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Clinical Evaluation of the Athlete's Shoulder

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Objective: To describe the history and physical examination of the athlete's shoulder.

Background: The complex, highly mobile shoulder joint is very susceptible to athletic injury. A comprehensive history and physical examination lay the groundwork for accurate decision making about the nature of the injury and the appropriate treatment plan.

Description: In taking the history, inquire about the patient's lifestyle (dominant hand, occupation, sports, activity level) and then focus on the specific complaint. Ask about the location, quality, and nature of the pain and activities that provoke the pain. If stiffness is a factor, a review of systems and the patient's past medical history are important. Discuss any previously undertaken interventions and their effects. The physical examination consists of inspection, range of motion, palpation, manual muscle testing, and provocative tests.

Clinical Advantages: Once the clinical evaluation has been completed, the nature of the injury will, in most cases, be apparent. If necessary, appropriate diagnostic tests are ordered, and then a treatment plan tailored to the athlete and the injury is instituted.

Key Words: acromioclavicular joint, rotator cuff, throwing athlete, shoulder instability, impingement, glenohumeral ligaments

In order to assess the athlete's shoulder adequately, the evaluator must first understand the basic anatomy of the glenohumeral joint and related structures. Once this foundation is in place, skill in clinical examination can be refined. The shoulder is the most mobile joint in the human body, the result of complex anatomical and biomechanical relationships. However, this complexity also makes shoulder problems among the most commonly encountered complaints presented to physicians, therapists, and athletic trainers.

Common complaints about the shoulder can include any combination of pain, instability, and stiffness. The etiology of these symptoms covers a broad range of diagnoses. A comprehensive history and physical examination is the cornerstone to accurate decision making regarding the need for diagnostic studies and formulation of an appropriate treatment plan.

HISTORY

A thorough history begins with the clinical evaluation of the shoulder; it can often narrow the differential diagnosis and serves to guide the physical examination. Clinical data forms are useful means of recording and organizing data obtained during the initial evaluation.

Before inquiring about the patient's specific complaint, obtain initial information including the patient's age, dominant hand, occupation, sporting activities, and activity level. Most complaints about the shoulder include some component of pain. Pain may result from acute trauma, from a chronic, insidious condition, or from an acute exacerbation of a chronic condition. When pain is present, several key points should be investigated.

The location of the patient's pain is important, because the pain of cervical etiology is often referred to the posterior aspect of the shoulder in the scapular region. Shoulder pain is most often present anterolaterally in the area of the subdeltoid bursa. Pain on top of the shoulder, especially after a direct fall, is suspicious for acromioclavicular joint injury. Also pay attention to the quality and nature of the pain. Nocturnal pain is suggestive of rotator cuff pathology and subdeltoid bursitis. Ask about relieving and exacerbating factors, radiation of pain, and any associated numbness or tingling suggestive of neurologic involvement.

Provocative activities and the effect of the pain on the athlete's performance are very important. Shoulder pain is an exceedingly common complaint in throwing athletes. When evaluating a throwing athlete, determine the position in the throwing motion that causes pain. Pain on follow-through is frequently due to rotator cuff pathology.[1] Pain in the cocked-arm position may result from instability or internal impingement. Loss of control or velocity, or both, provides important clues to the severity of involvement. Remember also that rotator cuff weakness can present as medial elbow pain in throwing athletes.

Occasionally instability rather than pain is the presenting complaint. Note the onset of the instability, as traumatic instability is treated differently than atraumatic instability. The frequency of the instability episodes and their impact on the patient's daily activities are important. Often the history can give important clues as to the direction of the instability. Provocation of symptoms with the extremity in abduction and external rotation suggests anterior instability. Symptoms with the arm in front of the body in adduction and internal rotation, such as in pushing open a door, are suspicious for posterior instability. Patients with predominantly inferior instability have symptoms while holding objects against gravity with their arms at their sides. These patients generally avoid lifting heavy objects with the affected extremity.

Stiffness alone is not a common complaint. It most often accompanies pain and is usually associated with adhesive capsulitis or postoperative adhesion formation. Internal rota-

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tion loss due to tightness of the posterior capsule is frequently encountered in patients with rotator cuff pathology. In a patient with a stiff shoulder, the review of systems and past medical history are important because of the association between endocrine disorders, such as diabetes, and adhesive capsulitis.

Finally, review any previous treatments, including medications, physical therapy exercises, modalities, and surgery, along with the duration and timing of these interventions. Record the number, dates, and patient response to any corticosteroid injections on the data sheet, along with any nonsteroidal anti-inflammatory medication or oral steroid use.

PHYSICAL EXAMINATION

Just as the history follows an ordered format, so does the physical examination. Adequate exposure is a must. Males should remove clothing above the waist, allowing access to both shoulders. For females, a tank top or gown modified to expose the shoulders is used. The examination begins with inspection of the shoulders for symmetry. Pay particular attention to the acromioclavicular joints and the scapular region. Assess the infraspinatus and supraspinatus fossae for muscular atrophy suggestive of a suprascapular neuropathy or chronic rotator cuff tear. Scapular winging, if severe, may be evident on inspection. Lateral winging is usually due to loss of the serratus anterior muscle secondary to a long thoracic nerve palsy, while medial winging is seen with loss of the spinal accessory nerve and denervation of the trapezius muscle. Note previous incisions, and inspect the deltoid muscle for atrophy or pull-off.

Assessing range of motion begins with checking both active and passive forward elevation in the plane of the scapula. Measure external rotation at both 0° and 90° of abduction. Evaluate active internal rotation by recording the highest spinal level a patient is able to reach with the "hitchhiking" thumb (Figure 1). While putting the shoulder through a passive range of motion, note any crepitation in the subacromial bursa, glenohumeral joint, or scapulothoracic bursa.

During assessment of motion, observe the scapular rhythm to ensure that the scapula moves in synchrony with the glenohumeral joint. A patient with a "captured" glenohumeral joint from adhesion formation demonstrates loss of the normal 2:1 ratio of glenohumeral:scapular motion during forward elevation. The scapula will be the main contributor to elevation, with very little motion actually occurring at the joint. If scapular dysrhythmia is evident, evaluate the scapular stabilizers for winging by having the patient do a wall push-up. Also, retraction of the scapulae with the patient's hands on the waist can be used to elicit scapular winging.

Several prominent structures about the shoulder are easily palpable. Both the acromioclavicular and sternoclavicular joints are subcutaneous and easily accessible. The biceps tendon is often palpable in its groove medial to the greater tuberosity. In thin patients, the greater tuberosity may be palpable along with the subscapularis tendon at the lesser tuberosity.

Manual muscle testing plays a key role in the evaluation of the injured shoulder. Pain often exaggerates weakness, and weak musculature may be masked by substitution of stronger muscles. Therefore, an attempt should be made to isolate each muscle for the best possible testing. Muscle strength is graded on a 5-point scale and is compared with the uninjured side. A plus or minus may be added as appropriate.

- Grade 5: symmetric strength
- Grade 4: a noticeable decrease in strength against resistance
- Grade 3: resistance to gravity only
- Grade 2: resistance to gravity with assistance
- Grade 1: visible contraction of the muscle
- Grade 0: no visible contraction of the muscle

We assess the anterior deltoid muscle at 90° of forward elevation and the middle deltoid at 90° of abduction with reference to the coronal plane. The supraspinatus muscle is best isolated in the "empty-can" position: the shoulder is placed in 90° of abduction and 30° of forward flexion with the arm internally rotated by pointing the thumb downward (Figure 2). Assess the main external rotators (the infraspinatus and teres minor muscles) by resisting external rotation with the arm at the patient's side. Internal rotation strength can also be assessed in this manner. The integrity of the subscapularis muscle is best evaluated with the "lift-off" test described by Gerber and Krushell.[2] The patient places the dorsum of the hand against the back in maximal internal rotation and then lifts the hand off (Figure 3). A patient lacking a functional subscapularis is unable to perform this maneuver.

The remainder of the examination consists of provocative tests performed with the patient either seated or supine. These

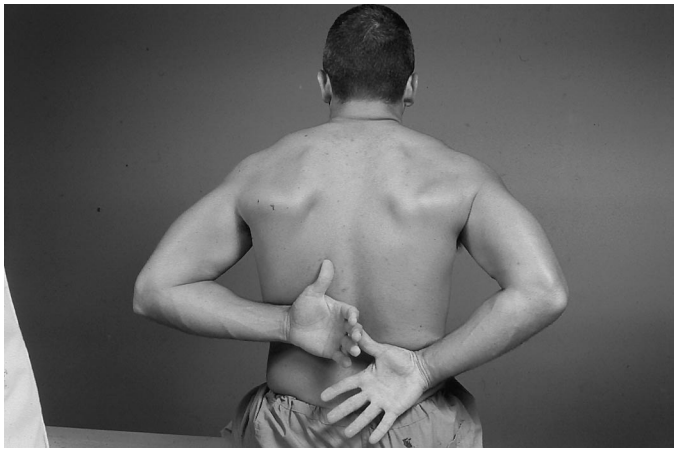

Figure 1. Evaluate active internal rotation by recording the highest spinal level a patient can reach with the "hitchhiking" thumb.

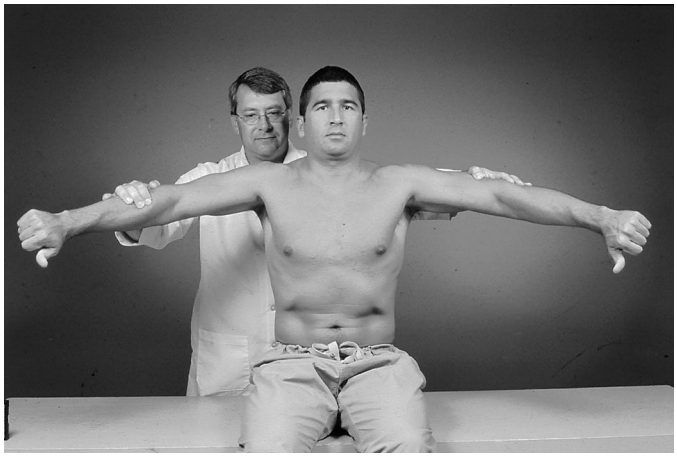

Figure 2. Isolate the supraspinatus muscle in the "empty-can" position by abducting the shoulder to 90° and forward flexing to 30°, internally rotating the arm by pointing the thumb downward.

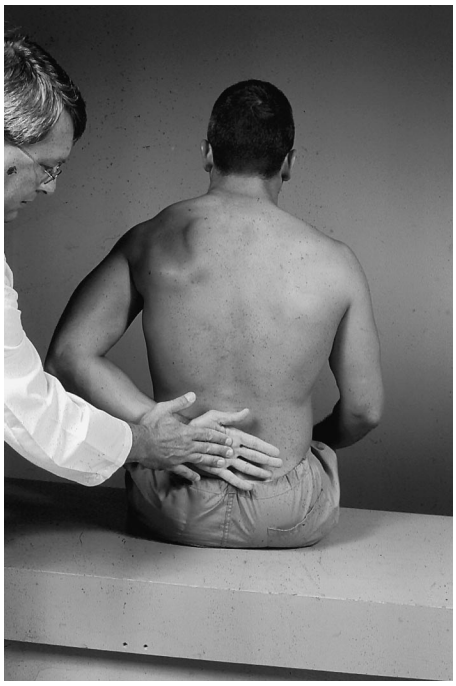

Figure 3. In the "lift-off" test, the athlete places the dorsum of the hand against the back in maximal internal rotation and then lifts the hand off. A patient with a nonfunctioning subscapularis cannot perform this maneuver.

provocative tests are guided by the history and general examination. Impingement is common in both the athletic and nonathletic population. To elicit the Neer classic impingement sign, forcibly elevate the shoulder while stabilizing the scapula (Figure 4).[3] If an impingement lesion is present, pain should be reproduced by this test. Hawkins described a modified impingement sign, which can be used to reinforce the classic impingement sign.[4] This maneuver attempts to reproduce pain from impingement by forced internal rotation at 90° of forward elevation and 30° of forward flexion to approximate a throwing position. The "painful arc," pain with resisted abduction while the shoulder is slightly extended, is considered a third sign of impingement.

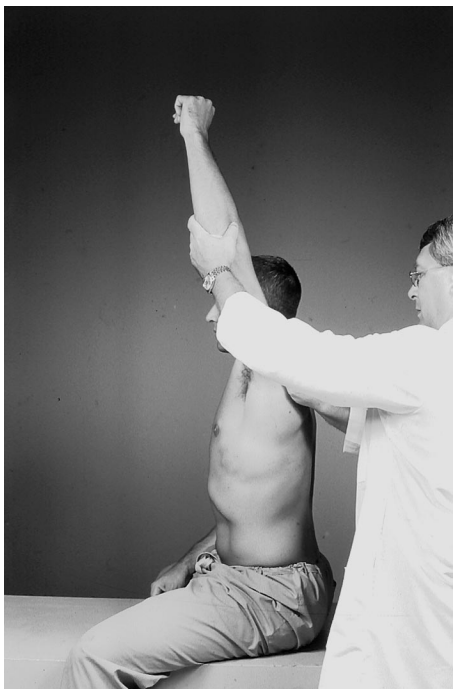

Figure 4. For the Neer impingement sign, forcibly elevate the shoulder while stabilizing the scapula, reproducing impingement pain.

Next, the shoulder can be brought to 90° of forward flexion and 15° of adduction. Resist as the patient attempts to elevate the extremity with the thumb pointed down toward the floor, and then repeat with the palm up. This is the O'Brien, or active compression, test for biceps-labral complex pathology or acromioclavicular joint pathology.[5] The thumb-down position is believed to load the biceps-glenoid labrum complex and the acromioclavicular joint. Note the location of the referred pain. Pain on top of the shoulder is thought to be from acromioclavicular joint etiology, while pain deep in the joint is thought to represent a superior labral lesion. For the test to be considered positive, pain must be relieved with the palm up. Horizontal crossed-arm adduction is used to confirm acromioclavicular joint pathology.

The assessment of laxity and instability begins with the patient in a seated position. Laxity is extremely variable and usually symmetric. Relative increases in laxity are common in females and among swimmers, gymnasts, cheerleaders, and tennis players. Asymmetric shoulder laxity may be a normal finding in throwing athletes. Instability is a symptom that results from pathologic laxity, which can stem from multiple etiologies. The purpose of the stability examination is to uncover the direction of the instability, grade it, and determine the pathology responsible.

Initially assess for signs of generalized ligamentous hyperlaxity, such as elbow recurvatum or a thumb-forearm sign. To assess the laxity of the glenohumeral joint, we assess anteroposterior translation with the load-shift test. The examiner stands behind the patient and stabilizes the scapula, then applies a compressive force to the humeral head, centering it in the glenoid. The humeral head is then translated both anteriorly and posteriorly, and the amount of translation is graded:

- Grade 1: translation up the glenoid face
- Grade 2: translation to the glenoid rim
- Grade 3: frank dislocation

Measuring the sulcus sign assesses inferior translation. Apply downward traction at the patient's elbow while stabilizing the scapula (Figure 5). Inferior translation is manifested by a widening of the subacromial space evident at the lateral border of the acromion. Grade 1 is 1 cm or less of widening; grade 2 is 1 to 2 cm; and grade 3 is greater than 2 cm. Remember, when assessing laxity, you are really assessing the symmetry of the shoulders.

Patients with glenohumeral instability often display apprehension when the extremity is stressed in a provocative position. The "crank" test can be used to elicit apprehension felt with anterior instability.[4] Apply an anterior force to the humeral head while externally rotating the shoulder from a position of 90° of abduction. Patients with anterior-inferior instability may have a feeling of impending dislocation, which is referred to as an apprehension sign. Posterior apprehension may be elicited by the jerk test. Forward flex, internally rotate, and adduct the extremity while applying a posterior force.

Continue the instability assessment with the patient in the supine position. The integrity of the glenohumeral ligaments is easily evaluated with the patient supine. Position the patient on the examination table so that the scapula is stabilized by the

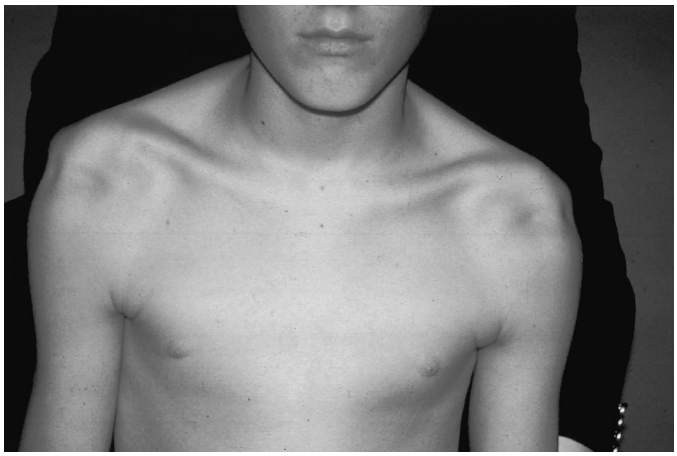

Figure 5. To measure the sulcus sign and assess inferior translation, apply downward traction at the elbow while stabilizing the scapula. Inferior translation is demonstrated by subacromial space widening at the lateral acromial border.

edge of the table. Grasp the patient's wrist with your outside hand and then position the thumb and index finger of the opposite hand on the anterior and posterior aspects of the humeral head. Have the patient relax, and allow gravity to pull the elbow toward the floor, causing the humeral head to translate anteriorly. The amount of translation can be felt between the thumb and index finger. By raising the wrist up and directing a posterior force with the thumb, reciprocal posterior translation can be felt. Assess the ligamentous restraints at 0°, 45°, and 90° of abduction with neutral and 90° of external rotation.

Turkel et al[6] demonstrated the major ligamentous restraints to anterior translation with the shoulder in varying degrees of abduction and external rotation. The superior glenohumeral ligament is the major restraint to anterior translation at 45° or less of abduction. The middle glenohumeral ligament becomes the significant checkrein from 45° to 90° of abduction. At 90° and greater abduction, the inferior glenohumeral ligament is the major stabilizer. When the glenohumeral ligaments are intact, external rotation from neutral toward 90° causes the ligaments to tighten, preventing further anterior translation of the humeral head. If the glenohumeral ligaments are disrupted, external rotation of the humeral head causes further anterior translation and apprehension, especially in the presence of an anteriorly directed force. Increased anterior translation and apprehension with external rotation at 45° to 60° of abduction are characteristic of anterior-superior or SLAC (superior labral anterior capsule) instability (G.C. Terry, MD, unpublished data, 1999), in which an anterior superior labral tear has caused detachment of the middle glenohumeral ligament. At 90° or greater, pathologic anterior translation becomes characteristic of anterior-inferior instability and a possible Bankart lesion. Often with the patient in this position, a labral click suggestive of tearing of the glenoid labrum can be detected and localized. This can be confirmed with the clunk test, as described by Andrews and Gillogly.[1] Abduct the arm to 180°, and apply an anterior compressive force while rotating the humeral head in an attempt to capture the torn piece of labrum. Applying an anteriorly directed force on the humerus aids in the capture of an anterior labral tear. A painful clunk is believed to represent the capture of a detached labral fragment.

Apprehension may also be elicited with the fulcrum test in the supine position. We combine this with a relocation test, as described by Jobe and Bradley,[7] when there is a strong suspicion of recurrent anterior instability (Figure 6). Abduct the arm to 90°, and then gradually increase external rotation until the patient becomes apprehensive. Apply a posterior stress to the proximal humerus, relocating the humeral head. With the posterior stress applied, further external rotation should be possible without exaggerating the patient's feeling of apprehension.

Superior glenoid impingement, recently described by Jobe and others,[8,9] is occasionally a cause of shoulder pain in throwing athletes. This is a secondary impingement felt to be caused by excessive translation of the humeral head, commonly present in throwers. We use the internal rotation resistance strength test[10] to assess for impingement of the infraspinatus tendon on the posterior-superior glenoid. With the patient in the supine position, abduct the shoulder to 90° and externally rotate to 90°. Perform resisted active internal and external rotation. Pain and weakness on external rotation that are absent on internal rotation may reflect this internal impingement.

The final segment of a complete shoulder examination consists of neurovascular testing. Cervical radiculopathy commonly presents as a shoulder complaint. Pain posteriorly, especially if it radiates past the elbow, is suggestive of cervical

Figure 6. A, To test for recurrent anterior instability, abduct the arm to 90° and gradually increase external rotation until the athlete becomes apprehensive. B, Apply a posterior stress to the proximal humerus, relocating the humeral head.

pathology. Injuries to the axillary, suprascapular, or long thoracic nerves may initially present as a painful shoulder. Stingers are traction injuries to the brachial plexus, commonly seen in athletes participating in contact sports. When there is suspicion of neurologic involvement, perform a complete assessment of upper extremity strength and deep tendon reflexes at the biceps, triceps, and brachioradialis. Athletes with stingers should not return to contact sports until upper extremity strength is symmetric.

Among the vascular causes of shoulder pain are thoracic outlet syndrome (the most common) and an aneurysm of the axillary or brachial artery (rare). These conditions are most often seen in throwing athletes and are usually diagnoses of exclusion. Patients complain of numbness and tingling related to activity. The physical examination is usually unremarkable, and radiographic studies are negative. When vascular compression is suspected, the Adson and Wright maneuvers[11] may be beneficial. To perform the Adson maneuver, have the patient seated with the shoulder extended and the neck rotated toward you. Evaluate the radial pulse as the patient holds a deep breath. (A modification has been described with the head rotated away from the examiner.) For the Wright maneuver, the patient is seated with the arm abducted, extended, and externally rotated. Assess the radial pulse as the neck is rotated away from the side being examined. These tests are only considered positive if they reproduce the patient's pain or paresthesias. Vascular assessment is critical in patients with shoulder trauma; be sure to evaluate distal pulses.

CONCLUSIONS

The shoulder is the most complex joint of the body, which is reflected by the number of test and maneuvers that have been described for the evaluation of shoulder complaints. The key to making timely, accurate diagnoses rests in taking a systematic approach to the history and physical examination. Only then can the appropriate diagnostic tests and treatment be prescribed.

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