Radiologic manifestations of gout in MRI

Poster No.: C-1053
Congress: ECR 2012
Type: Educational Exhibit
Authors: D. Gorostiza Laborda, A. Urresola Olabarrieta, B. Canteli Padilla, F. Perez-Ruiz, B. Iturre Salinas; Vizcaya/ES
Keywords: Diagnostic procedure, MR, Musculoskeletal system, Musculoskeletal joint, Arthritides
DOI: 10.1594/ecr2012/C-1053

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.
As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.
You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys’ fees, arising from or related to your use of these pages.
Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.
www.myESR.org
Learning objectives

To illustrate and review the features of gout in MRI.

To assess the utility of MRI in monitoring the evolution of gout.
Background

Gout is a common rheumatologic disease caused by the precipitation of monosodium monohydrate crystals (MSU) into tissue, frequently in joints. This deposition produces recurrent episodes of acute arthritis and, when progresses, chronic inflammation with changes in joints and periarticular tissues.

Hyperuricemia is the main risk factor. Urate level can be high because of increased purine intake, decreased urate excretion or increased urate production.

The certainty diagnosis of gout is based on the identification of MSU crystals in the synovial fluid or tophy. MSU crystals may be seen also in intercritic periods.

Radiographic changes in older adults with characteristic clinical presentation and hyperuricemia are suggestive of gout, however, to date no imaging technique can substitute the identification of MSU crystals.

Although imaging techniques can not demonstrate the crystals, they are useful to asses the severity of gout and to monitor its evolution.

Asymptomatic hyperuricemia seems to be the precursor of symptomatic gout, actually, the greater the degree and duration of hyperuricemia the greater is the likelihood of gout. Apart from that, any body fluid with a urate level greater than 6.8mg/dl exceeds the soluble concentration of MSU and leads to its deposition also in asymptomatic joints of patients with gout. Therefore, articular and periarticular MSU deposition could lead to early skeletal damage.
IMAGING TECHNIQUES IN GOUT

As in other arthritis, the lack of treatment in tophaceous gout leads to skeletal destructive changes.

1. Plain radiographs

Evaluation and monitoring skeletal and soft tissue changes in gout has been based on plain radiographs.

Plain radiographic features of chronic tophaceous gout include visualization of tophi as soft-tissue or intraosseous masses and nonde mineralizing erosive arthropathy with erosions that are well defined with sclerotic or overhanging margins. Extra-articular erosions and intraosseous calcifications can also be seen. The joint space is preserved until advanced disease.

During the first gouty attack, plain radiographs only demonstrate soft tissue swelling, the features described above are only detected on advanced stages (typically 15 years after the onset of the disease).

Early identification of bone and joint affection as well as early treatment could improve the prognosis because it has been shown that severe disease is strongly associated with loss of functional capacity.

As bone alterations and tophi occur before they are detectable on plain radiographs, other techniques capable of detecting alterations in earlier stages are necessary. In this way, a study has demonstrated that 56% of patients with gout showed alterations on advanced imaging techniques (US, CT, MRI) that were undetectable on plain radiographs.

2. Ultrasound

US can detect bone erosions three times more frequent than plain radiographs and also changes in early stages. Recent studies suggest that US is more sensible but less specific than plain radiographs.
Apart from that, US can guide the puncture of tophi and aspiration of synovial liquid.

Ultrasonography findings in gout include:

- Double-contour sign: hyperechoic and irregular band over the superficial margin of the joint cartilage, produced by the deposition of UMS crystals on the surface of hyalin cartilage of the joint which increases its thickness.
- Hyperechoic cloudy areas in the synovial.
- Bone erosions, defined in US as interruptions of the hyperechoic surface of bone, visible in two perpendicular planes.
- Tophi.
- Increased power doppler signal in the synovium can differentiate active from inactive inflammation.

3. Computed Tomography

Computed tomography (CT) allows visualization of both articular and subcutaneous tophi as masses of around 170 Hounsfield units density, this makes it possible to distinguish them from other nodules.

CT is superior to MRI and plain radiograph in the detection of bone erosions and can play a role in guiding aspiration of synovial liquid and other noninvasive procedures.

4. Magnetic Resonance Imaging

Although findings are nonspecific, Magnetic Resonance Imaging (MRI) allows early detection of tophi and bone erosions in asymptomatic gout even when plain radiograph shows no alterations.

Bone edema, synovial involvement, enhancement after Gadolinium and joint effusion can also be assessed.

Possible complications such as menisci tears or ligamentous sprain can also be evaluated.

However, gout features are very variable and can mimic a tumor or infection. This is why it is important to know its radiologic appearance not only to monitor evolution but also to detect gout in asymptomatic patients.

Surprisingly, few studies in literature describe the features of gout in MRI.
In this work we describe the spectrum of MRI findings in patients with tophaceous gout.

- **Tophi.**

Tophi are defined as amorphous aggregates of urate crystals and protein matrix surrounded by inflammatory tissue.

In MRI they appear as soft tissue masses of variable signal on T2 weighted images, frequently heterogeneous and of low signal.

In T1 weighted images they are homogeneous and hypointense.

They may show peripheral or nodular enhancement due to increased vascularization and granulomatous tissue.

Tophi can appear anywhere in the joint, and can be identified in intrasynovial, intraosseous, intratendinous or intraligamentous locations as well as in para-articular extraligamentous situation.
Fig. 1: MRI of the knee. Patient with tophaceous gout. Sagital T1 weighted image shows tophi as low signal soft tissue masses surrounding cruciate ligaments (arrow) and in the tibial plateau (arrow head). Both of them associate bone erosion. There are other tophi in the quadricipital tendon and patellar tendon (thick arrows).

References: Cruces University Hospital - Vizcaya/ES
Fig. 2: 2. Gadolinium-enhanced T1 SPIR (spectral inversion recovery) sagittal image of the knee shows tophi enhancement and synovitis.

References: Cruces University Hospital - Vizcaya/ES
Fig. 3: 3. Left image: Axial T2 weighted image of the knee. Tophi in both collateral ligaments (white arrows) and underlying bone erosions. Right image: Gadolinium-enhanced T1 SPIR image shows peripheric tophi enhancement.

References: Cruces University Hospital - Vizcaya/ES

- Synovitis

Synovitis is defined as an area in the synovial compartment that shows above normal post-gadolinium enhancement of a thickness greater than the width of the normal synovium (enhancement is judged by comparison of T1 weighted images obtained before and after intravenous gadolinium contrast).

When no alteration of the synovium is present, synovial membrane appears to be very thin and can not be seen. After gadolinium administration normal synovium shows very thin enhancement.

In our study we consider the synovial thickness to be normal when it is less than 1mm and linear enhancement is seen. Pathologic synovium is considered when it is greater than 2mm or has nodular foci of increased synovial thickness and enhances after gadolinium.

Synovial signal in tophaceous gout is variable but it normally appears as intermediate to low signal in T2 weighted images.
**Fig. 4:** Synovitis. Gadolinium-enhanced T1 SPIR image of the knee shows nodular enhanced foci of increased synovial thickness in a patient with tophaceous gout.

**References:** Cruces University Hospital - Vizcaya/ES

- **Bone erosions**

Bone erosions in MRI are defined as sharply marginated bone lesions, with correct juxta-articular localization and typical signal characteristics, which are visible in two planes with a cortical break seen in at least one plane.

Bone erosions in gout are para-articular and show sclerosing edges and overhanging osteophites.
Fig. 5: Axial T2* image of the knee shows overhanging osteophites (white arrows) and joint effusion.

References: Cruces University Hospital - Vizcaya/ES

- Joint effusion

In normal conditions, little amount of intraarticular liquid can be seen in healthy knees. We consider joint effusion to exist when liquid in suprapatellar recess is greater than 1 cm.

- Bone oedema
Bone oedema is defined as a lesion within the trabecular bone, with ill defined margins and signal characteristics consistent with increased water content.

MRI allows detection of associated disease (i.e. menisci tear) that although not specific of gout, is frequent in this population.

**MONITORING GOUT DURING URATE-LOWERING TREATMENT**

Long-term sustained control of serum urate levels to sub-saturating levels is associated with a significant reduction of tophi size and number of flares.

One way to monitor the reduction of deposits of urate would be aspirating a joint known previously to have MSU crystals to evaluate the persistence or absence of MSU crystals. However time to disappearance of MSU crystals can vary depending on the amount of deposit and it is a categorical variable (present/absent) which does not detect changes in a short period of time. Apart from that, this practice may not be available. For all these reasons a noninvasive and more accessible method to monitor gout is necessary.

Tophi measurement can be used to monitor urate lowering therapy: it can be done physically with a calliper or a standard tape or with imaging techniques:

Plain radiograph detects bone alterations only in advanced stages of the disease and does not allow tophi measurement. This would not be an appropriate issue to monitor gout.

US is an accessible technique that shows good intra and inter-observer correlation, it allows tophi measurement and detects the presence/absence of synovitis. Therefor, US is a suitable technique to monitor gout.

On the other hand, CT with multiplanar and volumetric reconstructions is a reproducible technique to measure tophi volume and shows good correlation with physical measurements.

Finally, MRI can measure tophi and can detect synovitis. Moreover, tophi and synovial enhancement can also be assessed and bone alterations are detectable from early stages. Apart from that MRI can rule out other causes of gonalgia such as ligament or meniscus injury. For all these reasons MRI is a good technique to monitor gout.
Fig. 6: Monitoring gout during urate-lowering therapy, tophi measurement. A and B- Sagital T2 weighted images of the knee. A- Tophi in both collateral ligaments. B- Same patient as in A two years later shows tophi reduction.

References: Cruces University Hospital - Vizcaya/ES

Fig. 7: Monitoring synovitis during urate-lowering therapy. A and B Gadolinium-enhanced T1 SPIR images. A- Nodular enhanced foci of increased synovial thickness. B- Same patient as in A: reduction in synovial thickness.

References: Cruces University Hospital - Vizcaya/ES
Conclusion

MRI allows early detection of tophi, synovitis, bone erosions and bone edema even in asymptomatic patients with gout. Apart from that, MRI is a good technique to monitor gout during urate-lowering therapy.
Personal Information


F. Perez-Ruiz. Department of Rheumatology.


Mail to: gorostizadiana@hotmail.com
References


