Shoulder pain in sports

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Shoulder pain in athletic individuals is common, particularly in those sports that are upper limb dominant. It is important to make an accurate diagnosis so that appropriate treatment can be directed at the cause.

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Shoulder pain in athletic individuals is an extremely common complaint, particularly in those sports that are upper limb dominant, for instance in racquet, throwing and hitting sports, swimming, and contact sports such as rugby. It is important to accurately diagnose the cause of the symptoms so that appropriate treatment can be directed at the cause.

The cause might be immediately apparent at the time when an acute injury occurs. However, many of these injuries are the result of chronic overuse causing attrition damage to the different structures in and around the shoulder.

ROTATOR CUFF PATHOLOGY

The rotator cuff comprises the four muscles and tendons that surround the top of the upper arm bone (humerus) and provide stability to the joint by holding the humeral head firmly against the glenoid: supraspinatus, infraspinatus, subscapularis and teres minor (*Figure 1*).

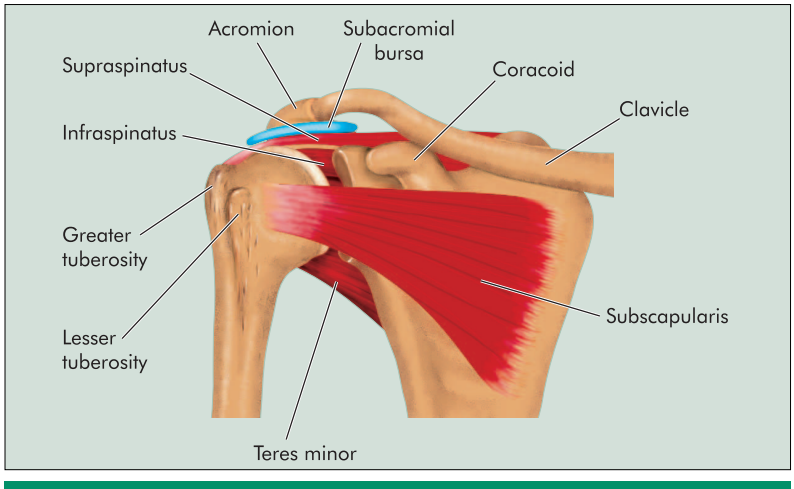

Figure 1. Anatomy of the rotator cuff.

TABLE 1.
Stages of impingement syndrome

	Stage 1 Oedema and haemorrhage	Stage 2 Fibrosis and tendinitis	Stage 3 Bone spurs and tendon rupture
Age	<25 years	25–40 years	>40 years
Clinical course	Reversible	Recurrent pain	Progressive disability
Treatment	Conservative	Conservative or acromioplasty	Cuff repair

Modified from Neer (1983)

Shoulder impingement syndrome

This is a painful condition resulting from impingement of the rotator cuff under the coracoacromial arch. It was described in detail by Neer (1972) who saw this process as a spectrum related to the patient's age (*Table 1*). The condition may be caused or made worse by the shape of the acromion (Bigliani et al, 1986). There are a number of causes involving different tissues:

- The bursa (lubricating sac) can become inflamed causing bursitis. The chance of developing the condition increases with age. Causes include throwing sports and overhead activities
- The rotator cuff tendons causing tendinitis. This may occur when someone whose muscles are poorly conditioned starts an overly aggressive training programme. In younger athletes, causes of tendinitis are similar to those of bursitis
- Calcium can be deposited in the tendons causing pain (calcific tendinitis).

There is usually no single acute initial episode and minor pain and a slight loss of strength may be noticed at first. With time the loss of range of motion, especially ability to lift the arm overhead, becomes more pronounced and pain can become severe. Inability to hold the arm in certain positions indicates tendinitis and recurrent episodes of tendinitis may indicate a rotator cuff tear.

The pain presents in two forms:

- A continuous dull ache, often worse at night, usually located over the lateral aspect of the shoulder joint and may extend down the side of the arm even as far as the elbow. Often it does not appear to be coming from the joint at all
- Sharp pain on lifting the arm is felt just below the acromion (the bony prominence at the top of the shoulder). The pain usually starts when the arm reaches horizontal and eases off if the arm can be brought all the way to vertical. This is the so-called 'painful arc'.

Diagnosis is made mostly on the history and examination, which includes local anaesthetic injection into the subacromial space to confirm the origin of the pain. X-rays should be taken to examine the shape of the acromion (lateral scapular view) and to help exclude other pathology within the shoulder. Ancillary investigations, e.g. ultrasound examination or magnetic resonance (MR) scanning, can help to confirm the diagnosis.

It may not be possible to differentiate between bursitis and tendinitis, and treatment is the same:

- Avoidance of aggravating activities
- Use of anti-inflammatory drugs, which may be all that is required
- Local injection of local anaesthetic and steroid, which often settles the acute episode
- After the inflammation subsides, the patient should do rotator cuff reconditioning exercises.

If symptoms persist despite conservative treatment the shoulder should be re-examined to exclude a rotator cuff tear. It may be necessary to perform an arthroscopic subacromial decompression (acromioplasty) in which the undersurface of the acromion is shaved to prevent it impinging on the rotator cuff.

Rotator cuff tears

A tear may result suddenly from a single traumatic event or develop gradually. In the latter, there is often a preceding history of impingement symptoms. The presence of any of the following indicates the possibility of a tear:

- Degeneration as a result of ageing
- Subacromial impingement (painful arc)
- Repetitive overhead motion, such as bowling or swimming
- Heavy lifting
- Excessive force, such as a fall.

Diagnosis: A number of physical symptoms may indicate a rotator cuff tear, including:

- Recurrent, constant pain, particularly with overhead activities
- Pain at night that prevents sleeping on the affected side
- Muscle weakness, especially when attempting to lift the arm above shoulder height
- Catching and grating or cracking sounds when the arm is moved
- Limited motion.

Rotator cuff tears may be partial or full thickness. Partial-thickness tears do not completely divide the tendon and may respond to non-operative treatments. Full-thickness tears require surgical repair if they continue to cause problems (pain or weakness) despite conservative treatment. Surgery may be used to treat partial-thickness tears that do not respond to non-operative treatment.

Several investigations may be required to confirm the diagnosis, including X-rays (where reduction in the size of the subacromial space is usually seen), ultrasound, MR scanning and arthrography.

Treatment: In most cases, the initial treatment is non-surgical and involves several modalities:

- Rest
- Physiotherapy to strengthen and stretch the muscles, especially those which are not torn
- Non-steroidal anti-inflammatory medications to help control pain
- Corticosteroid injections. These can help reduce pain but cannot be repeated frequently because they can also weaken the tendon.

The surgical options to treat rotator cuff tears depend on the size, depth and location of the tear. If the tear is partial thickness or small it may be treated arthroscopically, either by acromioplasty alone if it is small or by repairing the defect if it is larger. If the tear is very large a standard open procedure will be required to repair the defect.

Rehabilitation: It takes some time to recover from shoulder surgery. Full function may not return for 6 months or more. A physiotherapy programme of exercises to strengthen and restore motion will be started after surgery. Commitment to following the programme outlined affects the ultimate result. Although every case is unique, surgery can relieve pain for most people and rehabilitation can restore a functional range of motion.

CALCIFIC TENDINITIS

Although calcific tendinitis has a well-described clinical course and pathological changes, there is still no consensus about its cause. Decreased local oxygen tension has been suggested as a possible factor in calcium deposition; in addition, it is uncertain whether inflammation is the primary process or a secondary response to microscopic tendon injury (Uhthoff and Loehr, 1997).

Sarkar and Uhthoff (1983) described definite progression in most patients and inevitable resolution, with the length of time required being the only true variable.

Phase I is the precalcification stage. In this stage, patients are generally asymptomatic.

Phase II is the calcific stage. The initial part of this is the formation phase. The deposits are dry and chalky on gross inspection. The patient then enters a resting phase, during which pain may be minimal. This phase varies in length and ends with the beginning of the resorptive phase. This stage can be remarkably painful, and many patients seek treatment at this time. The calcium deposits at this time appear somewhat like cream or toothpaste.

Phase III is the postcalcific phase. During this phase the granulation tissue develops into

mature collagen, reconstituting the tendon. Pain subsides markedly during this phase.

Although most patients seek treatment during the acutely painful resorptive phase of the calcific stage, in some the calcium deposits are an incidental finding or are part of an impingement syndrome. In general, only patients in the resorptive phase should have treatment directed at the calcium deposit itself. Others should follow treatment protocols directed at the particular pathological condition (e.g. impingement).

Non-operative treatment is the initial treatment of choice for all patients and usually includes physical therapy, exercises, anti-inflammatory medications and steroid injections. All patients will eventually recover from calcific tendinitis.

ADHESIVE CAPSULITIS OR FROZEN SHOULDER

Neviaser (1945) proposed the term adhesive capsulitis to describe a contracted, thickened joint capsule that seemed to be drawn tightly around the humeral head, with a relative absence of synovial fluid and chronic inflammatory changes within the capsule.

It is a condition in which there is global stiffness of the shoulder. It may arise for no apparent reason or may follow an injury or surgery to the shoulder. Adhesive capsulitis is more common in women and diabetics, and can be precipitated by an episode of trauma or surgery around the shoulder. It is self-limiting in a vast majority of cases.

The first thing that most people notice is severe pain, which causes them to wake at night. The pain is 'within the shoulder' and usually cannot be localized precisely. The shoulder is painful to move, particularly in internal rotation (reaching behind the back) and external rotation (reaching away from the body). Most people complain of difficulty dressing. As the condition progresses the resting pain settles, although it may take 6 months; however, the stiffness may be so severe that the shoulder has virtually no movement ('frozen'). The stiffness usually subsides 18 months to 2 years after symptoms first started, although by and large full movement is not regained.

Initial treatment consists of painkillers and anti-inflammatory drugs, which settle the pain enough to allow physiotherapy to be started. On some occasions intra-articular corticosteroid injections are necessary to achieve this pain relief. The aim is to maintain as much movement as possible while the condition runs its course and eventually settles. In many cases this is all that is needed.

In a small number of cases the stiffness and pain fail to respond to painkillers and physiotherapy. In these cases manipulation under anaesthetic may be required. In this the shoulder joint is moved through all of its range to stretch the shoulder capsule and break down any scar tissue that has formed. This is sometimes combined with arthroscopic capsular release depending on the surgeon's preference and ability.

Most shoulders do not become stiff again once the condition has settled. Adherence to the physiotherapy programme, which will include exercises to be done at home, is essential. A small number of patients will relapse despite all of the intervention. In these cases the manipulation and/or arthroscopy may be repeated.

INSTABILITY

Glenohumeral

Glenohumeral instability is defined as the inability to maintain the humeral head centred in the glenoid. The shoulder can be unstable in any direction, although the most common is anterior.

There are several different types of instability, although there is usually overlap between categories, with combined types.

Traumatic: This is most common and usually occurs during a fall in which the arm is forced up and away from the body (as in overhead throwing). Tissues at the front of the shoulder can be damaged, tearing them away from their attachment.

Acute dislocation causes severe pain in the arm, which is commonly held by the side. Sometimes it is possible to see a swelling in the front of the shoulder. It is important to assess the integrity of the axillary nerve, which supplies sensation to the top of the arm, as it is commonly affected in this type of injury.

Acute dislocation is usually easy to diagnose based on the history and X-rays. In chronic recurrent dislocations or subluxations, the history of the dislocation(s) will be taken and the shoulder examined. There are usually certain positions in which the shoulder feels as if it is going to dislocate (apprehension test). Complementary investigations include X-ray, MR or computed tomography (CT) scan.

The first priority is to reduce the shoulder joint. This can be done immediately after the injury before the muscles get stiff. Otherwise, treatment should be undertaken in hospital. Following this the arm will be placed in a sling for a few weeks to allow the torn tissues to heal followed by physiotherapy to strengthen the muscles.

Unfortunately once the shoulder has dislocated the damage has been done to the inside of the joint, making further dislocations more likely. The chance is higher if the patient is younger or is involved in contact sports (Hovelius et al, 1983). Physiotherapy can help strengthen the

muscles and correct any imbalances. Avoidance of the cause (i.e. stopping the sport) may also reduce the risk of recurrence. If the shoulder keeps dislocating it may be necessary to operate to stabilize it. This can involve an arthroscopic or an open procedure to restore the tissues that have been damaged (Bankart procedure).

Atraumatic: This form of shoulder instability is less common and arises either as a result of abnormal laxity of the tissues or as a result of repetitive damage. This is experienced by people who repeatedly stress the shoulder through a wide range of motion, such as athletes involved in overhead movements (e.g. throwers or swimmers).

Symptoms may be of traumatic dislocation or there may be an ache in the shoulder and a feeling of looseness. History, examination and investigations are performed as for traumatic instability.

If the shoulder is dislocated then the acute treatment is the same. If the symptoms are vaguer then physiotherapy is required. The aim of this is to improve the balance of the shoulder muscles and to stabilize the shoulder blade. In most cases the shoulder will stabilize with physiotherapy, but if there is a significant structural problem within the shoulder it may be necessary to operate to repair this and to recreate the internal stabilizing structures (capsular shift).

Muscular imbalance: This is the least common form of instability and occurs when the coordination between the muscles of the shoulder is lost.

The shoulder is inherently unstable and relies on the fine balance between the rotator cuff and the extrinsic muscles (e.g. pectoralis major, latissimus dorsi) to keep it from dislocating. If these muscles contract out of sequence it can lead to instability.

There is usually nothing wrong inside the shoulder itself and physiotherapy can have very good results, although it is a long slow process.

Acromioclavicular

The joint between the clavicle and the acromion process can also become unstable, either acutely, as a result of trauma, or chronically.

Acute injuries to the acromioclavicular joint happen by sustaining a direct blow to the point of the shoulder. They are graded depending on the degree of separation of the two structures (Rockwood, 1984), implying sequential damage to the structures that provide stability to the joint:

- In grade I injuries there is a sprain of the acromioclavicular ligament
- In grade II injuries this ligament is fully torn, allowing superior subluxation
- In grade III injuries the coracoclavicular ligaments are ruptured
- Other types of injury are rarer.

These injuries are by and large easily diagnosed by inspection, as the lateral end of the clavicle is usually prominent.

Chronic instability usually manifests as a dull ache, made worse by elevation above shoulder level and by adduction across the body. It is common in weight lifters and is usually difficult to differentiate from impingement syndrome. Diagnosis can be made by injecting local anaesthetic into the joint, which abolishes the symptoms, and by imaging, such as MR scanning. When simple measures fail to control the pain, surgical treatment consists of excising the lateral end of the clavicle.

Sternoclavicular

Most recurrent dislocations of the sternoclavicular joint are anterior and require only conservative treatment; posterior dislocations, although uncommon, require reduction.

DEGENERATIVE DISEASE

In sports that are shoulder dominant, the articular cartilage of the glenohumeral joint can become damaged and deteriorate progressively over time. As this process advances, the joint surfaces become rough and areas of bone may be exposed. Motion of the arthritic joint causes the surfaces to grate rather than glide. Progressive joint destruction makes the shoulder stiff, painful and unable to carry out its normal functions.

Pain is usually the first complaint. It is generally constant, worse on any movement and interferes with sleep. It is felt deep within the shoulder and is ill-localized.

On examination the shoulder usually feels stiff and weak. There may be a sensation of grinding or catching within the shoulder. On occasion there may be crunching which can be heard.

Plain X-ray is usually sufficient for diagnosis. It shows reduction or loss of joint space, or bony erosion, both on humeral and glenoid surfaces.

Treatment

Initial treatment is conservative, consisting of painkillers and/or anti-inflammatory drugs, physiotherapy exercises to strengthen the rotator cuff and activity modification (avoiding things that hurt). Other non-surgical options include corticosteroid injection into the shoulder, but this only gives temporary pain relief and should be considered a palliative intervention when surgery is not an option.

Surgical treatment includes arthroscopy and debridement, in which the arthroscope is introduced into the shoulder joint and the rough cartilage is smoothed down. This also has variable results, with benefits comparable to those seen with injection, although usually longer lasting.

When pain and loss of function become disabling despite conservative measures, joint replacement surgery is the most reliable solution (*Figure 2*). Shoulder replacement aims to restore comfort and function to the joint by removing scar tissue, balancing muscles, and replacing the destroyed joint surfaces with artificial ones. This relieves pain in 90% of patients. The procedure is performed under general (or nerve block) anaesthesia. Shoulder motion is started immediately after the procedure. Patients learn to do their own physical therapy and are discharged 2–3 days after surgery if they are comfortable and have a good range of passive motion. Recovery of strength and function may continue for up to a year after surgery. Replacements last 15 years on average.

NERVE ENTRAPMENT

Axillary nerve

The quadrilateral space syndrome was originally described by Cahill and Palmer in 1983. It is caused by compression of the axillary nerves and posterior humeral circumflex artery in the quadrilateral space, which is bounded by the teres major and minor muscles, the humeral shaft, and the long head of the triceps. It usually affects the dominant arm of young adults and is characterized by poorly localized pain over the deltoid muscle. Diagnosis is made clinically by abducting and externally rotating the affected arm for 1 minute; this should reproduce the symptoms. Most patients do not require surgical treatment. If it becomes necessary, the space can be decompressed via a posterior approach.

Figure 2. Postoperative X-ray of total shoulder replacement.

Suprascapular nerve

The suprascapular nerve supplies the supraspinatus, the infraspinatus and the shoulder capsule, as well as the glenohumeral and acromioclavicular joints. Most suprascapular nerve entrapments occur at the suprascapular notch and are responsive to operative management once the correct diagnosis has been made. Patients usually complain of deep, aching, diffuse pain. Muscle atrophy may or may not be present, but should be looked for by examining the posterior contour of the shoulder. Once suspected, the diagnosis is usually confirmed by neurophysiological investigations.

CERVICAL SPINE

Referred pain from the cervical spine should always be considered as a possible source of shoulder symptoms. Associated symptoms include pins and needles, pain radiating in a dermatome distribution (similar to sciatica in the lower limb), numbness and weakness.

The examination involves testing the range of motion of the neck and a neurological examination of the upper limb. If the history and/or examination suggest the cervical spine as the origin of the shoulder pain, further investigation can be carried out with plain X-rays of the cervical spine or MR scanning. HM

KEY POINTS

- Shoulder pain in sports can result from an acute injury, e.g. traumatic dislocation of the glenohumeral or acromioclavicular joints, or from chronic overuse.
- These conditions can affect the rotator cuff, can be a result of instability or, in the long term, be a result of joint degeneration.
- As a general rule, these conditions are progressive and timely intervention usually avoids deterioration.
- The diagnosis can usually be made with the history of the complaint and a careful examination, although imaging of the structures involved can often assist in the differential diagnosis.
- Once the diagnosis is made treatment can be directed to the cause of the problem before the condition progresses.

Conflict of interest: none.

Bigliani LU, Morrison D, April EW (1986) The morphology of the acromion and its relationship to rotator cuff tears. *Orthop Trans* **10:** 228

Cahill BR, Palmer RE (1983) Quadrilateral space syndrome. *J Hand Surg* **8:** 65–9

Hovelius L, Eriksson K, Fredin H et al (1983) Recurrences after initial dislocation of the shoulder. Results of a prospective study of treatment. *J Bone Joint Surg Am* **65**(3): 343–9

Neer CS II (1972) Anterior acromioplasty for the chronic impingement syndrome in the shoulder: a preliminary report. *J Bone Joint Surg* **54-A:** 41–50

Neer CS II (1983) Impingement lesions. *Clin Orthop* **173:** 70–7

Neviaser JS (1945) Adhesive capsulitis of the shoulder. *J Bone Joint Surg* **27:** 211–22

Rockwood CA Jr (1984) Subluxations and dislocations about the shoulder. In: Rockwood CA Jr, Green DP, eds. *Fractures in Adults.* 2nd edn. JB Lippincott, Philadelphia: 871

Sarkar K, Uhthoff HK (1983) Ultrastructure of the subacromial bursa in painful shoulder syndromes. *Virchows Arch A Pathol Anat Histopathol* **400:** 107–17

Uhthoff HK, Loehr JW (1997) Calcific tendinopathy of the rotator cuff: pathogenesis, diagnosis, and management. *J Am Acad Orthop Surg* **5**(4): 183–91