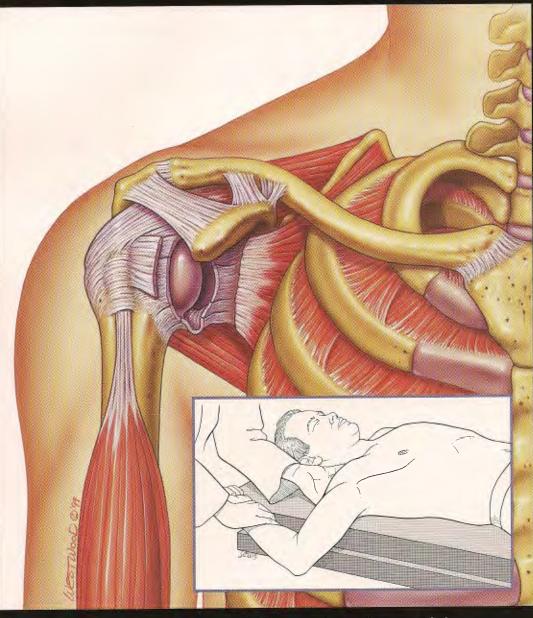
Osteoporosis: Risk factors and diagnosis

LANE B. SCHEIBER II, MD and LUIS TORREGROSA, MD

Rheumatoid foot: Minimize pain, maximize function SCOTT VOGELGESANG, MD, DONALD G. SHURR, CPO, PT, and CHARLES SALTZMAN, MD

Evaluating a suspected stress fracture ADAM GREENSPAN, MD

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Physical examination of the painful shoulder MARY LLOYD IRELAND, MD and GURMINDER S. AHUJA, MD

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Office-based detection of instability, labral tears, and impingement

Physical examination of the painful shoulder

ABSTRACT: When taking a history from a patient with shoulder problems, inquire about sports activities, changes in technique, and trauma. Also ask about the nature of pain; nocturnal symptoms suggest a rotator cuff problem. Begin with inspection and palpation, then observe scapular movement. The feeling that the humerus is slipping within the shoulder socket suggests instability. Laxity is normal, although the degree varies with gender and sport. Instability refers to movement of the humeral head out of the glenoid and can be further assessed during seated, lateral, supine, and prone examinations. A posterior clunk or pain when the shoulder is internally rotated suggests posterior glenohumeral instability; apprehension when the arm is abducted and externally rotated suggests anterior instability. (J Musculoskel Med. 1999;16:181-199)

The glenohumeral joint can be likened to a golf tee that supports an oversized ball. The very shallow, small glenoid fossa is mismatched in relation to the large humeral head. This unique anatomy allows the range of motion necessary for reaching, lifting, throwing, and other movements.

The same features that impart so much mobility can also contribute to a host of such shoulder problems as instability, stiffness, and pain. The underlying problem producing these symptoms can range from arthritis to a rotator cuff tear, labral tear, tendinitis, or overuse syndrome.

A history and comprehensive

physical examination are the keys to determining the underlying cause of shoulder problems in the athlete. In this article, we review shoulder anatomy and discuss how it relates to common disorders. We also offer a comprehensive approach to the shoulder examination, including positional testing.

ANATOMY

Understanding anatomy provides insight into the probable cause of symptoms in the person with shoulder pain.¹ The shoulder complex consists of the glenohumeral, acromioclavicular (AC), and sternoclavicular joints, as well as the scapulothoracic and subacromial articulations (Figure 1). The subcutaneous bony landmarks are the clavicle, AC joint, coracoid, scapula, and sternoclavicular joint.² The trunk, thoracic spine, and scapula provide a stable base for the whip action of the shoulder and arm during athletic activities.

The ligaments that stabilize the clavicle-the coracoclavicular (containing the medial conoid and lateral trapezoid portions), coracoacromial, and AC—are named for their bony attachments. The coracoacromial arch consists of these stabilizing ligaments plus the bone of the acromion and clavicle. The rotator cuff can be likened to a "soft-tissue sandwich," with the compressive roof of the acromial arch above and the proximally moving and rotating humeral head below. In impingement syndrome, the acromion, coracoacromial ligament, AC joint, and coracoid process cause compression or impingement on the underlying bursa, biceps tendon, and rotator cuff.

The glenohumeral articulation has both static and dynamic stabilizers.³ The anterior inferior glenohumeral ligament is the primary stabilizer; it acts like a hammock

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to prevent anterior humeral head translation. Other static stabilizers are the glenoid lip; the humeral head; and the inferior, middle, and superior anterior glenohumeral ligaments and capsule, which blend into the labrum. The glenoid labrum provides stability, anchors the biceps and, through a bumper effect, reduces anterior humeral head translation. The biceps–glenoid-labrum complex can have

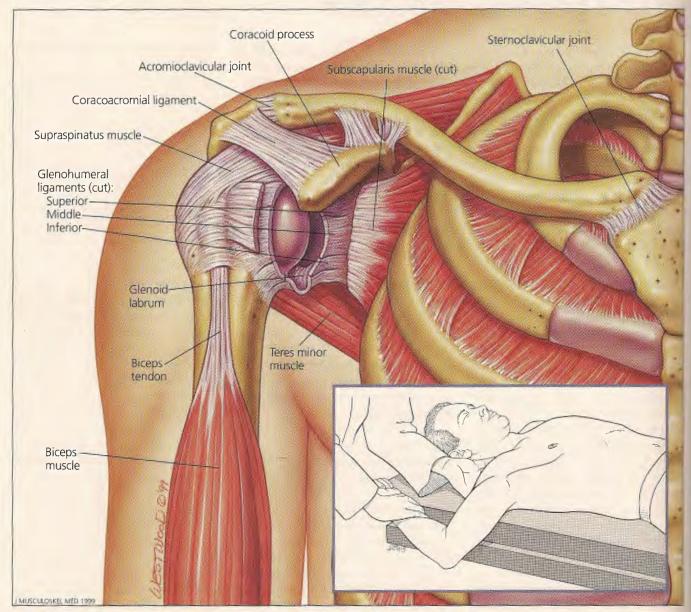


Figure 1 – The glenohumeral joint has both static and dynamic stabilizers. The musculotendinous units of the rotator cuff—the supraspinatus, infraspinatus, and teres minor—help provide rotational control and stability. The superior, middle, and inferior glenohumeral ligaments are the primary stabilizers. The capsule and ligaments blend into the labrum, which can become torn and detached from the anterior rim of the glenoid, contributing to instability. The examiner palpates the shoulder and passively moves the patient's arm into abduction and external rotation (inset). This test is positive for anterior instability if the patient reports that this position causes pain or a feeling that the shoulder will slip forward.

Table – Probable causes of shoulder pain according to age

Persons younger than 30 years

Instability of the glenohumeral joint related to subluxation or dislocation Acromioclavicular subluxation or dislocation

Persons between 30 and 50 years

Impingement syndrome associated with rotator cuff tear Frozen shoulder (slender women and persons with diabetes)

Persons older than 50 years

Complete rotator cuff tear Degenerative arthritis Frozen shoulder Humeral fracture

From Johnson TR. In: Snider RK, ed. Essentials of Musculoskeletal Care. 1997.⁶

anatomic variants in attachments to the glenoid.⁴

The dynamic stabilizers of the glenohumeral joint are the internal rotator of the subscapularis and the musculotendinous units of the rotator cuff—the supraspinatus, infraspinatus, and teres minor external rotators. These stabilizers also provide rotational control. The rotator cuff is a decelerator and acts like a brake.

EVALUATION History

The shoulder examination starts with a thorough history, including detailed information regarding the patient's sports activities as well as the duration and intensity of training and any changes in training or performance technique. It is important to determine whether symptoms are truly attributable to the shoulder itself or represent a pathologic process elsewhere, such as cervical pathology or nerve entrapment, a neurologic deficit, or a problem anywhere along the kinetic chain.⁵

If the patient sustained trauma,

obtain specifics regarding the mechanism of injury. A direct fall onto the point of the shoulder, for instance, can cause AC joint separation. Also ask about the nature and onset of pain. Discomfort that is localized to the top of the shoulder further supports the possibility of AC joint separation. Pain that is nocturnal or that radiates into the upper arm suggests a rotator cuff tear.

The patient with instability may feel that his or her shoulder slips out of joint, particularly when the arm assumes a throwing position of abduction and external rotation. Instability or neurologic involvement can also cause the arm to feel numb or dead. A tingling sensation into the forearm and hand can be caused by rotator cuff disease. If the patient is an overhead athlete, determine which phase of throwing is the most symptomatic. Rotator

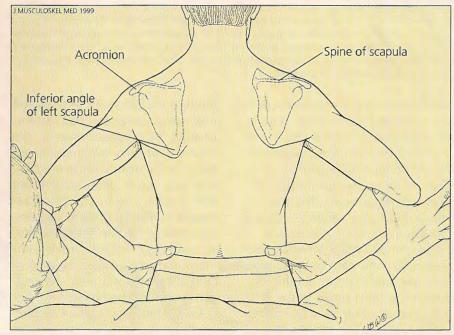


Figure 2 – During assessment of scapulothoracic function, the patient places his hands on his waist and pushes back against resistance from the examiner. This patient, a baseball player who had no shoulder complaints, has asymmetric scapular motion on the right with this maneuver. His right scapula is higher and demonstrates more pronounced winging (movement away from the thorax) than the non-dominant left side.

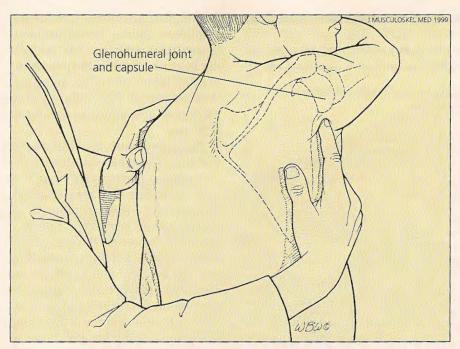


Figure 3 – Ask the patient to move his or her shoulder into horizontal adduction and internal rotation. If the direction of instability is posterior, this maneuver elicits pain. If you feel a clunk during palpation or if on inspection the humeral head moves posteriorly during horizontal adduction and internal rotation and reduces as the arm is externally rotated, posterior instability is confirmed. The examiner's index finger is pointing to the posterior capsule, also the area where a posterior glenoid exostosis may be present.

cuff disease causes discomfort during overhead movement that is most pronounced as the arm moves in greater than 90° of abduction and in a maximum degree of rotation. Also consider thoracic outlet syndromes and cervical disc disease, which both can cause weakness following repetitive movements.

The patient's age gives further clues about the diagnosis. In adolescents and young adults, instability is most likely. In the middle-aged or older person, rotator cuff problems are more common (Table).⁶

Inspection and palpation

Since there are so many positions of the shoulder, we recommend estab-

lishing a routine order of tests and performing the assessment systematically. Take measurements the same way at each examination and compare the results of the involved side with those of the uninvolved side. During the initial gross assessment, check for scars suggesting previous trauma or surgery and hypertrophy or muscle wasting. Also compare each side for temperature differences, a finding that suggests vascular involvement.

Ask the patient to abduct and forward flex his arms as you observe scapular movements for glide and synchrony. Observing as the patient places his hands on his waist and pushes back (Figure 2) and performs wall and regular push-ups makes it easier to evaluate scapular symmetry.

The AC and sternoclavicular joints are subcutaneous and easy to palpate. Deformity or pain on palpation is a clue to the diagnosis. Also examine the scapulothoracic articulation for range and symmetry of motion in planes of abduction, forward and backward flexion, and internal and external rotation. In a baseball pitcher, there will be less internal rotation and greater external rotation in the dominant arm.

Assessing laxity and instability

Laxity. Laxity is normal, although the degree varies with gender and sport.7 In such sports as gymnastics, cheerleading, and tennis, laxity is relatively common and may be regarded as advantageous. The intrinsic tissue laxity and increased external rotation allow the athlete to perform the repetitive movements required in these sports. Laxity is also relatively common in swimmers but can be painful and interfere with performance.8 Athletes such as weight lifters and football players tend to have shoulders that are tighter.

Laxity is usually symmetric, although this may not be true for persons who participate in dominanthanded sports. For instance, inferior laxity of the dominant arm is often anterior in throwers and posterior in golfers.

Instability. This refers to abnormal movement of the humeral head out of the glenoid. Instability is described by grade and direction. It is a pathologic process associated with tears in the labrum and rotator cuff. In the uninjured person, stability and range of motion are

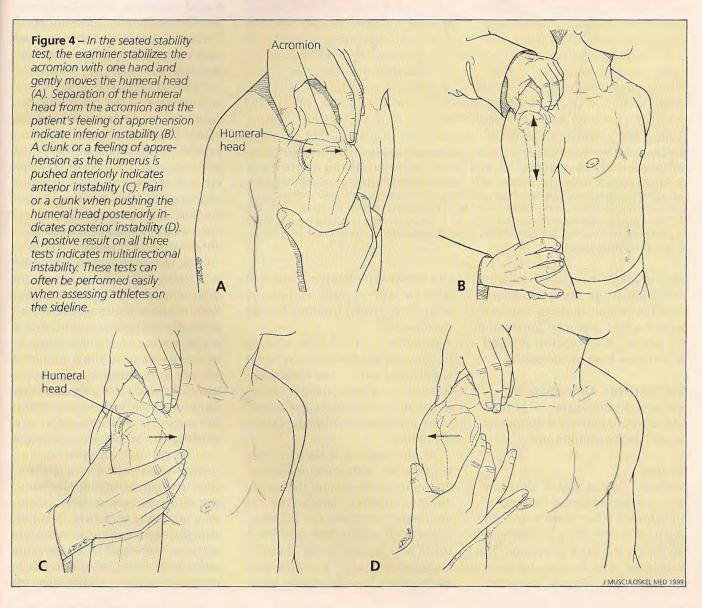
symmetric for both shoulders.

During the assessment, document the degree and direction of instability, beginning with the uninvolved side. It is also important to note apprehension and the presence of other abnormalities. Young pitchers with shoulder pain, for instance, may have a posterior exostosis associated with instability.^{9,10}

Classification of instability takes

into account the mechanism and acuteness of injury, the degree and direction of instability, the patient's age, and multiplicity effort (number of dislocations and level of activity that caused the dislocation). A classification system similar to that of the knee can be applied to grade shoulder instability. In the knee, instability is classified as grade I (less than 5 mm), grade II (5 to 10 mm), grade III (10 to 15 mm), and grade IV (greater than 15 mm).

Two common patterns of instability are represented by the acronyms TUBS (traumatic, unidirectional, Bankart lesion [a traumatic detachment of the fibrocartilaginous labrum from the anterior rim of the glenoid], surgery) and AMBRI (atraumatic, multidirectional, bilateral, rehabilitation). Young persons



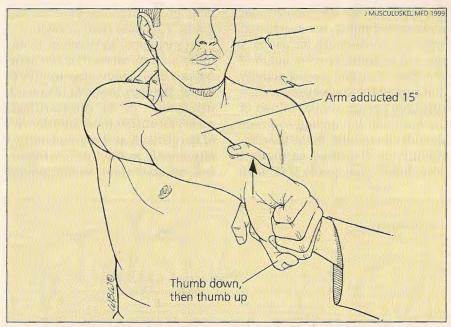


Figure 5 – The O'Brien test is performed with the patient's arm forward flexed 90° and horizontally adducted 15° with thumb down, then thumb up. If superficial pain occurs when the patient, with thumb down, pushes up against downward resistance from the examiner, suspect acromioclavicular (AC) pathology; if pain is deep, suspect an anterior labral tear. The thumb-down position loads the AC joint and compresses the biceps-glenoid-labrum anchor, creating pain if there is a pathologic process. For test results to be significant, the pain must be relieved in the thumb-up position.

with a single anterior dislocation and TUBS are generally considered candidates for surgery. Patients with AMBRI are only considered for surgery if all types of rehabilitation have been unsuccessful.¹¹

POSITIONAL ASSESSMENT

Perform the remainder of the physical examination with the patient seated, supine, and prone.

Seated

With the patient seated, the examiner performs several tests to determine whether there is involvement of the AC joint, subacromial space, rotator cuff, or labrum. The examiner also focuses on documenting symmetry of movement and checking for impingement, and tries to reproduce symptoms by asking the patient to actively move the shoulder.

Palpation of the biceps tendon, bicipital tuberosity, and coracoid is a routine part of the evaluation. However, it is very unusual to find abnormalities involving these structures, particularly in a young throwing athlete.

No one position of the arm truly isolates any particular muscle of the rotator cuff. Certain thumb positions, however, can isolate the supraspinatus from the infraspinatus. We find that the supraspinatus is best isolated in the thumbsdown ("empty can") position, with the humeral head internally rotated. The patient holds his arms in 90° of abduction and slight forward flexion. He is asked to push up against resistance while in two different positions: palms parallel to the floor (deltoid) and thumbs pointing down (supraspinatus).

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To assess internal rotation, ask the patient to reach his thumb as far up his back as possible. In a throwing athlete, the range of internal rotation is typically reduced—and that of external rotation is increased—on the involved side, compared with the contralateral side.

External rotational symmetry is routinely assessed with the patient's arm abducted to 90° and the elbow flexed to 90°. The examiner externally rotates the arm as much as possible and documents the difference between the two arms in degree of external rotation or discomfort. If the patient is apprehensive or has pain anteriorly, consider that there is anterior instability.

Next, move the patient's shoulder into horizontal adduction to create internal rotation (Figure 3). A posterior clunk or pain suggests a posterior process, such as instability, a labral tear, or exostosis. A posterior extension of a SLAP (superior labrum from anterior to posterior tear that occurs along the line from the biceps tendon attachment to the superior labrum) lesion can produce the same pain, yielding a positive result on this test.

Horizontal adduction and elevation can also cause scapular winging, which is normal in the skeletally immature person. In the adult, winging can mean weakness of the serratus anterior and trapezius muscles. If the serratus anterior is compromised, the scapula migrates

proximally and its inferior angle moves medially. Damage to the trapezius causes the scapula to migrate downward and its inferior angle to move laterally.¹² To assess subscapularis function anteriorly and scapulothoracic dysfunction posteriorly, look for scapular winging as the patient leans forward and raises his thigh off the table.

Impingement signs were initially described by Neer¹³ and have been modified by Hawkins and Kennedy,¹⁴ Hawkins and Hobeika,¹⁵ and Jobe.¹⁶ To elicit the Neer impingement sign, the patient's arm is forcibly flexed to an overhead position. Pain is caused by impingement of the humerus against the coracoacromial arch. For the Hawkins impingement sign, the patient's arm is placed in a throwing position and flexed forward approximately 30°. Pain that occurs at a reproducible point during forcible internal rotation of the humerus is a positive result that indicates impingement of the supraspinatus tendon against the coracoacromial ligament.

There are various tests for instability.¹⁵ We recommend stabilizing the acromion and, with the patient's arm relaxed and unsupported, moving the humeral head in and out of the glenoid to check for anterior, posterior, and inferior translation. Reproduction of symptoms, asymmetry, or painful clunk indicate instability (Figure 4).

During the seated apprehension test for stability, the patient's arm is abducted and externally rotated as the examiner palpates the subacromial space for crepitus (often normal) and tests the anterior shoulder for pain indicative of anterior instability. To check for pos-

terior instability, horizontally adduct and internally rotate the arm and palpate the posterior aspect of the shoulder. Apprehension, a clunk, or a pop indicates posterior capsular or labral involvement. The patient with posterior instability may be able to voluntarily sublux the shoulder posteriorly by moving his arm into horizontal adduction and internal rotation. With the arm in adduction and internal rotation, palpate the AC joint for pain or crepitus. In cases of AC instability, there will be asymmetric movement and pain at the distal clavicle.

A test for labral tears and AC joint pathology has been developed.¹⁷ The patient is positioned with his arms forward flexed 90° and adducted with thumbs down and palm up (Figure 5). This thumbs-down position loads the biceps-glenoid-labrum complex and places compressive loads on the AC joint. Pain on top of the shoulder indicates AC joint involvement. Pain described as deep inside the shoulder suggests a labral tear. The pain must be eliminated when the palm is supinated for results to be considered significant.

Supine

The purpose of the supine examination is to assess stability and check for labral tears. The table is positioned to accommodate walking around the patient's head.

Begin by examining the uninjured shoulder. Compare active and passive range of motion and palpate the joints around the shoulder and biceps tendon for tenderness. When evaluating stability, move your hand and wrist back and forth in a rocking chair movement. If there is anterior instability, it may



Figure 6 – To assess stability with the patient supine, the examiner uses a rocking motion to apply anterior forces with the patient's arm abducted and externally rotated. Subluxation or a clunk indicates anterior instability. Grasping the shoulder and applying an axial load to the humerus may elicit a painful pop, suggesting a labral tear.

be possible to anteriorly sublux the humeral head when abducting and externally rotating the arm while using your other hand to push the humeral head anteriorly. Reduction occurs with stopping the posterior pushing and, in a rocking motion, pushing posteriorly while moving the arm into forward flexion and internal rotation (Figure 6). Apprehension, pain, and shifting or clunking indicate instability. To further assess stability, stretch the anterior capsule in this rocking manner and externally rotate the arm while it is backward flexed.

To test for a labral tear, axially load the shoulder and modify this test as follows: Place one hand on the patient's elbow and load the humerus while the arm is externally rotated and abducted. A painful pop indicates a labral tear. Applying posteriorly directed forces and moving the arm into horizontal adduction and internal rotation can similarly assess the posterior capsule.

Prone

The prone position makes it possible for the examiner to stabilize the scapula with his hand (instead of with the table, as occurs in the supine position) and examine for instability both front and back.

With the patient in the prone position, place a hand on the anterior

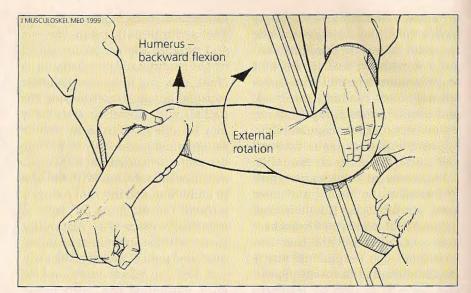


Figure 7 – Prone stability assessment begins by palpating the humeral head. Instability or anterior pain during abduction and external rotation (shown) indicates anterior pathology. A posterior clunk and pain when the arm is horizontally adducted and internally rotated indicates posterior instability.

and posterior aspects of the humeral head and apply anterior and posterior forces. Apprehension or pain when the patient's arm is over the side of the table in an abducted, externally rotated position indicates anterior instability (Figure 7). Apprehension when the horizontally adducted arm is subjected to axial loading and posteriorly directed forces indicates posterior instability. If axial loading elicits a painful pop, suspect a tear of the labrum, an injury frequently associated with instability. The combination of compression and distraction forces that occur with repetitive movements during such sports as swimming and tennis can cause rotator cuff dysfunction. Any maneuver that proximally moves the humeral head and lessens the space for the rotator cuff should reproduce symptoms of rotator cuff involvement. To test for subacromial injury, feel for subacromial crepitus or ask if pain occurs during a circumduction movement. Painless popping is no cause for concern.

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