Diagnosis and clinical assessment of a stiff shoulder

Alison Armstrong

Abstract

The assessment of a stiff shoulder is explored, the necessary investigations to reach a diagnosis are discussed, and the likely causes that can contribute to a frozen shoulder are described. Two flow diagrams are included to help in reaching a conclusion when seeing a patient with a stiff shoulder. The key elements to reaching that conclusion are: carefully listening to the patients story, noting whether there has been a history of trauma, as well as a careful and thorough examination and a plain X-ray with two views.

Keywords

diagnosis, examination, fracture, frozen shoulder, osteoarthritis, stiff shoulder

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Introduction

Patient's presenting with shoulder stiffness, with or without pain, is a common occurrence. I provide a personal perspective with respect to investigating the possible causes of a stiff shoulder in terms of the clinical examination and the common investigations that I use to reach the diagnosis. The management of individual causes of stiff shoulder is not discussed.

In approaching a patient who has presented with a 'stiff shoulder', the first thing to ascertain is that the patient has indeed a truly stiff shoulder and not one that they deem as stiff, either because they cannot move it or because it is too painful to move. A stiff shoulder can therefore be defined as one where 'There is a restriction in both, active and passive range of movement and these are broadly restricted about the same. Movement restriction is usually in all directions though they may not be all restricted to the same degree'. Although stiff shoulders are often painful, this is not always the case.

First, we need to consider which clinical conditions in the shoulder cause difficulty in moving the shoulder, which the patient may perceive as stiff. These broadly fall in to four groups, the 4 'N's':

- Neck
- Nasty (infection, malignancy)

- Near normal movements but associated with pain (impingement syndrome/cuff tendinopathy, calcific tendonitis)
- Not moving (true stiffness with glenohumeral movement deficit, either from a problem with the capsule or the joint itself)

It is the 'nasty' and 'not moving' groups that are truly stiff and these form the basis of the present review.

History

Good history taking is very important. It tells the story of the problem. It is helpful if 'the patient can put it all together'. In addition to the routine history taking, it is also useful to ask some pertinent questions;

- How did it all start? Gradual, sudden or variable, was there an injury?

University Hospitals of Leicester NHS Trust, Leicester General Hospital, Leicester, UK

Corresponding author:

Alison L Armstrong, Consultant Trauma and Orthopaedic Surgeon, University Hospitals of Leicester NHS Trust, Leicester General Hospital, Gwendolen Road, Leicester LE5 4PW, UK.
Tel: +44 (0)116 2588112. Fax: +44 (0)1162588111.
Email: alison@longarms.co.uk

- Where is the pain? Stiff shoulder pain is usually in front of the joint (interval contracture)
- When do you get the pain? Night pain is common in many shoulder conditions. It is not diagnostic but is often the reason they are seeking help. Rest pain may indicate a 'nasty aetiology'
- Has the pain level changed? A frozen shoulder may initially be very painful (stage I), then settle with the onset of stage II. Someone recovering from an injury who gets a frozen shoulder may have a late onset of increased pain.
- Have you experienced any other symptoms? Neck pain can create referred arm symptoms, pins and needles in the fingers may indicate peripheral entrapment neuropathy. Odd neurological symptoms can also be a feature of frozen shoulder.
- What treatment have you received already? Analgesics, Physiotherapy, cortisone injections, surgery and what effect have they had?
- Other medical conditions that may predispose to frozen shoulder (diabetes, hypothyroidism, malignancy, neurological disease, cardiovascular disease, hyperlipidaemia)

Examination of a stiff shoulder

During shoulder examination, first clear the neck. Examine to determine whether referred pain from the neck is partly or wholly responsible for shoulder pain. If required, perform a complete neurological examination.

Then, follow the standard protocol of shoulder examination from inspection of the shoulder from the front, side and back. Look for scars, cuff/deltoid wasting, bony landmarks and spinal and scapular alignment. Next, proceed to palpation to rule out acromioclavicular-induced pain.

Following this, proceed with assessment of shoulder range of motion (ROM). There are four movements that are useful in examination: flexion, abduction, internal rotation and external rotation. I examine flexion, abduction and internal rotation actively and passively but external rotation is assessed passively only. My practice is to examine the patient standing (Figures 1–4).

I ask them to elevate both shoulders together. When they are unable to get any higher, I gently try passively to see if any further can be achieved (stopping if it becomes too painful). I compare it with the other side. Elevation can vary from about 140° in the elderly to 190° in the very lax. By elevating both shoulders simultaneously, one eliminates the tendency for patients to extend the trunk in an attempt to get higher (Figure 1).

As a useful tip: if the patient is in a lot of pain and cannot attain passive elevation, ask the patient to bend

Figure 1. Flexion.

Figure 2. Abduction.

forwards to 90° at the waist (if their back is ok) and then repeat forwards elevation. If it was pain limiting elevation, elevation will now be normal.¹

Apply the same method in abduction. Ask them to elevate both arms together with palms facing upwards. Again, by moving both shoulders together, patients do not tip their body sideways to increase abduction. Abduction is usually approximately 180° in most people (Figure 2).

Go behind the patient and assess flexion and abduction again. In patients with true glenohumeral joint stiffness, patients recruit the scapulothoracic joint motion to compensate.

Ask the patient to tuck his elbows to the side of his body and rotate the shoulders externally. This is a

Figure 3. External rotation.

Figure 4. Internal rotation.

passive movement. Try and do both shoulders together to stop the body swinging round. I always compare with the other side as external rotation can be very variable from 30° to 100° in the very lax jointed (Figure 3).

I ask them to put their hand behind their back and touch their spine. This movement is an active movement. Because the hands will collide, it is best done one at a time (Figure 4). It is useful to measure the good side first. Record it according to where the extended thumbs reach on the spine. This technique measures functional internal rotation, which is a composite motion involving numerous upper limb joints. Beware that pathology in the elbow, wrist and thumbs can give the wrong measurement.

Following this, I assess the rotator cuff. Cuff rupture and stiffness may coexist but weakness may be secondary to pain and not cuff damage. If the shoulder is stiff, then testing for impingement and acromioclavicular pathology may be nondiagnostic because the patients will be unable to perform the required tests. However, I have found looking at the amount of internal rotation in abduction helpful in distinguishing mild frozen shoulder from impingement syndrome. If appropriate, I may go on to assess distal neurovascular status. Detailed discussion of all of these special tests is beyond the remit of the present review.

At this point, I have established whether the shoulder is truly stiff or the decreased movement is a result of pain with normal passive movement. I will have identified some probable causes identified from the history.

Investigations

I consider an X-ray, both anteroposterior (AP) and axial, to be essential because it clarifies, at the outset, whether the causation of a stiff shoulder is glenohumeral arthritis or not. A normal X-ray will rule out glenohumeral joint arthritis or malignancy as the cause of stiffness. An axial view will also rule out locked posterior dislocation because it can be easily missed on an AP view. An alternative to the axial view is the Stripp view, which, if the patient is in too much pain, allows an axial like view. A simple X-ray usually is sufficient. It is always depressing to see patients who have had an unnecessary magnetic resonance imaging (MRI) scan for want of a plain X-ray.

If there is concern about the integrity or capability (muscle volume and quality) of the cuff, MRI or an ultrasound scan can be performed. However, it is important to remember that, in a very stiff shoulder, it is often very difficult to get the arm sufficiently extended to allow the ultrasound probe to access the tendon. I have found MRI to be more reliable and therefore justifiable of the expense. It also gives me more quantifiable picture of the muscle bulk and quality. MRI is certainly the modality of choice if a tumour (such as from the scapula) is suspected and staging is required.

In cases of missed fractures, questionable union or avascular necrosis, computed tomography scans are also needed.

Rarely, if the predominant pathology is deemed to be in the neck or if peripheral entrapment neuropathy is suspected (either as a separate pathology or in conjunction with other causes of frozen shoulder), then an MRI of the neck with electromyography/nerve conduction studies may also be required.

Causes of a stiff shoulder

Causation of stiff shoulder is multifactorial. Figures 5 and 6 provide guidance with the causative mechanisms.

Broadly speaking, they are divided into:

1. No history of trauma (Figure 5)

Essentially, if there is no history of trauma then the problem is either in the capsule (primary frozen shoulder) or there is arthritis of some form or malignancy or infection.

2. History of trauma (Figure 6)

If there is a history of trauma then the cause of stiffness is either a bony injury (fracture or dislocation) or a soft tissue complication of trauma.

Figure 5. Flow diagram: no history of trauma.

Figure 6. Flow diagram: history of trauma.

3. After surgery

Usually some form of a frozen shoulder.

Shoulder stiffness: atraumatic

At this point, it will be best to go through the flow diagram. Figure 5 will allow us to make a clinical

diagnosis for cause of shoulder stiffness in a patient who has experienced spontaneous onset of stiffness (usually associated with pain) without a specific history of trauma. Discussion of individual causative pathologies is beyond the remit of the present review but key diagnostic groups to consider are: the arthritic joint, capsule tightness (frozen shoulder, primary or secondary) and malignancy of the humeral head or scapula.

A plain X-ray of the shoulder will confirm if there is a bony cause of stiffness.

If the plain X-rays are abnormal, then possible causes of shoulder stiffness are:

(a) Arthritis

These as explained in the flow diagram can be osteoarthritis, sero-negative arthritis, cuff tear arthropathy, avascular necrosis of the humeral head and rarely synovial chondromatosis. In addition to X-ray, if required, MRI, serological investigations and importantly, good history will provide the final diagnosis.

(b) Tumours

Plain X-rays may also suggest a tumour (e.g. giant cell tumour). Including the scapula in the plain film and tracing the outline of the scapula is important so as not to miss a scapular tumour. If there is a suspicion of a scapular tumour, an MRI scan is mandatory.

(c) Locked posterior dislocation of the humeral head ('atraumatic')

This is rare. Posterior dislocations may occur 'atraumatically' with a nocturnal fit. This may be the first fit and the patient only knows they woke with a stiff shoulder. If no X-ray was performed, particularly an axial X-ray, this condition may be mistaken clinically for a frozen shoulder and mistreated.

Xrays normal

If the shoulder X-rays are normal, then the most common cause of stiffness is idiopathic or primary frozen shoulder. This is characterized by contracture of the capsule and surrounding ligaments. This condition of idiopathic origin is defined as 'a condition of uncertain aetiology characterized by a significant reduction of both active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder'. Certain group of patients such as those suffering from diabetes, hypothyroidism and hyperlipidemia are known to have an increased risk of suffering from this condition.² It occurs classically in patients aged 40 years to 60 years but I have seen it in older patients. A contracture of the coracohumeral ligament occurs and it has been associated with abnormal expression of matrix metalloproteinase inhibitors.³ Unaided, it is said to have three stages, freezing (painful), frozen (stiff) and thawing (resolving), each of approximately 4 months to 8 months in duration as originally described by Reeves in 1975.⁴ This condition is known to be self-resolving though some patients may be resistant with chronic long term symptoms.

There are three other rare causes of atraumatic shoulder stiffness with normal shoulder X-rays. These are:

- (i) Radiation-induced stiffness. It is important to enquire during history of any malignancies such as Carcinoma of Breast for which the patient has received radiation therapy. Stiffness here may be a frozen shoulder or the more difficult to treat post-breast therapy pain syndrome.⁵
- (ii) Rarely, malignancies around the humerus or scapula can create shoulder stiffness.⁶ Scapular malignancies are often missed because they are deep seated and do not manifest till late. Also, normal radiological investigations can miss the scapular assessment unless there is a high index of suspicion and specific investigations are clearly requested. The pain of a bone malignancy is all day and night and may mimic the initial stages of a frozen shoulder.
- (iii) Shoulder hand syndrome. This is a combination of chronic regional pain syndrome and a frozen shoulder. This diagnosis should be considered if the patient complains of a very sore hand with finger stiffness and a painful and stiff shoulder.⁷

Shoulder stiffness: traumatic

In stiffness after trauma, it is important to ascertain whether the trauma has caused a bony injury (fracture or dislocation) or a soft tissue injury. Figure 6 will help us to make a clinical diagnosis for cause of shoulder stiffness in a patient who has experienced a traumatic episode.

Stiffness after missed anterior dislocation

These patients often present after a fall but in the very elderly who do not have much cuff present, it is possible for the joint to dislocate without trauma. Although most will present immediately, some patients present late. Clues if not in the history of the fall will be in the shape of the shoulder, that it is stiff and the X-ray reveals the true picture especially axial and stripped view. Managing this problem is challenging and depends on the length of time the shoulder has been out of joint, the age of the patient, cuff status, available bone stock etc. This again is beyond the scope of the present review.

Stiffness as a result of locked posterior dislocation

This may occur after an epileptic fit, an electric shock or a road traffic accident. Although it may have been

recognized that there was trauma, posterior dislocations do not have an obvious contour deformity and an AP X-ray may look 'normal' to the casual observer and so the axial or stripped view is very important. The management depends on the length of the time out of joint and amount of damage to the head. Detailed discussion is beyond the scope of the present review.

Stiffness as a result of fractures of the shoulder

One of the most difficult conditions to deal with is a stiff shoulder after a shoulder fracture. It presents usually approximately 3 months after injury when the patient has had the initial fracture treated nonsurgically followed by physiotherapy. The stiffness may be a result of poor rehabilitation, a result of the fracture configuration itself or the result of a superadded frozen shoulder. Adhesions creating stiffness are usually a combination of intra-articular, extra-articular and subacromial.

Assessing when a plateau status has been reached is a balance between deciding when adequate rehabilitation has been carried out and knowing the expected outcome of a particular fracture type. If, for example, a patient who presents late with a missed diagnosis of a small, usually undisplaced greater tuberosity fracture and has a stiff shoulder, it is likely that there has been inadequate rehabilitation. I would give a trial of physiotherapy. However, if they still fail to make progress, a diagnosis of frozen shoulder is more likely. In such cases, a glenohumeral cortisone injection followed by arthroscopic interval release (if required) has given successful results. Contrast that with a bad four-part fracture in an 80-year-old lady, treated nonoperatively where an outcome of 50% elevation might be considered acceptable.

The key questions to remember in assessing the patient are:

- (a) Is the stiffness as I expect from the injury?
- (b) Has the rehabilitation been done well?
- (c) Is it a secondary frozen shoulder?

Stiffness as a result of fractures near the shoulder

Frozen shoulder can be associated with clavicle fractures. Clavicle fractures normally cause pain for probably around 3 weeks to 4 weeks. As the fracture heals, the range of movement is usually surprisingly normal, even at 6 weeks. What catches people out is the patient with a clavicle fracture, which, at 6 weeks, is still very

painful, thoughts are that the fracture may not have united (or infection if it has been operated on). The patient cannot always distinguish fracture pain from the frozen shoulder pain, nor distinguish the site of pain. It is important to not only review the X-ray, but also look at external rotation. If it is significantly reduced, consider frozen shoulder as a possible diagnosis.

It is important to remember that a frozen shoulder can be a secondary consequence of any upper limb injury (soft tissue or bony). It does not often become symptomatic until sometime after the initial injury. It is worth X-raying to make sure a fracture was not missed but, subsequently, it just needs treating like a primary frozen shoulder.

Stiffness after reduced anterior dislocation

This is most likely in someone aged approximately 40 years who is unlikely to have continuing problems with instability and is most likely too young to have a cuff tear. The expectation is that, after a period in a sling, they will be a bit stiff but with physiotherapy, the movement eases out so that, by 6 weeks after starting rehabilitation, movements have returned to normality. Secondary frozen shoulder should be kept in mind in patients who do not achieve these milestones, especially when there is a lot of pain. The treatment is as for any frozen shoulder except that I would be reluctant to manipulate for fear of re-dislocating the shoulder.

Shoulder stiffness as a result of soft tissue injuries around the shoulder

(a) With cuff tear

An acute traumatic event can also cause a rotator cuff tear (partial or complete) with secondary frozen shoulder. The clue may be in the story. A cuff tear may be sore at the time but then the pain level may settle. However, if a secondary frozen shoulder develops, then pain may return (which the patient may not separate from the first pain, in time or character). Examination may reveal cuff weakness (which could just be pain related). Ultrasound scan may demonstrate a cuff tear.

(b) Without cuff tear

A primary frozen shoulder can develop after soft tissue trauma with no cuff tear. Typically, the patient may fall but the minimal pain starts to increase

progressively along with increasing stiffness. The management is beyond the scope of the present review but is as for an atraumatic frozen shoulder.

Shoulder stiffness: post surgery

Any type of shoulder surgery can create stiffness. These procedures could be sub-acromial decompression, cuff repairs, excision of calcific deposits etc. After shoulder surgery, patients will often describe an initial phase where all was going well and then a sudden change occurs, an increase in pain and reduction in movements. Though infection may need to be considered, secondary frozen shoulder should be high up on the list of differential diagnosis. Post-surgical shoulder stiffness can be difficult to treat and the treatment depends upon indication for primary surgery and numerous other associated factors. This again is beyond the scope of the present review.

Conclusions

To manage a stiff shoulder, listen to the patient's story. Ascertaining a history of trauma can be helpful in closing down the options. Carefully examine the patient, determine that there is true stiffness and test the cuff function. X-ray is essential.

Next, determine why they are stiff and treat accordingly. Stiffness may have many causes but remember that a frozen shoulder may come without any history

or may sit on top of any shoulder condition, either traumatic, nontraumatic or post-surgical in origin.

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References

1. Bunker T. The shoulder. In: Bulstrode C, Wilson-Macdonald J, Eastwood D, et al (eds) *Oxford Text Book of Orthopaedics and Trauma*, 5th edition. Oxford: Oxford University Press, 2011, pp.279–374.
2. Hsu JE, Okechukwu A, Warrender WJ, Abboud JA. Current Review of adhesive capsulitis. *J Shoulder Elbow Surgery* 2011; 20: 502–14.
3. Bunker TD and Anthony PP. The pathology of frozen shoulder. A Dupuytren-like disease. *J Bone Joint Surg Br* 1995; 77: 677–83.
4. Reeves B. The natural history of the frozen shoulder syndrome. *Scand J Rheumatol* 1975; 4: 193–6.
5. Stubblefield MD and Custodio CM. Upper extremity pain disorders in breast cancer. *Arch Phys Med Rehabil* 2006; 87(Suppl 1): S96–S99.
6. Quan GMY, Carr D, Schlicht S, Powell G and Choong PFM. Lessons learnt from the painful shoulder: a case series of malignant girdle tumours misdiagnosed as frozen shoulder. *Int Semin Surg Oncol* 2005; 2: 2.
7. Green DP. *Operative Hand Surgery*. Edinburgh: Churchill Livingstone, 1993.