Limited knee joint range of motion due to invisible gouty tophi

K. H. Yu, L. C. Lien¹ and H. H. Ho

Objectives. Tophi deposits are a well-known cause of joint destruction, gouty nephropathy and spinal cord compression. This study reports another major complication of gout, namely tophi deposition causing limited knee joint excursion.

Methods. Seven gout patients with limited knee joint excursion owing to tophi deposition were studied to reveal clinical features and magnetic resonance imaging (MRI) findings. None of the patients were able to assume a full squatting posture.

Results. No patients had visible subcutaneous tophi over the knee joints, except for one case in which a pea-sized subcutaneous tophus was noted. Additionally, two patients even lacked visible tophi elsewhere. All knee problems in the study group were initially regarded as being due to degenerative or other internal derangements, but MRI unexpectedly revealed multiple tophaceous deposits within and around the joint.

Conclusions. Intra-articular and periarticular tophi limiting knee joint range of motion are a rare but important cause of walking disability in gout patients. Although most patients do not display visible subcutaneous tophi over the knee on physical examination, the differential diagnosis should consider intra-articular tophi and MRI is valuable in this clinical setting.

Key words: Gout, Knee, Invisible tophi, MR image.

Gout is a disease of purine metabolism characterized by monosodium urate crystal deposition [1, 2]. Subcutaneous tophi usually are a late manifestation of gout, but also have been reported before gouty attacks [3, 4]. Tophi deposition with punch-out bony erosion is a well-recognized complication of chronic gout, but usually lacks obvious symptoms [5]. The magnetic resonance imaging (MRI) appearance of tophaceous gout has been reported [6–12], but previous studies have focused mainly on demonstrating rare spinal involvement [6, 7] or have emphasized unusual clinical presentations of gout mimicking epidural infection [8, 9] or the typical peripheral joints. Tophi deposition of knee joints and other areas has occasionally been reported, but detailed clinical information is lacking [10–12].

This investigation examines seven gout patients with limited knee joint range of motion, two of whom even lacked subcutaneous tophi. MRI clearly displays tophi deposition inside and around the knee joints, and the patients were initially assumed to have a ligament-meniscus or degenerative disorder.

Patients and methods

Gout is frequently encountered in general practice and accounts for around 20 to 25% of out-patients in rheumatology clinics in medical centres in Taiwan. Tophi remain a problem in some gout patients [13, 14]. This study describes seven gout patients with limited knee joint range of motion, followed-up between October 2001 and March 2003. All patients had previously fulfilled the American Rheumatism Association diagnostic criteria for gout [15]. The patients were followed-up at the out-patient clinics of two senior rheumatologists (Drs Yu and Ho). Initial plain knee joint films revealed normal or non-specific findings, and MRI was conducted to assess the cause of limited knee joint excursion.

Clinical features were recorded, including gout duration, tophi duration, previous trauma history, surgical treatment, and duration and degree of range of motion limitation. MRI was performed for 12 affected knees in seven patients, from December 2002 to March 2003, in our hospital on an out-patient basis using a 1.0 or 1.5 T magnet (Siemens Magneton or GE signa scanner).

Results

Table 1 lists patient demographics and the radiographic findings. All patients were male and the mean age of onset of gout was 31.6 ± 7.7 yr (range 23 to 47). Additionally, the mean gout duration was 9.7 ± 5.8 yr (range 2 to 16). Serum urate level ranged from 8.5 to 12.3 mg/dl (normal reference range: 2.7–8.0 mg/dl), and all but one patient had normal renal function (the exception was case 2, with creatinine of 5.1 mg/dl).

Case 1 involved a 41-yr-old man with gout for 13 yr and subcutaneous tophi for 9 yr. The patient had received two arthroscopic examinations at other hospitals, 9 and 3 yr previously, owing to limited excursion of the bilateral knee joints and inability to assume a full squatting posture. Intra-articular tophi were found during these previous examinations and debridement was carried out, but the patient displayed minimal improvement of knee symptoms following the procedure. On initial visit to our clinic, physical examination showed large right ankle and right elbow tophi, but only a pea-sized subcutaneous tophus over the left patella area. Extension and flexion range of motion in both knees was between 25 and 70° (normal range: 0–135°). Full knee extension was impossible, and the man walked with a mildly flexed knee posture. Plain knee radiography was non-specific, while both knee MR images showed tophaceous depositions over the retro-suprapatellar pouches, the intercondylar fossae and around the patella area. Extension and flexion range of motion in both knees was between 25 and 70° (normal range: 0–135°). Full knee extension was impossible, and the man walked with a mildly flexed knee posture.

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Table 1. Clinical features of seven gout patients with limited knee joint range of motion

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (yr)</th>
<th>Age of onset (yr)</th>
<th>Gout duration (yr)</th>
<th>Subcutaneous tophi (yr)</th>
<th>Knee symptoms duration (yr)</th>
<th>Tophaceous findings in MR image</th>
<th>Range of motion of both knees</th>
<th>L: left, R: right</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41</td>
<td>28</td>
<td>13</td>
<td>9</td>
<td>9</td>
<td>R: 25–70, Tophi deposit around the quadriceps tendon</td>
<td>R: 0–90, L: 0–100</td>
<td>L: 0–90, R: 0–90</td>
</tr>
<tr>
<td>2</td>
<td>46</td>
<td>33</td>
<td>13</td>
<td>5</td>
<td>10</td>
<td>R: 0–100, Tophi and bony erosion in the intercondylar fossae</td>
<td>R: 0–100, L: 0–100</td>
<td>L: 0–100, R: 0–100</td>
</tr>
<tr>
<td>3</td>
<td>29</td>
<td>27</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>R: 0–135, Tophi in the infrapatellar fat pad</td>
<td>R: 0–135, L: 0–90</td>
<td>L: 0–100, R: 0–100</td>
</tr>
<tr>
<td>4</td>
<td>39</td>
<td>23</td>
<td>16</td>
<td>Absent</td>
<td>6</td>
<td>R: 30–100, Tophi in the intercondylar fossae and condylar roof bony erosions</td>
<td>R: 30–100, L: 30–100</td>
<td>L: 0–100, R: 0–100</td>
</tr>
<tr>
<td>5</td>
<td>39</td>
<td>34</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>R: 0–90, Tophi in the infrapatellar fat pad</td>
<td>R: 0–90, L: 0–90</td>
<td>L: 0–90, R: 0–90</td>
</tr>
<tr>
<td>6</td>
<td>51</td>
<td>47</td>
<td>15</td>
<td>Absent</td>
<td>4</td>
<td>R: 0–105, Tophi in the intercondylar fossae</td>
<td>R: 0–105, L: 0–100</td>
<td>L: 0–100, R: 0–100</td>
</tr>
<tr>
<td>7</td>
<td>44</td>
<td>29</td>
<td>15</td>
<td>Absent</td>
<td>3</td>
<td>R: 0–100, Tophi in the intercondylar fossae</td>
<td>R: 0–100, L: 0–90</td>
<td>L: 0–90, R: 0–90</td>
</tr>
</tbody>
</table>

MR image findings:
- Infracondylar, intercondylar tophi and intercondylar roof bony erosions of the femoral intercondylar roof.
- Tophaceous bony erosions in the tibial plateau.
- Tophaceous deposits over the bilateral knee joints just beneath the patellar retinaculum.

Discussion

Gout is a disease of purine metabolism or renal excretion of uric acid and is considered to have four different phases...
characterized by asymptomatic hyperuricaemia, recurrent attacks of acute arthritis, intercritical gout and chronic tophaceous gout. Monosodium urate tophi may appear in subcutaneous tissue or within the joint and can affect any joint of the body with a predilection for peripheral joints of the lower extremities [1, 2]. Subcutaneous tophi generally are a late clinical manifestation, and typically are located in the peripheral joints of the hand or foot. Subcutaneous tophi are rarely visible over the knee joint. However, intra-articular tophi may develop very early since crystal shedding is pathogenetically assumed to precipitate acute gouty attacks, but this condition is invisible and usually not identified by plain radiographs [9, 16]. Plain radiographs and physical examination thus markedly underestimate the size and extent of soft tissue and osseous involvement by tophi [17].

The typical plain radiographic features of gout include asymmetrical soft tissue swelling, calcification and bony erosion. However, these plain radiographic features generally are normal in early [9] and even chronic gout patients with intra-articular deposits and bony erosions, as demonstrated in the subject cases. MRI is critical for assessing abnormalities in bones, ligaments, tendons and other non-osseous structures within joints. Common MRI findings in the present patients included tophi deposition over the infrapatellar fat pad, anterior recess, intercondylar fossae and intercondylar roof bony erosions. These findings are compatible with those of previous studies [10, 11, 18]. Such deposits present on MR images as masses with low to intermediate signal intensity on both T₁- and T₂-weighted images, but may display high signal intensity in the presence of associated inflammation [11, 18, 19]. MRI findings are suggestive and the diagnoses of some of the subject patients were confirmed by previous arthroscopic or synovial fluid examination. The
differential diagnosis based on MRI appearance also includes chronic rheumatoid arthritis, pigmented villonodular synovitis, chronic infectious arthritis and amyloidosis. The constellation of clinical and MRI findings often allow a relatively specific diagnosis to be rendered [20].

In summary, tophaceous deposition should be considered in the differential diagnosis when a mass displays heterogeneous low to intermediate signal intensity, particularly if the adjacent bone shows typical erosive changes, if other joints are involved, or if multiple foci exist within and around the knee joints [21]. MRI is expensive and rarely indicated in gout, but is valuable in patients with limited excursion or walking disability of the knee joint. The present observations also highlight that large intra-articular tophi and bony erosions may occur even in patients without visible subcutaneous tophi.

Tophi deposits are well known to cause joint destruction, gouty nephropathy, concomitant septic infection [22], and spinal cord compression [5, 6]. This study reports another important complication of gout that limits knee joint excursion by intra-articular and periarticular tophi deposition. This condition is frequently overlooked because of a lack of visible subcutaneous tophi around the knee joint and even elsewhere. Tophi deposition thus should be considered not only in patients with chronic severe tophaceous gout but also in those with early gout. Demonstration of intra-articular tophi urges adequate hypo-uricaemic medical treatment. Individual cases with large or extensive tophi may benefit from surgery and rehabilitation in improving joint range of motion.

References