

Rare Case of Diffuse Skeletal Fluorosis due to Inhalant Abuse of Difluoroethane

Olivia G. Leonovicz, B.S.; Patrik Suwak, D.O.; J Chandler Van Dyke, M.D.; Kaleb J. Robin, B.S.; Matthew G. Cable, M.D.
LSUHSC, Department of Orthopaedics.



Introduction

- Skeletal fluorosis is a metabolic bone disorder caused by excessive ingestion or inhalation of fluoride
- Serious health concern among poor populations in volcanic regions that have elevated fluoride concentrations of potable water such as India, Asia, and Africa
- A rare diagnosis in developed countries where water monitoring regulates fluoride content of potable water [1,2]
- Sporadic cases occur from excessive ingestion of fluoride which can occur from certain teas or wines with high fluoride content, eating toothpaste, or drinking well water
- An extremely rare cause of systemic fluorosis is the inhalational abuse, or “huffing”, of aerosolized dust cleaner containing difluoroethane [3,4]

Case History and Exam

- 56-year-old man
- Presented to the orthopedic oncology clinic, referred for potential metabolic bone disease
- Complaint of 5-year history of progressively worsening lumbar and bilateral ankle pain. His back pain was constant and ankle pain was aggravated with ambulation
- Initially denied any history of substance abuse or environmental exposures
- After several office visits, and only after the confirmatory elevated serum fluoride test disclosed his two year history of inhalational abuse of dust cleaner, a refrigerant-based propellant cleaner containing 1,1-difluoroethane using 3 cans daily
- Physical exam significant for multiple, non-tender, bony prominences over the bilateral tibial crests and multiple areas of cutaneous hypopigmentation over his legs attributed to chronic aerosol burns from topical abuse of computer cleaner
- Subjective tenderness of the lumbar spine was non-reproducible
- Neurologic exam was benign
- Initial laboratory workup revealed an elevated alkaline phosphatase, while parathyroid hormone, calcium, serum lead, and HLA-B27 were in normal limits
- The radiographic workup prompted concern for fluoride toxicity, and the serum fluoride level was significantly elevated (Figures 1-3)

Imaging



Figure 1. A/P radiograph of the left forearm (left), right tibia and fibula (right) demonstrate multifocal areas of periosteal bone formation. There is relative osteopenia of the long bones when compared to the sclerotic axial skeleton



Figure 2. Bone scan (right) demonstrates multifocal areas of increased radiotracer uptake consistent with osteoblastic activity within the axial skeleton as well as along multiple long bones consistent with periosteal bone formation. PA radiograph of the left hand (left) exhibits irregular, solid periosteal reaction of the long bones and hyper-sclerotic carpals



Figure 3. Lateral radiograph of the cervical spine (left) and A/P radiograph of the pelvis (right) demonstrate predominantly diffuse sclerosis of the axial skeleton, including the cervical/lumbar vertebral bodies and pelvis

Discussion

- A sporadic form of diffuse skeletal fluorosis developed from the inhalational abuse of an aerosolized computer cleaning spray containing 1,1-difluoroethane which can cause psychoactive effects including dizziness, loss of inhibitions, and feelings of euphoria
- Dangers of abusing 1,1-difluoroethane include cardiomyopathy, myocarditis, kidney injury, and systemic fluorosis [3,4]
- Renal osteodystrophy typically displays osteopenia earlier, more often, and with a typical subperiosteal resorption pattern and characteristically displays a “ruger jersey spine”
- Hypervitaminosis D results in a diffuse sclerotic appearance and other findings of hypercalcemia including nephrocalcinosis, peptic ulcer disease, and pancreatitis
- In Paget's disease of the bone, earlier phases will feature an osteolytic/lucent appearance, whereas sclerotic changes occur later in the disease process and manifestations of Paget's disease include squaring of the vertebral bodies, ivory vertebrae, a characteristic mosaic bone pattern, and coarsened trabecular pattern on histology
- Myelofibrosis will show a diffuse sclerotic pattern without bony architectural distortion typically involving the axial skeleton, ribs, proximal humerus, and femur as well as hepatosplenomegaly and evidence of portal hypertension
- Malignant etiologies such as lymphoma and metastatic disease can have a variety of mixed diffuse, focal, lytic and sclerotic appearances
- Spondyloarthropathies such as ankylosing spondylitis will demonstrate squaring of vertebral bodies, findings consistent with sacroiliitis, diffuse syndesmophytic ankylosis, and enthesopathy

Conclusion

- Although this pathology is endemic in some parts of the world, it should be considered as a differential diagnosis for patients with characteristic radiographic findings and history of inhalant abuse

References

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