[Imaging]

Sports Health Orthopaedic Magnetic Resonance Challenge

Mark H. Awh, MD,* and Michael E. Stadnick, MD

CHALLENGE

A 28-year-old male with persistent shoulder pain and limited range of motion presents for magnetic resonance (MR) imaging. T1-weighted coronal oblique (Figure 1) and fast spin echo T2-weighted sagittal oblique (Figure 2) images are provided. What are the findings? What is your diagnosis?

FINDINGS

Failure of fusion of an anterior acromial ossification center is demonstrated on both images.

DIAGNOSIS

Os acromiale.

MR DIAGNOSIS

In this case, the diagnosis is admittedly challenging when based on coronal and sagittal images only. Indeed, the os acromiale, an un-united acromial ossification center in adults, is one of the most frequently missed abnormalities by physicians who interpret MR. The reason is twofold. For one, the os acromiale, when viewed in the coronal or sagittal planes, bears a strong resemblance to a normal acromioclavicular (AC) joint (Figures 3 and 4). Second, the os acromiale is fairly common, being seen in approximately 8% of shoulder examinations.[7] This combination of a not-uncommon yet challenging finding leads to the high frequency of missed diagnoses of the os acromiale.

It is essential in routine MR imaging of the shoulder to obtain axials that extend superior to a point above the level of the acromion. The key to the simple and reliable diagnosis of the os acromiale lies in these upper axial images. On such images, the acromion is completely visualized, and the diagnosis of an os acromiale becomes much simpler. Only in the axial plane is one able to reliably visualize both the AC joint and the os acromiale on a single slice (Figure 5).

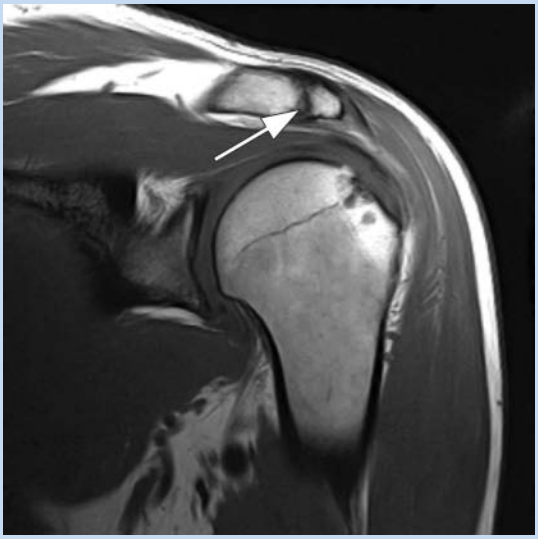

Figure 1. The persistent apophysis (arrow) is visible medial to the lateral aspect of the acromion on the T1-weighted coronal oblique view.

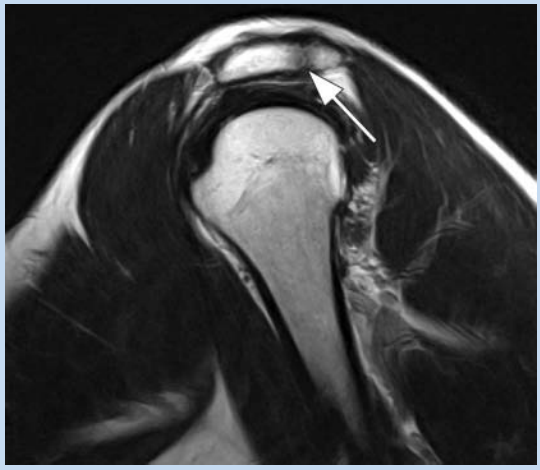

Figure 2. The persistent apophysis (arrow) is visible anterior to the posterior aspect of the acromion on the T2-weighted sagittal oblique image.

From Radsource, Brentwood, Tennessee.
*Address correspondence to Mark H. Awh, MD, 8 Cadillac Drive, Brentwood, TN 37027 (e-mail: mawh@radsource.us).
No potential conflict of interest declared.
DOI: 10.1177/1941738109359613

Figure 3. The original T1-weighted coronal image of the os acromiale (arrow; A) is now seen next to a T1-weighted coronal image that depicts the normal acromioclavicular joint (arrow; B). Note the similar configurations; also note that the os acromiale lies at a point lateral and posterior to the acromioclavicular joint.

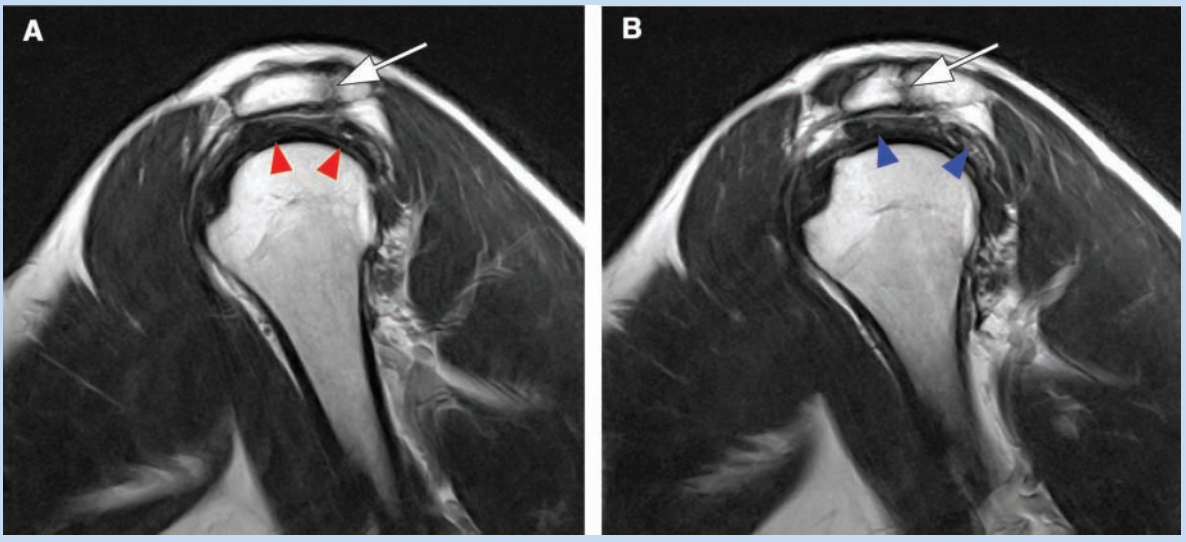

Figure 4. The os acromiale (arrow; A), although it resembles an acromioclavicular joint, is seen to lie at a point both posterior and lateral to it (arrow; B) on T2-weighted sagittal views. Note that the os acromiale is visible on lateral images where the rotator cuff tendons are continuous (red arrowheads) whereas the acromioclavicular joint lies at the level of the musculotendinous junction of the cuff (blue arrowheads).

DISCUSSION

One to 3 ossification centers of the acromion appear by age 15 to 18 years, and they normally fuse no later than 25 years of age.[6] Failure of any of these ossification centers to fuse results in an os acromiale. The 3 potential ossification centers are the preacromion, mesoacromion, and meta-acromion, from anterior to posterior (Figure 6). The adjacent ossification center for the lateral scapular spine is known as the basi-acromion. Failure of fusion can occur at the junction of any of these ossification centers, in a single junction or in combination. As a result, 7 types of os acromiale may arise (Figure 7).[6]

Figure 5. A fat-suppressed proton density-weighted axial image through the upper shoulder demonstrated an un-united anterior acromial ossification center compatible with an os acromiale. The synchondrosis of the os (arrow) is easily distinguished from the more medial and anterior acromioclavicular joint (arrowhead).

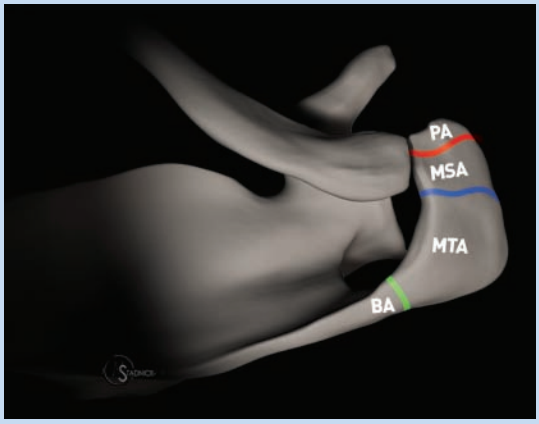

Figure 6. A view of the scapula from above illustrates the 3 ossification centers of the acromion, the preacromion (PA), the mesoacromion (MSA), and the meta-acromion (MTA). The adjacent basi-acromion (BA) of the lateral scapula is also depicted.

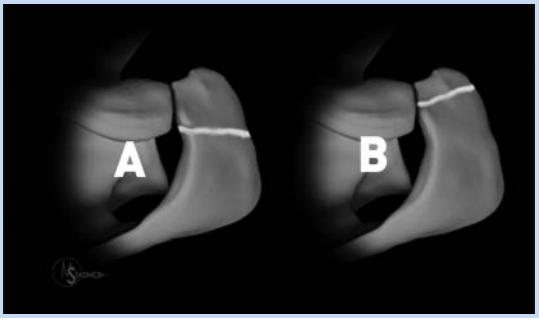

Figure 7. The mesoacromion (A) is the most common type of os acromiale, followed distantly by the preacromion variant (B).

Figure 8. Inferior osteophyte formation (arrow) at the synchondrosis of a mesoacromion type os acromiale is depicted in this 3-dimensional representation of the lateral shoulder.

By far the most common site of nonunion is posterior to the mesoacromion—that is, the mesoacromion variety, or a type A os acromiale. The next most common site of nonunion is posterior to the preacromion, or the preacromion variety. In one of the original studies of os acromiale, by Liberson in 1937,[4] 21 of 25 os acromiales were of the mesoacromion variety.

The os acromiale has been implicated as a risk factor for the development of impingement syndrome.[2] Hypertrophic osteophytes may arise at the synchondrosis of an os acromiale (Figure 8), and the os acromiale is thought to increase the incidence of osteoarthritis at the AC joint,[3] both cases of which may predispose the patient to impingement. In addition, when an os acromiale is unstable, the downward pull of the deltoid muscle reduces the subacromial space, causing mass effect upon the rotator cuff (Figure 9).

In addition to the role that an os acromiale plays in increasing the risk for impingement syndrome, it is important to realize that recognition of an os acromiale is necessary because the os itself may be a primary source of patient symptoms.[9] Such patients typically have point tenderness over the os acromiale and pain

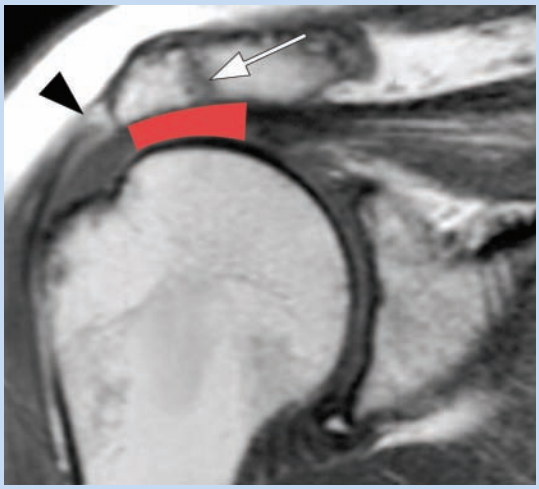

Figure 9. A T1-weighted coronal image in a patient with an os acromiale (arrow at synchondrosis) demonstrates the lateral deltoid attachment to the os (arrowhead). With deltoid contraction, the downward pull upon an unstable os acromiale narrows the subacromial space (red area), increasing the patient's risk for impingement syndrome.

Figure 10. A fat-suppressed T2-weighted sagittal view in a patient with a symptomatic os acromiale reveals edema and fluid at and adjacent to the synchondrosis of the os (arrow). The more anteriorly located acromioclavicular joint is also visible on this sagittal slice (arrowhead), the "double-joint" appearance[6] of an os acromiale.

with forward elevation of the shoulder. On MR images, edema and/or fluid may be noted along the synchondrosis of the os acromiale (Figures 10 and 11); as is true with other body regions, edema on MR is a reliable indicator of a site of patient pain.

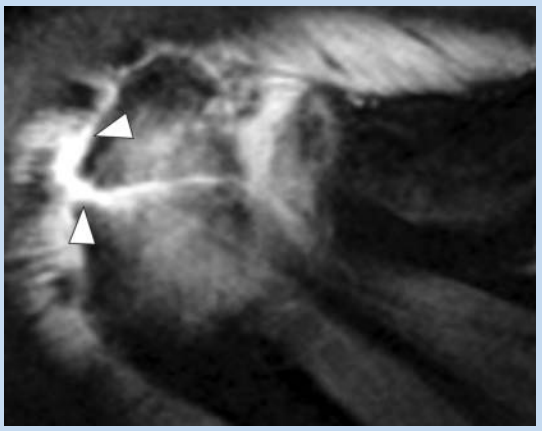

Figure 11. A T2*-weighted axial image confirms the edema and fluid (arrowheads) in association with an os acromiale.

TREATMENT

The clinical importance of an os acromiale in the development of shoulder pain has not been fully established. The os acromiale can be found in asymptomatic patients, but as described above, it has been implicated both as a risk factor for impingement syndrome and as a primary cause of patient pain. In patients with os acromiale and symptoms of impingement syndrome without rotator cuff tear, treatment is generally conservative, using rest, ice, and nonsteroidal anti-inflammatory drugs to reduce inflammation. Steroid injections may also be of benefit.

If conservative measures fail over a period of 6 weeks to 6 months, operative therapy may be warranted.[8] Preoperative recognition of an os acromiale is important in patients with impingement syndrome or rotator cuff tear because an unstable os acromiale may render a typical anterior acromioplasty impossible. It is generally accepted that in patients with both an os acromiale and a tear of the rotator cuff, the surgeon should correct both abnormalities.[1] Small os acromiales, such as the preacromion or small mesoacromion variants, are usually resected, and it is now possible to accomplish this procedure arthroscopically. Neer reported that large os acromiales should be stabilized rather than resected at the time of rotator cuff repair,[5] given that resection of large fragments may lead to unacceptable weakness. Though not without controversy, such an approach remains popular with many orthopaedic surgeons.

CONCLUSION

The os acromiale is a not-uncommon abnormality that is frequently missed on routine MR examinations of the shoulder. Proper MR scanning technique and the careful evaluation of axial images through the acromion make the correct diagnosis relatively simple. In patients with impingement syndrome, recognition of an os acromiale is important because the lesion may be an important

source of patient symptoms and an awareness of its presence can significantly alter the planned operative approach.

REFERENCES

1. Boehm TD, Matzer M, Brazda D, Gohlke FE. Os acromiale associated with tear of the rotator cuff treated operatively: review of 33 patients. *J Bone Joint Surg Br.* 2003;85:545-549.
2. Davlin CD, Fluker C. Bilateral os acromiale in a Division I basketball player. *J Sports Sci Med.* 2003;2:175-179.
3. Grass A. The incidence and role of the os acromiale in the acromiohumeral impingement syndrome. *Radiol Med.* 1992;84:567-570.
4. Liberson F. Os acromiale: a contested anomaly. *J Bone Joint Surg Am.* 1937;19:683-389.
5. Neer C. Anterior acromioplasty for the chronic impingement syndrome in the shoulder. *J Bone Joint Surg Am.* 1972;54:41-50.
6. Park GP, Lee JK, Phelps CT. Os acromiale associated with rotator cuff impingement: MR imaging of the shoulder. *Radiology.* 1994;193:255-257.
7. Sammarco VJ. Os acromiale: frequency, anatomy, and clinical implications. *J Bone Joint Surg Am.* 2000;82:394-400.
8. Swain R, Wilson F, Harsha D. The os acromiale: another cause of impingement. *Med Sci Sports Exerc.* 1996;28:1459-1462.
9. Warner JJP, Beim GM, Higgins L. The treatment of symptomatic os acromiale. *J Bone Joint Surg.* 1998;80:1320-1326.