Journal of Medical Imaging & Case Reports

https://doi.org/10.17756/micr.2025-119

Case Report

Open Access

Keyboard Duster Abuse and its Rare Consequences: A Case of Skeletal Fluorosis

Keith Stolzfus[1], Priya Sunkara[1*], Keren George[1], Andrew Fisher[2] and Raman Desikan[3]

[1]*White River Medical Centre, White River Health, United States*
[2]*Department of Radiology, White River Medical Centre, White River Health, United States*
[3]*Department of Hematology-oncology, White River Medical Centre, White River Health, United States*

***Correspondence to:**
Priya Sunkara
White River Medical Centre,
White River Health,
United States.
E-mail: priyasunkara1111@gmail.com

Received: July 14, 2025
Accepted: September 12, 2025
Published: September 17, 2025

Citation: Stolzfus K, Sunkara P, George K, Fisher A, Desikan R. 2025. Keyboard Duster Abuse and its Rare Consequences: A Case of Skeletal Fluorosis. *J Med Imaging Case Rep* 9(2): 35-37.

Published by United Scientific Group

Case Report

Skeletal fluorosis is a metabolic bone disease caused by chronic exposure to fluoride ions, which could be due ingestion or inhalation. Keyboard duster inhalation is a unique form of substance abuse that can cause skeletal fluorosis due to containing 1-1 difluoroethane.

A 42-year-old female with depression, anxiety, and a history of polysubstance abuse (methamphetamine, benzodiazepines, and compressed-gas duster inhalation) was evaluated by an orthopedic surgeon for low back and hip pain. Initial labs showed C-reactive protein – 1.64 mg/dL (normal range (NR) – 0 - 0.99 mg/dL), erythrocyte sedimentation rate – 50, and alkaline phosphatase – 584 U/L (NR – 38 - 126), with a negative autoimmune antibody panel. Computed tomography (CT) scan revealed diffuse lumbar spine sclerosis, an old T12 compression fracture, and a subacute L1 compression fracture (Figure 1 and figure 2). Her history included prior cervical spine surgery, ankle fracture, and a nondisplaced metatarsal fracture. Oncology referral was made to rule out malignancy; CT of the chest/abdomen/pelvis and mammogram were negative for malignancy, shows diffuse sclerotic changes with hyperostosis at capsular attachments (Figure 3). Bone scan showed diffuse skeletal hyperactivity, consistent with a super scan (Figure 4). X-ray ankle showed subtle diffuse osteosclerosis (Figure 5). Serum and urine monoclonal proteins were negative. After taking a detailed history, the patient admitted to relapsing and abusing multiple substances, including keyboard duster. An investigation into the contents of the keyboard duster showed the presence of 1,1-difluoroethane, prompting suspicion of skeletal fluorosis. Serum alkaline phosphatase was elevated to 752 u/L; alanine transaminase, aspartate aminotransferase and creatinine were normal. Parathyroid hormone (PTH) was elevated to 125 pg/mL (NR - 10 - 55), with normal calcium. Despite normal calcium, her 25-hydroxy vitamin D was low (25 ng/mL). Urine fluoride was elevated to 4.5 mg/L (0.2 - 3.2 mg/L), as was the urine fluoride/creatinine ratio - 8.2 mg/g (NR - 0.0 - 3.0); however, serum fluoride was normal. Serum and urine fluoride were quantified using ion specific electrode, performed at Quest diagnostics. Malignancy, autoimmune diseases, renal and hepatic causes were ruled out before concluding this diagnosis of skeletal fluorosis secondary to keyboard duster inhalation. Patient was educated on underlying causes of bone abnormality and advised to avoid compressed-gas duster inhalation.

Discussion

Skeletal fluorosis is uncommon in developed countries. The endemic form, observed in less developed regions, is typically caused by ingestion of groundwater with elevated fluoride concentrations. In developed countries, fluorosis usually results from oral ingestion of medications—such as voriconazole, used for chronic fungal prophylaxis or from excessive consumption of fluoride-rich substances

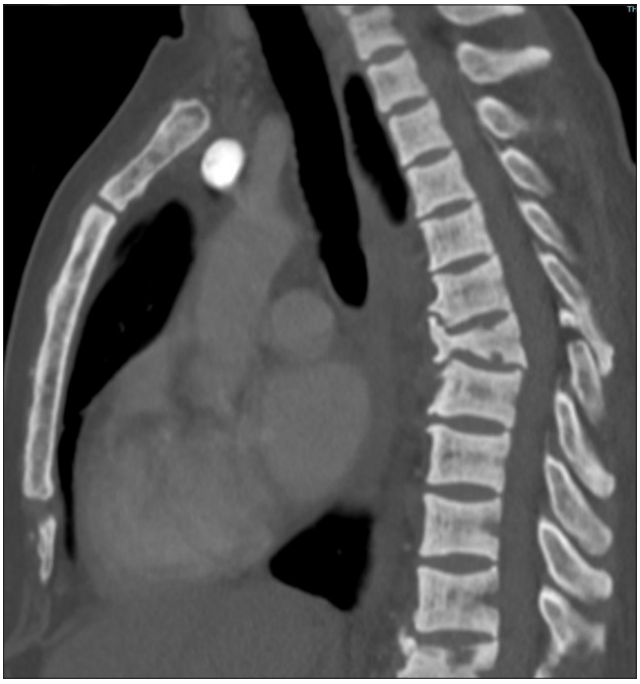

Figure 1: Diffuse sclerotic changes in the bony structures with chronic pathologic mid-thoracic compression fracture.

Figure 2: Diffuse sclerotic changes with chronic pathologic fractures of thoracic and lumbar vertebral bodies.

like black tea, surreptitious ingestion of toothpaste, or inhalant abuse involving volatile anesthetics and fluoride-containing aerosols [1].

Ingested fluoride is deposited in bones, where it has a half-life of more than seven years [2]. Fluoride becomes incorporated into the hydroxyapatite crystals, altering bone

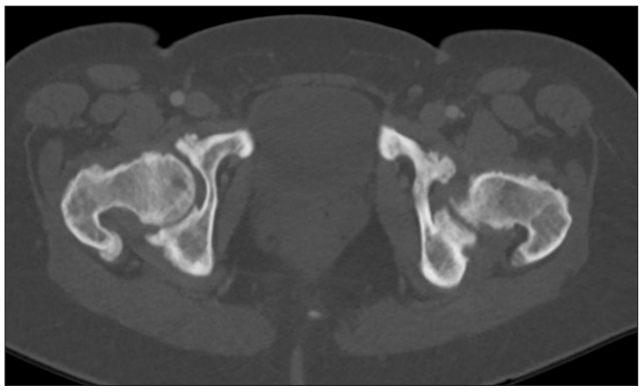

Figure 3: Diffuse sclerotic changes with hyperostosis at capsular attachments.

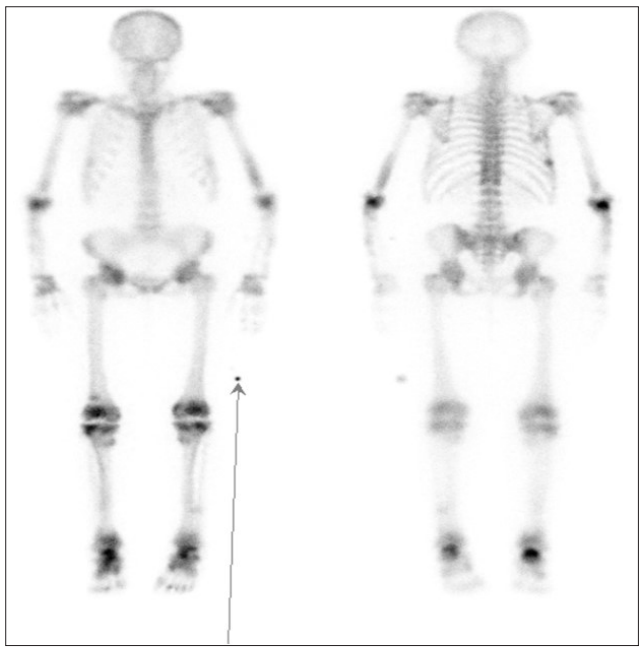

Figure 4: Diffuse increased osseous uptake on Tc-99m radionuclide bone scan resulting in super scan. Also, right rib pathologic fracture.

strength. It influences bone remodeling via the Runt-related transcription factor and receptor activator of nuclear factor-κB ligand pathway, affecting the expression of osteocalcin and osteoprotegerin, leading to increased osteoblastic activity [3]. The elevated urine fluoride with normal serum fluoride is consistent with recent exposure, as fluoride is rapidly excreted. Serum fluoride reflects only short-term exposure and may normalize quickly, while urine levels can remain elevated due to renal clearance of stored skeletal fluoride, especially in chronic exposure settings. A recent study by Patriarca et al. [4] reported skeletal fluorosis in patients following inhalation of computer cleaner containing 1,1-difluoroethane for six months. The study emphasized the dose-response relationship between inhalant exposure and severity of bone changes, highlighting the importance of detailed substance use history in similar presentations [4].

Clinical features include dental mottling (more common in endemic forms due to excessive fluoride exposure during childhood), bone pain, joint stiffness, and an increased risk of fractures. The severity of clinical and radiologic findings correlates directly with the amount of fluoride accumulated in the skeleton.

Figure 5: Periosteal reaction noted in proximal phalanx of fifth toe and in distal tibia with more subtle diffuse osteosclerosis.

Elevated PTH is a recognized effect of fluoride ingestion. This elevation may occur as a compensatory mechanism for hypocalcemia; however, a direct stimulatory effect of fluoride on the parathyroid glands is also possible. Increased PTH contributes to the progression of skeletal fluorosis [5].

Low 25-hydroxy vitamin D levels can decrease calcium absorption and facilitate fluoride accumulation in bones. In this context, multiple animal and human studies have shown that 25-hydroxy vitamin D not only serves as a mitigating factor but may also have therapeutic potential in the management of skeletal fluorosis along with calcium supplementation [6, 7].

Acknowledgements

None.

Conflict of Interest

None.

References

1. Joseph A, Rajan R, Paul J, Cherian KE, Kapoor N, et al. 2022. The continuing crippling challenge of skeletal fluorosis – case series and review of literature. *J Clin Transl Endocrinol Case Rep* 24: 100114. https://doi.org/10.1016/j.jecr.2022.100114
2. Mostafaei F, McNeill FE, Chettle DR, Wainman BC, Pidruczny AE, et al. 2015. Measurements of fluorine in contemporary urban Canadians: a comparison of the levels found in human bone using *in vivo* and *ex vivo* neutron activation analysis. *Physiol Meas* 36(3): 465-487. https://doi.org/10.1088/0967-3334/36/3/465
3. Yang L, Li Q, Wang S, Ji Y, Ma X, et al. 2024. Sirtuin 3-activated superoxide dismutase 2 mediates fluoride-induced osteoblastic differentiation *in vitro* and *in vivo* by down-regulating reactive oxygen species. *Arch Toxicol* 98(10): 3351-3363. https://doi.org/10.1007/s00204-024-03819-x
4. Patriarca T, Pescatore JR, Rushton W, Sochovka E, Brown J. 2025. Skeletal fluorosis: a case report of rare diagnosis of computer-cleaner toxicosis. *Clin Pract Cases Emerg Med* 9(3): 302-309. https://doi.org/10.5811/cpcem.42020
5. Koroglu BK, Ersoy IH, Koroglu M, Balkarli A, Ersoy S, et al. 2011. Serum parathyroid hormone levels in chronic endemic fluorosis. *Biol Trace Elem Res* 143(1): 79-86. https://doi.org/10.1007/s12011-010-8847-2
6. Bhowmik AD, Shaw P, Mondal P, Chakraborty A, Sudarshan M, et al. 2021. Calcium and vitamin D supplementation effectively alleviates dental and skeletal fluorosis and retains elemental homeostasis in mice. *Biol Trace Elem Res* 199(8): 3035-3044. https://doi.org/10.1007/s12011-020-02435-x
7. Mulualem D, Hailu D, Tessema M, Whiting SJ. 2021. Efficacy of calcium-containing eggshell powder supplementation on urinary fluoride and fluorosis symptoms in women in the Ethiopian rift valley. *Nutrients* 13(4): 1052. https://doi.org/10.3390/nu13041052