

## CASE REPORT

# A Case of Spinal Infectious Osteomyelitis Versus Gout: Advanced Imaging with Dual Energy CT

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A 67-year-old male presented to the hospital for lower back pain and left lower extremity radiculopathy. Although the patient was afebrile and white blood cell count was normal, MRI was concerning for discitis/osteomyelitis at L4-L5. Subsequently, the patient developed a right knee joint effusion and underwent an arthrocentesis that was notable for the presence of urate crystals. A systemic urate crystal arthropathy was proposed as a potential etiology for the patient's back pain and radiculopathy. Dual energy CT of the lumbar spine was performed, a technique which determines material composition by comparing the photon attenuation of the substance from two different x-ray energy levels. Results revealed the presence of monosodium urate crystals in the intervertebral discs. This technique is proposed as a noninvasive way to evaluate for gout in atypical locations or those difficult to sample and may replace an invasive intervertebral disc/endplate aspiration and/or biopsy. Dual energy CT should be considered in patients with elevated serum uric acid and concern for spinal involvement of gout.

## CASE PRESENTATION

A 67-year-old male presented to the hospital for lower back pain that started 3 days prior to arrival, associated with muscle spasms and pain radiating to the left lower extremity. He denied any recent trauma or urinary/fecal incontinence, and there was no prior history of a crystal arthropathy. An MRI of the lumbar spine was initially performed without intravenous contrast, demonstrating increased T2 signal involving the L4-L5 disc, adjacent

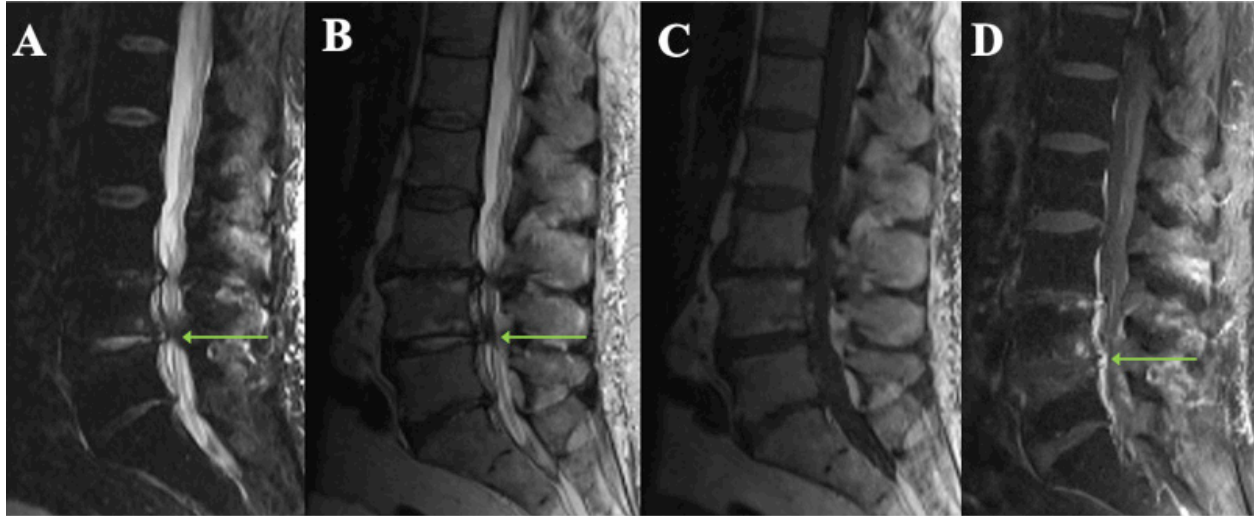
vertebral endplates, and right psoas muscle. The patient was noted to be afebrile with a normal white blood cell count. However, given concern for discitis/osteomyelitis, a contrast enhanced MRI was performed and was notable for absence of significant enhancement in the area of concern. A few days later, the patient developed right knee pain and joint effusion; an arthrocentesis was performed that revealed urate crystals. The following day, the patient developed right ankle and shoulder pain, with laboratory evaluation at this time significant for an increase in serum

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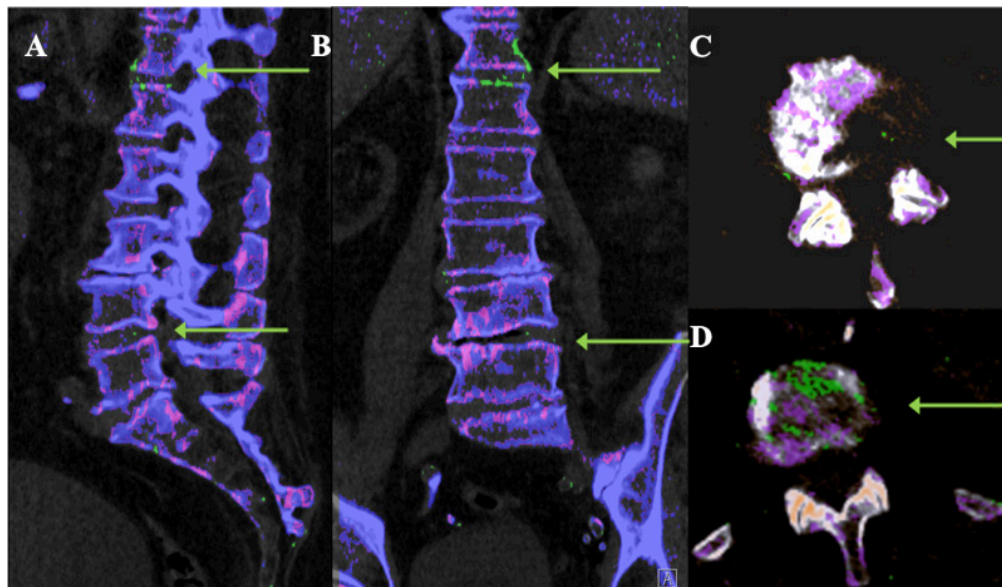
Abbreviations: MRI, magnetic resonance imaging; CT, computed tomography; kVp, peak kilovoltage; MSU, monosodium urate; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein.

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**Figure 1.** (A) Sagittal STIR and (B) sagittal T2-weighted MRI reveal hyperintensity in the disc and vertebral endplates at L4-L5. (C) Sagittal T1-weighted pre and (D) sagittal T1-weighted contrast images reveal mild enhancement, which can be seen with degenerative changes, and is less than expected for infectious discitis/osteomyelitis.



**Figure 2.** (A) Sagittal, (B) coronal, (C) axial L4-L5, and (D) axial T12-L1 post processed dual energy CT images through the lumbar spine show presence of scattered monosodium urate (MSU) crystals as green in color throughout the lumbar intervertebral discs.

uric acid, ESR, and CRP. This prompted the possibility of a urate crystal arthropathy as an etiology for the findings in the lumbar spine. Given the concern for gout, a dual energy CT of the lumbar spine was recommended.

## IMAGING FINDINGS

MRI without contrast revealed mild STIR and T2 hyperintensity (Figure 1 A,B) within the right aspect of the L4-L5 disc and the surrounding vertebral body endplates at L4 and L5, consistent with inflammatory edema. In ad-

dition, there was edema within the adjacent right psoas muscle. To further evaluate for discitis/osteomyelitis, an MRI was performed with contrast, but showed very mild enhancement (Figure 1 C,D) in the area of concern, which was not overwhelmingly supportive of spinal infection.

A dual energy CT was performed to evaluate the lumbar spine for presence of gout as an etiology of the patient's back pain. The CT was somewhat limited due to a lack of contrast to evaluate for inflammation or infection/abscess. There were osteophytic endplates along with some mild erosions, although these findings are alone

nonspecific and can be seen with degeneration, inflammation, or infection. However, there was a more specific finding with some of the dual energy CT post-processed images demonstrating a small quantity of monosodium urate (MSU) crystals (Figure 2) in the intervertebral discs.

## DISCUSSION

Gout is a common condition in the United States. The clinical presentation of gout depends on the location of MSU crystal deposits [1]. Although previously thought to be a rare complication, gout in the axial skeleton is now understood to be more prevalent than originally believed [2]. Spinal gout is the deposition of MSU crystals in the intervertebral joint spaces and discs. The presence of this deposition can cause inflammation and erosion of the affected joint, which can extend to the adjacent structures and result in a variety of symptoms. Spinal gout most frequently presents as back pain, myelopathy, or radiculopathy, as well as other nonspecific symptoms [3]. The most common location of the axial skeleton is the lumbar spine, followed by the thoracic, then cervical spine.

Given the clinical presentation of back pain and/or radiculopathy, imaging is generally initiated with plain radiograph (x-rays) and/or MRI evaluation. Radiography and CT may show osseous erosions or surrounding tophi. However, with early or subtle disease such as this case, these may not yet be present, and gout crystals are not as readily detected on conventional CT as compared to a dual energy CT. Signal characteristics of spinal gout on MRI can be varied, with T1 hypointense and heterogeneous T2 signal. In addition, there can often be contrast enhancement, which may relate to the amount of MSU deposition causing current inflammation. This case demonstrates only mild enhancement, compatible with the small quantity of urate seen on dual energy imaging. Gout is typically diagnosed when conventional CT and MRI findings prompt tissue sampling, yielding a sterile sample, although with MSU crystals.

While conventional CT can detect the mineralization associated with gout, it cannot distinguish it from dystrophic calcification. With the development of dual energy CT, differences in tissue attenuation can determine the material's composition. Dual energy CT can discriminate MSU crystals from other substances [3-8], even detecting small or low concentration lesions that would have been otherwise overlooked, with a sensitivity of 88-90% and specificity of 83-90% [9,10]. In addition, dual energy CT is a noninvasive technique that can be used to evaluate atypical locations or areas that are difficult for aspiration, such as the spine. It can also be used to estimate the extent of spinal involvement, thus assessing the severity and prognosis. As with any imaging technique, false positive results can occur with dual energy CT. Often, this can

occur in the setting of thickened skin or nails, which can occur if this technique is used to evaluate gout in an extremity. In the spine, false positive results can originate from artifacts from beam hardening artifacts from metallic objects or dense bone.

Dual energy CT technique includes the acquisition two sets of data, usually at 80 and 140 peak kilovoltage (kVp), using one of four techniques [6,11]. For this case, dual-source dual-energy technique includes two separate x-ray tubes and detector arrays located at right angles from each other, where the lower energy source is set at 80 kVp and the higher energy source is set to 140 kVp (or increased to 100 and 150 kVp for obese patients). The data is then post-processed by the radiologist with a material decomposition algorithm to characterize the material with a spatial resolution of 1-2 mm. Gout is displayed as green and calcium is colored purple with our software (syngo.via, Siemens, Erlangen, Germany). The data is displayed in multiplanar reconstructions (axial, coronal, and sagittal planes) to facilitate evaluation of MSU location and extent of gouty disease involvement.

## CONCLUSION

Dual energy CT can provide a non-invasive evaluation for deposition of MSU crystals in atypical locations, including intervertebral discs. Dual energy CT should be considered in patients with elevated serum uric acid and/or concern for spinal involvement of gout.

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