# Subacromial Region Injuries

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## Contributors

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## Overview

- The glenohumeral joint (GHJ) is a large ball sitting in a small socket with static and dynamic restraints to aid stability. The subacromial space is outlined by the acromion and coracoid process, and the coraco-acromial ligament connecting the two.
- Wide variety of possible pathology including rotator cuff tendinopathy/tears, calcific tendonitis, long head of bicep pathology, bony spurs & Arcomioclavicular Joint Osteoarthritis (ACJ OA).
- Pain with overhead activities is common. Subacromial pain accounts for up to 70% of all shoulder problems.
- A thorough history and clinical examination can indicate potential subacromial pathology.
- Ultrasound is a quick, cheap, non-invasive imaging modality and should be used if there is a high index of suspicion for rotator cuff pathology.
- The vast majority of patients with subacromial symptoms will settle with appropriate non-surgical management. This will include physiotherapy, activity modification, analgesia and NSAIDs as needed.
- Injections into the subacromial space should be used judiciously in the management of subacromial region injuries. Corticosteroid or Platelet Rich Plasma (PRP) injections are two available options.
- Surgery is rarely required in these patients.

## Case Studies

Mr. Smith is a 53-year-old gardener without any known comorbidities. In his spare time, he enjoys swimming, climbing and running for several hours a week. While climbing, he fell on his right outstretched hand and presented to a Sport and Exercise Medicine (SEM) Clinic with severe pain in his right shoulder (Visual Analog Scale = 9/10). Clinically, the right shoulder demonstrated painful shoulder abduction and internal rotation. On evaluation with goniometer, the right shoulder displayed a 150-degree forward flexion and a 130-degree painful abduction. Jobe, Neer and Hawkins tests were positive. A complete 1cm tear of the supraspinatus tendon as well as signs of tendinopathy (tendon thickening, loss of normal fibrillary pattern with hypoechogenicity, neovascularity in colour Doppler mode) were evidenced via ultrasound. The patient underwent three-months of physiotherapy, including passive exercises to restore range of motion (ROM) of the affected shoulder, followed by scapula stability exercises and strength training exercises targeting rotator cuff muscles. Finally, the patient underwent functional sports specific rehabilitation (swimming and climbing), before returning to swimming and climbing three and six months after the initial trauma respectively.

Ms. Clarke is a 16-year-old swimmer. Four months ago, she increased her swimming volume from 12 hours to 16 hours per week with the goal of qualifying for the European Junior Championships. She presented to a SEM Clinic with a three-month history of worsening, moderate posterior left shoulder pain. Clinically, a loss of external rotation, a painful arc between 90° and 120° during active elevation as well as positive Jobe and Neer tests were noted. Supraspinatus tendon swelling and thickening of the subacromial bursa were detected on ultrasound. The diagnosis of a left shoulder impingement, secondary to a primary GHJ instability was made. Rehabilitation focused on improving GHJ stability by strengthening rotator cuff muscles and scapular retractors. She returned to swimming three months later and to competition seven months after the initial presentation.

## Anatomy

The shoulder complex consists of 3 bones; the humerus, clavicle and scapula and 4 joints; the glenohumeral joint (GHJ), acromioclavicular joint (ACJ), sternoclavicular joint (SCJ) and the scapulothoracic articulation that facilitates movement of the scapula on the rib cage.

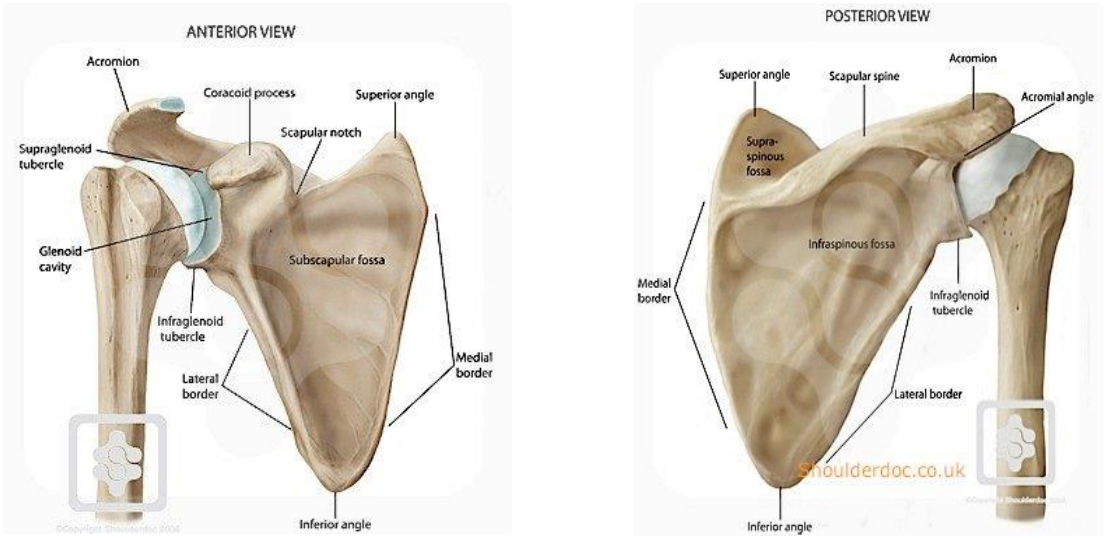


*Figure 1: Shoulder Complex Osteology. Image Courtesy of Lennard Funk, shoulderdoc.co.uk*

The GHJ is a very mobile joint and particularly susceptible to injury in the overhead athlete, e.g. cricket, tennis, volleyball, swimming, handball.[1] The GHJ is a ball and socket joint consisting of the humeral head sitting in the shallow socket of the scapula's glenoid. Articular cartilage covers the humeral head and functions to facilitate smooth motion of the humeral head in the glenoid. The glenoid comprises a labrum consisting of fibrocartilage that deepens the socket and a joint capsule.[2] The superior, middle and inferior glenohumeral ligaments act as the final static restraints of the GHJ. The rotator cuff muscles provide dynamic stability to the GHJ. There are 4 rotator cuff muscles; subscapularis, supraspinatus, infraspinatus and teres minor. Collectively, they work in unison to help maintain scapula-thoracic control and GHJ stability. In the subacromial space, we will find the tendon of supraspinatus, long head of biceps tendon, coracohumeral and coracoacromial ligaments, and the subacromial bursa.

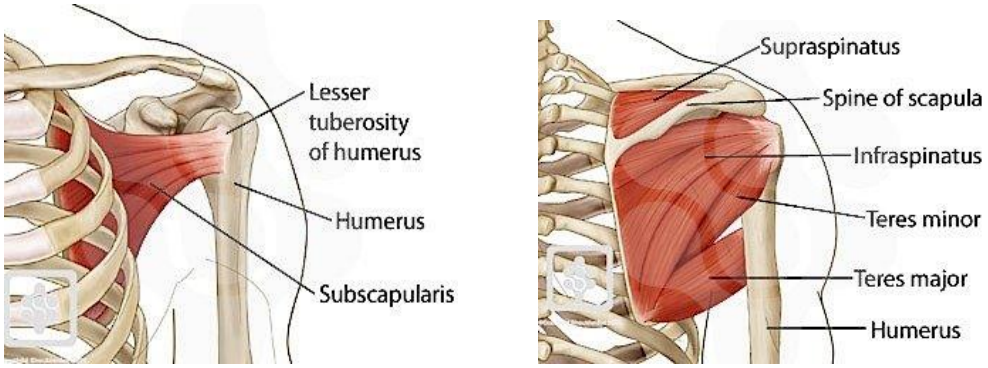


*Figure 2: Rotator Cuff Muscles (Anterior & Posterior Views). Image Courtesy of Lennard Funk, shoulderdoc.co.uk*

Integral to the smooth movement of the shoulder joint is 'scapulohumeral rhythm' which is the coordinated action of the periscapular muscles as the scapula glides on the rib cage (scapulothoracic articulation).[3] Periscapular muscles are the mid and lower trapezii, rhomboids minor and major, levator scapula and serratus anterior. Superficially, the pectoralis major, lattisimus dorsi, upper trapezius and deltoid muscle forms the superficial muscular layer of the shoulder complex and are powerful prime movers of the GHJ. A normally functioning shoulder complex permits flexion, extension, abduction, adduction, external rotation, internal rotation and circumduction.

## Aetiology and pathophysiology

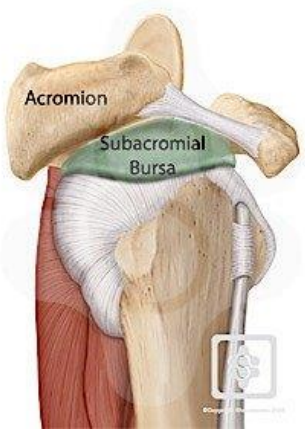


*Figure 3: Subacromial Region (Lateral View). Image Courtesy of Lennard Funk, shoulderdoc.co.uk*

Subacromial pain accounts for up to 70% of all shoulder problems.[4] As the GHJ moves overhead, there is a critical interplay between the rotator cuff and periscapular muscles to preserve the structures passing through the subacromial space and thereby mitigating the risk of impinging these structures, i.e. impingement syndrome. Failure to control the humeral head in overhead activities can result in deleterious consequences in the subacromial region. GHJ stability and appropriate rotator cuff balance is required particularly in the athletic population. Overuse & fatigue are often major contributory factors to subacromial pain.

## Clinical Features

Overuse injuries occur gradually, while traumatic cuff tears occur acutely. Patients may present with pain in the lateral aspect of the proximal humerus radiating down the upper arm. For the overhead athletes, this pain is often felt at greater than 90 degrees of GHJ abduction. If the supraspinatus tendon is involved, the patient may feel a lack of control of the humeral head as he/she performs the inciting activity. Reduced range of motion may be reported due to exposure of subacromial structures to repetitive forces leading to fibrosis of the subacromial structures.[5] Finally, night pain is very common and often debilitating.

Acquired pathology of the subacromial region is multifactorial and warrants a thorough musculoskeletal history & examination. Poor scapula control and poor rotator cuff function may produce superior migration of the humeral head causing entrapment of pain sensitive structures under the acromion.[6] Chronic microtrauma or acute trauma may lead to rotator cuff related symptoms. A sequelae of sub optimal rotator cuff control is subacromial bursitis whereby the bursa becomes irritated leading to an inflammatory cascade.[7]

A protracted scapula due to a shortened pectoralis minor muscle can cause an anteriorly tilted scapula, hence closing down the subacromial space and may contribute to subacromial symptoms.[8] This can be occupationally induced, e.g. participating in an overhead sport, poor posture in the work environment and activities involving repetitive shoulder movements. Good scapula-thoracic control is important in the short-term management but also in the longer term to prevent recurrence.[9]

For the overhead athlete, it is important to establish when symptoms occur. Typically, symptoms occur in the late cocking phase (Figure 4) where the supraspinatus activates maximally, i.e. abduction, extension and external rotation.[10]

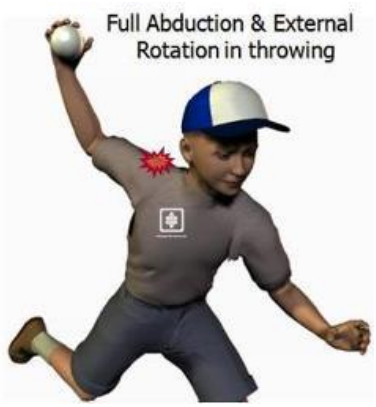


*Figure 4: Subacromial structures susceptible to injury in this position. Image Courtesy of Lennard Funk, shoulderdoc.co.uk*

## Examination

It is imperative to carry out the following when assessing a patient's shoulder:

1. Observe: The patient's posture may give you clues. Forward head posture and protracted scapulae may be observed.[11] With the patient appropriately undressed, posture should be observed anteriorly, posteriorly and laterally. Muscle bulk / wasting should be noted and any obvious scars that indicate prior surgery should be clarified with the patient. Scapular position at rest should be documented. Medial border winging may be seen and will give a clue that there may be scapular dyskinesis. It is imperative to rule out any obvious neural involvement (long thoracic nerve injury) in the presence of a winged scapula.[12]
2. Palpate: Apply gentle pressure in the area of the long head of biceps tendon and observe patient's facial expression for grimace. A bilateral comparison is warranted.
3. Move: As tolerated, request the patient to perform shoulder flexion, extension, abduction, external rotation and internal rotation movements actively to get an appreciation of range of motion bilaterally noting any pain or inconsistencies of movement throughout the available range of motion. A painful arc of motion between 70-120 degrees has been described extensively and may indicate subacromial impingement.[13] A scapular examination should be carried out by observing the patient from behind as he/she flexes and abducts. Excessive medial border winging and anterior tilting of the scapula could be contributing to early closure of the subacromial space.
4. Special tests: There are over 100 special tests for the shoulder.[14] Specific to subacromial pathology are Hawkin's-Kennedy, Neer's, & Jobe's' Test.

## Investigations

Investigation selection is contingent on a thorough subjective history and sound clinical examination of the shoulder complex. Before choosing an imaging modality, consider the following:

1. Could this be a full thickness rotator cuff tear? If so Ultrasound (US) & MRI demonstrate similar diagnostic accuracy of full thickness rotator cuff tears. Since US is safe, cheap and can be accessed at the point of care, this is the optimal imaging modality choice. However, US is operator dependent and thus adequate training in US use and interpretation is imperative for diagnostic accuracy.[15]
2. Was there an insidious onset of pain and is the patient < 40 years old? An insidious onset of pain is more suggestive of overuse injury, e.g. tendinopathy. Diagnosis of rotator cuff tendinopathy using US has high specificity (0.94) but lower sensitivity (0.79).15 Furthermore, US is the modality of choice for identifying full thickness tears of the rotator cuff and long head of biceps pathology.[16]
3. Was there acute trauma and/ or is the patient > 40 years old? A plain film X-Ray should be ordered looking for calcific tendonitis, OA and/ or bony abnormalities.[17]
4. Is there a suspicion of labrum, cartilage or ligamentous injury? MRA is the modality of choice.[17]

## Management

The vast majority of patients are managed non-surgically. Physiotherapy has a large role in patient management and rehabilitation but requires adequate pain control to facilitate this.

- Pain control
  - Activity modification – rest from aggravating activities
  - Simple analgesia
  - Consideration of corticosteroid injection to achieve short-term symptom control[18,19] – facilitates a pain-free window for appropriate rehabilitation (does not alone cure the underlying pathology and may damage the rotator cuff tendon.[20])
  - PRP injections show equivocal results in terms of pain reduction and tendon healing, highlighting the need for more high-quality randomised control trials.[21]
  - If using injection therapy, consider cost, accessibility and practicality of administering an injection for pain control.
- Physiotherapy
  - Ensure goal-oriented from the start
  - Assess shoulder ROM, strength, scapular rhythm, thoracic ROM, kinetic chain deficiencies
  - Review and modification of patient's strength & conditioning programme
  - Progressive cuff strengthening along with scapular control regime
  - Incorporation of sports-specific movements form the end-stage of the rehabilitation programme
- Surgery
  - Role to play if significant structural abnormality e.g. Cuff tears >1cm
  - Mainstay of management remains non-surgical – There have been several research studies that demonstrate subacromial decompression surgery does not always work and that there is little evidence surgery in these patients is any better than non-surgical management.[22]

## References


Asker M, Brooke H, Waldén M, Tranaeus U, Johansson F, Skillgate E et al. Risk factors for, and prevention of, shoulder injuries in overhead sports: a systematic review with best-evidence synthesis. 2020. 2. Lugo R, Kung P, Ma C. Shoulder biomechanics. European Journal of Radiology. 2008;68(1):16-24. 3. Cathcart CW: Movements of the shoulder girdle involved in those of the arm on the trunk. ] Anat Physiol 18:209- 218, 1884 4. Mitchell C, Adebajo A, Hay E, Carr A. Shoulder pain: diagnosis and management in primary care. BMJ. 2005;331(7525):1124-1128. 5. Neer CS. Impingement Lesions. CORR. 173. 1983 6. Shah N, Bayliss N, Malcolm A. Shape of the acromion: Congenital or acquired—A macroscopic, radiographic, and microscopic study of acromion. Journal of Shoulder and Elbow Surgery. 2001;10(4):309-316.7. Terrier A, Reist A, Vogel A, Farron A. Effect of supraspinatus deficiency on humerus translation and glenohumeral contact force during abduction. Clinical Biomechanics. 2007;22(6):645-651. 8.Blaine T, Kim Y, Voloshin I, Chen D, Murakami K, Chang S et al. The molecular pathophysiology of subacromial bursitis in rotator cuff disease. Journal of Shoulder and Elbow Surgery. 2005;14(1):S84-S89. 9.Kibler WB, Sciascia A Current concepts: scapular dyskinesis British Journal of Sports Medicine 2010;44:300-305. 10. Copeland S. Throwing injuries of the shoulder. British Journal of Sports Medicine. 1993;27(4):221-227. 11.Lewis J, Green A, Wright C. Subacromial impingement syndrome: The role of posture and muscle imbalance. Journal of Shoulder and Elbow Surgery. 2005;14(4):385-392. 12.Winging Scapula | ShoulderDoc [Internet]. Shoulderdoc.co.uk. 2020 [cited 21 June 2020]. Available from: https://www.shoulderdoc.co.uk/article/577 13.Brukner P. Clinical sports medicine. Sydney: McGraw-Hill; 2010; Chapter 21, pp357 14. Shoulder Examination Tests | ShoulderDoc [Internet]. Shoulderdoc.co.uk. 2020 [cited 21 June 2020]. Available from: https://www.shoulderdoc.co.uk/section/497" https://www.shoulderdoc.co.uk/section/497 15. Roy J, Braën C, Leblond J, et al Diagnostic accuracy of ultrasonography, MRI and MR arthrography in the characterisation of rotator cuff disorders: a systematic review and meta-analysis. British Journal of Sports Medicine 2015;49:1316-1328. 16.Read J, Perko M. Shoulder ultrasound: Diagnostic accuracy for impingement syndrome, rotator cuff tear, and biceps tendon pathology. Journal of Shoulder and Elbow Surgery. 1998;7(3):264-271.17. Nazarian L, Jacobson J, Benson C, Bancroft L, Bedi A, McShane J et al. Imaging Algorithms for Evaluating Suspected Rotator Cuff Disease: Society of Radiologists in Ultrasound Consensus Conference Statement. Radiology. 2013;267(2):589-595. 18.Koester M, George M, Kuhn J. Shoulder impingement syndrome. The American Journal of Medicine. 2005;118(5):452-455. 19.Cook T, Lewis J. Rotator Cuff-Related Shoulder Pain: To Inject or Not to Inject?. Journal of Orthopaedic & Sports Physical Therapy. 2019;49(5):289-293. 20. Dean BJF, Franklin SL, Murphy RJ*, et al* Glucocorticoids induce specific ion-channel-mediated toxicity in human rotator cuff tendon: a mechanism underpinning the ultimately deleterious effect of steroid injection in tendinopathy? *British Journal of Sports Medicine* 2014;**48:**1620-1626. 21. Miller LE, Parrish WR, Roides B*, et al* Efficacy of platelet-rich plasma injections for symptomatic tendinopathy: systematic review and meta-analysis of randomised injection-controlled trials. *BMJ Open Sport & Exercise Medicine 2017;3:e000237. doi: 10.1136/bmjsem-2017-000237.* 22. Lähdeoja T, Karjalainen T, Jokihaara J, et al. Subacromial decompression surgery for adults with shoulder pain: a systematic review with meta-analysis British Journal of Sports Medicine 2020;54:665-673.