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CASE REPORT

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Characteristic appearance of large subcutaneous gouty tophi in magnetic resonance imaging

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Abstract The development of multiple large tophi in patients with gout is rare. We report magnetic resonance (MR) and histological features of large subcutaneous tophi in a 32-year-old male patient with no known arthritis. His subcutaneous lesions were confused with a neoplastic process, evaluated by MR imaging, and surgically excised after biopsy. The honeycomb-like appearance on the gadolinium-enhanced images may reflect the characteristic multilobular structure of the tophi composed of avascular urate deposits and surrounding vascularized granulation tissue.

Key words Gouty tophi · Magnetic resonance (MR) imaging

Introduction

Gout is characterized by hyperuricemia and urate crystal deposit in articular and periarticular structures. Tophaceous gout represents the chronic phase of the disease process. Since the introduction of modern medication for hyperuricemia, the development of a large tophus is rare.[1] When such a large tophus presents as a soft tissue mass in the absence of previous episodes of gouty attack or arthritis, it may be difficult to distinguish the tophus from a neoplastic process.[2–6]

This article reports a rare case of multiple large soft tissue tophi. Since this patient had no medical history and no remarkable symptoms related to gout, the tophi were confused with soft tissue neoplasm, evaluated by magnetic resonance (MR) imaging, and surgically excised after biopsy. Pathologic examinations of the specimens demonstrated that the large subcutaneous gouty tophi showed characteristic MR findings in relation to the histological features.

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Case report

In November 2002, a 32-year-old man visited our outpatient clinic with multiple subcutaneous masses at both knees and both ankles (Fig. 1). He first recognized these masses at the age of 17, and they had gradually enlarged. He had no medical history for these lesions because they had caused no pain and no major functional disturbance. As family history, his father had been diagnosed with gout. Physical examination revealed that they were elastic, soft masses without tenderness, their sizes being 4×4 cm at both knees, 3×3 cm at the lateral aspect of the left ankle, 3×3 cm at the medial aspect of the right ankle, and 5×5 cm at the lateral aspect of the right ankle.

Laboratory evaluation revealed no abnormal findings except serum urate of 10.3 mg/dl (normal range, 3–8 mg/dl) and total cholesterol of 233 mg/dl (normal range, 130–220 mg/dl). Plain radiographs showed eccentric soft tissue swelling of the lesions without calcification or ossification. Bony erosion was also observed around both ankle joints.

The patient was referred for MR examinations. Figure 2 shows coronal MR images of the mass at the lateral aspect of the right ankle. The signal intensity of the lesion was nearly as isointense as that of muscle on T1-weighted images. On T2-weighted images, a heterogeneous low to high signal intensity was observed. After intravenous administration of gadolinium, the lesion showed honeycomb-like heterogeneous enhancement. These enhancement areas appeared to correspond to low signal intensity areas on the T2-weighted images. The other lesions exhibited similar MR findings. Our suspicion from the clinical and radiographic findings was of a soft tissue neoplasm. To define the

Fig. 1. Multiple soft tissue lesions in a 32-year-old man. These lesions were elastic, soft masses without tenderness

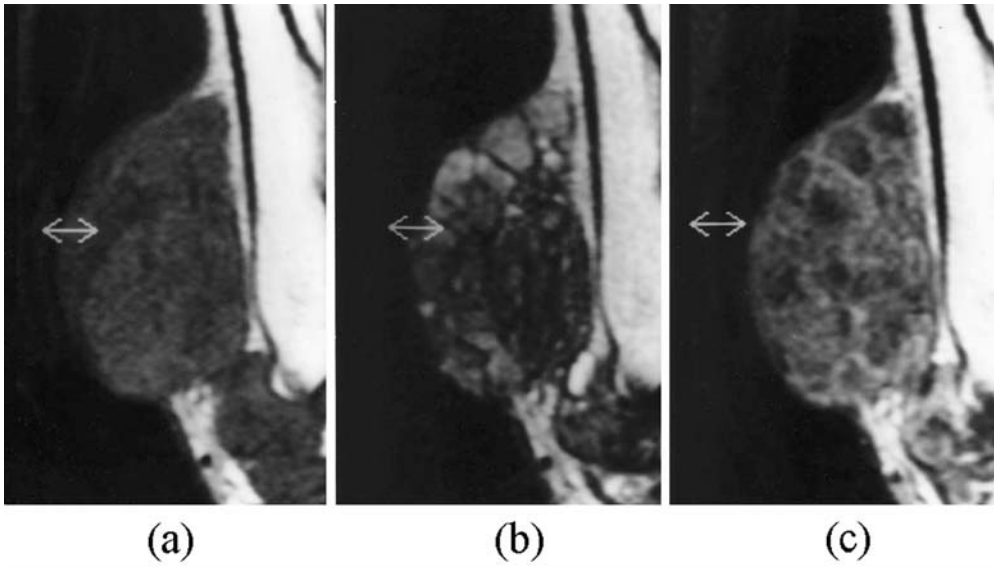

Fig. 2a–c. Coronal magnetic resonance imaging of the lesion at the lateral aspect of the right ankle. **a** The lesion revealed relatively homogeneous intermediate signal intensity on T1-weighted images (TR536, TE14). **b** Heterogeneous low to high signal intensity was observed on T2-weighted images (TR4000, TE120). **c** After intravenous administration of contrast material, the lesion showed heterogeneous honeycomb-like enhancement (TR536, TE120). *Double up-down arrows*, phase encoding

diagnosis, a small tissue specimen was obtained from the mass at the right knee, and the lesion was diagnosed as a gouty tophus.

For cosmetic reasons, the tophi at both knees and both ankles were surgically excised. Figure 3 shows the macroscopic and microscopic findings of the specimen obtained from the lesion at the lateral aspect of the right ankle. The cut surface of the tophus showed a multilobular appearance, and the center of each lobule was composed of white, chalky urate deposits. Microscopically, the urate deposits were surrounded by granulation tissue showing increased vascularity and an inflammation reaction, composed of lymphocytes, histiocytes, fibroblasts, and foreign-body giant cells. The distributions of these granulation tissues appeared to correspond to the enhancement areas on the MR images. Nearly the same histological features were observed in the other specimens. Oral medication of allopurinol was started after surgery. The serum urate level then decreased to the normal range. Thus far, there has been no recurrence of the tophi.

Discussion

Previously, only a few studies have shown MR features of tophaceous gout. Seidle et al. studied articular lesions in 14 patients, and demonstrated that the MR appearance of

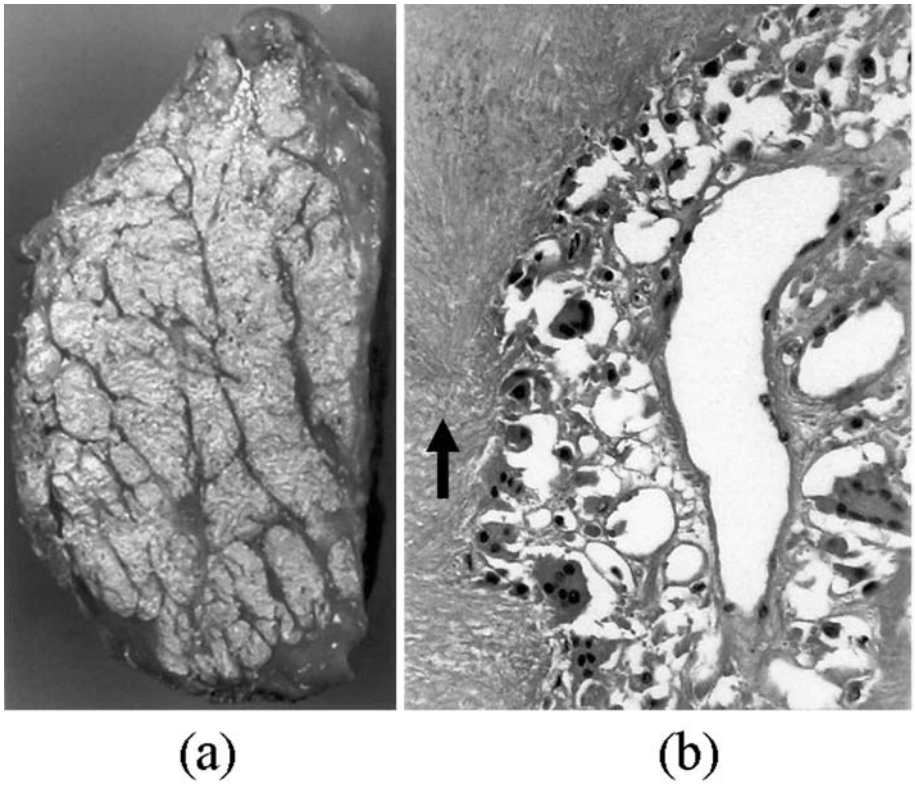

Fig. 3a,b. Macroscopic and microscopic findings of the specimen obtained from the lesion at the lateral aspect of the right ankle. **a** The cut surface of the tophus showed a multilobular structure, and the center of each lobule was composed of white, chalky urate deposits. **b** Microscopically, the urate deposits (*arrow*) were surrounded by granulation tissues showing increased vascularity and an inflammation reaction, composed of lymphocytes, histiocytes, fibroblasts, and foreign-body giant cells (H&E, ×200)

intraosseous gouty tophi is characteristic.[7] In this series, MR imaging was shown to be superior to plain radiography for early detection of tophi. In contrast, Yu et al. evaluated both articular and soft tissue lesions in nine patients, and concluded that the MR appearance of tophi is nonspecific.[8] According to these reports, the signal intensity of a tophus is usually intermediate on T1-weighted images, but more variable on T2-weighted images, ranging from homogeneous low or high to heterogeneous low to high. The variability in signal intensity patterns on T2-weighted images is likely due to differences in calcium concentration, local edema, or protein content within a tophus.[7,8] After intravenous administration of contrast medium, a tophus appears to show heterogeneous or near-homogeneous enhancement, which may be a reflection of hypervascular granulation tissue.[7,8]

In our patient, the signal intensity of the tophi on T1- and T2-weighted images was nearly consistent with that in previous studies. The most distinctive MR feature was the honeycomb-like heterogeneous enhancement with contrast medium. Histologically, the tophi had a multilobular appearance: the center of each lobule was composed of avascular urate deposits, which were surrounded by vascularized granulation tissues. The correlation of these MR and histological findings indicated that the urate deposits themselves were of intermediate signal intensity on T1-weighted images and of intermediate to high signal intensity on T2-weighted images, showing no enhancement. On the other hand, the surrounding hypervascular granulation tissue likely exhibited gadolinium-enhanced MR images, which resulted in the honeycomb-like appearance.

Previous MR studies of intraosseous or soft tissue tophi have not described such enhancement patterns. Intraosseous tophi are usually small, and therefore they seldom show multilobular structures in histology.[7–9] In addition, it may be difficult to obtain detailed image findings for small lesions. Gadolinium-enhanced MR images for these intraosseous lesions have been reported as rim enhancement, near-homogeneous enhancement, or heterogeneous enhancement. On the other hand, it is possible that soft tissue tophi become larger. Our patient first noted the tophi 15 years previously, but had not received any medical treatment because they had caused no pain. For 15 years, the tophi continued to enlarge, the largest one reaching 5 × 5 cm, and finally, this man visited our outpatient clinic due to the cosmetic problem. To our knowledge, MR features of such large subcutaneous tophi have not been studied in detail. Thus, the honeycomb-like heterogeneous enhancement is likely not a common feature of gouty tophi, but characteristic of large tophi showing a multilobular appearance.

Development of tophi before gouty arthritis is unusual. Only two such cases occurred in a series of over 1300 patients with primary gout. Several possibilities may account for this phenomenon. First, active inflammation in gout may be relatively suppressed by medication, age, or other illness. Many patients may take nonsteroidal anti-inflammatory drugs, which may suppress gouty inflammation. A second possibility may be misdiagnosis of attacks of gout that do occur. Some patients may have other forms of arthritis (rheumatoid arthritis, pseudogout, and septic arthritis) that could mask mild gouty inflammation, or result in misdiag-

Table 1. Magnetic resonance appearances in multiple soft tissue lesions

	Signal intensity compared to muscle		
	T1WI	T2WI	Gd enhanced
Gouty tophi (this case)	Iso	Heterogeneous, low to high	Honeycomb-like
Gouty tophi (previous report)	Iso	Heterogeneous, low to high	Heterogeneous
Neurofibromatosis	Iso	Heterogeneous, low to high	Heterogeneous
Pigmented villonodular synovitis	Low	Heterogeneous, low to high	Heterogeneous
Xanthoma	High	Heterogeneous, low to high	Heterogeneous
Tumoral calcinosis	Low	Low	No enhancement

T1WI, T1-weighted imaging; T2WI, T2-weighted imaging; Iso, isointense

nosis. Finally, the presence of urate deposits does not ensure the development of arthritis.

The conditions that may produce multiple soft tissue masses include neurofibromatosis, pigmented villonodular synovitis, xanthoma, and tumoral calcinosis, as well as gouty tophi. To distinguish these lesions, disease history, physical examination, and laboratory data appear to be important. Imaging studies may also be helpful in defining the diagnosis. General features of MR images in these multiple soft tissue lesions are shown in Table 1.[7,8,10–15] In our case, the patient revealed hyperuricemia and had a family history of gout. These findings, together with the slow growth of the lesions, should have been more carefully evaluated. Although the MR appearances of the lesions were also rather specific, we could not diagnose the gouty tophi. By comparing the MR with the histological features of the specimens, we found that the honeycomb-like enhancement is a pathognomonic finding of a large soft tissue gouty tophus.

References

1. Straub LR, Smith JW, Carpenter GK Jr. The surgery of gout in the upper extremity. J Bone Joint Surg 1961;43-A:731–52.
2. Shmerling RH, Stern SH, Gravallese EM, Krantrowitz FG. Tophaceous deposition in the finger pads without gouty arthritis. Arch Intern Med 1988;148:1830–2.
3. Wernick R, Winkler C, Campbell S. Tophi as the initial manifestation of gout. Arch Intern Med 1992;152:873–6.
4. Kerman BL, Mack G, Moshirfar MM. Tophaceous gout of the foot an usual presentation of severe chronic gout in an undiagnosed patient. J Foot Ankle Surg 1993;32:167–70.
5. Liu K, Moffatt EJ, Hudson ER, Layfield LJ. Gouty tophus presenting as a soft-tissue mass diagnosed by fine-needle aspiration: a case report. Diagn Cytopathol 1996;15(3):246–9.
6. Chaoui A, Garcia J, Kurt AM. Gouty tophus simulating soft tissue tumor in a heart transplant recipient. Skelet Radiol 1997;26(10):626–8.
7. Seidl G, Ullrich R, Trattnig S, Dominkus M, Morscher M, Aringer M, et al. MR imaging in gout. Radiologe 1996;36(8):632–6.
8. Yu JS, Chung C, Recht M, Dailiana T, Jurdi R. MR imaging of tophaceous gout. Am J Roentgenol 1997;168(2):523–7.
9. Recht MP, Seragini F, Kramer J, Dalinka MK, Hurtgen K, Resnick D. Isolated or dominant lesions of the patella in gout: a report of seven patients. Skelet Radiol 1994;23:113–6.
10. Lim R, Jaramillo D, Poussaint TY, Chang Y, Korf B. Superficial neurofibroma: a lesion with unique MRI characteristics in patients with neurofibromatosis type 1. Am J Roentgenol 2005;184(3):962–8.
11. Poletti SC, Gates HS 3rd, Martinez SM, Richardson WJ. The use of magnetic resonance imaging in the diagnosis of pigmented villonodular synovitis. Orthopedics 1990;13(2):185–90.
12. Durr HR, Stabler A, Maier M, Refior HJ. Pigmented villonodular synovitis. Review of 20 cases. J Rheumatol 2001;28(7):1620–30.
13. Matoba M, Tonami H, Kuginuki M, Yamamoto I, Akai T, Iizuka H. CT and MRI findings of xanthoma in the orbitofrontal region. Radiat Med 2004;22(2):116–9.
14. Senol U, Karaal K, Cevikol C, Dincer A. MR imaging findings of recurrent tumoral calcinosis. Clin Imaging 2000;24(3):154–6.
15. Iglesias A, Arias M, Brasa J, Gonzalez A, Conde C. Tumoral calcinosis presenting as an extradural mass: MR findings and pathological correlation. Eur Radiol 2002;12(9):2377–80.