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CASE REPORT

Gout tophus on an intradural fascicle: a case description

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Abstract
Study design Case report and review of literature.
Objective Detailed description of case and review of literature to determine its uniqueness with special regard to intradural gout tophus formation without any boney attachment or underlying systemic gout.
Summary of background data Gout tophi commonly involve the peripheral joints of the upper and lower extremities. Rarely, gout tophi are located within the spinal cord, especially without any underlying hyperuricemia.
Methods We report the case of a 64-year-old patient presenting with radiculopathy along the right L2-dermatome and bladder dysfunction and review literature for further discussion.
Results Imaging studies showed a partly calcified round intradural lesion at the level L2 without contrast enhancement. The lesion was removed via a hemilaminectomy L2. It was adherent to a dorsal sensory fascicle exiting with the L2 nerve root. The neuropathological examination showed a gout tophus. Serologic testing revealed no signs of hyperuricemia.
Conclusion To the best of our knowledge, this is the first report of a gout tophus originating from an intradural fascicle and without any boney attachment or underlying systemic gout. The literature is reviewed and possible pathophysiological mechanisms are discussed.

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Keywords Gout tophus · Intradural · Nerve fascicle · Uric acid · CSF

Introduction

Gout tophi commonly occur in peripheral joints of the upper and lower extremities [1], usually with underlying hyperuricemia. In chronic hyperuricemia, renal insufficiency can develop, and deposition of monosodium urate (MSU) crystals occurs mainly in locations where blood circulation and temperature are very low [2, 3]. Although there have been several reports about gout tophi without systemic hyperuricemia and also about spinal gout tophi, reports about intradural gout tophi in the spine are rare [4], and the presence of tophus in the absence of any systemic manifestation of gout is exceptional [5]. In this article, we report for the first time a case about an intradural gout tophus attached to an intradural nerve root.

Case report

A 64-year-old female patient was admitted to our department, suffering from lumbar back pain, radiating to both sides and radiculopathy in the right ventral thigh and the right inguinal region along the L2-dermatome. She complained of numbness of the right foot with a subjective cold feeling. A few months prior to admission, she had a feeling of pressure regarding her bladder, combined with an imperative urge to urinate. Urological and gynecological examinations delivered no groundbreaking results. Besides an arterial hypertension and moderate spinal degenerative changes like osteochondrosis and spondylarthrosis (especially in the levels L4/5 and L3/4) the patient had no

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systemic or other diseases. The uric acid levels as well as urea and creatinine levels were always in the normal ranges, underlining the absence of systemic gout.

Imaging studies, magnetic resonance imaging (MRI) of the lower spine (Fig. 1) and computed tomography (CT) (Fig. 2), showed a partially calcified, round, intradural mass in the dorsal part of the spinal canal at the level L2 without any contrast enhancement. The size was 1.4 cm × 1.5 cm × 1.3 cm. Because there was no bone attachment of the tumor, the most probable differential diagnosis was supposed to be partially calcified schwannoma or myxopapillary ependymoma. The operation was performed under electrophysiological monitoring including somatosensory-evoked potentials (SEPs) and electromyography (EMG) of the pelvic floor, anal sphincter, triceps surae and tibialis anterior muscles. The lesion was removed completely via a right hemilaminectomy of L2 and was found to be a white, calcified, round tumor, extremely adherent to a dorsal sensory fascicle exiting with the L2 nerve root after microscopically opening the dura.

Histopathological examination showed areas of birefringent acicular material surrounded by foreign-body giant cell, foamy macrophages and a small amount of lymphocytes (Fig. 3). Immunohistochemistry showed strong positivity for CD68 (Dako, Glostrup, Denmark) in the giant cells and macrophages. With the antibody against the glial fibrillary acid protein (GFAP, Dako, Glostrup, Denmark) no positive cells were detected; thus a myxopapillary ependymoma was excluded. The final histopathological diagnosis was an intradural gout tophus.

Postoperatively, the radicular pain had clearly improved with a persistent sensory deficit along the L2-dermatome after 3 months. Postoperative spinal MRI showed a total removal of the intradural mass.

Discussion

Gout is one of the most common inflammatory arthritic alterations with a prevalence of 1–2 % in the Western countries [6] and one of the most common causes for nociceptive pain and physical disability [7]. Hyperuricemia is a common biochemical abnormality that is strongly associated with an increased incidence of gout, knowing that 10 % of patients with hyperuricemia develop gout [1, 3]. As a result of persistent hyperuricemia, deposition of MSU crystals in joints and other soft tissue like ligaments, tendons, menisci, articular cartilage and bursa can occur [8], which can be a trigger for an inflammatory response resulting in acute gouty arthritis. This process can lead to chronic gouty arthropathy and the formation of gout tophi if not treated properly [9]. Commonly, gout tophi are located in the peripheral joints of the appendicular skeleton and have been reported to rarely involve the axial joints [1–3, 10, 11]. Recent studies report a prevalence of axial gout up to 35 % in a prospective CT study of 45 patients, also pointing out that first the majority of the study population (87 %) was black and having a higher prevalence of gout than Caucasians [12], and second that the studied patients had at least a 3-year history of inappropriately treated systemic gout [13]. MRI can detect gout tophi, but with non-specific appearances, and calcifications within the bony erosions are better seen on CT scan [4, 11, 14]. CT characteristics of axial gout are intraarticular and juxtaarticular erosions with sclerotic margins with a higher density than the surrounding muscle. Even more diagnostic potential seems to have dual-energy CT, as it allows distinguishing urate from calcific mineralization, an asset especially in cases of unclear diagnosis or atypical clinical manifestations, as well as the ability to objectively quantify

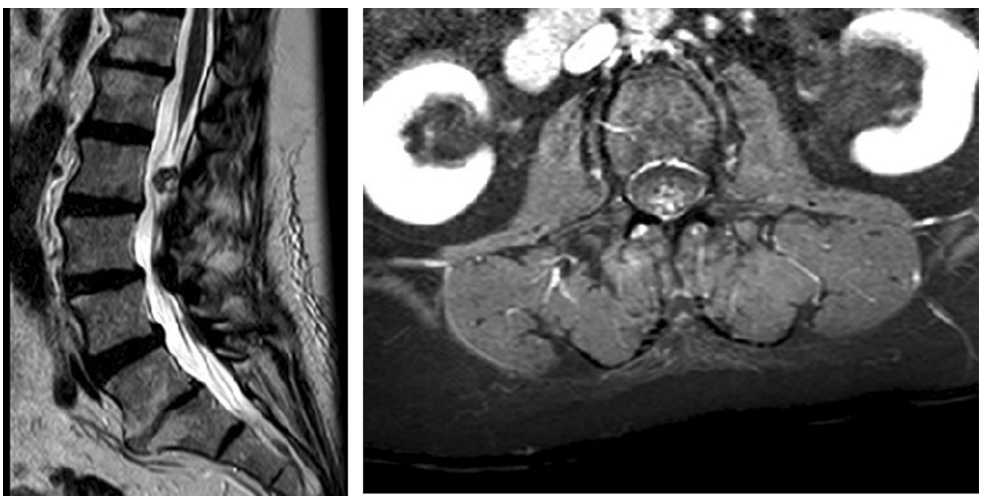

Fig. 1 Magnetic resonance imaging (MRI) of the lower spine showing (sagittal plane T2-weighted section on the *left*, axial contrast enhanced T1 section on the *right*) a round, intraspinal, intradural mass in the dorsal part of the spinal canal at the level L2 without any contrast enhancement

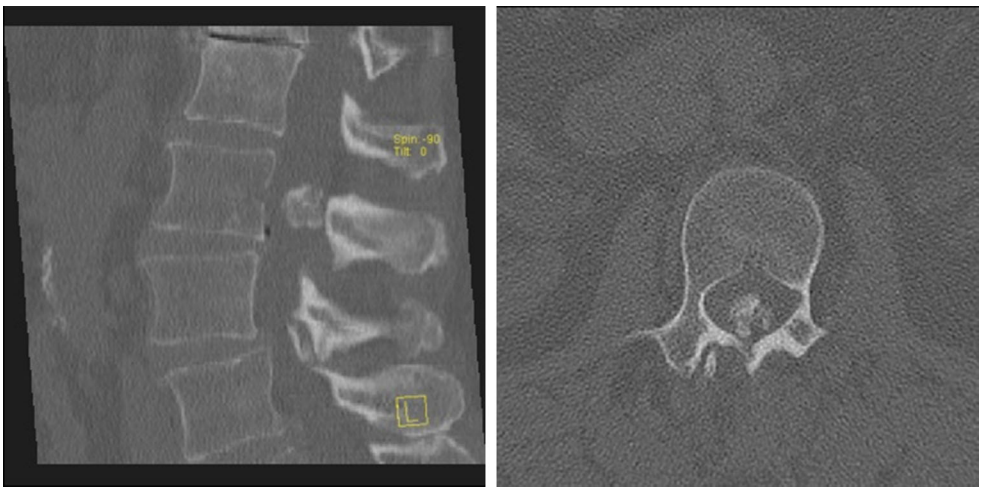

Fig. 2 Computed tomography (CT) of the level L1–L4 showing (sagittal section on the *left*, axial section on the *right side*) a round, partially calcified mass with an approximate seize of 1.4 cm × 1.5 cm × 1.3 cm without any contact to the facet joints or any other bony compartment

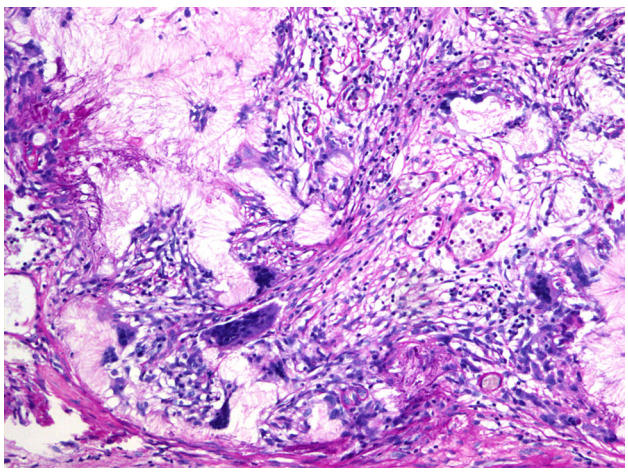

Fig. 3 Hematoxylin and eosin (HE) staining in ×200 magnification showed areas of birefringent acicular material (seen in additional and not depicted polarized light microscopy) surrounded by foreign-body giant cell, foamy macrophages and a small amount of lymphocytes, typical for a gout tophus

gout tophus for monitoring measurements and document regression of tophi [15]. A previous study on 69 case reports by Konatalapalli et al. in 2009 illustrated that most of the gout tophi are located in the lumbar spine with 48 % of the cases, followed by cervical vertebrae with 29 % of cases and the sacroiliac joints (SIJ) with 8.7 %. 46 % of the patients suffered from chronic tophaceus gout and serum uric acid (SUA) was elevated in 63 % of this patient collective [16]. This might be a hint for the increasing prevalence in axial gout, regarding the increase of case reports from 69 in 2009 to 211 reports in 2013. However, only one of the over 200 case reports describes an intradural gout tophus [4]. This only other case report in 2000 by Paquette et al. presented a case of lumbar radiculopathy secondary to a gout tophus in the filum terminale in a patient without systemic gout. Ntsiba et al. reported a case of thoracic spinal cord compression due to a dural lesion, describing a gout tophus which is attached to the dura and extending extradurally in a patient with known chronic systematic gout of at least 10 years [17]. In most recent studies a relation between the tophus and the erosion of the facet articulation has been described [18–20]. Also Ntsiba et al. found a relation of the tophus to the left T10 articular process. Up to 80–90 % of patients with gout are hyperuricemic [6]. Likewise, the patient presented by Ntsiba et al. suffered from chronic systemic gout with hyperuricemia. Hasturk et al. reported that serum uric acid levels in gout patients with spinal involvement are generally high, as well [21]. In contrast to these reports, there was neither a relation between the gout tophus and erosive facet articulations nor with systemic gout nor with hyperuricemia in our case. Neuroradiological procedures revealed moderate degenerative changes of the spine like osteosclerosis and spondylarthrosis especially in the levels L4/5 and L3/4, but no further hint about the origin and pathogenesis of the gout tophus in the cerebrospinal fluid (CSF). Usually a gout tophus formation is found in avascular tissues, because the solubility of MSU crystals decreases when the temperature is low [11, 18, 21, 22]. In addition, when the blood pH decreases, the binding plasma protein decreases and a possible trauma leads to a higher precipitation of urate crystals, which both increases the tophus formation as well [10, 11, 19, 22]. As to our knowledge, we describe for the first time an intradural gout tophus arising from a nerve rout without any attachment to the bony structures and without any existence of hyperuricemia, systemic gout, other peripheral gout tophi or a former trauma.

The lack of obvious signs of hyperuricemia and systemic gout gives rise to the question about the origin of the intradural gout tophus. Uric acid (UA) is an endogenously produced water-soluble antioxidant and is supposed to have a neuroprotective function in neurodegenerative diseases like M. Alzheimer, multiple sclerosis or Parkinson's disease [23] as well as an neuroprotective effect in cellular and animal models [24, 25]. As there have been studies showing that brain tissue has the capacity to generate UA in situ [26, 27], the fact that plasma UA level is 10 times higher than the UA CSF level suggests that the peripheral production is majority and the access to the brain is limited by the blood–brain barrier. However, CSF and blood UA levels are correlating [24]. Paquette et al. described that their gout tophus was attached to the filum terminale by a vascular pedicle. We did not find any blood vessel attachment to our gout tophus, but only to a dorsal sensory fascicle exiting with the L2 nerve root. So the gout tophus could either have been precipitating in the CSF or from the blood supplying vessels surrounding the nerve root.

The suggested treatment target in present guidelines for gout therapy is a serum urate level <0.36 mmol/l or 6 mg/dl [28], in patients with severe manifestation of chronic gout even <5 mg/dl [29–32]. Because of accurate levels of urate, urea and creatinine within normal ranges even in a 3 months follow-up, we suggested no further medical treatment for our patient but regularly biochemical testing. MSU crystal identification is the reference standard for the diagnosis of gout [33, 34] and was also observed in our case, as the first differential diagnosis was partial calcified tumor and spinal gout tophi can mimic a variety of different entities like lumbar discopathy, spinal stenosis, degenerative spondylosis [18–20], infections (like abscess) or neoplastic tumors due to hypermetabolic activity [19, 22]. So gout tophi are an important differential diagnosis in a variety of spinal symptoms.

Conclusion

Commonly, gout tophi are located in the peripheral joints of the appendicular skeleton and have been reported to rarely involve the axial joints. Due to increasing incidence and prevalence of systemic gout, the prevalence of spinal gout tophi is also increasing. To the best of our knowledge, this is the first description of a gout tophus originating from an intradural nerve root without systemic gout or any boney attachment. Due to the distinct neurological deficit, accurate and timely surgery was the treatment of best choice. Therefore, spinal gout tophi should be kept in mind as differential diagnosis in a variety of symptoms as the consequence of surgery persists, providing cure for the patient.

Compliance with ethical standards

Conflict of interest None of the authors has any potential conflict of interest.

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