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ORIGINAL ARTICLE

Predictive findings on magnetic resonance imaging in patients with symptomatic acromioclavicular osteoarthritis

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Background: A magnetic resonance imaging (MRI) scan of the shoulder can have added value in diagnosing symptomatic osteoarthritis of the acromioclavicular (AC) joint. Specific MRI signs have been recognized but not analyzed extensively before. This study aims to identify predictive MRI signs in patients with symptomatic AC osteoarthritis.

Methods: The MRI scans of 70 patients with symptomatic AC osteoarthritis were compared with those of 70 patients with subacromial pain syndrome and no clinical signs of symptomatic AC osteoarthritis. Seven variables were evaluated on the MRI scans of the AC joint: joint space narrowing, inferior osteophytes, joint effusion, osteolysis, bone marrow edema, impression on the supraspinatus, and inferior joint distension. Logistic regression analysis of these variables was performed.

Results: The presence of inferior osteophytes, bone marrow edema, impression on the supraspinatus, and inferior joint distension was individually associated with symptomatic AC osteoarthritis. Bone marrow edema was observed only in patients with symptomatic AC osteoarthritis. Multivariate analysis showed a significant association between inferior joint distension, as well as impression on the supraspinatus muscle, and symptomatic AC osteoarthritis. The area under the receiver operating characteristic curve in the multivariate logistic model was 0.839 (95% confidence interval, 0.771 to 0.907). Interobserver and intraobserver variability showed good to excellent κ values (range, 0.68 to 0.88).

Conclusion: We identified predictive MRI signs in patients with symptomatic AC osteoarthritis. These findings, including bone marrow edema, inferior joint distension, and impression on the supraspinatus muscle, showed good discriminative ability. They are practical and easy to use and can assist the physician in diagnosing symptomatic AC osteoarthritis.

Level of evidence: Level IV; Case-Control Design; Diagnostic Study

Keywords: AC joint; AC osteoarthritis; MRI scan; bone marrow edema; impression on musculus supraspinatus; predictive findings

Approval of this study was obtained from the regional Medical Ethical Committee (METC Isala, No. 15.0222).

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Degeneration of the acromioclavicular (AC) joint, with joint space narrowing and osteophyte formation, is part of the normal aging process.[10,19] In most of the general population, osteoarthritis of the AC joint is not symptomatic, but in some cases, such degenerative changes cause pain and loss of normal shoulder function.[12] Treatment of symptomatic osteoarthritis of the AC joint was proved effective with either injection therapy or distal clavicle resection.[5,7,21] However, the diagnostic accuracy of the patient's history and clinical examination findings is limited because of the complex anatomy and kinematics of the shoulder joint.[4,16,17]

The diagnosis of symptomatic AC osteoarthritis is made by an accurate history, clinical examination, and additional radiodiagnostic imaging studies. Previous studies have debated the accuracy and reliability of clinical tests of the AC joint.[5,11] Imaging techniques such as magnetic resonance imaging (MRI) scans could be of added value in patients with shoulder pain and could assist the clinician in determining treatment options.[6,15]

Previous research has shown that advanced signs of degeneration in the AC joint seen on the MRI scan are correlated with symptoms and that bone marrow edema is only observed in patients with symptomatic AC osteoarthritis.[8,18] Choo et al[2] observed that superior capsular distension of the AC joint on MRI scans was a predictable finding in symptomatic patients.

The aim of this study was to identify predictive MRI signs in patients with symptomatic AC osteoarthritis. We hypothesized that specific MRI signs would be found in patients with symptomatic AC osteoarthritis.

Materials and methods

Design

This study had a retrospective, case-control, diagnostic study design and was conducted in a general teaching hospital with a specialized shoulder unit.

Study population

A total of 140 patients were selected from the electronic patient files: 70 consecutive patients with clinical isolated symptomatic AC osteoarthritis (group 1) and 70 consecutive patients with chronic subacromial pain syndrome (group 2). Groups 1 and 2 were matched for sex and age (maximal deviation of 5 years) to avoid bias resulting from age-related degeneration of the AC joint.[18]

Patients in both groups were recruited from our outpatient department: group 1 in 2009 to 2014 and group 2 in 2012 to 2014. The inclusion criteria for group 1 were pain localized in the AC joint that increased with activities requiring cross-body adduction, focal tenderness at the AC joint, and a positive cross-body adduction test. Patients with additional shoulder disorders, as stated later, were excluded in order to include only patients with clinical isolated symptomatic AC osteoarthritis. Group 2 consisted of patients with nontraumatic shoulder problems that caused pain localized around the acromion, which worsened during lifting of the arm; a positive Hawkins test; a positive empty-can test; and/or focal tenderness of the supraspinatus. The exclusion criteria for group 2 were focal tenderness of the AC joint and a positive cross-body adduction test. The exclusion criteria for both groups were rheumatoid arthritis, a history of shoulder surgery or fracture, glenohumeral osteoarthritis, ruptures of the cuff or labrum on MRI scans, or clinical painful biceps tendinopathy.

All patients with shoulder pain were reviewed in our shoulder unit by 2 experienced shoulder surgeons using a standard protocol for clinical history and clinical examination. Data were collected in a standardized manner and noted in patients' electronic medical files. The following clinical variables were assessed and stored in a database: age, sex, affected side, dominant side, duration of shoulder complaints, focal tenderness at the AC joint, cross-body adduction test, Hawkins test, empty-can test, and focal tenderness of the supraspinatus.

Signs on MRI

All MRI scans were performed 2 to 3 weeks after the outpatient visit in our hospital on a 1.5-T Signa HDx TwinSpeed1 MRI system (General Electric, Milwaukee, WI, USA). The shoulder was placed in a dedicated shoulder coil while in external rotation. All MRI scans were performed according to a standard protocol. Coronal T2-weighted fat-saturated images, sagittal T1-weighted or proton density sequences, and axial images were obtained for each patient. All MRI scans were evaluated blindly on a consensus basis by a musculoskeletal radiologist, an orthopedic surgeon, and a final-year medical student.

On the basis of previous research and clinical experience, 7 variables were evaluated on the MRI scans:

1. AC joint space narrowing: minimal space between the clavicle and acromion on axial images, with the cutoff value for joint space narrowing set at 2 mm
2. AC joint effusion: fluid-equivalent signal in the AC joint space
3. Subchondral bone marrow edema of the distal clavicle and/or medial acromion: hyperintense signal from cranial to caudal on fat-saturated T2-weighted images and hypointense signal on T1-weighted images
4. AC osteolysis: lytic bone lesion with cortical destruction of the distal clavicle
5. AC inferior osteophytes: inferior osteophyte, 2 mm or longer (length measured from a horizontal line on the original undersurface of the clavicle on coronal images, Fig. 1).
6. Inferior AC joint distension: distal protrusion of the AC joint, 3 mm or longer (measured from a horizontal line on the original undersurface of the clavicle on sagittal or coronal images, Fig. 1).
7. Impression on the supraspinatus due to the AC joint: 3 scores (on sagittal T1 or proton density sequences): (1) normal fat between AC joint and supraspinatus, (2) no fat between AC joint and supraspinatus, and (3) an indentation on the supraspinatus (Fig. 2)

To enhance interpretation of the findings on MRI in clinical practice, variables were expressed dichotomously. Cutoff values for joint space narrowing, inferior osteophytes, and joint distension were based on the 75th percentile and rounded to the nearest millimeter.

Statistical analysis

Demographic and clinical characteristics

The demographic and clinical characteristics were presented as proportion, mean (standard deviation), or median (interquartile range)