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CASE REPORT

Tophaceous pseudogout of the thoracic spine

Vasisht Srinivasan · Henry Kesler · Mahlon Johnson · Howard Dorfman · Kevin Walter

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Abstract Calcium pyrophosphate dihydrate deposition disease (CPDD, tophaceous pseudogout) is a rare crystal arthropathy characterized by pyrophosphate crystal deposition in joints, synovitis and chondrocalcinosis on imaging. We present the case of a 72-year-old man with 6 months of left chest pain; magnetic resonance imaging revealed a T9/T10 herniated disc. Intraoperatively, the material was sent for pathological analysis revealing pseudogout. Axial calcium pyrophosphate crystal deposition is rare but reported in the literature and found at the craniocervical junction and skull. Spinal calcium pyrophosphate crystal deposition is rare in the thoracic spine. It is often asymptompatic and can involve the disc or ligaments. This case demonstrates a unique presentation of CPDD.

Keywords Tophaceous pseudogout · CPDD · Herniated disk · Thoracic spine

Introduction

Calcium pyrophosphate dihydrate deposition disease (CPDD) is a crystal arthropathy which features calcium pyrophosphate crystal deposition in joint spaces, episodes of synovitis and radiological features of chondrocalcinosis [1]. The disease is most commonly found in the appendicular skeleton, with the shoulders, pelvis, knees and hands being the most frequently affected joints [1–4]. The axial skeleton is infrequently affected and CPDD often presents with symptoms mimicking more common diseases [2, 5]. Pathologically, calcium pyrophosphate dihydrate deposition appears as birefringent rhomboid polarizable crystals. We present a patient recently treated at our institution diagnosed with tophaceous pseudogout with unusual pathologic features.

V. Srinivasan (✉) · H. Kesler · K. Walter
Department of Neurosurgery,
University of Rochester Medical Center,
601 Elmwood Avenue, Box 670, Rochester, NY 14623, USA
e-mail: vasisht_srinivasan@urmc.rochester.edu

M. Johnson
Department of Pathology, University of Rochester Medical Center,
Rochester, NY, USA

H. Dorfman
Department of Orthopaedic Surgery, Montefiore Medical Center,
Bronx, NY, USA

Patient case

The patient was a 72-year-old, right-handed, Caucasian man with a 6-month history of left sided chest pain. While the pain was initially medically manageable, with pain medications and anxiolytics, it became increasingly progressive, disabling and omnipresent. His physical examination was unremarkable. A preoperative magnetic resonance imaging (MRI) scan was consistent with a left sided T9-T10 disc herniation with foraminal stenosis and T10 nerve root compression (Fig. 1a, b). Intraoperatively, removal of the left T9 lamina and exposure of the disc space revealed a mass lesion distinct from the disc space and adherent to the nerve root. The lesion was debulked and sent for frozen section analysis. Intraoperative pathology revealed a "calcified epithelioid tumor" suspicious for a meningioma.

The initial frozen specimen (Fig. 2) revealed amorphous material with focal epithelioid/meningothelial-like cells and an apparent psammoma body. The tissue was fixed in formalin, processed routinely and then stained with hematoxylin and eosin. Additional unstained sections were evaluated with polarized light and immunohistochemistry with monoclonal

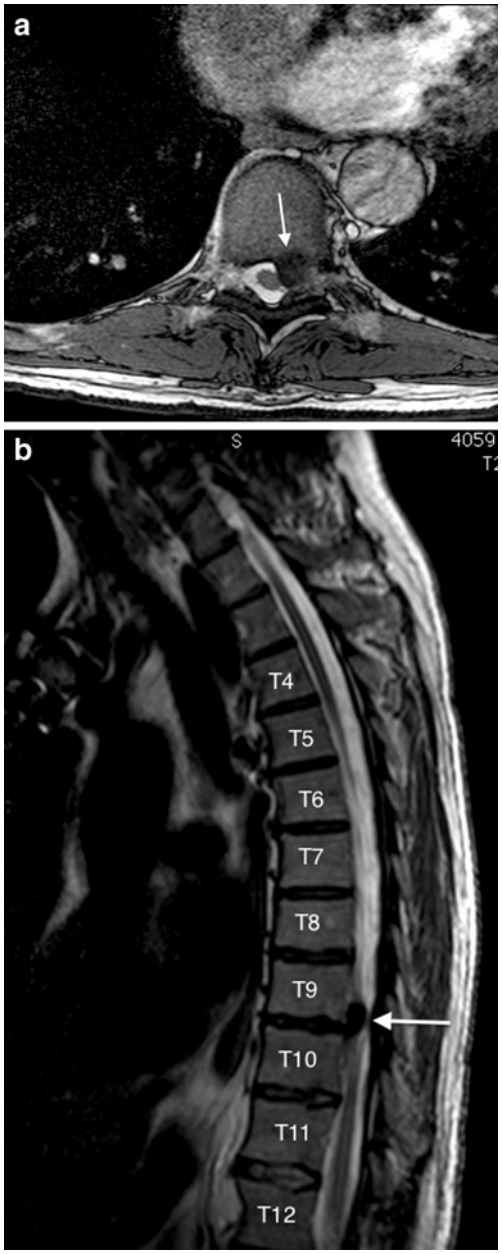

Fig. 1 **a** Axial view of a T2-weighted non-contrast MRI demonstrating herniation of the intervertebral disc with encroachment of the left T10 neural foramen. **b** Sagittal view of a T2-weighted non-contrast MRI demonstrating herniation of the T9/10 intervertebral disc

antibodies to EMA, S100, Factor 13, K-67, and collagen IV. For antigen retrieval, used with most antibodies, tissue sections were incubated in a thermoresistant chamber with Reveal Decloaker (Biocare Medical, Concord CA) at 120-123°C and a pressure of 20-24 psi for 45 min. Immunohistochemistry was performed Dako Automated immunostainer. Hematoxylin and eosin stain (H & E) and immunohistochemistry revealed an epithelioid mass with granular material, rare reactive chondrocytes (Fig. 3) and concentric calcifications resembling (but not true) psammoma bodies. Lesional cells

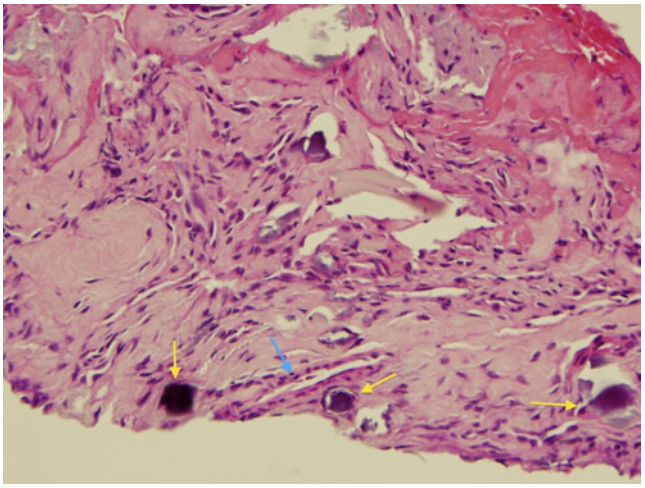

Fig. 2 Frozen section. *Yellow arrows* point to three psammoma bodies; *blue arrow* points to leptomeningeal cells with hyalinzed blood vessels (H & E, original magnification 400×)

had irregular nuclei and nucleoli. Initial stained sections revealed no polarizable material. However, birefrigent rhomboid crystals were found in sections made by one of us (H.D.) and also found in additional unstained deeper sections made by us at URMC (Fig. 4a, b). Ki-67 labeling was seen but appeared, in part, in reactive cells. No EMA, S100, factor 13 or CD68 immunostaining was seen. A final diagnosis of tophaceous pesudogout was made.

Upon further staining, the specimen (Fig. 3) appeared to be an epithelioid mass with granular material, with rare reactive chondrocytes and concentric calcifications. The cells themselves had irregular nuclei and nucleoli with rare mitoses and scattered Ki-67 labeling. Initial stained sections revealed no polarizable material. However, upon further analysis of deeper sections, and in concert with another

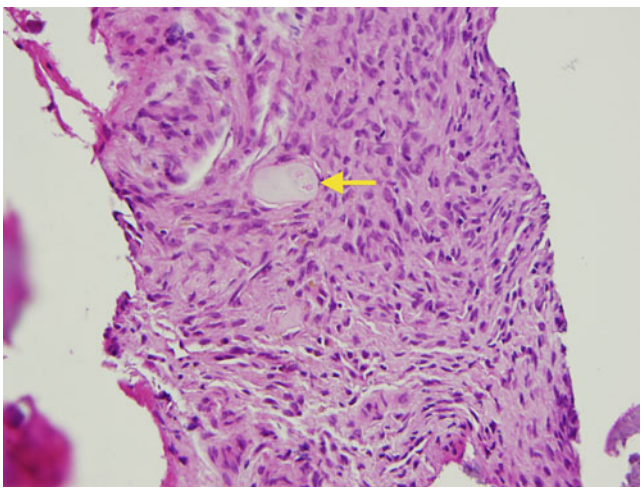

Fig. 3 Reactive chondrocyte (*yellow arrow*) seen alongside fibroblast stroma (H&E, original magnification 400×)

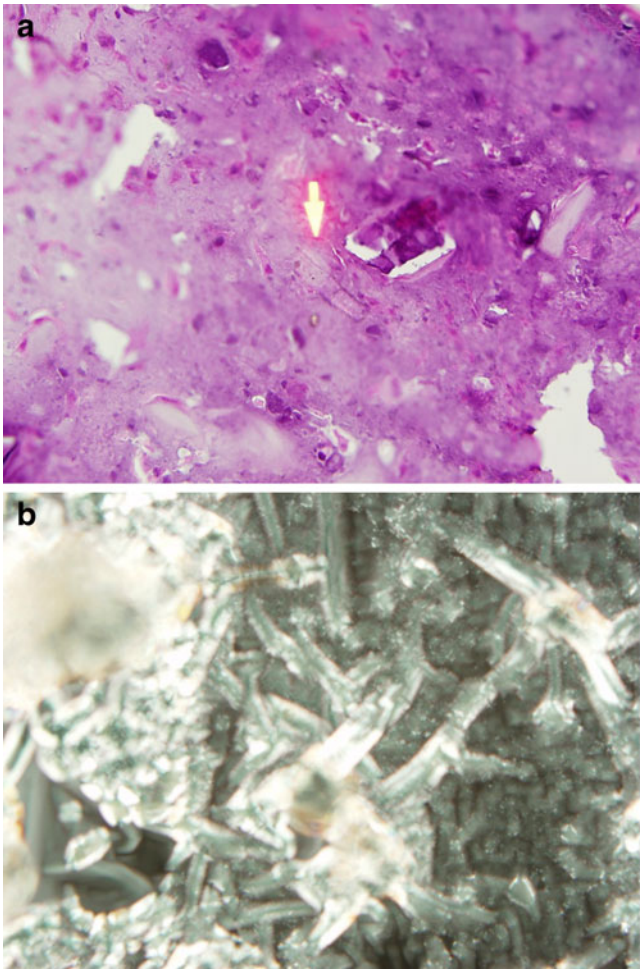

Fig. 4 **a** Presence of rhomboid crystals (*yellow arrow*) in deeper sections (H&E, original magnification 400×). **b** Needle and rhomboid crystals in deeper sections under polarized light (H & E, original magnification 400×)

institution, a final diagnosis of tophaceous pesudogout was made.

The patient did well postoperatively and was discharged home 3 days later. In his postoperative visits, he described very minimal pain, and only with sitting or lying for long periods of time. His pain was very well controlled with oral pain medications and anxiolytics.

Discussion

CPDD was first described by McCarty in 1962 as pseudogout due to its similarities to gout [2, 6, 7]. Previous work was done by Zitnan and Sitaj who described what they called "chondrocalcinosis polyarticularis" [2]. Abnormal pyrophosphate deposition in the joint space combines with calcium to form dihydrate crystals on collagen fibers; release of these crystals into the joint space results in neutrophil and monocyte-macrophage phagocytosis and release of inflammatory mediators, causing joint destruction [2, 8]. This becomes evident on radiological examination as chondrocalcinosis.

Calcium pyrophosphate deposition arthropathy is often associated with other conditions, including hyperparathyroidism, hemochromatosis, chronic gout, hypomagnesemia and hypophosphatemia [3]. It may also occur on a hereditary basis but is usually sporadic. The prevalence increases with age, with as many as 45% of those over 85 years of age affected in some manner [9]. The joints most commonly affected are the knee, shoulder, hip, elbow and metacarpophalangeal joints, while axial skeleton involvement is rare but reported in the literature [1–4]. Many times, spinal calcium pyrophosphate deposition is asymptomatic and can be an isolated site of disease [2].

Axial calcium pyrophosphate deposition involving the spine can be lytic and create pseudospondolylistheses (i.e., listhesis without a congenital pars defect) [3]. Some studies have shown the incidence of symptomatic calcium pyrophosphate deposition in the axial skeleton can be as high as 33% [9, 10]. Involvement of the ligamentum flavum or atalto-ocipital ligament can result in severe myelopathy or mimic cauda equina syndrome [3, 9, 11]. Radiologically, spinal involvement demonstrates loss of disc space height, vertebral body sclerosis, osteophyte formation and subluxation [3, 12]. Calcium pyrophosphate deposition at the craniocervical junction can effect the foraminal exit sites of cranial nerves, resulting in neuropathy [2, 5].

There are reports in the literature of calcium pyrophosphate crystal deposition in the intervertebral disc itself [1, 2, 4]. Previous disc surgery has been suggested as a risk factor for the development of calcium pyrophosphate deposition [1, 2]. In one study, seven of 73 discs excised over an 18-month period revealed signs of calcium pyrophosphate deposition; all seven had previous surgery at the same or an adjacent disc space [3, 5]. Most cases appear to affect the cervical spine, while thoracic spine is the least common site [4]. Histologically, the outlines of the crystal can be visualized on hematoxylin and eosin stains. Under polarized light, the variable birefringent rhomboid or rod-shaped crystals can be appreciated.

This case is unusual in that the patient presented with a commonly encountered problem (i.e., chest pain) in the outpatient setting, which, upon further investigation, was the result of an uncommon etiology. Furthermore, the first patient's specimen had features not associated with calcium pyrophosphate deposition (Psammoma bodies, meningeal proliferation) and did not initially reveal crystals under polarized light; further analysis demonstrated the presence of one rhomboid crystal (Fig. 4a) and deeper sections demonstrated needle and rhomboid crystals (Fig. 4b).

Conclusion

CPDD can be a rare cause of common symptoms and a high threshold of suspicion is necessary to arrive at the correct etiology. As calcium pyrophosphate crystal deposition often presents in patients with chronic illnesses, neurosurgeons may be the first to diagnose these problems by accurately diagnosing masses as calcium pyrophosphate crystal deposition.

Conflicts of interest None.

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Comment

The authors present an unusual presentation of an uncommon disorder in a well written and illustrated case report.

Daniel Resnick
Wisconsin, USA