

Using Size of a Rotator Cuff Tear to Determine Surgery

When is surgery indicated for a rotator cuff tear? Usually surgery is scheduled when the patient has completed a rehab program and is still experiencing significant pain and loss of motion. If loss of motion (and therefore function) depends on the size of the tear, what is the critical tear stage that just won't respond to rehab and requires surgery?

That is the focus of this cadaver study from the Orthopaedic Biomechanics Laboratory in California. They started with the hypothesis that there is a critical point at which a rotator cuff tear is large enough to cause abnormal joint biomechanics.

When that happens, the head of the humerus (upper arm bone) no longer drops down in the glenoid fossa (shoulder socket) during arm motions. As a result, the arm loses its full ability to abduct (move away from the body out to the side). Other muscles (e.g., latissimus dorsi, pectoralis major, deltoid) start to contract to help stabilize the shoulder. These muscles around the scapula (shoulder blade) are referred to as parascapular muscles.

This study was done in order to identify stages of rotator cuff tears that signal the need for surgery. The researchers used a custom-built shoulder testing system to measure the effects of varying loads placed on the muscles of the rotator cuff and parascapular muscles.

They loaded the muscles under three separate conditions: 1) rotator cuff only, 2) rotator cuff muscles with deltoid muscle, and 3) rotator cuff, deltoid, pectoralis major, and latissimus dorsi muscles. They used the traditional staging for rotator cuff tears based on footprint anatomy (that's where the muscle inserts on the bone).

Stage I was a tear of the front or anterior portion of the supraspinatus tendon (one of the four tendons of the rotator cuff). Stage II represented a complete tear of the supraspinatus tendon insertion. Stage III was a complete tear of the supraspinatus and half of the infraspinatus (another of the four tendons of the rotator cuff). And finally, Stage IV was defined as a complete tear of both the supraspinatus and infraspinatus tendons.

Using the shoulder testing system, the authors were able to study the movements of the shoulder joint (called kinematics). They measured the differences in shoulder arthrokinematics (movement) between normal shoulders (no rotator cuff tears) and shoulders with all four stages of rotator cuff tears.

They found changes in muscle loading during shoulder external rotation with Stage II (supraspinatus) tears and during internal rotation after a Stage IV tear (full tears of both supraspinatus and infraspinatus).

The ability of the deltoid muscle to stabilize the shoulder during abduction movement was compromised right away with a Stage I tear. The whole humeral head shifted posteriorly (backwards) with a Stage III tear -- this change in alignment significantly affected shoulder biomechanics.

Testing also showed that normal shoulder motion is limited when parascapular muscles are holding to stabilize the shoulder and no longer able to do their own regular jobs. This is another key reason why shoulder motion can be so compromised with larger rotator cuff tears.

What did the researchers conclude from this information about the critical stage when surgery is needed for rotator cuff tears? Stage II tears signal a change in shoulder external rotation and abduction. Progression to

Stage III and Stage IV result in biomechanical changes in the humeral head in relation to the shoulder socket (also affecting motion).

Rehab early on is still recommended as the first line of treatment. The goal is to prevent progression of the tear while restoring normal shoulder joint kinematics. Strengthening the suprascapular muscles is equally important during conservative care (rehab). By strengthening the pectoralis major, latissimus dorsi, and deltoid muscles, it may be possible to restore normal joint movement, reduce pain, and eliminate the need for surgery.

Reference: Joo Han Oh, MD, PhD, et al. Does a Critical Rotator Cuff Tear Stage Exist? In The Journal of Bone and Joint Surgery. November 2011. Vol. 93-A. No. 22. Pp. 2100-2109.