

An algorithmic approach to shoulder pathology

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ABSTRACT

Introduction: Shoulder pain is a common presentation in both hospitals and the community. Shoulder pain can result from a number of different pathologies and to manage the shoulder pain, an accurate diagnosis is needed. **Method:** An accurate diagnosis can often be made following a detailed history and examination. Investigations, such as imaging and blood tests may also be required. In this study, we provide an algorithmic approach to shoulder pain that can be used in the clinical setting. **Summary:** This algorithm can be used in hospitals and the community to help identify and manage the different causes of shoulder pain.

Keywords: Algorithm, diagnosis, management, shoulder

Introduction

Shoulder pain is one of the most common presenting complaints in the community and is a highly prevalent presentation in trauma and orthopedic clinics.^[1] It is often a complex condition to manage with a narrow spectrum of symptoms but a broad list of etiologies. One study in Scandinavia identified that neck and shoulder disorders account for 18% of sick leave.^[2,3] When presented with a patient with shoulder pain in the community, one should initially assess the patient clinically. This involves a detailed history and a thorough examination. Imaging techniques, including ultrasound scans (USS), plain radiographs, computerized tomography (CT) scans, and magnetic resonance images (MRI) can be used in addition to the clinical assessment; however, although available in the hospital setting, requesting such serviced from the community may delay

the management. History alone, based on a well-defined algorithm, can lead to a very accurate estimation of shoulder pathology in the community and the orthopedic setting.^[4] Additional clinical examination can almost always direct us toward a diagnosis that can be confirmed with radiological investigations. The purpose of this study is to present an algorithmic approach to the diagnosis of all shoulder pathologies in both the community and the trauma and orthopedic clinic. Using four steps, four questions, and respecting four “red flags” a very accurate diagnosis can be made.

Algorithmic approach to the diagnosis of shoulder problems (four steps)

Step 1: Trauma

The first step is to clarify whether the cause is trauma. Patient history will help us. The patient can localize the site of pain and clinical examination can reveal deformity or abnormal motion. X-rays will almost always reveal fractures to the shoulder bones or injury to the acromioclavicular joint. If the pain persists after a traumatic incident and no injury is evident on the X-rays, one must suspect

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soft tissue injury, usually a rotator cuff (RC) tendon tear, especially in a middle-aged patient. In such a case, we must proceed to the third step of the algorithm and look for intrinsic causes of shoulder pain.

Step 2: Exclude referred pain

If the pain is vague or sharp, shooting and radiating along the limb, the patient is unable to localize it and the shoulder has a painless full range of motion, then one must suspect causes outside the shoulder.

Causes of referred pain are:

- a. Sharp, shooting, or radiating along with the limb pain with numbness of the hand may be caused by cervical spine pathology.
- b. The dull, vague, or deep pain that cannot be localized may be caused by irritation of the diaphragm from abdominal trauma or pathology; usually spleen trauma and cholecystitis.
- c. Pain that comes with shortness of breath may indicate myocardial ischemia.
- d. Pain that is sharp and poorly localized, especially if the patient has lost significant weight and looks like he is suffering, may indicate a tumor.

Step 3: Extraglenohumeral pain

Three causes of extraglenohumeral pain exist:

- 3a. Acromioclavicular (AC)
- 3b. Long head of biceps tendon
- 3c. Scapular

The patient can usually localize problems of the biceps tendon and the AC joint. Pain and dysfunction originating from the scapular muscles can be more difficult to localize and assess; however, scapulothoracic motion and observation of scapular winging can help.

Step 4. Glenohumeral pathology

Four different types of glenohumeral pathology exist:

- 4.a Pain and/or loss of power
- 4.b Stiffness
- 4.c Instability and
- 4.d Osteoarthritis-joint incongruity

Each has different characteristics and often affects different age groups. In rare cases, mixed pathologies, such as pain and instability, may exist.

Glenohumeral Pathology (Four Questions)

As we have already mentioned, once all other causes of shoulder problems have been excluded, one may focus on the glenohumeral joint and its pathologies.

In step four of the algorithmic approach, we identified four different pathologies of the glenohumeral joint: pain, stiffness,

instability, and osteoarthritis. To evaluate these problems, we must once more choose an appropriate algorithm by asking four questions.

Question 1. What is the main complaint?

- a. Pain and loss of power usually indicate a problem of the RC tendons: tendinitis, tear, or calcifying tendinitis.^[5] Pain from the intra-articular portion of the long head of the biceps tendon can either coexist or mimic pain caused by the cuff tendons and make the diagnosis, on history alone, difficult.
- b. Instability can be either traumatic or result from general joint laxity.^[6]
- c. Loss of range of movement, usually painful, may indicate either frozen shoulder or osteoarthritis. A plain X-ray will assist us in the final diagnosis because osteoarthritis is evident in it.

Question 2. What is the age of the patient?

Three different age groups exist, adolescent and young adults, middle-aged, and older patients.^[5]

Question 3. What is the activity type and level of the patient?

Different problems affect middle-aged marathon swimmers than middle-aged office workers. Young throwers with pain have a range of problems often termed "internal impingement."^[5,7]

Question 4. How long has this problem persisted?

Acute problems without a history of trauma are often benign in nature and usually indicate overuse injuries such as tendinitis. Chronic shoulder pain that leads to loss of range of movement is indicative of arthritis.^[5,8,9] Once all four of the above-mentioned questions have been replied to, a fairly secure estimation of the diagnosis can be made. Some very characteristic case scenarios are:

1. Instability without pain, usually in young patients following a shoulder dislocation.
2. Acute pain in young active patients usually indicates tendinitis, unless they participate in overhead sports and complain of pain during throwing. In the latter case, problems of the superior labrum or articular side tears of the supraspinatus tendon can be anticipated.
3. Prolonged pain in middle-aged overhead workers or pain that persists after an injury to the shoulder indicates an RC tendon tear.
4. Acute night pain in middle-aged women, without a history of trauma and a fairly inactive lifestyle is often caused by calcifying tendinitis.
5. Pain and loss of range of movement in middle-aged patients with a history of mild shoulder problems are indicative of a frozen shoulder.
6. Pain without loss of range of movement in middle-aged patients indicates RC tear.

7. Pain and loss of range of movement in an elderly patient without a history of shoulder problems may be caused by osteoarthritis.
8. Pain and loss of range of moment in an elderly patient with a history of shoulder problems indicate RC arthropathy.

Red flags (four red flag signs)

While implementing the algorithm we have described, the practitioner must always be careful of ambiguous conditions and pathologies that can lead to an improper diagnosis and thereafter to inadequate treatment. Four such cases exist, and we must always be aware of them:

1. Pain and loss of movement, that is, disproportional to the clinical and radiographic findings:
 - a. If the patient has lost significant weight and looks like he is suffering, we must exclude the possibility of a primary or a metastatic bone tumor.
 - b. Dull or sharp pain that worsens at night and that is usually relieved by aspirin or other anti-inflammatory drugs may indicate the existence of an osteoid osteoma of the scapula or the proximal humerus.
2. Pain and loss of range of movement that is accompanied by local signs of infection such as redness, heat, and swelling together with fever may indicate the presence of an infection. This could be the result of a previous local injection with cortisone or lidocaine.
3. A rheumatic condition with shoulder pain usually indicates arthritis of rheumatic origin.
4. In some cases, a mixture of glenohumeral pathologies may exist. A traumatic dislocation that causes instability could be accompanied by a rotator cuff tear that causes pain, especially in a middle-aged patient. In such cases, it is difficult to make a clear diagnosis using the above-mentioned four questions.

Shoulder Pain and Psychological Disorders

Sometimes non-specific shoulder problems persist and cannot be correlated to a physical cause. In such cases, and only after true pathology has been ruled out, one can assume that shoulder pain reflects psychological causes or overtones from cases under litigation or malingering.^[4,10]

Clinical examination

The clinical examination of the shoulder is based on the principles of “look, feel, and move”. Firstly, an accurate assessment of the patient’s overall health and a record of the coexistent medical conditions must be done. Additionally, a complete evaluation of the neurovascular condition of the limb should be performed. The special tests that will be carried out and the order in which they will be executed depend on the initial clinical suspicion.

Look

The first part of the examination is to carefully inspect the patient. A statement should be made regarding the patient’s overall health. The signs of rheumatoid or cushingoid habitus should be noted.

Both shoulders should be examined and compared. The skin should be inspected for scars, sinuses, swelling, pigmentation, ecchymosis, or erythema. Bone symmetry and muscle wasting of the deltoid, the pectoral contour, or Popeye deformity of bicep’s tendon should be recorded. Swelling of the glenohumeral joint is often difficult to see because it lies deep in the skin; however, if it is visible it can only be seen from the anterior aspect and when a comparison is made to the other shoulder. Other sites of swelling or redness are the sternoclavicular (SC) and the acromioclavicular (AC) joints. Muscle wasting of the deltoid can cause a “squaring” appearance of the affected shoulder when inspected from the anterior. Inspection from the posterior can indicate muscle atrophy of the supraspinatus and scapular winging. The position in which the patient holds the arm is also very important, for example, if the arm is locked in internal rotation then a posterior shoulder dislocation can be suspected (for more look in clinical examination-external rotation)

Feel

The second part of the examination is to palpate the shoulder for areas of:

- Pain tenderness
- Crepitus
- Warmth
- Deformity
- Fluctuation edema

We must first establish where the pain is by asking the patient. That area should be examined last. It is important to look at the patient’s face while palpating. The examination should start anteriorly, followed by lateral, and then end with the posterior part of the shoulder. From the anterior the SC joint is examined first, then the clavicle and the AC joint follow. Just below the distal third of the clavicle is the coracoid process where the short head of bicep’s tendon attaches. From the lateral side with the arm externally rotated, the lesser tubercle and the bicipital groove are palpated. Then with internal rotation, the greater tubercle is examined just below the anterior aspect of the bony acromion. Posteriorly, the muscles of the RC can be palpated above and below the spine of the scapula. Additionally, the border or the scapula and the muscles that move it, including the trapezius, can be inspected.

Move

The active and passive movement must be examined, and muscle strength should be graded. The movements of the shoulder joint from the anterior are abduction, forward flexion, and internal and external rotation. From behind internal rotation–adduction, scapulothoracic motion, and winging of the scapula are obvious. Both arms should be tested at the same time. Look for two things, the smoothness of the movement and the range of the movement. Active motion is examined first. The passive motion is examined second, especially if the active motion is restricted. A note should be made if active or passive movement is restricted due to pain or mechanical locking.

The normal range of lateral abduction is 0 to 160/180 degrees. Movement is initiated by the supraspinatus and the first 30 degrees of abduction and forward flexion are primarily glenohumeral. For the remaining abduction and elevation, the glenohumeral (GH) and scapulothoracic (ST) joints move simultaneously. This is called the scapulothoracic rhythm with a GH to ST movement ratio of 2:1. During abduction, the painful arc should be noted. Pain from 60 to 120 degrees usually indicates RC pathology. Pain after 120 degrees indicates AC joint pathology. If the passive is more than the active range then RC pathology can be suspected. The normal range of forward flexion is 0 to 160/180. Reduced active and passive range of motion indicates arthritis or adhesive capsulitis. RC pathology limits abduction more than forward flexion and active more than passive range of movement. Adduction is measured by an effort to touch the opposite shoulder. Normally the cup of the hand reaches over the other shoulder at least. Reduced adduction indicates AC joint pathology. External rotation at 0 degrees of abduction and elevation is very important. It is a movement of the GH joint and if it is reduced it is always a sign of GH pathology. If active external rotation is reduced more than passive, then a massive RC tear is the probable diagnosis. If both active and passive external rotation are reduced then three possible causes exist; arthritis of the GH joint, frozen shoulder, or posterior locked shoulder dislocation. Internal rotation and adduction can be noted from behind the patient. The level that the thumb reaches is noted. The normal height is the angle of the scapula for men (T7 level) and the blade of the scapula for women (T4 level). Internal rotation and adduction are the first to be lost in adhesive capsulitis and the last to come back. Two more movements that should be tested are external rotation in 90 degrees abduction and the hands behind and above the head. These are very important movements for everyday function.

The “NFL Touchdown Sign”

The “NFL touchdown sign” is a very useful screening test.^[4] The patient is asked to raise both arms from the sides to straight overhead. Full movement requires a normal GH joint, AC joint, intact RC tendons, and functional deltoid and RC muscles. The findings of this test are:

- The full painless motion suggests an extrinsic cause of pain rather than pain from GH pathology.
- Severe pain indicates RC tendinitis or arthritis.
- Weakness can be caused by RC tendon tear, muscle atrophy, or neurological pathology; either C5 radiculopathy or suprascapular nerve palsy.
- Limited motion is consistent with arthritis or adhesive capsulitis.
- The patient who has sustained trauma resulting in fracture, dislocation, or AC injury will not even attempt the maneuver.

Shoulder clinical tests

Over 100 different clinical tests for shoulder pathology have been described. Different health care professionals adopt their

own routine of shoulder examinations when examining a patient with shoulder pain with the goal of identifying the underlying cause. The lack of standardisation enables autonomy for health care providers to decide which they find more specific and sensitive.

General Shoulder Pathology

- Codman Sign – This is a test of passive shoulder motion. One hand of the examiner supports the patient’s scapular whilst the other hand supports the arm. The examiner then moves the arm in different directions. The disease of the RC may reduce the range of movement.
- Palm Sign and Finger Sign – This can identify the source of pain. If the patient points to the lateral clavicle with a finger (positive finger sign) then the pathology may be from the acromioclavicular joint (ACJ). If they place their palm over the anterolateral shoulder region then the pathology may arise from the glenohumeral joint (GHJ) or the subacromial region.

Instability and labrum tests

Anterior instability

- Anterior Drawer Test – The patient lies supine on a couch with the arm abducted to 90 degrees. The examiner then supports and immobilizes the scapular with one hand whilst pulling the proximal arm anteriorly.
- Anterior Apprehension test – The patient may be upright or lying supine. The arm is abducted and the elbow flexed. The examiner externally rotates the arm with one hand whilst stabilizing the scapula with the other hand.

Posterior instability

- Posterior Drawer Test – Similar to the anterior drawer, except force is applied posteriorly.
- Posterior Apprehension test – Patient in the upright or supine position with the arm adducted and flexed. Examiner applies anterior to posterior force whilst stabilizing the scapula.
- Sulcus Sign at 0 degrees and 90 degrees

Inferior instability

- Inferior Apprehension Test – The examiner supports the 90-degree abducted arm with one hand and with the other hand, the examiner applies downward pressure on the patient’s upper arm, invoking an inferior subluxation of the humeral head.

SLAP lesions

- O’ Breins Test – The patient sits upright with the shoulder at 90 degrees on flexion. With the arm pronated, the patient is asked to further flex the shoulder against resistance. If this causes pain, then the patient is asked to repeat the examination with the arm supinated. If this relieves the pain, then this is a positive finding.

Posterior labral tear

- Push-Pull Test – With the patient supine and shoulder abducted 90 degrees, the examiner applies posterior force to the proximal humerus whilst supporting the arm distally.

This translates the proximal humerus posteriorly and is a positive test if it reproduces the patient's symptoms.

- Jahnke Jerk Test – Performed seated or supine. The patient's shoulder and elbow are placed in 90 degrees of flexion and the arm is internally rotated. Posterior force is applied at the elbow whilst the shoulder abducts along a horizontal plane (maintain posterior force). During this, the shoulder may “clun” indicating posterior subluxation reducing during the horizontal abduction.

Long Head of the Biceps Pathology

- Speed's Test – Patient has shoulder in 90 degrees of flexion whilst supinated. The patient was asked to further flex the shoulder whilst the examiner provides resistance.

AC Joint Pathology

- Cross chest Adduction (Scarf test) – The patient has their arm in internal rotation and 90 degrees of flexion. The arm is passively adducted across the chest so that the elbow of the arm being examined is pushed in the direction of the contralateral shoulder.
- Paxinos Test – The examiner's thumb is placed posterior to the acromion and anterior-superior pressure is applied whilst the index and middle fingers are placed anterior to the lateral aspect of the clavicle where posterior-inferior pressure is applied.

Rotator cuff tests

Supraspinatus

- Codman's Sign (Drop Arm Sign) – The patient's arm is passively abducted to 90 degrees before the examiner asks the patient to keep their arm in that position actively. This can reproduce pain as seen in patients with rupture of the supraspinatus tendon.
- Burkhead's thumbs up – Patients arm is placed into 70 degrees of forward flexion in the scapula plane (out of the painful arc) with the thumbs pointing up. The patient then attempts further flexion against resistance. Pain may indicate anterosuperior cuff weakness.
- Burkhead's thumbs down – The same as above; however, thumb pointing down. Pain may indicate posterosuperior cuff weakness.
- Empty can test – Patient has their arms in 90 degrees of forward flexion and 45 degrees of abduction (in the plane of the scapular). The patient was then asked to pronate arms (as if they are emptying a can). The patient is then asked to further flex the arm while the examiner applies resistance.

Infraspinatus

- External rotation lag sign – Patients arm is passively placed into maximal external rotation and is asked to actively maintain this position. Failure to do this may indicate infraspinatus injury.
- Pain or reduced range of movement in external rotation and adduction may also indicate infraspinatus injury

Subscapularis

- Gerber's Lift-off test – Patient places a hand behind their back, around the lumbar region, with palms facing posteriorly. The patient was then asked to move their hand off their back posteriorly whilst the examiner applies resistance.
- Belly Off Sign – The patient applies their hand on their abdomen and the examiner tries to pull the hand away from the abdomen.
- Belly Press/Napoleon Sign – The patient is asked to put their hand on their abdomen and internally rotate their shoulder (moving their elbow anteriorly). If the patient cannot fully internally rotate their elbow will move posteriorly.

Massive cuff tear

- Hornblower's sign – Patients have their arm in 90 degrees of forward flexion and 45 degrees of abduction (scapular plane). The elbow is then flexed to 90 degrees. The patient is asked to externally rotate against resistance.
- The Dropping Sign (Walch) – The examiner passively places the patient arm into 90 degrees of shoulder flexion and 45 of shoulder abduction and external rotation. The examiner then asks the patient to maintain this position whilst removing support. Failure of the patient to maintain the position indicates a massive cuff tear.

Impingement Pathology

Internal impingement syndrome

- Posterior Impingement Sign – The patient arm is placed in 90 degrees of shoulder abduction and 90 degrees of elbow flexion. The examiner stabilizes the elbow and applies external rotation to the patient's arm.

Suprascapular nerve entrapment

- Thompson and Kopell Horizontal Flexion Test – The patient has their arm in 90 degrees of shoulder abduction and is asked to move the arm across the body in a horizontal plane. Pain over the scapula may indicate suprascapular nerve entrapment.

Subacromial impingement

- Hawkins–Kennedy test – The patient has the shoulder abducted to 90 degrees and their elbows flexed to 90 degrees. The examiner stabilizes the elbow whilst internally rotating the shoulder.

Subcoracoid impingement

- Coracoid Impingement Sign – This is a modification of the “Hawkins–Kennedy test”. The patient has their shoulder abducted to 90 degrees and elbows flexed to 90 degrees along a horizontal plane. The arm is then further adducted an additional 20–30 degrees along the horizontal plane across the body. In this position, the examiner applies internal rotations to the patient's arm.

Frozen Shoulder

- Shoulder Quadrant Test – With the examiner stabilizing the scapula, the patient's arm is abducted to 90 degrees and external rotation. From this position, the examiner abducts the arm until the humerus internally rotates.

Local injection tests

Local injection tests can be used in cases of unclear history and clinical examination and the presence of multiple sites of shoulder pathology. Three such tests exist:

- The GH injection test
- The AC injection test
- The bicipital groove test.

The Glenohumeral lidocaine injection test

- After the injection with lidocaine a patient with shoulder pain and:
 - a. RC tendinitis will have normal painless movement with adequate strength.
 - b. RC tear will have a persistent weakness.
 - c. A Frozen shoulder will have persistent stiffness.

The AC joint injection test

- A local anesthetic block of the AC joint is useful to exclude its involvement.

The bicipital groove joint injection test

- Local anesthetic block at the bicipital groove is useful in cases of coexisting signs of bicipital tendinopathy and RC tendinopathy, especially of the subscapularis tendon.

Summary

Shoulder pain and or stiffness is a very common presentation that unfortunately can represent a very broad number of pathologies. Identifying the cause of the presentation often requires a detailed history and examination of the patient, which is often complemented by imaging studies. The lack of availability of imaging studies in the community may result in an emphasis on the examination findings to dictate the urgency of imaging and referral to a specialist. A “look, feel, move” protocol can provide a tool that ensures a thorough examination is performed and can also highlight specific aspects of the examination that may indicate specific pathologies. By following the above protocol we are confident that this will provide support to those managing patients in the community.

Conclusion

Shoulder pain is a common presentation in both the community and the hospital setting. Accurate history and examination are key aspects in the diagnosis and management of shoulder pathology.

Here we have provided an algorithm on how to approach a patient presenting with shoulder pain.

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References

1. Urwin M, Symmons D, Allison T, Brammah T, Busby H, Roxby M, *et al.* Estimating the burden of musculoskeletal disorders in the community: The comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis* 1998;57:649-55.
2. Nygren A, Berglund A, von Koch M. Neck-and-shoulder pain, an increasing problem. Strategies for using insurance material to follow trends. *Scand J Rehabil Med Suppl* 1995;32:107-12.
3. Dylla J, Forrest JL. Fit to sit--strategies to maximize function and minimize occupational pain. *J Mich Dent Assoc* 2008;90:38-45.
4. Anderson BC, Anderson RJ, Fields KB, Grayzel J. Evaluation of the patient with shoulder complaints. UpToDate, Waltham 2011. Available from: <https://www.uptodate.com>. [Last accessed on 2022 Jul 19].
5. Lohr JF, Uthoff HK. [Epidemiology and pathophysiology of rotator cuff tears]. *Orthopade* 2007;36:788-95.
6. Antonio GE, Griffith JF, Yu AB, Yung PS, Chan KM, Ahuja AT. First-time shoulder dislocation: High prevalence of labral injury and age-related differences revealed by MR arthrography. *J Magn Reson Imaging*, 2007;26:983-91.
7. Rudzki JR, Adler RS, Warren RF, Kadrmaz WR, Verma N, Pearle AD, *et al.* Contrast-enhanced ultrasound characterization of the vascularity of the rotator cuff tendon: Age- and activity-related changes in the intact asymptomatic rotator cuff. *J Shoulder Elbow Surg* 2008;17 (1 Suppl):96S-100S.
8. Abate M, Schiavone C, Salini V. Sonographic evaluation of the shoulder in asymptomatic elderly subjects with diabetes. *BMC Musculoskelet Disord* 2010;11:278.
9. Tempelhof S, Rupp S, Seil R. Age-related prevalence of rotator cuff tears in asymptomatic shoulders. *J Shoulder Elbow Surg* 1999;8:296-9.
10. Miranda H, Viikari-Juntura E, Heistaro S, Heliövaara M, Riihimäki H. A population study on differences in the determinants of a specific shoulder disorder versus nonspecific shoulder pain without clinical findings. *Am J Epidemiol* 2005;161:847-55.