European Journal of Radiology Open 3 (2016) 259–263

Contents lists available at ScienceDirect

European Journal of Radiology Open

journal homepage: www.elsevier.com/locate/ejro

Original Article

Chondral lesions in the patellofemoral joint in MRI: Intra-individual comparison of short-tau inversion recovery sequence (STIR) with 2D multiple-echo data image combination sequence (MEDIC)

Boris Bodelle*, Wolfgang Luboldt, Julian L. Wichmann, Sebastian Fischer, Thomas J. Vogl, Martin Beeres

Goethe University of Frankfurt, Department of Diagnostic and Interventional Radiology, Theodor-Stern-Kai 7, 60590, Frankfurt, Germany

ARTICLE INFO

Article history:
Received 6 October 2016
Received in revised form 25 October 2016
Accepted 27 October 2016

Keywords:
MRI
Chondral Lesion
Patellofemoral Joint
STIR
MEDIC

ABSTRACT

Purpose: To determine the value of the 2D multiple-echo data image combination (MEDIC) sequence relative to the short-tau inversion recovery (STIR) sequence regarding the depiction of chondral lesions in the patellofemoral joint.

Materials and methods: During a period of 6 month patients with acute pain at the anterior aspect of the knee, joint effusion and suspected chondral lesion defect in the patellofemoral joint underwent MRI including axial MEDIC and STIR imaging. Patients with chondral lesions in the patellofemoral joint on at least one sequence were included. The MEDIC and STIR sequence were quantitatively compared regarding the patella cartilage-to-effusion contrast-to-noise ratio (CNR) and qualitatively regarding the depiction of chondral lesions independently scored by two radiologists on a 3-point scale (1 = not depicted; 2 = blurred depicted; 3 = clearly depicted) using the Wilcoxon-Mann-Whitney-Test. For the analysis of inter-observer agreement the Cohen's Weighted Kappa test was used.

Results: 30 of 58 patients (male: female, 21:9; age: 44 ± 12 yrs) revealed cartilage lesions (fissures, n = 5 including fibrillation; gaps, n = 15; delamination, n = 7; osteoarthritis, n = 3) and were included in this study. The STIR-sequence was significantly ($p < 0.001$) superior to the MEDIC-sequence regarding both, the patella cartilage-to-effusion CNR (mean CNR: 232 ± 61 vs. 40 ± 16) as well as the depiction of chondral lesion (mean score: 2.83 ± 0.4 vs. 1.75 ± 0.7) with substantial inter-observer agreement in the rating of both sequences ($\kappa = 0.76–0.89$).

Conclusion: For the depiction of chondral lesions in the patellofemoral joint, the axial STIR-sequence should be chosen in preference to the axial MEDIC-sequence.

© 2016 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Chondral lesions in the patellofemoral joint are the most common cause for acute pain at the anterior aspect of the knee. They can be roughly divided in cartilaginous fissures or gaps. When the fissure is located at the medial retro patellar aspect and a plica mediopatellaris exists, it is assumed that the fissure is caused by the plica as incision injury so that the removal of the plica is indicated to prevent further cartilaginous incision injuries. How to prevent cartilaginous gap injuries is unclear. However, the method of choice to diagnose chondral lesions is MRI. There are cartilage specific gradient echo sequences like the 2D multiple-echo data image combination sequence (MEDIC) which are used in musculoskeletal imaging to delineate cervical disc herniation, tiny ligaments such as the scapholunate ligament [2], labrum injuries such as the Bankart lesion, calcific deposits like in tendinitis calcarea or loose bodies in the joint. This sequence is used to determine the thickness of the cartilage and can be performed in 3D to quantify and map the volume of the cartilage. On the other hand, there are spin echo sequences which in contrast to the gradient echo-sequence better demarcate bone marrow edema when fat suppressed. In addition, these sequences provide a kind of indirect arthrography due to the high contrast between cartilage and surrounding fluid. Thus, the short-tau inversion recovery sequence (STIR) seems to be the optimal sequence to demarcate both, tiny cartilaginous fissures and bone marrow edema as their consequence. However, the value

Abbreviations: STIR, short-tau inversion recovery sequence; MEDIC, 2D multiple-echo data image combination sequence.

* Corresponding author.
E-mail address: bbodelle@googlemail.com (B. Bodelle).

http://dx.doi.org/10.1016/j.ejro.2016.10.004
2352-0477/© 2016 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

of the MEDIC is still unclear. The Medic has been only absolutely assessed but not relatively to other sequences Schmid MR et al. [1]. Thus, the purpose of our study was to determine the value of the 2D multiple-echo data image combination sequence relative to the short-tau inversion recovery sequence regarding the depiction of chondral lesions in the patellofemoral joint.

2. Materials and methods

During a period of 6 month patients with acute pain at the anterior aspect of the knee, joint effusion and suspected chondral lesion in the patellofemoral joint underwent MRI including axial MEDIC and STIR imaging. The study was approved by the local ethics committee. Informed consent was obtained from all patients.

MRI was performed on a 70 cm open bore and 125 cm short 1.5T scanner (MAGNETOM Espree, Siemens Healthcare, Erlangen, Germany) using a circular polarized knee coil. The MRI protocol is outlined in Table 1.

Only patients with chondral lesions in the patellofemoral joint on at least one MRI sequence were elected for sequence comparison.

2.1. Objective/quantitative Comparison

The MEDIC and STIR sequence were *quantitatively* compared regarding the patella cartilage-to-effusion contrast-to-noise ratio (CNR). For that purpose the mean signal intensity (SI) of retropatellar cartilage and effusion as well as the standard deviation (SD) of air were measured by standardized region-of-interest (ROI) measurement at the level of the chondral lesion with 3–6 mm diameter depending on the thickness of the retropatellar cartilage. The standard deviation of air served as noise, so that CNR was calculated according to the formula: $CNR: = (SI_{cartilage} - SI_{Effusion})/SD_{air}$

2.2. Subjective/qualitative Comparison

The MEDIC and STIR sequence were *qualitatively* compared by two radiologists with 2 and 6 years experiences in musculoskeletal imaging who independently scored the depiction of the chondral lesion on a 3-point scale (1 = not depicted; 2 = blurred depicted; 3 = clearly depicted).

2.3. Statistical analysis

The comparison in objective CNR and subjective rating was performed by the Wilcoxon-Mann-Whitney-Test using a p-value less than 0.05 as level of significance. Inter-observer agreement was analyzed with Cohen κ analysis using the four categories in agreement: fair (κ = 0.21–0.40), moderate (κ = 0.41–0.60), substantial (κ = 0.61–0.80), almost perfect (κ = 0.81–1.00) [3].

3. Results

30 of 58 patients (male: female, 21:9; age: 44 ± 12 yrs) revealed cartilage lesions (fissures, n = 5 (Fig. 1, Fig. 2) including fibrillation (Fig. 3); gaps, n = 15 (Figs. 4 and 5); delamination, n = 7 (Fig. 6); osteoarthritis, n = 3) and were included in this study. The STIR-sequence was significantly ($p < 0.001$) superior to the MEDIC-sequence regarding both, the patella cartilage-to-effusion CNR (mean CNR: 232 ± 61 vs. 40 ± 16) as well as the depiction of chondral lesion (mean score: 2.83 ± 0.4 vs. 1.75 ± 0.7) with substantial inter-observer agreement in the rating of both sequences (κ = 0.76-0.89).

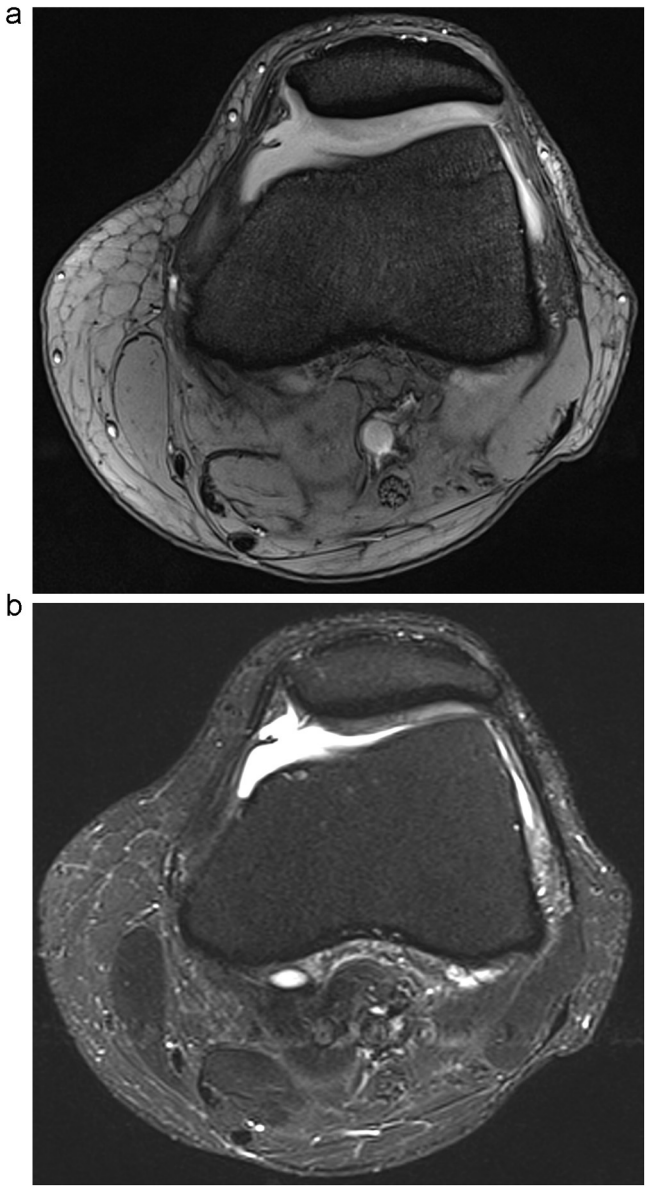

Fig. 1. Cartilaginous fissure of the medial aspect of the patella imaged with MEDIC (a) and STIR (b). The fissure is presumably caused by a plica mediopatellaris as incision injury. The chondropathia patellae is better depicted by the STIR-sequence (b) due to the higher cartilage-to-effusion contrast-to-noise ratio (STIR = 219 vs. MEDIC = 20).

4. Discussion

Our results show that the STIR-sequence is significantly superior to the MEDIC-sequence regarding the depiction of chondral lesions in the patellofemoral joint (Figs. 1–6). Thus, the STIR-sequence should be preferred over the MEDIC-sequence for the depiction of chondral lesions in the patellofemoral joint.

Although the MEDIC-sequence provides a higher spatial resolution (0.5 × 0.4 mm vs. 0.7 × 0.6 mm) (Tab. 1) it masks tiny injuries like fissures (Figs. 1 and 2), defibrillation (Fig. 3) or delamination (Fig. 6). Due to the high prevalence of mediopatellar plica in up to 80% of cases [4] and its association with cartilage damage [5,6] the depiction of plica induced cartilage damage seems crucial. In contrast to the MEDIC-sequence the STIR- sequence also depicts reactive edemas in the bone marrow as indirect sign of cartilage stress or damage (Fig. 3). Furthermore, edema depiction facilitates the assessment of severity, acuteness and consequence of carti-

Download English Version:

https://daneshyari.com/en/article/8822900

Download Persian Version:

https://daneshyari.com/article/8822900

Daneshyari.com