Magnetic resonance imaging scans are not a reliable tool for predicting symptomatic acromioclavicular arthritis

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Abstract

Background: We investigated whether magnetic resonance imaging (MRI) scans can accurately diagnose arthritis of the acromioclavicular joint (ACJ) because it has recently been suggested that bone marrow oedema on MRI scans is a predictive sign of symptomatic ACJ arthritis.

Methods: The MRI scans of 43 patients (50 shoulders) who underwent ACJ excision for clinically symptomatic ACJ arthritis were compared to a control group of 43 age- and sex-matched patients (48 shoulders) who underwent an MRI scan for investigation of shoulder pain but did not have clinical symptoms or signs of ACJ arthritis. The scans were evaluated by an experienced musculoskeletal radiologist, who was blinded to the examination findings.

Results: Bone marrow oedema was present in only 15 (30%) shoulders in the ACJ excision group, although this was higher than the six shoulders in the asymptomatic group ($p = 0.03$). Forty-one (82%) shoulders in the symptomatic group had grade III/IV ACJ arthritis compared to 31 (65%) in the asymptomatic group ($p = 0.05$). However, 44 out of 48 (92%) shoulders in the asymptomatic group had signs of osteoarthritis on MRI scans.

Conclusions: In contrast to recent reports, the present study shows that MRI is not helpful in making the diagnosis of ACJ arthritis. A focused history and clinical examination should remain the mainstay for surgical decision making.

Level of evidence: Level 3

Keywords

ACJ excision, acromioclavicular joint, bone marrow oedema, MRI, osteoarthritis, radiographs

Date received: 29th December 2016; accepted: 1st July 2017

Introduction

Acromioclavicular joint (ACJ) arthritis is a common cause of shoulder pain. The ACJ is incongruous and often begins to degenerate as early as the second decade of life. Although degenerative changes start in the second decade, most become symptomatic in the fifth decade.¹

ACJ excision, open or arthroscopic, is a simple and effective treatment for ACJ arthritis. The decision to treat surgically is usually made on clinical grounds using a focused history, clinical examination and, sometimes, a response to local anaesthetic injections. Various physical examination tests for ACJ arthritis have been described in the literature. Not all signs are positive in each patient and the tests have variable

sensitivity and specificity.^{2,3} Investigations to assess the extent of degenerative changes in the ACJ include plain radiographs and magnetic resonance imaging (MRI) scans. Some studies have suggested that MRI can be a useful investigation to help guide treatment. Stein et al.⁴ found that bone marrow oedema was present in 80% of patients with symptomatic ACJ arthritis and concluded that its presence on MRI may assist in the decision-making process for treatment. Choo et al.,⁵

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however, did not find marrow oedema to be a reliable MRI scan finding of symptomatic ACJ arthritis and instead suggested that capsular distension on MR arthrography is a more predictive finding of symptomatic ACJ arthritis. However, some studies report over 80% changes in MRI and plain radiographs, even in asymptomatic joints, raising concern regarding the usefulness of MRI in guiding treatment for ACJ arthritis.⁶

In the senior author's (BS) practice, decision to excise the AC joint is usually made after a focused history and clinical examination rather than on radiological findings. We hypothesized that changes in the ACJ on MRI scans do not accurately predict the presence or absence of symptoms arising from the ACJ. Therefore, the null hypothesis that we aimed to reject is that there is good correlation between MRI changes of ACJ arthritis and the presence of symptoms.

Materials and methods

In this retrospective study, we looked at records of 43 consecutive patients (50 shoulders) who underwent arthroscopic ACJ excision for clinically symptomatic ACJ arthritis within a 2-year period from 1 January 2012 to 31 December 2013 (Group A). This group was compared with a second group of 43 (48 shoulders) age- and sex-matched patients who underwent an MRI scan for investigation of shoulder pain but did not have ACJ excision (Group B). Patients in group B did not have clinical symptoms or signs of symptomatic AC arthritis but had surgery for other shoulder pathology such as arthroscopic subacromial decompression, rotator cuff repair or biceps tenodesis (Table 1).

Patients were identified from theatre records. All of the patients had been seen by a single surgeon and assessed in accordance with a standard protocol. A relevant history and physical examination was undertaken. Specific provocative tests for ACJ arthritis included cross-body adduction, The results of O'Brien's active compression test and also pain on elevation beyond 120° were noted. The patients had standard plain radiographs, including anteroposterior, lateral, axillary and Zanca views.⁷ The MRI scans in these patients were performed purely to rule out associated rotator cuff pathology. MRI findings of the ACJ were not taken into consideration when deciding upon surgical treatment. All patients in group A had non-operative treatment prior to surgery including physiotherapy and a therapeutic trial of steroid injections, administered under image guidance.

The MRI was performed using standard noncontrast technique with 3-mm slices. The MRI protocol consisted of axial, coronal and sagittal fat suppressed proton density and coronal oblique T1 images. The

Table 1. Age, sex and side distribution of patients who had acromioclavicular joint excision (Group A) compared to those who had other arthroscopic procedures (Group B).

	Group A	Group B
Number of patients	43	43
Shoulders (n)	50	48
Age (years), mean (range)	55 (27–82)	54.5 (25–83)
Sex		
Female	20	19
Male	23	24
Side		
Right	26	23
Left	24	25

MRI scans and plain radiographs were evaluated by an experienced musculoskeletal radiologist who was blinded to the clinical examination and diagnosis, as well as age and sex of the patients. ACJ osteoarthritis was graded based on an established scale of I to IV (none, mild, moderate and severe).² A note was made of the acromion process morphology,⁸ bone marrow oedema on either side of ACJ, status of the rotator cuff and any other significant finding.

Statistical comparisons were made between the incidence of different MRI scan findings in group A and group B using the chi-squared test. $p < 0.05$ was considered statistically significant.

Results

The age, sex and side distribution of the patients in the two groups is presented in Table 1.

All patients in Group A had an arthroscopic subacromial decompression (ASAD) at the same time as ACJ excision. All patients in Group B had ASAD, although, in addition, 17 patients had an arthroscopic rotator cuff repair, five had arthrolysis, two had biceps tenotomy and one had biceps tenodesis.

The incidence of various MRI scan findings, including the grade of arthritis, presence of bone marrow oedema, acromion morphology and the presence of rotator cuff tears, is summarized in Table 2.

Bone marrow oedema was found in only 30% of shoulders in the symptomatic group, although this was higher than the 12% of shoulders in the asymptomatic group ($p = 0.03$). Distal clavicle bone marrow oedema was seen in 11 patients in the symptomatic

Table 2. Magnetic resonance imaging (MRI) findings in patients who had acromioclavicular joint (ACJ) excision (Group A) compared to those who had other arthroscopic procedures (Group B)

MRI scan finding	Group A (n = 50) (symptomatic ACJ)	Group B (n = 48) (asymptomatic ACJ)	p-value (chi-squared test)
ACJ arthritis grade			
I (None)	0	4	0.03
II (Mild)	9	13	0.28
III (Moderate)	28	24	0.55
IV (Severe)	13	7	0.16
Bone marrow oedema			
None	35	42	0.03
Clavicular side	4	4	0.95
Acromion side	4	0	0.04
Both sides	7	2	0.07
Acromion morphology			
Type I	22	16	0.27
Type II	7	18	0.007
Type III	21	14	0.18
Rotator cuff status			
Normal	4	3	0.73
Full-thickness tear	10	15	0.2
Partial tear	12	19	0.09
Tendinosis	24	11	0.009

group and six patients in the asymptomatic group ($p=0.2$), whereas oedema of the acromion side was seen in 11 patients in the symptomatic group compared to two patients in the asymptomatic group ($p=0.009$). Eighty-two percent of shoulders in the symptomatic group had grade III or IV ACJ arthritis compared to 65% of shoulders in the asymptomatic group ($p=0.05$).

The incidence of a type II acromion was 14% in the symptomatic group and 36% in the asymptomatic group ($p=0.007$), although there was no difference in the incidence of type I ($p=0.27$) or type III ($p=0.18$) acromion between the two groups. Twenty-two patients in the symptomatic group had a partial or full-thickness rotator cuff tear compared to 34 in the asymptomatic group ($p=0.007$).

Signs of osteoarthritis were seen on plain radiographs in 45 of the 50 shoulders in Group A and 42 of the 45 shoulders in group B ($p=0.7$).

Discussion

We found that there was a significantly higher incidence of bone marrow oedema in the symptomatic group compared to the asymptomatic group. However, this finding was seen in the MRI scans of only 30% of patients and therefore is unlikely to be a reliable indicator of symptomatic ACJ arthritis. Our results are different from those of Stein et al.⁴ who found that none of the patients in their asymptomatic group had bone marrow oedema on MRI scan. They also reported a much higher incidence of bone marrow oedema

(80%) in patients who had symptomatic ACJ arthritis than our study (30%). Stein et al.⁴ concluded that reactive bone oedema on MRI scan has high correlation with clinical examination.

Our results, showing only 30% incidence of bone marrow oedema, do not support their conclusion. We have also compared bone marrow oedema in the acromion or distal clavicle and found a significantly higher incidence of bone marrow oedema on the acromion side in the symptomatic group. Our results are different from those of Jordan et al.⁹ who also studied the relationship between MRI and clinical findings in the ACJ and found a significant correlation between high signal in the distal clavicle and clinically symptomatic ACJ arthritis.

Choo et al.⁵ reported a larger series of 146 patients and attempted to differentiate between symptomatic and asymptomatic ACJ arthritis. Their group was very heterogeneous with more women in the symptomatic than the asymptomatic group. They also undertook direct or indirect MR arthrography, which is not the standard investigation for ACJ pain in the UK. They found that presence of bone oedema was not a significant variable in the diagnosis of symptomatic ACJ arthritis. In their series, a superior capsular distension was more predictive of symptomatic ACJ arthritis.

We also found a significantly higher percentage of patients who had grade III or IV ACJ arthritis in the symptomatic group, although 44 shoulders (92%) in the asymptomatic group also had signs of ACJ arthritis on MRI scan. There was also no difference in the number of shoulders with positive plain radiographic findings between the two groups. Therefore, we consider that the presence of degenerative changes on MRI scans or plain radiographs is not a useful predictor of clinically symptomatic ACJ arthritis.

There were a higher number of patients with a type II acromion in the asymptomatic group. In our opinion, this is likely to represent a statistical anomaly rather than comprise a clinically significant finding.

We found that the asymptomatic group had a higher incidence of rotator cuff tears, both partial and full thickness. This was a result of our patient selection because we selected those patients undergoing arthroscopic procedures other than ACJ excision in Group B.

ACJ pain is often reported over the anterosuperior aspect of the shoulder, usually worsened by overhead activities.¹⁰ These symptoms, however, can be present in other pathologies, such as rotator cuff tears, biceps tendonitis and superior labral tears.¹¹ It is therefore important to perform a careful clinical examination aiming to determine whether the ACJ arthritis is contributing to the symptoms. Tests described for the

diagnosis of ACJ arthritis include tenderness over the joint, the cross-adduction test and O'Brien's test, amongst others, although none of these tests has been shown to be highly sensitive and specific.³ Tenderness over the ACJ has a 96% sensitivity but a specificity of only 10%.¹² The cross-adduction test has a sensitivity of 77% and a specificity of 79%, whereas O'Brien's test has a sensitivity of 41% and a specificity of 95%. Therefore, a combination of careful history, focused clinical examination and a response to a local anaesthetic/steroid injection would be more reliable in the diagnosis of ACJ arthritis. Furthermore, imaging is often obtained to assess the cuff and degenerative ACJ changes may be observed incidentally. It can be tempting for surgeons to use MRI findings when deciding whether to excise the ACJ or not. Thus, knowing whether or not MRI findings are reliable becomes important in the decision-making process.

The present study has increased significance in any government delivered health service where there are always pressures on reducing costs. We consider that a significant number of unnecessary MRI scans can be avoided by performing a focused clinical assessment, hence reducing costs for the UK National Health Service. The present study also reinforces our considered opinion that the MRI scans of the shoulder joint should ideally only be performed after assessment by a specialist orthopaedic service and not be requested from Primary Care because this is likely to lead to over-diagnosis and an increased number of referrals to secondary or tertiary care.

We recognize the limitations of a retrospective study. It is possible that the lack of a correlation between symptomatic ACJ arthritis and MRI scan findings may be the result of a high intra- and inter-observer variability, although this was not assessed in our study.

Conclusions

In the present study, we found that MRI was not a useful predictor of symptomatic ACJ arthritis because a high proportion of patients (92%) with no symptoms attributable to the ACJ had changes indicating degeneration of the ACJ on MRI scans. Furthermore, bone marrow oedema in the clavicle or acromion on MRI scans was not a reliable predictor of symptoms because it was not observed in 70% of shoulders with clinically symptomatic ACJ arthritis. We consider that the decision to surgically excise the ACJ for symptomatic arthritis should be based on a focused history and clinical examination and reliance should not be placed on MRI scans in the decision-making process.

Acknowledgements

The study was previously presented at the American Academy of Orthopaedic Surgeons (AAOS) Annual Conference 2016 and the British Shoulder and Elbow Society (BESS) Annual Conference 2016.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical Review and Patient Consent

Not required for this article.

References

1. Ogata S and Uthoff HK. The early development and ossification of the human clavicle – an embryologic study. *Acta Orthop Scand* 1990; 61: 330–333.
2. Chronopoulos E, Kim TK, Park HB, Ashenbrenner D and McFarland EG. Diagnostic value of physical tests for isolated chronic acromioclavicular lesions. *Am J Sports Med* 2004; 32: 655–661.
3. Mall NA1, Foley E, Chalmers PN, Cole BJ, Romeo AA and Bach BR Jr. Degenerative joint disease of the acromioclavicular joint: a review. *Am J Sports Med* 2013; 41: 2684–2692.
4. Stein S, Ahmad CS, Pfaff CH, Bigliani LU and Levine WN. A comparison of magnetic resonance imaging findings of the acromioclavicular joint in symptomatic versus asymptomatic patients. *J Shoulder Elbow Surg* 2006; 15: 56–59.
5. Choo HJ, Lee SJ, Kim JH, et al. Can symptomatic acromioclavicular joints be differentiated from asymptomatic acromioclavicular joints on 3-T MR imaging. *Euro J Radiology* 2013; 82: e184–e191.
6. Stein BE, Wiater JM, Pfaff HC, Bigliani LU and Levine WN. Detection of acromioclavicular joint pathology in asymptomatic shoulders with magnetic resonance imaging. *J Shoulder Elbow Surg* 2001; 10: 204–208.
7. Zanca P. Shoulder pain: involvement of the acromioclavicular joint (analysis of 1,000 cases). *Am J Roentgenol Radium Ther Nucl Med* 1971; 112: 493–506.
8. Bigliani LU, Ticker JB, Flatow EL, Soslowsky LJ and Mow VC. The relationship of acromial architecture to rotator cuff disease. *Clin Sports Med* 1991; 10: 823–838.
9. Jordan LK, Kenter K and Griffiths HL. Relationship between MRI and clinical findings in the acromioclavicular joint. *Skeletal Radiology* 2002; 31: 516–521.
10. Simovitch R1, Sanders B, Ozbaydar M, Lavery K and Warner JJ. Acromioclavicular joint injuries: diagnosis and management. *J Am Acad Orthop Surg* 2009; 17: 207–219.
11. Brown JN, Roberts SN, Hayes MG and Sales AD. Shoulder pathology associated with symptomatic acromioclavicular joint degeneration. *J Shoulder Elbow Surg* 2000; 9: 173–176.
12. Walton J, Mahajan S, Paxinos A, et al. Diagnostic values of tests for acromioclavicular joint pain. *J Bone Joint Surg Am* 2004; 86A: 807–812.