Assessment of Acetabular Cartilage and Labrum for Painful Hips Using Radial MRI with Biochemical and Morphological Sequences: Arthroscopic Verification

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【Target audience】 Orthopedic surgeon, Arthroscopist, Radiologist

【Purpose】 To evaluate diagnostic ability of 1) radial MRI with T2 mapping for the acetabular cartilage lesions and 2) radial MRI with T2*- and T2-weighted sequences for the labral lesions with arthroscopic verification in patients with painful hip.

【Methods】 Nineteen patients with painful hip who underwent both MRI examinations and hip arthroscopy were studied. There were 15 female and 4 male patients, and the mean age was 32 years (14 to 47). On plain radiographs, all patients showed no osteoarthritic changes, but had DDH deformity in 11 hips, FAI deformity in 3 hips, and no morphological deformity in 5 hips. Radial T2 map images of the unilateral hip were obtained at 30° intervals passing through the center of the acetabular dome and perpendicular to the acetabular rims for biochemical evaluation of the acetabular cartilage (Plane A90 to P90, Fig 1). In each radial image, average cartilage T2 value in the lateral zone of the weight bearing was calculated using custom-made semiautomatic software (Fig 2). Radial fast spin-echo T2-weighted images and radial gradient echo T2* -weighted images were also obtained for morphological evaluation of the acetabular labrum in each radial image. Labral tear was defined as abnormal internal signal or exhibiting effusion extending into labrum, as previously reported.[2] The relationship between acetabular cartilage T2 value and arthroscopic cartilage degeneration evaluated by both existence and severity according to the classification of Outerbridge was analyzed in each matched location. Sensitivity, specificity and accuracy of both T2 mapping for detecting cartilage lesion and T2*- and T2-weighted imaging for the labral lesions were evaluated by using receiver operating characteristic (ROC) curves.

【Results】

Acetabular cartilage T2 value at zone where arthroscopic cartilage degeneration existed was significantly greater than that at zone with normal cartilage finding (43.6ms and 38.6ms respectively, p<0.0001). Acetabular cartilage T2 value correlated with severity of cartilage lesion according to the classification of Outerbridge (r=0.57, p<0.0001, Fig.3), and sensitivity/ specificity/ accuracy of T2 mapping for detecting lesions of grade 1 and above were 66%/77%/70% and for detecting lesions of grade 2 and above were 83%/70%/75% when threshold T2 value of 42 ms was employed from ROC curve analysis. Sensitivity/ specificity/ accuracy were 62%/83%/70% in T2-weighted image and 86%/70%/79% in T2*-weighted image, respectively.

【Discussion】

Radial MRI with T2 mapping and T2*- and T2-weighted sequences was useful in non-invasive reliable assessment of cartilage and labral lesions over the whole acetabular area. These techniques may allow clarification of clinical impacts of morphological DDH and FAI abnormalities on occurrence of cartilage or labral disorder, and establishment of suitable treatment strategy for painful hips according to subclinical pathological abnormalities.

【Conclusion】 Radial MRI with T2 mapping and T2*- and T2-weighted sequences was useful in non-invasive reliable assessment of cartilage and labral lesions over the whole acetabular area.

【References】 1, Mosher TJ, Walker EA, Petscavage-Thomas J, et al. Osteoarthritis year 2013 in review: imaging. Osteoarthritis Cartilage. 2013; 21(10):1425-35. 2, Abe I, Harada Y, Oinuma K, et al. Acetabular labrum: abnormal findings at MR imaging in asymptomatic hips. Radiology. 2000; 216(2):576-81
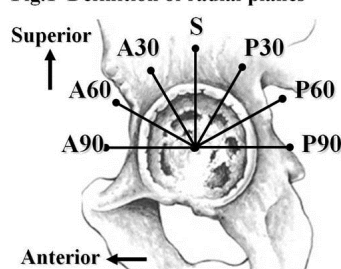
Fig.1 Definition of radial planes

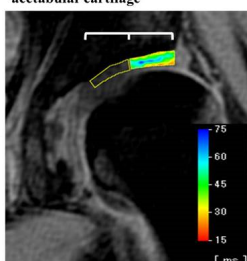Fig.2 T2 mapping in lateral zone of acetabular cartilage

Fig.3 T2*-weighted image of acetabular labrum

Fig.4 Correlation of acetabular cartilage T2 value with severity of cartilage lesion to according to Classification of Outerbridge.

r= 0.57, p <0.001