Case Report:
Fast Joint Imaging at 1.5 Tesla with a Combination of the Quadrature Knee and Body Matrix Coil in Case of Severe Knee Pain of an Obese Patient

Marietta Garmer M.D., Serban Mateiescu
Gröneweyer Institute of Microtherapy, Bochum, Germany

Introduction

Examinations of the knees of obese patients are challenging; most dedicated knee coils are optimized to offer a comfortable positioning and optimal coil load as well as signal contribution for a wide range of patients. However, even under such prerequisites, some patients do require special coil setups and cannot be examined with a conventional closed knee coil. This is not only true for obese patients; it may also apply also under other clinical conditions such as casted or stiffed joints and can result in an insufficient image quality (e.g. caused by inadequate signal contribution of the coil). But an uncomfortable patient positioning can also compromise the outcome of such an MR exam. Fortunately, imaging of a joint under such conditions is a rare request in the daily clinical routine. But if required it represents a clear challenge for the technologist. In addition to the simple technical challenges of such an examination, the patient is very often in pain and the compliance strongly depends on comfortable positioning – which may be difficult to achieve. Additionally, because of the pain, image acquisition must be fast and of sufficient quality to avoid re-examination. In the presented case we demonstrate how a flexible coil setup provided by the Tim coil technology in combination with open-bore MR technology can assist in the diagnoses of knee pain in obese patients.

Patient history

An obese 60-year-old female patient (150 kg, 175 cm, BMI = 49) consulted our institution because of progressive knee pain over the previous two weeks. The pain persisted under stress as well as in rest. Walking was only possible with assistance.

The patient could not remember any traumatic accident. The clinical examination showed neither findings of crepitation of the patella nor medial pressure pain. Patient anamneses revealed known osteoarthritis; an artificial hip joint had been implanted in 2005 because of hip osteoarthritis. MRI was performed to evaluate known osteoarthritis.
MR examination

All shown images were acquired with an open-bore 1.5 Tesla system (MAGNETOM Espree; software version syngo MR B15).

The patient was positioned feet first in supine position. The affected knee was positioned inside the lower part of the quadrature knee coil. Because of the large size of the knee (68 cm circumference) the extremity coil could not be closed. Therefore the examination required a different imaging strategy; to achieve an optimal illumination of the knee, one Body Matrix coil was used and replaced the upper part of the knee coil. The other knee was covered by an electrical shielding to avoid back folding.

The imaging protocol included:

- Sagittal T1w SE: TR 544 ms, TE 18 ms, slice thickness 4 mm, FOV 196 x 220 mm, Matrix 260 x 512, phase-encoding head – feet, TA 3:31 min (Fig. 1)
- Sagittal T2w STIR: TR 4850 ms, TE 40 ms, TI 130 ms, slice thickness 4 mm, FOV 196 x 220 mm, Matrix 392 x 512, phase-encoding head – feet, TA 3:00 min (Fig. 2)
- Coronal T1w SE: TR 544 ms, TE 18 ms, slice thickness 4 mm, FOV 230 x 230 mm, Matrix 292 x 512, phase-encoding right – left, TA 3:20 min (Fig. 3)
- Coronal T2w STIR: TR 4650 ms, TE 39 ms, TI 150 ms, slice thickness 4 mm, FOV 230 x 230 mm, Matrix 384 x 512, phase-encoding right - left, TA 3:20 min (Fig. 4)
- Transversal T1w SE: TR 544 ms, TE 18 ms, slice thickness 6.5 mm, FOV = 230 x 230 mm, Matrix 292 x 512, phase-encoding right - left, TA 3:01 min (Fig. 5)
- Sagittal PDw FS: TR 1610 ms, TE 36 ms, PAT2, slice thickness 4 mm, FOV 240 x 240 mm, Matrix 320 x 320, phase-encoding head-feet, TA 1:48 min (not shown)

The resulting total imaging time was less than 25 minutes.

Imaging findings and diagnosis

A bone marrow edema (asterisk in figures 1–5) of the femur and signs of knee osteoarthritis were found as well as an effusion in the suprapatellar bursa (Figs. 1, 2). A hypointense linear band (arrowhead in figures 3–5) on both T1-weighted images (Figs. 3, 5) and STIR sequence (Fig. 4) was observed, representing a fracture cleft. Edema and partial loosening of the anterior cruciate ligament was present, too. In conclusion, a clinically not suspected non-traumatic stress fracture of the distal femur was diagnosed although, based on the image findings, a partial rupture of the anterior cruciate ligament could not be excluded. In addition, severe osteoarthritis with defects of the articular cartilage, medial meniscopathy and arthrosis of the femoropatellar joint were also diagnosed.