

A practical guide to shoulder injuries in the throwing athlete

Repeatedly throwing a ball can take a toll on an athlete's shoulder. Prompt diagnosis and treatment hinges on asking some targeted questions and doing the proper in-office tests.

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PRACTICE RECOMMENDATIONS

› *Manage most throwing injuries with relative rest and physical therapy.* (A)

› *Evaluate patients for total loss of range of motion, which is a predictor of increased injury.* (B)

Strength of recommendation (SOR)

- (A) Good-quality patient-oriented evidence
- (B) Inconsistent or limited-quality patient-oriented evidence
- (C) Consensus, usual practice, opinion, disease-oriented evidence, case series

Baseball players and other athletes who spend much of their time throwing a ball risk a variety of shoulder injuries because the repetitive motion causes repeated microtraumatic stress in the area. Injuries result from overuse of the muscles involved, improper technique—or both.

The review that follows will help you zero in on the correct diagnosis and identify the treatment that's best for your patient.

First step: Cover these points in the history

In order to gather a detailed history of a patient with shoulder pain, you'll want to do the following:

■ **Ask about the location of the pain.** Anterior shoulder pain is associated with subluxation, multidirectional instability, subacromial bursitis, and injury to the biceps, supraspinatus or subscapularis.¹ Posterior shoulder pain has been linked to infraspinatus injuries.

■ **Assess the severity of the pain.** Ask patients: "On a scale of one to 10, where 10 is the worst pain you have ever felt, how would you rate the pain you are feeling?"

■ **Pinpoint the timing of the pain.** Determine the phase of the throwing process that reproduces the primary symptoms. The 6 phases are wind up, early cocking, late cocking, acceleration, deceleration, and follow-through (FIGURE 1). So if, for instance, the patient tells you that his arm "went dead" during the late cocking, or early acceleration phase, it should prompt you to suspect subluxation.²

■ **Ascertain the nature of the patient's pain after activity.** Does the patient experience the pain at night? If he answers Yes, you'll want to consider the possibility of a rotator cuff tear.

■ **Ask these targeted questions:**

- *When you raise your arm, do you feel a pinching pain*

WATCH THE VIDEOS

See how the Neer's and Hawkins's tests are done

Courtesy of: Christopher Faubel, MD, ThePainSource.com

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FIGURE 1

The 6 phases of throwing

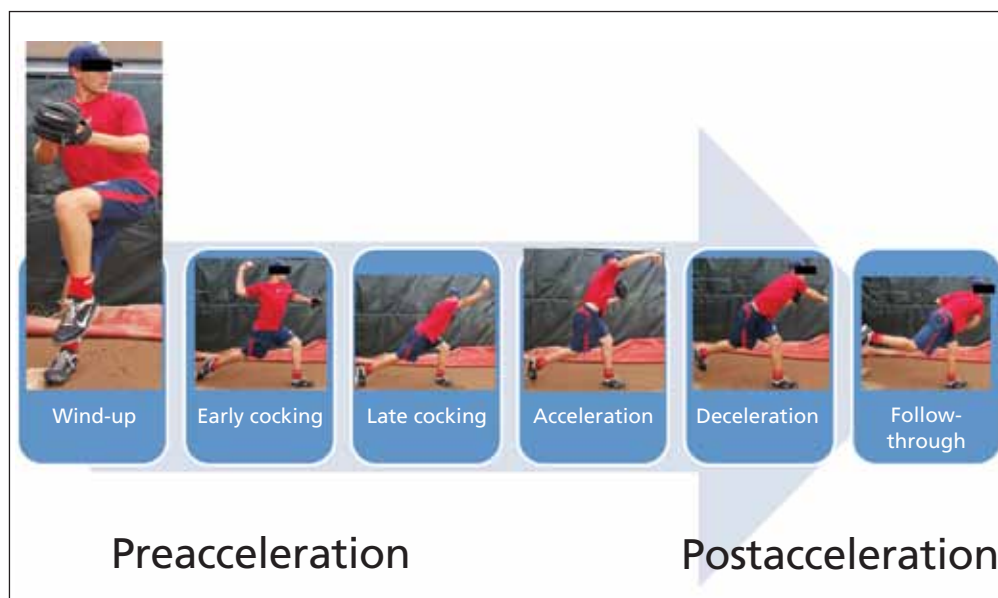


IMAGE COURTESY OF: TRACY L. ZASLOW, MD

➤ If the patient tells you that his arm went dead during the late cocking or early acceleration phase of his pitch, suspect a labral tear or subluxation.

in your shoulder? This may suggest the presence of impingement.

- *Is your shoulder “catching” or “locking up”?* If so, consider a labral tear or loose body, eg, a piece of cartilage or bone floating around in the joint.
- *Does your shoulder feel like it is coming out of its socket—either partially or completely?* This suggests shoulder instability.
- *Is it difficult for you to reach behind your back, or do you have shoulder pain when you try to do this?* This may indicate glenohumeral internal rotation deficit.
- *Do you feel like you are throwing the ball slower, or with less accuracy?* This may be an indication that there is something wrong with the rotator cuff muscles, the innervation around the shoulders, or the labrum that partly holds the shoulder together. Sometimes, a tear of the labrum presents simply as a “loss of power” in throwing, as defined by the athlete who is used to throwing the ball faster or farther.

Diagnoses to consider

Based on the patient’s history and responses to your questions, you’ll likely consider one of the following diagnoses as part of the differential.

External or internal impingement syndromes

What you’ll see. *External* or “subacromial” impingement syndrome results from compression of the rotator cuff between the coracoacromial arch and the humeral head. A sloping or hooked acromion or osteophyte may contribute to the syndrome.³ Neer’s and Hawkins’ tests are often positive, and there may be pain with the arc of motion. (For more on these and the other tests mentioned here, see “Athlete has shoulder problems? Consider these tests” on page 177.)

Internal impingement results from pinching of the rotator cuff between the posterosuperior labrum and the greater tuberosity. The pain usually occurs with repetitive maximal shoulder internal rotation and abduction, which leads to cumulative microtrauma and eventual articular-sided rotator cuff pathology.⁴ The patient will complain of

Athlete has shoulder problems? Consider these tests^{1,3,16,18}

While a full review of provocative shoulder testing is beyond the scope of this article, specific tests for impingement, labral tears, instability, and rotator cuff tears should be included when examining the throwing athlete.

Impingement

Neer's test. The clinician uses one hand to passively flex the arm of a patient whose thumb is pointing down, as the clinician's other hand stabilizes the patient's scapula. The test is positive for impingement if the patient feels pain in the shoulder with this maneuver.

Hawkin's test. This test involves stabilizing the scapula, passively abducting the shoulder to 90°, flexing the shoulder to 30°, flexing the elbow to 90°, and internally rotating the shoulder. Pain with this maneuver suggests rotator cuff impingement.

Labral tears

O'Brien's test. The physician asks the patient to adduct his arm across the midline of his body while keeping his shoulder flexed at 90° and his thumb down. As he does this, the physician pushes downward to resist the patient's shoulder flexion and to see if the patient feels pain. Then, the same motion is done by the patient, but this time with the thumb up. If the pain is not present—or diminishes—with the thumb up, the test is considered positive for a labral tear.

Instability

Load and shift test. The physician uses force to push the humeral head centrally onto the glenoid fossa and then attempts to move the humeral head backward and forward, while keeping the scapula stable, to see how far it can go. Displacement <1 cm is mild; 1 to 2 cm is moderate; and >2 cm is severe.

Sulcus sign. With the patient's arm in a relaxed position at his side, the physician pulls it downward. If a gap more than 1 cm wide develops between the humeral head and the acromion, the test is positive for inferior glenohumeral instability.

Apprehension-relocation test. The physician asks the patient to lie down on his back and abduct his shoulder at 90°. The physician then externally rotates the patient's arm and places stress on the glenohumeral joint. A patient with shoulder instability will often stop the physician and say that he feels as if his shoulder is going to "pop out."

The relocation part of the test is done by the physician applying a posteriorly directed force on the front of the shoulder. If the patient says that the almost popping out feeling of his shoulder has disappeared (and experiences a sense of relief), the test is considered positive.

Rotator cuff tears

Drop arm test. The shoulder is passively abducted to 90° and flexed to 30° while the thumb is pointing down. The test is considered positive for a supraspinatus muscle tear if the patient is unable to keep the arm elevated after the physician releases the arm.

Empty can test (Jobe test). The shoulder is passively abducted to 90° and flexed to 30° while the thumb is pointing down. In this position, resistance is provided as the patient tries to lift the arm upward. Pain with weakness suggests a tear of the supraspinatus muscle.

Push-off test. The clinician asks the patient to adduct and internally rotate his arm behind the back. The examiner provides resistance as the patient tries to push the arm away from the body. Pain with weakness suggests a tear of the subscapularis muscle.

pain with shoulder internal rotation and abduction. Neer's and Hawkin's tests are helpful in detecting internal impingement.

Shoulder girdle fatigue from lack of conditioning and overthrowing—or the tight posterior capsule often seen in throwing athletes—may also contribute to the disorder.⁴

■ **Treatment.** Proper management involves relative rest from overhead activities, and an individualized rehabilitation program that includes dynamic stretching/strengthening through the rotator cuff, posterior capsule, and scapular stabilizers. Injecting a corticosteroid-analgesic solution into

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Full-thickness rotator cuff tears are rare; consider a diagnosis of instability or a partial tear instead.

the subacromial space may help you arrive at a diagnosis and also offers symptomatic relief.^{1,3} Consider bursectomy, arthroscopic acromioplasty, capsulotomy and/or debridement for recalcitrant cases.^{4,5}

Shoulder labrum pathology

What you'll see. Overhead-throwing athletes are at risk of labral tears. The externally rotated, abducted arm of a thrower causes posterior rotation of the biceps anchor, peeling the biceps from its superior labrum attachment,⁶ a superior labrum anterior and posterior (SLAP) tear, or a type II tear from anterior to posterior. SLAP tears may lead to shoulder catching and locking. The patient may complain of vague shoulder pain,⁷ which is worse in the late cocking phase. O'Brien's test will be positive.

Magnetic resonance imaging (MRI) with arthrogram can reveal a labral tear. Consider ordering an MRI when the athlete's pain is accompanied by mechanical symptoms, such as locking, catching, or instability, or if the shoulder signs and symptoms do not appear to be responding to appropriate physical therapy interventions after a period of time—usually 4 to 6 weeks.

■ **Treatment.** For small tears, conservative management includes relative rest and physical therapy.³ Depending on the tear morphology, consider arthroscopic labral debridement or repair if conservative measures fail. The literature offers mixed conclusions on the benefits of surgery, with varying rates of full return to play.⁸⁻¹⁰

Shoulder instability

What you'll see. Instability in throwing athletes is multifactorial, and rarely due to an isolated shoulder structure injury.¹¹ Patients will complain that their shoulder feels as if it is going to come out of its socket, even when they are not throwing. To help detect instability, look for the sulcus sign, and do a load and shift test and an apprehension-relocation test.

■ **Two categories of injury.** Instability injuries fall into 2 primary categories: TUBS (Traumatic, Unilateral, associated with Bankart lesion, treated with Surgery) and AMBRI (Atraumatic, Multidirectional, Bilat-

eral, treated with Rehabilitation, Inferior capsular shift).

As its name makes clear, TUBS is associated with a Bankart lesion (an avulsion of the anteroinferior glenoid labrum to its attachment to the humerus). Shoulder x-rays, including outlet, axillary lateral, and anteroposterior views,³ may reveal a bony Bankart lesion. You may also see a Hill-Sachs lesion here, which is noted on the humeral posterolateral head as a depression in the bony cortex.

AMBRI is more common than TUBS in throwers. Athletes often gain a competitive edge by increasing external rotation. However, when overdone, this results in the excessive laxity seen in AMBRI. While rare, acute traumatic dislocation can occur in those with AMBRI-type instability.

■ **Treatment.** Scapular stabilization exercises, dynamic rotator cuff strengthening, relative rest, and a short course (7-10 days) of nonsteroidal anti-inflammatory drugs are the mainstays of shoulder instability treatment in the throwing athlete.^{1,3} A throwing program may be started when the athlete is asymptomatic and has rested. You may also need to prescribe a longer rest period of 4 to 6 weeks if the symptoms return after commencing activity. For recalcitrant cases, consider surgery (via open or arthroscopic approaches⁶) to treat the associated underlying pathology.

Glenohumeral internal rotation deficit

What you'll see. Posterior capsular contracture, common in the throwing athlete's shoulder, causes decreased internal rotation and posterior shift of the total arc of glenohumeral motion.³ The patient may complain of decreased ability to reach backwards or pain when attempting to do so.

The anterior aspect of the shoulder's capsule also lengthens, allowing anterior capsular laxity that causes additional problems, including internal impingement, SLAP tears, articular-sided, partial-thickness rotator cuff tears, and posterosuperior rotator cuff impingement. The risk for this cascade of complications increases in patients with throwing-shoulder internal rotation deficits $\geq 25^\circ$ compared with the nonthrowing side, and a total arc of motion $< 180^\circ$.¹²

FIGURE 2

The sleeper stretch



PHOTOS COURTESY OF: GEORGE GUNTUR, A, PUJALTÉ, MD

■ **Treatment.** Stretching the tight posterior capsule using the sleeper stretch (FIGURE 2) or the cross-body stretch (FIGURE 3) has proven very successful, with 90% of athletes seeing their symptoms resolve within 2 weeks.^{13,14} If conservative treatment is ineffective, consider selective arthroscopic capsular release of the posterior inferior glenohumeral ligament.

Rotator cuff tears

What you'll see. Partial-thickness, articular-sided tears of the supraspinatus, infraspinatus, or both—found posterosuperiorly at the posterior rotator interval—are common in throwing athletes. The patient may complain of weakness when trying to do overhead tasks or movements requiring shoulder abduction. The supraspinatus is usually the muscle affected, and so testing of this muscle with the “empty can test” will show pain with weakness if there is a tear. However, full-thickness rotator cuff tears are rare;³ consider a diagnosis of instability or a partial tear in such cases. An MRI can reveal a rotator cuff tear. In fact, the imaging may be necessary for any suspicion of a tear in an athlete.

■ **Treatment.** Recommend strengthening exercises to patients before considering surgery. Nonoperative treatment is preferred, and should be given a fair trial before surgery; studies have not consistently supported the operative approach to rotator cuff tears.^{5,15}

FIGURE 3

The cross-body stretch



However, if conservative management fails, arthroscopic debridement of torn tissues is recommended over open procedures.³

Scapular dyskinesia and “SICK syndrome”

What you'll see. Poor development of, or fatigue in, the scapular stabilizers leads to scapular dyskinesia (poor scapular control and motion). Scapulothoracic dyskinesia can progress to an overuse muscular fatigue syndrome called the “SICK syndrome” (Scapular malposition, Inferior medial border prominence, Coracoid pain and malposition, and dysKinesia of scapular movement).¹⁶ The most common symptoms include anterior shoulder pain, posterior/superior scapular pain with or without radiation,¹⁶ and a “dead arm” sensation. If not treated, this can result in rotator cuff lesions, impingement, and labral pathology.

■ **Treatment.** Both treatment and prevention are dependent on the proper biomechanics to retract and rotate the scapula correctly during throwing.¹ Strengthening the scapular stabilizers and stretching tight posterior structures help to promote proper biomechanics, and enable a successful return to throwing.¹⁴

Help patients prevent injuries in the first place

To reduce the risk of shoulder injuries, athletes need to maintain an appropriate



Warn patients to avoid overaggressive stretching to gain mobility.

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Core strengthening is a very important component of injury prevention exercise regimens for throwing athletes.

“thrower’s motion” at the glenohumeral joint.¹⁷ Overhead throwing athletes often exhibit excessive external rotation in their dominant shoulders,¹⁸ while internal rotation is reduced.¹⁹

Frequent gentle stretching may help maintain equal total motion in both the throwing shoulder and the nondominant shoulder. However, warn patients to avoid overaggressive stretching to gain mobility; the goal should be to maintain mobility.¹⁷

Strengthening of the entire upper extremity (shoulder, scapula, elbow, and wrist) is essential. While the individual needs of each athlete must be addressed, electromyographic studies of the throwing motion suggest that stretching, strengthening, and retraining of the muscles that allow the shoulders to rotate upwards and backwards help the shoulder blade keep close to the rib cage at the back. These are the most important initial steps in rehabilitating shoulder injuries in a throwing athlete.

Prevention and treatment programs for the throwing athlete should always incorporate dynamic stabilization and neuromuscular control.¹⁷ Additionally, the transfer of kinetic energy, as well as proximal stability with distal mobility of the upper extremity,

are enhanced by core stabilization drills, including planks and side planks, as well as lower body training. As such, core strengthening is a very important component of injury prevention exercise regimens for throwing athletes.

Lastly, throwing programs incorporating maximum pitch counts per day, rest days, and gentle throwing are key to injury prevention. Direct young throwing athletes and their parents to resources such as <http://pediatrics.aappublications.org/content/129/3/e842.full.pdf+html>. (Tell them to see the recommendations at the end of the document.) Keep in mind, however, that there are no clear recommendations for college and professional pitching.

■ **Young athletes.** It is important to note that athletes with immature skeletons are at particular risk of injury due to the relative weakness of the open growth plate and the development of muscle imbalance. It is essential to appropriately apply the principles discussed here to young athletes to prevent injury.

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