KANSAS JOURNAL of MEDICINE

Case Report

Tophaceous Gout in the Axial Skeleton: An Unusual Case with Key Imaging Characteristics

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Received Aug. 31, 2024; Accepted for publication Nov. 1, 2024; Published online Feb. 17, 2025
Kans J Med 2025 Jan-Feb; 18:14-16. https://doi.org/10.17161/kjm.vol18.22771

INTRODUCTION

Gout is a common form of inflammatory arthritis, characterized by the deposition of monosodium urate crystals in joints and soft tissues.[1] The prevalence of gout in the U.S. is estimated to be approximately 3.9%, according to a National Health and Nutrition Examination Survey.[2] While most cases present as intermittent flares of monoarthritis, chronic tophaceous gout is a more severe form of the disease.[3] It is distinguished by the formation of tophi, which are large aggregations of monosodium urate crystals surrounded by inflammatory cells and tissues.[3]

The gold standard for diagnosing gout is joint aspiration or lesional biopsy, with visualization of the needle-shaped monosodium urate crystals under polarized light microscopy.[3] However, the clinical presentation and imaging findings of tophaceous gout can be nonspecific, often mimicking other conditions such as rheumatoid arthritis, infection, or malignancies.[4-6] Although magnetic resonance imaging (MRI) findings in gout lesions may resemble those of other inflammatory, infectious, or neoplastic conditions, computed tomography (CT) and dual-energy CT can provide crucial information for a more accurate diagnosis.[7]

In this case report, we present a detailed account of a patient with chronic tophaceous gout involving the thoracic spine, emphasizing the clinical presentation, and imaging findings. This unusual presentation highlights the importance of considering gout in the differential diagnosis of paraspinal masses and the critical role of different imaging modalities in reaching the correct diagnosis.

CASE REPORT

A 39-year-old male with a history of chronic variable immunodeficiency, disseminated histoplasmosis, and poorly controlled tophaceous gout presented with altered mental status, chest pain, and shortness of breath. Physical examination revealed focal swelling of the right elbow, multiple metacarpophalangeal and interphalangeal joints in both hands, and the right metatarsophalangeal joint, all corresponding to known gouty tophi. Additionally, there was generalized swelling and tenderness, along with pitting edema in both lower extremities.

An electrocardiogram was unremarkable. Initial laboratory work-up showed leukopenia, iron deficiency, and elevated C-reactive protein. The uric acid level was elevated at 6.1 mg/dL (target < 3 mg/dL), despite the patient taking 300 mg of allopurinol daily. A lumbar puncture revealed significantly elevated white blood cell and total protein levels, with findings positive for John Cunningham virus, also known as human polyomavirus 2. MRI of the brain showed confluent T2 hyperintense signal in the bilateral supratentorial white matter (Figure 1), consistent with progressive multifocal leukoencephalopathy.

A CT scan of the chest revealed multifocal paraspinal soft tissue masses along the thoracic spine, involving adjacent vertebrae and ribs, with sharply demarcated osseous erosions (Figure 2). Subsequent MRI of the thoracic spine showed multiple T1 and T2 hypointense enhancing paraspinal masses with associated osseous involvement and erosion (Figures 3 and 4). Some masses extended along the posterior intercostal spaces and transverse foramina into the adjacent epidural space, causing thecal sac narrowing and spinal cord compression.

While the sharply demarcated osseous erosions on CT suggested tophaceous gout or lymphoma, other possibilities included metastatic disease, plasmacytoma, and infection. A dual-energy CT scan revealed extensive uric acid deposition in the paraspinal and intercostal regions of the thoracic spine (Figure 5). A CT-guided needle biopsy at T8-T9 confirmed the diagnosis of gout.

The patient's gout treatment plan included increasing the dose of allopurinol and initiating recombinant uricase (such as pegloticase) to achieve better disease control. However, due to the complexity of his medical conditions and subsequent clinical deterioration, the patient chose palliative care and passed away one month after his initial presentation.

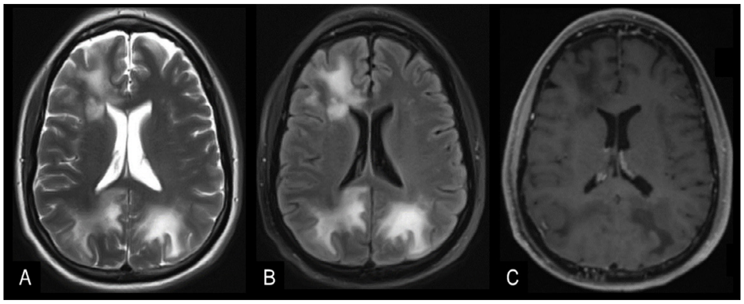

Figure 1. Axial T2 (A) and FLAIR (B) MRI images of the brain showing geographic and confluent T2 and FLAIR hyperintense signal involving the bilateral supratentorial white matter. Axial postcontrast T1 (C) demonstrates no associated enhancement.

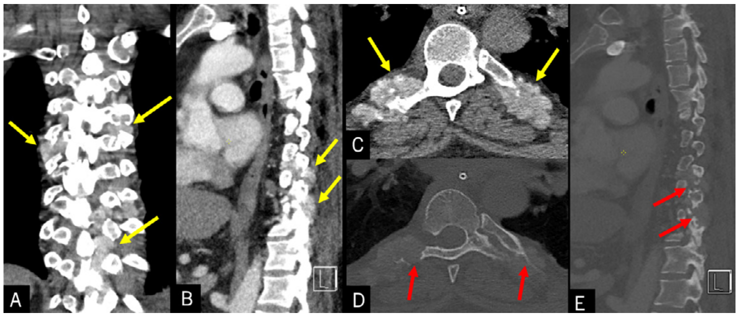

Figure 2. (A-C) Coronal, sagittal, and axial CT reformats demonstrate multiple paraspinal soft tissue masses with internal amorphous calcification (yellow arrows). (D-E) Axial and sagittal CT reformats with bone kernels demonstrate sharply demarcated osseous erosions (red arrows).

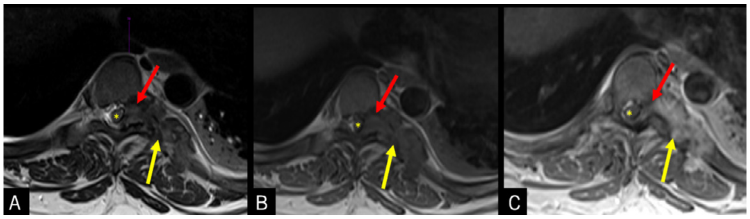

Figure 3. Axial MRI images of the thoracic spine demonstrate multiple paraspinal T2 hypointense (A) and T1 hypointense (B) masses with post contrast enhancement (C) (yellow arrows). The mass is noted to involve the posterior thoracic spinal elements, paraspinal soft tissues, and intercostal space. Some of these masses are noted to extend through the neural foramina into the epidural space (red arrows) with associated compression of the spinal cord (asterisk).

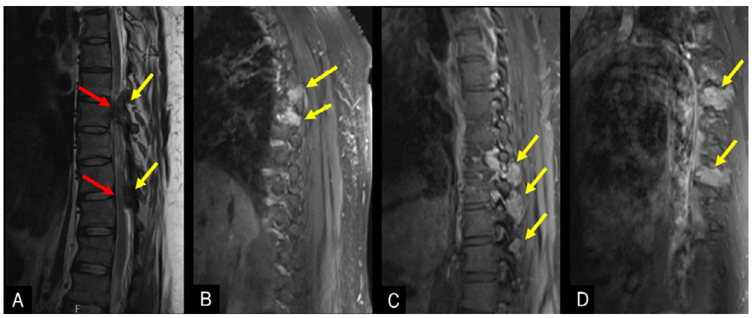

Figure 4. Sagittal T2 (A) and postcontrast sagittal T1 (B-D) MRI images of the thoracic spine again show the multifocal T2 hypointense, enhancing masses involving the adjacent vertebral bodies and posterior elements (yellow arrows). Some of these masses extend into the epidural space causing thecal sac narrowing and spinal cord compression at T7-8 and T10-11 levels (red arrows).

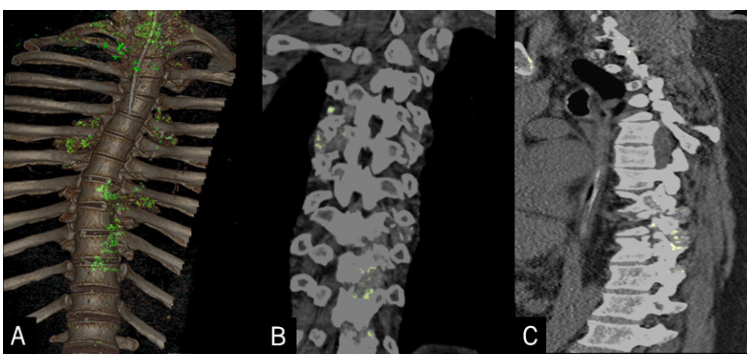

Figure 5. 3D reconstruction (A), and coronal (B) and sagittal (C) reformats of dual-energy CT with color mapping of the thoracic spine demonstrating green color-coded pixels in the paraspinal masses, indicating monosodium urate crystal deposition, confirming the diagnosis of gout.

DISCUSSION

Gout typically manifests in the peripheral joints, however as many as 29% of patients with gout have CT findings in the axial skeleton.[8] The prevalence of spinal gout is estimated to be up to 35% based on small studies, though the true value is still unknown due to some patients being asymptomatic.[9,10] When symptomatic, spinal tophaceous gout typically presents with back or neck pain resulting from compression of the spinal cord or nerve roots.[11] The lack of specific symptoms may lead to delayed diagnosis. In our patient, with a complex history and a myriad of non-specific imaging findings, suspicion of possible infection or disseminated metastasis could have masked the etiology of the spinal masses. Keeping a broad differential diagnosis and recognizing the imaging characteristics of gout are critical in differentiating these masses from other potential pathologies.

Conventional radiographs are the first line imaging tool in evaluation of rheumatic diseases. Classic radiograph findings of gout include well-demarcated marginal and juxta-articular erosions.[12] Chronic tophaceous gout typically have well defined punched out erosions.[13] CT typically demonstrates tophi as lesions with well-demarcated corticated osseous erosions and overhanging margins at the intra-articular and extra articular sites.[14] This finding was key in the presented case, as it raised suspicion for gout over other differential diagnoses, prompting further investigation. MRI in gout is considered sensitive but not specific with imaging features overlapping with other pathologies, so confirmatory support often is needed in the form of biopsy or other imaging modalities.[14] The typical appearance of tophaceous gout on MRI is lobulated lesions with intermediate or low T1 signal intensity, heterogenous signal intensity on T2 weighted sequences, and homogenous postcontrast enhancement.[14,15] Tophaceous lesions can cause mass effect resulting in spinal canal and neuroforaminal stenosis, and ligamentum flavum hypertrophy.[15] Gout tophi also can cause erosion of the facet joints leading to joint effusion.[15]

Dual-energy CT is an advanced imaging technique that can differentiate different substances based on the level of X-ray absorption. This is useful in detecting monosodium urate crystal deposition by using photon energy levels that correlate with monosodium urate crystals. A meta-analysis of 11 studies done by Ogdie et al.,[16] showed that dual-energy CT has a sensitivity of up to 0.90 and a specificity of up to 0.93 in gout diagnosis, compared to the standard of joint aspiration and crystal identification by polarized light microscopy.[17] Using dual-energy CT in conjunction with other imaging studies will allow for confirmation of suspected diagnosis. Spinal gout is initially treated with conservative management including anti-inflammatories and urate lowering therapy.[9] In patients with neurological symptoms, surgical treatment is recommended.[9]

CONCLUSIONS

This case underscores the importance of recognizing classic imaging features in the diagnosis of tophaceous gout, particularly in atypical or complex presentations. Both CT and MRI can help visualize masses and refine the differential diagnosis, while advanced imaging techniques like dual-energy CT add further value by confirming the diagnosis. It also emphasizes the need for considering a broad differential and employing a comprehensive diagnostic approach when evaluating patients with spinal masses.

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Keywords: gout, axial spondyloarthritis, gouty arthritis