

# **“Doctor I tore my rotator cuff”---Interpreting MRI results in patients with rotator cuff disease**

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## **Introduction/ Abstract:**

Rotator cuff disease is the most common ailment in the shoulder.

Once the diagnosis of rotator cuff disease has been made, the challenge then becomes making the appropriate treatment recommendations based on the patient’s symptoms in conjunction with the imaging results.

The term “rotator cuff disease” is a term used to describe pathology involving one, two, three, or all four of the rotator cuff tendons.

Once rotator cuff disease is suspected, an MRI is usually indicated to confirm the diagnosis. The challenge for providers is learning how to correctly interpret these results and make the appropriate treatment recommendations.

On MR imaging, there are two main categories of rotator cuff pathology, rotator cuff tendonitis and rotator cuff tearing. These two categories are further classified by the degree of severity within each category.

In classifying tendonitis the terms mild; moderate; and severe are often used. In classifying tearing, low grade, high grade partial thickness tearing, or full thickness tearing are terms most often see on an MRI report.

The following is a discussion on how to first interpret the MRI report, and then how to utilize these findings in conjunction with the patient’s clinical exam in an attempt to formulate the appropriate treatment recommendations.

## **Rotator cuff tear**

Tearing of one or more of the rotator cuff tendons describes the disruption of the tendon-bone connection that enables the rotator cuff to function in both statically stabilizing the head of the humerus in the glenoid, as well as mobilizing the arm.

Symptom presentation will vary depending on the tendon involvement as well as the degree of tearing. If only one tendon is partially torn, a patient may have severe pain but good function and strength. Since only one tendon is involved, the three other tendons have the capability in compensating for the unhealthy tendon.

Since there are varying degrees of partial thickness tearing, it is important to consider the rotator cuff from a structural standpoint.

From a surgical standpoint, surgery is recommended when the degree of partial thickness tearing is threatening the structural integrity of the tendon. One example to better illustrate this is if you think of a rope.

A rope is made up of fibers. When a rope is used, repetitively, over time, it becomes frayed. This fraying doesn't compromise the rope's ability to function.

Alternatively, if the rope is rotted and only held together by a few fibers, the structural integrity is compromised and the rope is not able to support resistance.

When a patient has a high-grade rotator cuff tear, they may have little to no pain. For these patients it is hard to recommend surgery. What our job is to educate them about the natural course of high-grade, partial thickness rotator cuff tear, and let them make their decision about whether or not to have it fixed.

The natural course of a compensated, high-grade, partial thickness rotator cuff tear is such that over time the other tendons that make up the rotator cuff will decompensate as a result of the increased work load that they were taking on to compensate for the torn tendon. This manifests as increase in the patient's pain and a decrease in their function.

The complicating factor in this equation is that it is impossible to predict when this decompensation will occur. There is a possibility that when it does occur, and the patient becomes symptomatic, the quality of the tendon may be poor and irreparable at that time (this will be further elaborated on under the "Fatty Atrophy" subheading).

These concepts of structural integrity as it relates to compensation and decompensation is important to consider when making treatment recommendations based on the results of a MRI.

### **Degrees of tears**

As we age, the rotator cuff becomes more susceptible to injury and tearing. The phrase "wear and tear" can also be applied in the context of the rotator cuff tendons.

There are varying degrees of tearing that the rotator cuff tendons may be susceptible to as we age. With the help of MR imaging, and taking into consideration the patient's age, pain level, and function, the appropriate treatment plan can be formulated.

### **Case examples**

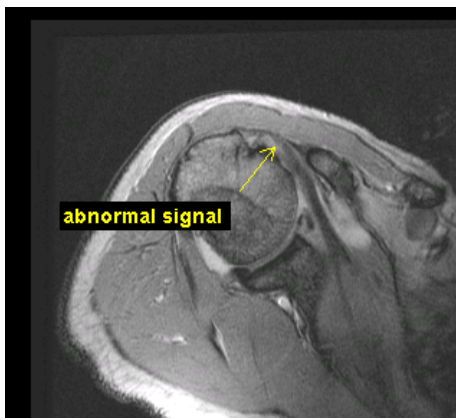
This is one example of a sagittal T2 MRI image of the shoulder and the corresponding radiology report interpreting the findings.



*“At least a high grade partial, possible full-thickness perforation at the anterior leading edge of the supraspinatus”*

To simplify the radiology interpretation, it is often helpful to look at each piece individually. First, “high-grade partial” translates into a significant amount of fibers are torn with very few still intact. Second, “full thickness perforation” means there is basically a hole in the tendon. Third, “anterior leading edge of the supraspinatus” is describing exactly where in the bundle of fibers it is torn. Anterior means front. Since anatomically the supraspinatus tendon is above the joint (on the top of the shoulder) the front of the tendon would be towards the front of the shoulder.

Here is a second example of an axial image and the corresponding radiologist report indicating the findings:

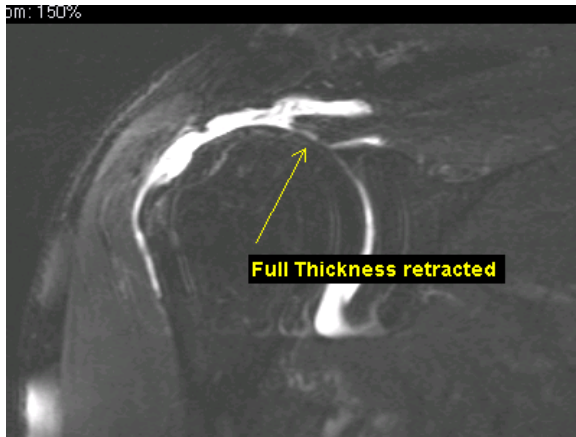


*“There is thickening with abnormal signal involving the cranial fibers of the subscapularis consistent with at least a partial tear.”*

The subscapularis tendon anatomically is located in the front of the shoulder. Its orientation is like a wall that sits just in front of the head of the humerus. “Cranial fibers” of the subscapularis refers to the very top portion of the tendon or the fibers closest to the head (cranium).

This type of tearing can usually be treated conservatively, which means without surgical intervention. However, if this same patient comes to you and has already failed conservative treatment, they may require a simple arthroscopic debridement and decompression. This simply means smoothing off the torn fibers so that they are no longer irritating the joint.

Here is a third MRI example:



*“There is full-thickness tear involving the entire supraspinatus tendon with nearly 4 cm of tendon retraction medially.”*

This type of tear requires surgical intervention. In this image, there are no fibers left intact. Not only that the tendon has retracted back like a rubber band.

To better understand how this type of tear would require surgical intervention, a comprehensive understanding of shoulder anatomy is necessary.

### **Intricacy of the rotator cuff repair**

A bony prominence on the lateral border of the head of the humerus, referred to as the greater tuberosity, is the attachment site of the supraspinatus tendon.

A rotator cuff repair is performed by placing anchor(s) into the greater tuberosity and sowing the attached sutures through the tendon so that the tendon can be pulled back to the greater tuberosity (its anatomic location) where it is then secured by tying a specific type of knot.

Even though the tendon is “tied” back to its original insertion site, it is not “fixed”. It still needs to heal. This is why a surgeon will put you in a sling for a certain timeframe and then put restrictions on the use of your arm while it heals (secures back to the bone).

Full thickness tearing with retraction can become a problem over time. Visually, this scenario can be equated to a rubber band that was previously stretched between two

insertion sites. Once it is detached from one of the attachments it snaps back. When it is stretched it is skinny. When it snaps back its length is decreased and its girth increased. The individual muscle fibers that were previously very close together (when they were stretched) are now further apart (which increased the girth of the tendon).

### **Fatty atrophy**

When there is a full thickness tear of a tendon, the muscle-bone connection is lost. Overtime the muscle decreases in size secondary to lack of use which is referred to as atrophy.

In addition to muscle atrophy, fat infiltrates the space between the individual fibers. Atrophy plus the fatty infiltration is called fatty atrophy. As fatty atrophy develops, the tendon's quality becomes compromised. The greater degree of fatty atrophy (which can be seen on both MRI and CT) correlates with an increasingly unhealthy tendon.

This is very important when considering surgical repair of a tendon. Here is an analogy to help you better understand its significance.

If you put a fork into a lean piece of steak, then you try to pull the fork out of the meat laterally (across the plate), the fork won't move. This is because the meat has a low fat content. If on the other hand you do the same thing with a fatty piece of steak, the fork will pull through the meat with relatively little force. This is due to its high fat content.

In comparing this to surgical repair, the fork represents the suture in this analogy. When the suture is sowed into the tendon it is then pulled in a lateral direction to bring the tear back to its insertion the quality of the tendon will determine if this is possible or not.

The process of fatty atrophy does not occur rapidly. There is little literature that discusses the timeframe for this process to occur. However, suspicion for fatty atrophy in the case of a full thickness tear that is left untreated for over one year is high. In some cases this timeframe may be accelerated or decelerated.

With that said, the window of opportunity to fix a rotator cuff tendon is not well known and cannot reliably be predicted. Typically waiting longer than one year is not desired in patients with full thickness tears.

As touched on briefly, earlier on, this same phenomenon occurs with high-grade, partial thickness rotator cuff tears due to the fact that with these types of tears, the structural integrity of the tendon is threatened thereby preventing the tendon from being active. This inactivity is what results in the fatty atrophy over time.

### **Treating the patient not the MRI:**

While the MR image is used to evaluate the structural integrity of the rotator cuff, it is important for providers to consider the patient's age, pain level, and overall function. It

is not always the case that a patient will present with significant pain, poor function, and a full-thickness rotator cuff tear.

The patients who are the hardest to make treatment recommendations for are those who have MR imaging that doesn't match their clinical picture.

For example, for a patient that presents to the office with little to no pain, great function and a full-thickness rotator cuff tear diagnosed on MR imaging, it is hard to recommend surgery.

Surgery is recommended to improve on patient's pain and function. Therefore patients who have no symptoms (no pain and no weakness) have very little to gain from surgery and the potential to actually be made worse from the risks associated with the surgery such as loss of motion and increased pain.

It would seem positive that a patient with a full-thickness rotator cuff tear and no symptoms is able to avoid surgery. However, it should be made clear to the patient that the reparability of the tendon will decrease over time.

There is no way of predicting the timing of this decline and therefore the patient should be provided with an estimated timeline. Typically I tell patients that having a rotator cuff tear fixed within the year is advised. Waiting longer than one year (from suspected date of injury) is risky and not advisable. I also tell them that this timeline is very much an average and that the tendon quality can decompensate faster or slower than one year, there is never a guarantee. Again, this timeline is also dependent on the size of the tear and how it affects the structural integrity of the tendon.

### **Summary**

MR imaging is useful in identifying a tear of the rotator cuff. Careful interpretation of the images in combination with considering the patient's symptoms is necessary in formulating a treatment plan.

It is important to provide the patient with as much information about the natural history of rotator cuff disease in terms of their treatment options as well as the long term implications of non-operative/conservative management so that they can make an informed decision that they feel comfortable with.