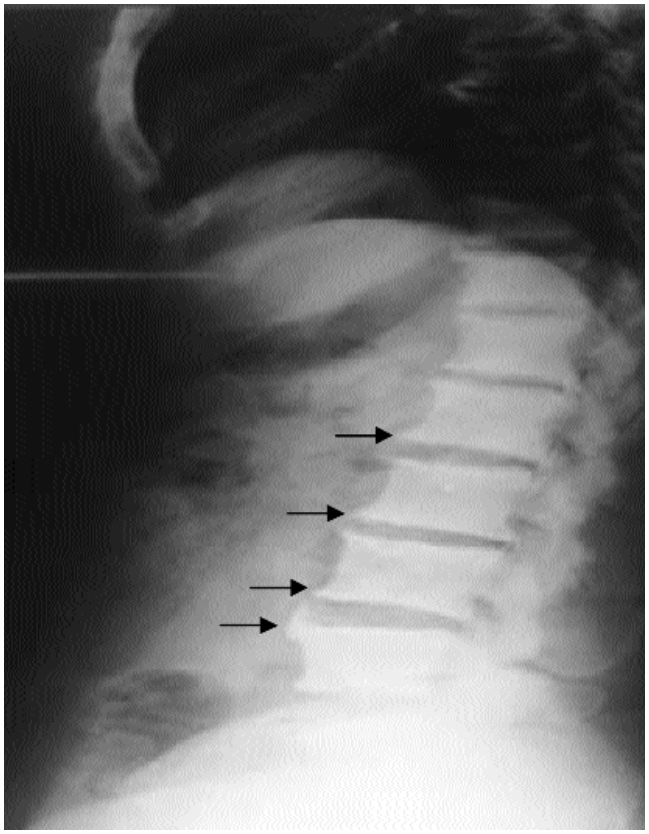

Figure-2: Plain x-ray of dorso-lumbar spine showing osteophytes.

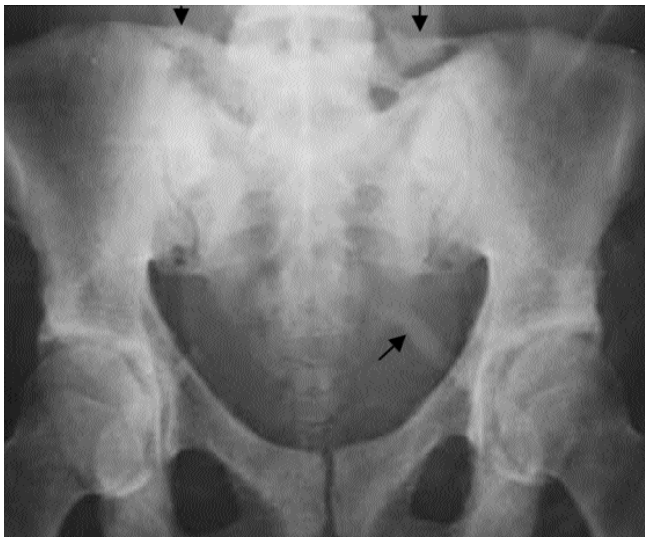

Figure-3: Plain x-ray of pelvis showing ossification of illio-lumbar and sacro-spinous ligaments (arrowhead).

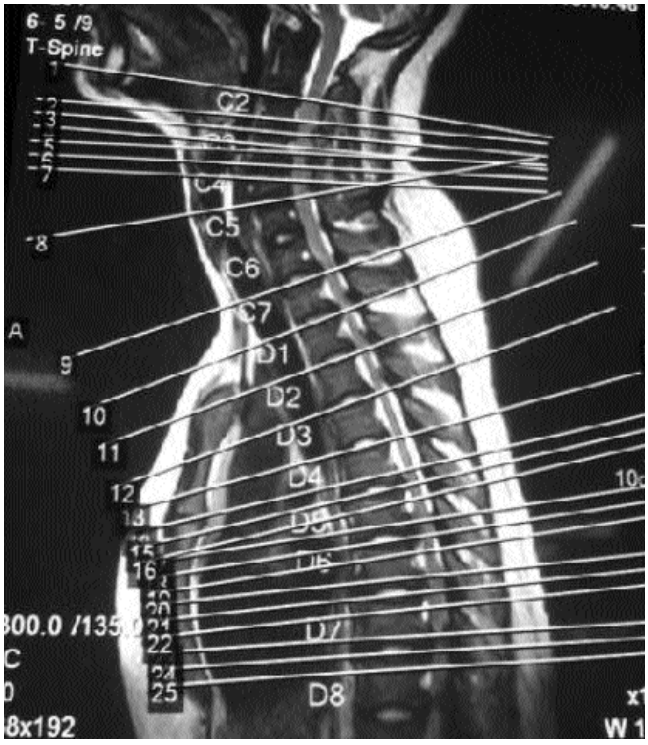

Figure-4: MRI of cervical dorsal spine showing widespread compression of cord. (C2-C5, C7-D2, D4-D8).

examination of both upper limbs was normal. Her higher mental functions and cranial nerves were intact. Rest of the examination was unremarkable. Other family members seen, also had brown dental staining.

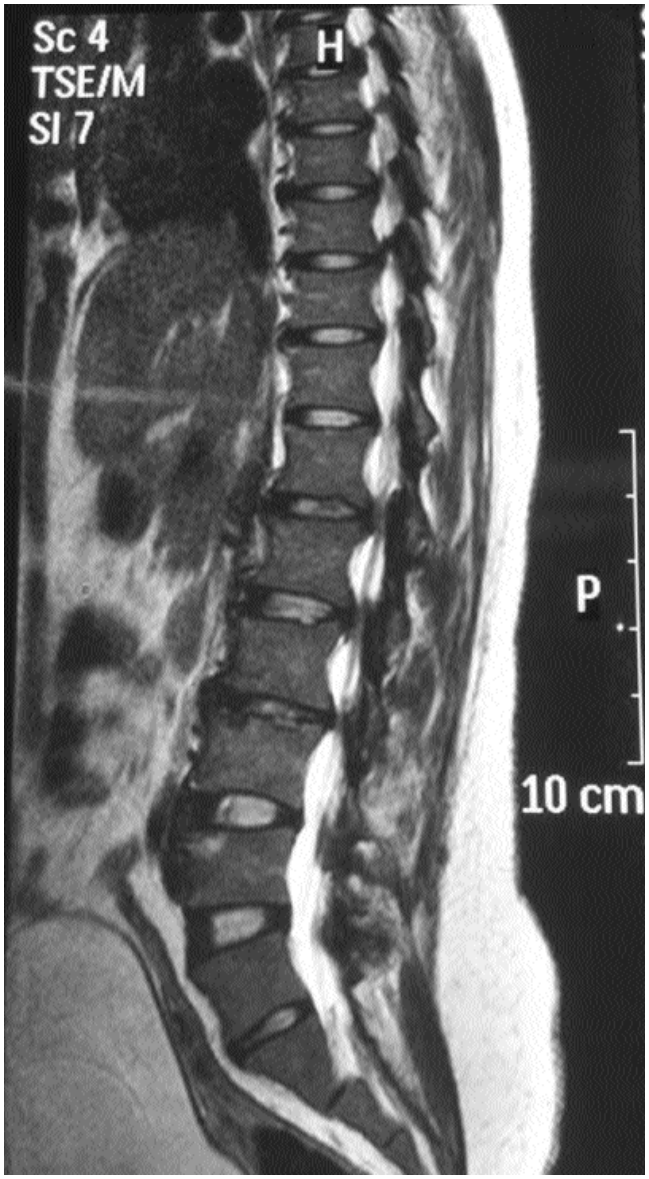

Figure-5: MRI of dorso-lumbar spine showing compression of the cord at multiple levels (L1-L4).

Laboratory investigations, including complete blood count, urea, creatinine, electrolytes, ESR, calcium, albumin and alkaline phosphatase, were all within normal ranges. Radiology (Figure-2-3) showed high density bones, ossification of sacro-spinous and illio-lumbar ligaments, as well as extensive osteophytes of vertebral bodies. MRI (Figure-4-5) of cervical and dorso-lumbar spine showed diffuse low signal marrow, hypertrophy of ligamentum flavum, causing canal stenosis and compression of the cord at multiple levels especially at D7-D8. Her serum fluoride level was found significantly elevated at 1.3ppm

(normal range is 0.008-0.045ppm).[5,6] Drinking well water was obtained from her locality and analyzed, with confirmation of high fluoride level of 4.6ppm (WHO safe limit is 1.5 ppm).[7]

Discussion

Water with high levels of fluoride is found either at the foot of high mountains or where the sea has produced geological deposits. There are documented belts of high fluoride content water, and one such belt also stretches from Turkey through Iraq, Iran, Afghanistan, India and Northern China. Hence maximum cases of fluorosis have been reported from India and China. The mountainous terrain also stretches through Northern and Western Pakistan, and hence exposes the population resident there to similar risks. However, there is scant reporting on chronic fluoride toxicity from Pakistan. Most fluoride in ground water is geological in origin, being derived from breakdown of rocks and soils and atmospheric volcanic particles. It can also be derived from infiltration of chemical fertilizers, septic tank and sewage treatment discharges and chemical effluents. Major reasons for escalating deterioration of ground water appear to be dumping of untreated sewage, industrial effluents, excessive use of insecticides and chemicals.

Fluorosis has been reported globally with various factors responsible for this overload. These include use of deep well water, burning coal; excessive intake of tea, wine, toothpaste, industrial exposure and certain drugs. However, fluoride rich ground water consumption appears to be the main cause in Pakistan. Tahir et al have reported water fluoride content from 16 different cities of Pakistan, with ground and underground water fluoride content ranging from 1.6-25 mg/l, which is way above the WHO safe limit of 1.5ppm.[8] Moreover, the highest levels were seen in Balochistan and Punjab. Despite this, only limited number of cases has been reported from Pakistan. The case of crippling fluorosis reported here, in a family resident in Thul, Sindh, were all using well water for drinking with an estimated fluoride consumption of approximately 24mg/day. Due to excessive heat, approximately 6-7 liters of water was consumed individually, daily through drinking water alone.

Pakistan is projected to have even more severe water scarcity issues than what we are faced with at the present time. In addition to being an agricultural country, it has major water consumption for this purpose. This escalating need, combined with exponential growth in the use of chemical fertilizers, may contribute to deteriorating water quality in areas adjoining these activities. The percapita water availability in Pakistan is steadily falling from 5000/m^3 in 1951 to a projected decline upto a level of 700/m^3 by 2025, which is below the internationally prescribed scarcity rate.[9] The resultant over exploitation has led to decrease in quantity as well as deterioration in quality of subsoil and surface water. Pakistan Council of Research in Water Resources (PCRWR) have in addition to bacteriological contaminants (68%), identified arsenic (28%), nitrate (13%) and fluoride (5%), as the major contaminants of water and have also red flagged areas of Pakistan especially at risk.[10] We have already published the devastating effects of excessive arsenic content of subsoil water for families near Sukkur, using well water.[11] Even though removal of fluoride from water is difficult and expensive, it may be the only option for providing safe drinking water in some areas. De-fluoridation may be done with bone charcoal, contact precipitation, use of nalgonda or activated alumina. Only drinking and cooking water should be treated in such a manner, as the residue of concentrate has also to be disposed of safely. Once deposited in the bone over a long period of time, there is no known remedy for extracting the excess fluoride. Teriperatide, by increasing the bone turn over, may offer some scope for therapy in skeletal fluorosis.

Chronic fluoride poisoning progresses to manifest with dental, non-skeletal and skeletal features, hence affecting almost every organ system. Duration of exposure is a key determinant of severity and nature of the disease. Dean classified dental fluorosis from mild form of white streaking to severe brown staining and pitting[12] during tooth development; contrary to its decay preventing effect when consumed in small beneficial amount as recommended by WHO i.e. <1.5mg/l. Symptoms of skeletal form range from pain in the neck, back and joints to paraesthesia in the limbs. This could be the consequence of fluoride consumption above 2ppm.[13,14] Consumption of about 10-25mg fluoride per day may lead to skeletal form in about 10-20 years.[15] Skeletal changes may include sclerotic bones, ossification of ligaments, stress fractures, osteophytes causing narrowing of spinal and neural foramina. Moreover, pain and stiffness of joints and muscles as well as involvement of every organ system including kidneys, neurological and endocrine system is possible.[16] Neurological manifestations result from compression of the nerves and roots causing radiculopathy, myelopathy and neuropathy.[17] X-ray and imaging findings are characteristic, low intensity signals in both T1 and T2 images, hypertrophy and sclerosis of ligaments and narrowing of foramina, as presented in our case, are characteristically demonstrated. MRI has an edge over X-ray and CT to demonstrate intraspinal ligaments, especially prior to calcification.[18] Serum fluoride levels are

usually elevated.[17] High bone mineral density, serum, urinary and nail fluoride levels are diagnostic. There is no specific curative treatment. Moreover, neurosurgical interventions are limited.

A recently reported MRI study of spine of residents of Manga Mandi and of Thar Desert also confirmed changes of accelerated vertebral sclerosis, anterior disc herniation and a high incidence of spinal haemangioma. This study showed pre-symptomatic soft tissue changes in the spine of residents of these areas, showing premature degeneration of the spine and calcification in the para-spinal tissues.[4]

A study conducted by Iftikhar et al has confirmed the presence of statistically significant elevated levels of plasma, serum and urinary fluoride levels in a cohort drawn from indigenous residents of Thar compared to a matched population drawn from Gadap area of Sindh.[19] Both cohorts consumed underground water extensively. Water samples from these wells in the Thar desert showed fluoride levels of 7-12mg/L, which were far in excess of fluoride levels prescribed by WHO for human consumption.[6] Groundwater fluoride concentration of Thar Desert has been documented to be between 7-32 mg/L.[19]

Conclusion

Many areas of Pakistan are already identified and documented as areas of high fluoride and arsenic content in ground water. Huge population resident in these areas are suffering from serious and debilitating consequences of chronic fluoride and arsenic over dosage from consumption of toxic water. There is an urgent need to disseminate this public health message of great importance. Serious and urgent government intervention is required to provide safe drinking water in these areas.

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