The Abduction External Rotation (ABER) View for MRI of the Shoulder

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The ABER view is an excellent tool for detecting subtle soft tissue pathology of the anteroinferior labrum and rotator cuff and is strongly advocated for all contrast-enhanced imaging of the shoulder.

Shoulder magnetic resonance imaging (MRI) is the gold standard imaging modality for evaluating soft tissue in the shoulder joint. The abduction external rotation (ABER) view has been discussed in the literature as an excellent tool beyond the conventional 3 sequences (coronal, sagittal, and axial) for accurately assessing anteroinferior labral detachment and both partial- and full-thickness tears of the rotator cuff tendons. Placing the arm in an abducted and externally rotated position tensions the anteroinferior glenohumeral ligament and labrum. If a labral detachment is present, contrast solution defines the defect. Likewise, abduction and external rotation of the arm releases tension on the cuff relative to the normal coronal view obtained with the arm in adduction. As a result, subtle articular-sided partial thickness flap tears will not lie apposed to the adjacent intact fibers of the remaining rotator cuff nor be effaced against the humeral head, and intra-articular or intravenous contrast can enhance visualization of the tear. In addition, tears with a horizontal component are identified and characterized with increased sensitivity with the ABER view.

The ABER view is a modified axial view. Because the orientation of the ABER view differs from the traditional images that orthopedists are accustomed to viewing, its interpretation can be confusing for those with limited or no experience. Furthermore, the execution of the ABER view can be a challenge for the technologist unfamiliar with its use. This article addresses the method by which the ABER technique is performed and the regional anatomy that can be seen on these MRI scans.

**TECHNIQUE**

Orthopedists consider 90° of abduction and 90° of external rotation the position of apprehension. However, most conventional bore-style MRI scanners do not allow for the shoulder to be placed in this position. The narrow confines of a closed tube usually necessitate use of the more commonly performed position for the ABER view with the arm abducted and the hand tucked beneath the patient’s head, so as to lessen the mediolateral dimension of the patient’s upper torso (Figure 1).

**Settings**

The ABER scout views are first obtained by acquiring images along a plane parallel to the long axis of the humerus...
(Figure 2). Once the orientation is set with respect to the shaft of the humerus, the plane with respect to the scapula is determined. The position of the patient’s arm can vary based on size, flexibility, and comfort.

The ABER plane is chosen so that a stack of images are obtained at right angles to the glenohumeral articulation, extending between the supraglenoid tubercle and axillary recess. If the patient assumed a 90°-90° position of the arm, as might be obtained in a vertical field open-sided scanner, the images of the glenoid and scapula would be much the same as those seen in true axial imaging. However, most ABER views result in unique representations of scapular bony landmarks, each of which is a variation of a true axial image of the scapula. This occurs because the orientation is based on the humeral shaft rather than the scapula.

The ABER sequence, like all magnetic resonance arthrographic sequences, is generally obtained as T1-weighted to enhance the definition of injected contrast, which appears white (Figure 3). Further definition is provided by the use of a method that includes suppression of fat signal in the bone marrow and soft tissue around the joint. At magnetic fields >1 T, this requires spectral fat saturation; at magnetic fields <1 T, a special form of fat separation is used. Typically, both of these techniques are lumped together under the rubric of fat suppression. Acquisition parameters for both high and low field are relatively similar with the exception of applying either fat saturation or fat separation techniques as appropriate based on the magnet strength. Although technically different approaches, the output is nearly equivalent. Should the patient be allergic to gadolinium or suffer from renal failure, one may alternatively achieve capsular distention and sufficient fluid contrast with intra-articular saline solution. If so, the ABER view is not precluded and images can be obtained with a T2-weighted sequence and fat saturation (Figure 4).

**Interpretation**

Conventional axial MRIs are oriented such that posterior structures are displayed toward the lower edge of the frame, and anterior structures are in the superior margin of the frame, irrespective of which shoulder is scanned. However, the ABER view rotates the image 90°. The ABER view is a glenohumeral view that is essentially axial to the scapula but coronal to the humerus. Therefore, the anterior structures of the humerus (ie, long head of the biceps tendon) are rotated to the superior glenoid and the cuff is rotated posteriorly, adjacent to the scapular spine (Figure 5).

To avoid confusion and enhance ease of interpretation, we recommend adoption of the following convention for display of all ABER sequences. The scapular spine is always displayed to the viewer’s right, placing the rotator cuff also on the right, the anterior glenoid on the left, and the shaft of the humerus toward the top. This display protocol will maximize consistent recognition of anatomic structures and pathologic lesions, especially of the rotator cuff and labrum, independent of which side is imaged.

The ABER view can enhance interpretive and diagnostic accuracy for several types of pathology in the shoulder. The ABER series can be a useful adjunct in the diagnosis of articular-sided partial thickness and full thickness rotator cuff tears (Figure 6A). A recent meta-analysis comparing the relative accuracies of magnetic resonance arthrography, conventional MRI, and ultrasound in diagnosing rotator cuff tears concluded that magnetic resonance arthrography had superior sensitivity and specificity in diagnosing both full- and partial-thickness tears than the other 2 modalities.7

Similarly, labral pathology can be difficult to assess on physical examination and/or...
conventional MRI sequences. The ABER series improves visualization of labral tears in younger patients, especially of the posterior superior labrum and superior labral anterior posterior (SLAP) tears in throwing athletes, as well as Bankart lesions associated with shoulder dislocations or instability events (Figure 6B). In many cases, lesions found on the ABER views are not present on conventional coronal or axial MRI sequences and would have otherwise been missed (Figure 7). The ABER sequence is particularly useful in the case of partial-thickness rotator cuff tears, where diagnostic accuracy continues to present a challenge for conventional MRI or even ultrasound (Figure 8).

DISCUSSION

Despite the clear diagnostic advantages of the ABER sequence, adoption has not been ubiquitous. This fact is confirmed by the informal polling of our sports medicine fellows and the attendees and faculty at a yearly international conference exclusively devoted to shoulder surgery (K. Burnett, oral communication, 2005-2008). While the issue has not been systematically investigated, we postulate several responsible factors. Adding the sequence prolongs examination time by approximately 25% (including positioning), potentially detracting from time available to other patient needs and decreasing efficient use of limited scanner resources.

Also, the ABER positioning is uncomfortable for some patients and can detract from the patient’s perception of the testing experience. For a few patients, typically those with a history of multiple shoulder dislocations, the positioning itself may be intolerable due to apprehension. Nevertheless, the ABER noncompliance rate for all MRI remains low, but is likely between 1% and 3% (K. Burnett, oral communication, 2003-2009). Busy departments may not wish to add time to their scans, and low-volume facilities may not be able to cope with the complexities required to perform, display, or interpret the images with care and competence.

Recent publications have highlighted circumstances that favor either adding the ABER sequence or even substituting the ABER sequence for a conventional series. There are advocates for the indirect magnetic resonance arthrogram (intravenous as opposed to intra-articular injection). Although this examination has its own limitations and interpretive pitfalls, adding the ABER sequence has been reported to enhance sensitivity and specificity for the diagnosis of partial- and full-thickness cuff tears. The ABER view should be considered mandatory when indirect magnetic resonance arthrograms are used.

There may also be situations where patients cannot tolerate much imaging time (eg, claustrophobia, restless leg syndrome, or mild dementia) and a full conventional arthrogram is out of the question. For these patients, a recent article has highlighted the feasibility and accuracy of substituting 1 ABER sequence for the entire conventional arthrogram as a reasonable and accurate alternative for the diagnosis of rotator cuff tears.

CONCLUSION

The ABER view is an excellent tool for detecting subtle soft tissue pathology of the anteroinferior labrum and rotator cuff. A standard display format enhances anatomical understanding and facilitates the teaching of interpretative principles and pit-
falls. The ABER sequence is strongly advocated for all contrast-enhanced imaging of the shoulder, whether it is intra-articularly or intravenously administered. Surprisingly, the inherent sensitivity and specificity of ABER qualifies it as a stand-in for the entire conventional 3-plane examination, should circumstances require.

REFERENCES