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Fluorosis of the Cervical Spine

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Fluorosis in human being was first reported as an occupational disease by Feil in 1930 [1]. Roholm [2] in 1937 published, a monograph on chronic fluoride intoxication based on a study of 12 post mortem cases and 68 clinical cases exposed to cryolite dust, which is a mineral containing sodium, aluminium and fluoride. Subsequently, skeletal fluorosis was reported as a disease endemic to an area in the Madras presidency of India by Shortt et al. in 1937 [3]. Fluorosis is prevalent in India and cases have been reported from China, Middle East, Africa, U.K., U.S.A., etc.

The optimum fluoride content of drinking water is 1ppm., but even consuming water 3 - 5 ppm., may not produce skeletal fluorosis in individuals with healthy kidneys. But in a tropical country like India, the optimum fluoride level is low, ranging between 0.3 - 0.5 ppm., since individuals consume enormous quantities of water especially in summer months. In view of higher fluoride intake from water as well as foods, the incidence of fluorosis is high in India.

It has been estimated that 25 to 30 million people are at risk of developing skeletal fluorosis and half a million people are actually suffering from the disease.

There are two large endemic belts in our country, one in the northern part of the country consisting of Punjab, adjacent areas of Haryana, U.P., and Rajasthan. In the southern region there is a large endemic area in Andhra Pradesh which extends to adjacent Tamil Nadu and Karnataka. It may be pertinent to note that the maximum quantity of fluoride in drinking water is 29.7 ppm., found in Andhra Pradesh (Nalgonda district).

Skeletal fluorosis affects usually the manual labourers who drink huge quantities of water. Fluorides are absorbed rapidly from the gut by a process of simple diffusion without any mechanism of active transport. Dietary components like salts of calcium, magnesium and aluminium reduce the fluoride absorption by forming their less soluble fluorides. About 96 to 99% of the fluoride retained in the body combines with mineralised bones since fluoride is the most exclusive bone seeking element on account of it affinity for calcium phosphate. There is no significant retention of fluoride in the body, if only small quantities like 4 - 5 mg, is ingested per day. But when more than 5 mg is ingested per day, half of it is retained by the skeleton and the rest is excreted through the urine.

The uptake of fluoride by the skeleton is very rapid and depends upon the vascularity and its growth. The fluoride uptake of young ones is faster than of mature bones. Fluoride is incorporated more readily in the active growing and cancerous areas than in the compact regions. The fluoride concentrations in the skeleton increase almost proportionately to the amount of fluoride ingested and the duration of its ingestion [4].

The amount of fluoride present in the various bones of the same skeleton differs from bone to bone with the pelvis, vertebrae and ribs registering higher fluoride content than limb bones. Physical strain involved, like carrying of heavy loads on the head or the back apparently quickens the development of fluorotic changes in the bones and also their manifestations in the spine [5]. The amount of fluoride deposited in the bones of the experimental animals was found to be related to the activity of the muscles attached to them [6]. Thus it is the cervical spine that is commonly affected by fluorosis because of increased mobility. Though the lumbar spine is usually the first to exhibit skeletal changes caused by fluorosis, compression of cauda equina rarely occurs because its roots are well accommodated due to the spacious spinal canal. Because of the less mobility of the thoracic spine, it is not affected by fluorosis to such an extent as the cervical spine [7].

Material and Methods

Fluorotic spinal compression is of fairly common occurrence in our unit and during the past three years, excluding the cases of TB, trauma, spondylosis and prolapsed discs, they accounted for 20% cases of spinal compression operated during this period. During the past 15 years, 40 cases of cervical cord compression (fluorotic) have been operated, out of which 4 were females. Their age distribution is shown in Table 1.

Table 1 - Age Distribution

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The clinical features of these cases are summarised in Table 2.

Table 1 - Clinical features

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Radiological investigations confirmed the nature of the disease and indicated the degree of skeletal changes. They all had grade-III fluorotic changes. Apart from routine blood and urine examinations, these patients were particularly examined for impaired renal function, as measured by blood urea and serum creatine. In all these forty cases, the blood urea and serum creatine were normal. There is a separate group of patients (15), in whom, these investigations were abnormal and hence the skeletal fluorosis in those patients was thought to be due to occult renal disease. In some of them renal ultrasound and IVP were done and they revealed bilateral contracted kidneys with irregular margins [8]. In this series, 7 patients were subjected to lung function tests, which revealed restrictive lung disease in 5 cases and in another 2 patients, there was also reversible airway obstruction.

Radiological investigations include X-rays of the cervical spine, chest PA & forearms. All the patients underwent myodil myelography which showed extradural partial or total compression. Recently we have started doing CT scan of the spine for some of these patients and the visualisation of the narrowing of the canal due to osteophytes from different directions has been very impressive apart from avoiding multiple myelographic procedures, which is often necessary in these patients [9]. Figures 1 to 3 are CT pictures at C2 level showing an osteophyte behind the odontoid process.

- ***Skiagram of the forearm showing calcification of the intero-osseous membrane***
- ***Skiagram of the cervical spine showing extreme sclerosis of the bone and calcification of the ligaments***
- ***Cisternal myodil myelogram showing extradural compression at C2 level***
- ***CT scan at C1 level showing an osteophyte behind the odontoid process***

Surgical intervention was undertaken in such of those cases without extensive skeletal involvement, good pulmonary and renal functions. The extent of the decompression was decided on the operation table depending upon the extent of skeletal compression.

Results

Outcome

Outcome

Out of the forty cases of fluorotic cervical cord compression, 30 patients made reasonably good recovery, who are independent in the routine activities of daily life. Three patients died in the immediate postoperative period, one due to severe myocardial infraction and the other two deteriorated in neurological state, after the surgery and died of respiratory problem.

Long term follow-up has been poor except in 6-7 patients. It is not known what would happen if they go back to their native place and continue to consume the water and diet containing high fluoride levels. Inspite of that, in selected cases, surgical decompression is useful.

Discussion

Fluorotic spinal compression seems to be lot more commoner than was presumed. With increased awareness, more number of cases of fluorosis have been reported from non-endemic areas like Maharashtra, Gujarat (Bhagwati & Singhal, personal communication 1985), and may be from some other parts. Among the investigations, CT scan is the ideal one, due to its noninvasive nature and better visualisation of the compression, apart from avoiding multiple myelographic procedures. Anaesthetic problems and respiratory care in the postoperative period have to be specially attended to. In selected cases, results are quite encouraging following surgery.

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