# Postoperative Shoulder Magnetic Resonance Imaging

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**KEYWORDS**

• Postoperative • Shoulder • Rotator cuff tear • Labral tear • Magnetic resonance imaging • Complications

Magnetic resonance imaging (MRI) and MR arthrography have proven invaluable for the management of the postoperative shoulder, particularly in relation to the rotator cuff and labrum. MRI has proven to be an accurate imaging technique for the differentiation of expected findings versus complications in the postoperative setting. The transition from metallic hardware to bioabsorbable suture anchors used in orthopedic surgery has rendered less metallic susceptibility artifact over the years, allowing a more accurate interpretation of MR images. This article gives a pictorial review of various expected postoperative findings in the shoulder and complications related to repair of the rotator cuff and labrum.

## TECHNICAL CONSIDERATIONS

The preferred imaging methods for evaluating the postoperative shoulder include MR arthrography, conventional MRI, and sonography (depending on the expertise of the interpreting radiologist).[1] When bioabsorbable anchors and other nonmetallic devices have been used, shoulder MR arthrography or conventional MRI are acquired in a similar fashion as in the preoperative patient, as outlined in the American College of Radiology-Society of Skeletal Radiology (ACR-SSR) Practice Guideline for the Performance and interpretation of Magnetic Resonance Imaging (MRI) of the Shoulder.[2] Metallic suture anchors and shoulder arthroplasties do not pose an MRI safety risk for patients, but techniques should be implemented to decrease metallic artifact.[3,4] These include increasing the bandwidth, increasing the of echo train, using a small field of view, increasing the matrix, using fast STIR (short tau inversion recovery) sequences as opposed to fat suppressed sequences, and avoiding gradient echo imaging.[2]

Although this article is limited to the use of MRI for evaluating the postoperative shoulder, computed tomography (CT) arthrography is regarded as superior to MRI or MR arthrography in the evaluation of the rotator cuff in the setting of a previous shoulder arthroplasty.[1] However, CT arthrography is viewed as a second-line procedure for evaluating shoulders with suspected instability or labral disorders when MRI is not available or contraindicated.[1] Contraindications to MRI include the presence of non-MRI compatible intracranial aneurysm clips, pacemakers, implanted cardioverter defibrillators, intraorbital metal, and a variety of electronic and magnetically activated implants, devices, stents, and coils.[3,4]

## EXPECTED POSTOPERATIVE FINDINGS

### *Rotator Cuff Repair*

Arthroscopic repair of rotator cuff tears generally yields excellent pain relief and improvement in the ability to perform daily activities, despite structural

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failure demonstrated on MRI.[5] Early repair of traumatic rotator cuff tears provides better results in terms of shoulder function, in comparison with delayed tendon repair.[6] The factors affecting tendon healing are patient age, the size and extent of the tear, and the presence of fatty degeneration of the rotator cuff muscle.[5] Although functional status tends to improve with time after 6 months, the structural status of repaired cuffs remains unchanged and can be well evaluated with MRI.[7] Repaired rotator cuff tendons will have a variable appearance on MRI, with temporal evolution on serial imaging.[8,9] Within 3 months of operating, tendons appear most disorganized compared with native tendons, and intermediate signal intensity within the surgical bed will correspond to granulation tissue.[8,9] With time, the development of fibrotic tissue will yield areas of low signal intensity on all sequences. Of note, only 10% of repaired tendons demonstrate normal signal intensity on MRI.[8,9]

### *Partial-Thickness Rotator Cuff Tendon Tear Repair*

If partial-thickness rotator cuff tears are treated surgically, they may be debrided, repaired with a transtendon technique, or repaired after tear completion. When tears are bursal sided and there are morphologic changes in the coracoacromial arch, a subacromial decompression may also be performed.[10,11] Repair of high-grade articular sided tears may also be accompanied by anterior acromioplasty.[11] When tears are debrided, they typically have a defect that is longer than deep relative to the long axis of the tendon on MRI (**Fig. 1**). If the converse is true, then a recurrent tear is likely. In a study of 48 patients treated for high-grade partial-thickness rotator cuff tears, repair after conversion to a full-thickness tear showed less postoperative morbidity compared with those treated with transtendon technique; however, recurrent tears developed in 8% of those repaired tendons after tear completion.[12]

The transosseous equivalent repair technique is designed for small to medium U-shaped tears and for iatrogenically completed partial articular supraspinatus tendon avulsions of moderate to large size.[13] The use of selective knot placement allows the surgeon to convert a linear construct into a V configuration, which will optimize repair strength and allow earlier rehabilitation due to increased footprint contact dimensions and less repair gap.[13]

### *Full-Thickness Rotator Cuff Tendon Tear Repair*

#### *Direct suture repair*

Rotator cuff tendon tears involving the myotendinous junction or critical zone may be treated with direct suture repair. There is often a slight difference in tendon caliber at the reattachment (**Fig. 2**), and, as with any repaired tendon, only 10% of repaired tendons will maintain the normal, native low signal intensity.

**Fig. 1.** Debrided partial thickness articular sided tear. Coronal image from magnetic resonance (MR) arthrogram shows a smooth defect that is longer than deep (*arrowheads*), consistent with prior debridement of partial-thickness articular sided supraspinatus tendon tear. No tendon retear was found at second look arthroscopy.

### *Single Row Technique*

Most small full-thickness rotator cuff repairs are performed by using the tendon-to-bone repair technique, and various surgical tacks and suture material are available on the market. Assessment of the integrity of repaired rotator cuff tendon on postoperative MRI must address both the suture anchors and the tendon. Osteolysis around bioabsorbable suture anchors is an expected reaction (**Fig. 3**), and this is caused by mechanical forces or focal necrosis resulting from drilling. These osseous lucencies may double in size at 6 months, but should eventually stabilize and become replaced with bone at 2 years.[14]

Two-tendon tears of the rotator cuff can heal at a high rate with the use of transosseous-equivalent (TOE) suture bridge repair technique.[15] In a study by Sethi and colleagues, 83% of the repairs demonstrated intact rotator cuff repairs at a mean of 16 months postoperatively. Larger tears (3.5 vs 2.8 cm) were associated with failure ($P = .01$), as was more advanced fatty infiltration (Goutallier 1.3 vs 0.3, $P = .01$).[11] Furthermore, the modified transosseous equivalent procedure, otherwise known as surface holding repair with transosseous