

ROTATOR CUFF TEARS

Understanding the anatomy, natural history and treatment options

This information sheet explains how the rotator cuff works, how tears can progress, and the available non-operative and surgical treatment options. Treatment is individualised according to symptoms, examination findings, imaging, functional needs and the characteristics of the tear.

What is the rotator cuff?

The rotator cuff is made up of four muscles and their tendons surrounding the shoulder:

- Supraspinatus - helps elevate the arm and contributes to shoulder stability.
- Infraspinatus - an important external rotator.
- Teres minor - also assists external rotation.
- Subscapularis - the major rotator cuff muscle responsible for internal rotation.

The shoulder has a relatively shallow socket, allowing a large range of motion. The rotator cuff therefore has an important role not only in moving the shoulder, but in compressing and centring the humeral head within the glenoid socket while the arm moves. [1]

How does the rotator cuff work?

When you raise your arm, the deltoid and rotator cuff work together. The rotator cuff creates coordinated force couples that stabilise the humeral head while larger muscles move the arm. [1]

The cuff also contains a thickened region of fibres known as the rotator cable. This helps distribute forces across the cuff and has been compared biomechanically with a suspension bridge. [2]

Small tears can therefore sometimes cause relatively little disturbance to shoulder function, whereas enlargement of a tear can progressively affect the mechanical balance of the shoulder.

What is a rotator cuff tear?

A rotator cuff tear occurs when part or all of a cuff tendon separates from its attachment on the humerus.

A partial-thickness tear involves only part of the thickness of the tendon.

A full-thickness tear extends through the entire thickness of the tendon.

Tears are also assessed according to:

- Which tendons are involved.
- Size of the tear.
- Tendon retraction.
- Tendon quality.
- Muscle atrophy.
- Fatty infiltration of the muscle.
- Whether the tear is acute, chronic or acute-on-chronic.

These features can influence symptoms, the likelihood of progression, reparability and the chance of successful healing after surgery.

Why do rotator cuff tears occur?

Many cuff tears are degenerative and become increasingly common with age. Others occur following a specific injury.

Tendon degeneration, repetitive mechanical loading and acute trauma can all contribute. Smoking and diabetes are particularly relevant because they are associated with poorer tendon healing after repair. [15],[16]

An injury can also cause a previously degenerative or partially torn tendon to extend into a larger tear.

How common are rotator cuff tears?

Rotator cuff tears become substantially more common with age. In a classic ultrasound study of people without shoulder symptoms, tears were detected in approximately: [3]

- 13% aged 50-59
- 20% aged 60-69
- 31% aged 70-79
- 51% aged over 80

In another population ultrasound study, 22.1% of participants had a full-thickness tear, and 65.3% of those tears were asymptomatic. [4]

This is an important point: a tear demonstrated on MRI or ultrasound does not automatically mean that the tear is responsible for all of a patient's shoulder pain.

Natural history: what happens if the tear is not repaired?

Not all rotator cuff tears behave in the same way. Some remain stable for years. Others enlarge progressively.

In a prospective study of initially asymptomatic degenerative tears followed for a median of approximately five years, enlargement occurred in 44% of partial-thickness tears and 61% of full-thickness tears. Approximately 46% of shoulders developed new pain during follow-up. [5]

These are population data from a particular cohort and do not predict exactly what will happen to an individual patient's tear.

What is the risk that a partial-thickness tear will progress?

The behaviour of partial tears depends greatly on their depth and configuration. Small, low-grade partial tears can often remain stable and may respond well to non-operative treatment. High-grade partial tears are more concerning.

In one study of 52 non-operatively managed high-grade partial-thickness tears, Kaplan-Meier analysis estimated progression to a full-thickness tear in approximately: [6]

- 23.2% at 2 years
- 33.1% at 3 years
- 64.0% at 4 years

These figures come from a relatively small high-grade-tear cohort and should therefore not be applied to every partial rotator cuff tear.

What is the risk of progression of a full-thickness tear?

Full-thickness degenerative tears generally have a greater risk of enlargement than partial tears. [5],[7]

In a longer-term prospective study of patients aged 65 years or younger with initially asymptomatic degenerative cuff disease, 60% of shoulders demonstrated tear enlargement during a median 7.1-year follow-up. Full-thickness tears enlarged earlier and were more likely to progress than partial tears. [7]

As a tear progresses, there can be:

- Increasing tear size.
- Increasing tendon retraction.
- Deterioration in tendon quality.
- Muscle atrophy.

- Fatty infiltration of the cuff muscles.

Muscle atrophy and fatty infiltration

A longstanding detached tendon can be associated with deterioration in the muscle attached to it. This may include both muscle atrophy and fatty infiltration, where normal muscle is progressively replaced by fatty tissue.

In the Keener prospective study, supraspinatus muscle degeneration progressed in approximately 30% of shoulders in which the tear enlarged, compared with 4% of shoulders with a stable tear. [5]

In a longer-term study of full-thickness tears, progression of fatty degeneration occurred in approximately 33% of supraspinatus muscles and 29% of infraspinatus muscles in the subgroup analysed. [7]

Importantly, established muscle atrophy and fatty infiltration do not necessarily reverse after a technically successful cuff repair. [8]

Can a rotator cuff tear become irreparable?

Yes. The term irreparable rotator cuff tear is generally used when an anatomical repair is no longer technically feasible or when the tendon-muscle unit has deteriorated to a point where meaningful repair is unlikely.

Factors strongly associated with irreparability include large or massive tear size, substantial tendon retraction, advanced fatty infiltration, muscle atrophy and superior migration of the humeral head. A recent systematic review found Patte stage 3 retraction strongly associated with irreparability. [9]

There is no reliable single percentage risk that can be quoted for an individual tear becoming irreparable.

However, because tear enlargement, retraction and muscle degeneration can progress over time, progression can reduce the likelihood that an anatomical repair will remain feasible. [7],[9]

Do all rotator cuff tears need surgery?

No. Treatment depends on symptoms, weakness and loss of function, whether the tear was traumatic, age, activity and occupational demands, tear size, tendon retraction, muscle quality and fatty infiltration, associated shoulder pathology and the patient's goals.

The latest AAOS clinical practice guideline concludes that both physiotherapy and surgical repair can significantly improve patient-reported outcomes in symptomatic small-to-medium full-thickness tears. [10]

Non-operative management

Physiotherapy

Physiotherapy can improve symptoms and function even though it does not anatomically reconnect a detached full-thickness tendon. Treatment may include:

- Restoring shoulder motion.
- Strengthening the remaining cuff.
- Deltoid strengthening.
- Scapular control.
- Progressive resistance exercises.
- Gradual restoration of functional loading.

Long-term evidence shows that patients can improve with physiotherapy, although tear size, muscle atrophy and fatty infiltration can continue to progress in some patients treated non-operatively. [10]

Activity modification and medication

Temporary modification of painful or heavy overhead activities and appropriate simple analgesic or anti-inflammatory medication may assist symptom control.

Corticosteroid injection

A single corticosteroid injection may provide short-term improvement in pain and function in appropriately selected patients. Corticosteroid injections should be used thoughtfully if surgery may be required, as injection close to the time of rotator cuff repair may adversely affect healing or surgical outcomes. [10]

Monitoring

For a tear managed non-operatively, ongoing clinical review and, where appropriate, repeat ultrasound or MRI can be considered - particularly if future surgical repair remains an option. [10]

When may surgery be considered?

Surgery may be considered where there is a combination of:

- Persistent pain despite appropriate non-operative management.
- Significant weakness.
- Loss of function.
- Acute traumatic full-thickness tearing.
- A symptomatic high-grade partial tear that has failed conservative treatment.
- A larger repairable tear.
- Progressive enlargement.
- Increasing tendon retraction or muscle degeneration.
- Occupational, sporting or personal requirements that favour repair.

The decision should be individualised rather than based on an MRI abnormality alone.

Arthroscopic rotator cuff repair

My preferred technique is arthroscopic rotator cuff repair.

The procedure is performed through several small keyhole incisions. During surgery the tear is assessed, the tendon is mobilised where necessary, the bone attachment site is prepared and the tendon is secured back to the humerus using suture anchors.

The goal is to restore the tendon as closely as possible to its anatomical attachment and hold it securely while biological tendon-to-bone healing occurs.

Double-row rotator cuff repair

Where appropriate, I use an arthroscopic double-row repair technique. This uses fixation across both the medial and lateral aspects of the tendon footprint to recreate a broad area of tendon-to-bone contact.

Double-row repair has demonstrated lower structural retear rates than single-row repair in several studies. A Level-I meta-analysis reported imaging-detected retears in 25.9% following single-row repair and 14.2% following double-row repair. [11]

However, this requires some qualification. The 2025 AAOS guideline concludes that double-row constructs have not consistently produced clinically meaningful improvements in patient-reported outcomes for all tears, although double-row repair can reduce overall/partial retear rates and may have greater benefit in larger tears greater than approximately 3 cm. [10]

Other procedures that may be performed

The exact operation is tailored to the pathology identified clinically, on imaging and at arthroscopy.

Acromioplasty

Acromioplasty is not performed routinely simply because a cuff tear is present. The 2025 AAOS guideline does not recommend routine acromioplasty for therapeutic benefit when repairing small-to-medium full-thickness tears. It

may nevertheless be appropriate selectively according to individual anatomy, associated pathology or technical requirements during repair. [10]

AC joint excision

A distal clavicle/AC joint excision may be performed when there is clinically significant symptomatic AC joint pathology. It is not a routine component of cuff repair. Randomised-trial meta-analysis has not demonstrated benefit from routine distal clavicle excision during cuff repair. [19]

Biceps tenotomy or tenodesis

The long head of the biceps tendon can develop tearing, inflammation or instability in association with cuff pathology.

When clinically indicated, it can be treated with either biceps tenotomy - releasing the diseased tendon - or biceps tenodesis - releasing the tendon from its attachment inside the shoulder and fixing it to the humerus.

Randomised-trial meta-analysis suggests broadly similar pain and functional outcomes between the procedures, although tenodesis has a lower risk of cosmetic "Popeye" deformity. [20]

Healing after surgery

The anchors and sutures provide fixation, but the ultimate success of the operation depends on the tendon biologically healing back onto the bone.

For this reason, rehabilitation is deliberately progressive. The repair has to be protected from excessive loading during the early healing period before strength and loading are gradually increased. Recovery therefore occurs over a period of months rather than weeks.

What is the risk of a retear?

There is no single retear percentage that applies to every patient. Across 38 imaging studies included in one systematic review/meta-analysis, the pooled estimate was approximately 22.1%, but there was considerable variation between studies. [13]

Tear size is particularly important. A separate meta-analysis found average retear rates of approximately 12.5% for small/medium tears and 37% for large/massive tears. [12]

These are group averages, not an individual prediction.

What increases the risk of a retear?

Tear size and tendon retraction

Large tears and more retracted tears have a higher risk of structural failure.

Fatty infiltration and muscle quality

Preoperative fatty infiltration is one of the most important predictors of healing. A systematic review reported retear rates of approximately 25% with Goutallier grade 0-1 fatty infiltration and 59% with Goutallier grade 2-4 fatty infiltration. [14]

Age

Age is associated with increasing retear risk. One meta-analysis model estimated approximately 15% retear risk at age 50 and more than 30% at age 70. These are modelled population estimates rather than an individual's predicted risk. [13]

Smoking

Smoking is associated with poorer structural healing. A systematic review/meta-analysis found approximately twice the risk of retear in smokers compared with nonsmokers. [15]

Diabetes

Diabetes is also associated with increased structural failure. One meta-analysis found retears in 19.3% of patients without diabetes compared with 28.2% of patients with diabetes. [16]

Rehabilitation and loading

A repaired tendon needs time to achieve biological healing. Rehabilitation therefore aims to balance protection of the repair against restoration of motion and function.

Does a retear mean the operation has completely failed?

Not necessarily. Some patients can still obtain meaningful improvement in pain and function despite a recurrent structural defect. However, healed repairs generally produce better patient-reported and functional outcomes than unhealed repairs, so achieving biological healing remains an important goal of surgery. [10]

Risks of arthroscopic rotator cuff repair

Possible complications include:

1. Retear or incomplete tendon healing - strongly influenced by tear size, tendon quality, retraction, fatty infiltration, age and patient factors.
2. Shoulder stiffness - reported rates vary depending on how stiffness is defined and when it is measured. One systematic review reported approximately 6.4%, while a newer meta-analysis reported a pooled incidence of 12.9%. [17],[18]
3. Infection - uncommon. One series of 3,294 all-arthroscopic cuff repairs reported postoperative infection in approximately 0.85%. [21]

Other recognised risks include postoperative pain, bleeding or haematoma, nerve injury, blood vessel injury, blood clots, anaesthetic complications, fixation or anchor problems, persistent pain or weakness, and the possibility of requiring further surgery.

Balancing the risks of surgery and observation

There are two sides to the decision.

Surgery carries risks including stiffness, infection, incomplete healing and recurrent tearing.

Non-operative treatment avoids surgical risk and can provide excellent symptom improvement, but some tears enlarge over time and can develop increasing retraction, muscle atrophy and fatty infiltration. [5],[7],[10]

The appropriate decision therefore depends on the individual patient and the characteristics of the individual tear.

Key points

- Rotator cuff tears become increasingly common with age and can exist without causing symptoms.
- Not every tear requires surgery.
- Both partial and full-thickness tears can enlarge, although full-thickness and high-grade partial tears generally warrant closer consideration of their natural history.
- Progressive tearing can be associated with tendon retraction, muscle atrophy and fatty infiltration.
- Advanced retraction and muscle degeneration can reduce the likelihood that a tear remains repairable.
- Physiotherapy can provide substantial improvements in pain and function in appropriately selected patients.
- When repair is appropriate, I generally use an arthroscopic double-row rotator cuff repair technique, with additional procedures such as selective acromioplasty, AC joint excision, and biceps tenotomy or tenodesis only where individually indicated.
- The likelihood of healing depends particularly on tear size, tendon retraction, muscle quality, fatty infiltration, age, smoking, diabetes and other individual factors.

Important: This sheet provides general information only. Your individual treatment should be based on your symptoms, examination, imaging, functional requirements and the characteristics of your tear.

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