Subacromial impingement syndrome: review article

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Abstract

Introduction
The subacromial impingement syndrome is a common cause of shoulder pain; it involves the soft tissue compromising the subacromial space. Impingement arises from mechanical compression of the rotator cuff centered primarily on the supraspinatus tendon insertion onto the greater tuberosity against the undersurface of the anterior edge of the acromion.

The aetiology of this condition has been debated over the last few decades. Nevertheless, nowadays, many authors consider that this condition is multifactorial.

Management includes physical therapy, injections and surgery in some selected patients. This article aims to provide an overview of the nature and pathogenesis of subacromial impingement syndromes, the widely accepted management modalities and the efficiency of the surgical intervention based on other studies.

Conclusion
We recommend arthroscopic subacromial decompression as it has less surgical morbidities and it allows direct evaluation of the glenohumeral joint and the integrity of the rotator cuff.

Introduction
Impingement syndrome is a common disorder about the shoulder involving the soft tissue compromising the subacromial space; it represents a spectrum of pathology. The syndrome is caused by many factors resulting from an impingement on the rotator cuff, the overlying subacromial bursa and occasionally the tendon of the long head of biceps against the anterior edge of the acromion and its associated coracoacromial arch.

Subacromial impingement syndrome (SIS) encompasses a spectrum of subacromial space pathologies including partial thickness rotator cuff tears, rotator cuff tendinosis, calcific tendinitis and subacromial bursitis. These conditions may all present similarly and they are often distinguishable mainly by magnetic resonance imaging (MRI) or arthroscopy. The aim of this review was to discuss SIS.

History
In 1904, Codman¹ started drawing the attention to the bursa and the adjacent rotator cuff tendons. Generally, he favoured a traumatic explanation for supraspinatus tears. However, Meyer² argued for ‘use attrition’ in which the rotator cuff tendon and biceps were ‘ground between the acromion and the humeral head’.

In 1972, Neer³ introduced the concept of rotator cuff impingement; he described the syndrome as a mechanical impingement of the rotator cuff tendons beneath the anterior-inferior of the acromion occurring when the shoulder is placed in the forwardly flexed and internally rotated position.

Neer³ described three progressive stages in the spectrum of rotator cuff impingement. Stage I consists of oedema and haemorrhage of the subacromial bursa and it is commonly seen in patients younger than 25 years of age. Stage II is usually seen in patients aged 25–40 years and represents a progression of stage I to thickening and fibrosis of the bursa and tendinitis of the cuff, this stage may not respond to conservative treatment. Stage III results from further impingement producing degeneration or incomplete or complete cuff tears. These changes are commonly seen in patients older than 40 years of age.

Discussion

Functional anatomy
The glenohumeral joint is inherently unstable because the large humeral head articulates with the small shallow glenoid fossa. Minimal bone stability in the shoulder permits a wide range of motion (ROM)⁴. Stability of the shoulder joint is based on both static and dynamic stabilizers. Static stabilizers include the glenoid labrum, the joint capsule, glenohumeral ligaments and the rotator interval⁵.

Dynamic stabilizers include the rotator cuff muscles, the long head of biceps muscle tendon and the scapulothoracic motion⁶.

The rotator cuff consists of four muscles that control three basic motions: abduction, internal rotation and external rotation. The supraspinatus muscle is responsible for initiating abduction, the infraspinatus and teres minor control external rotation and the subscapularis controls internal rotation. The rotator cuff muscles provide a dynamic stabilization of the humeral head in the

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not lateral and led to these changes. Therefore, Neer proposed the use of anterior acromioplasty to manage this type of impingement. Additionally, Neer stated that the reasons rotator cuff tears develop in some people and not others is mainly due to the shape of acromion. Likewise, Bigliani and Morrison described variations in acromial size and shape that contribute to impingement. There have been three different variations in the morphology of the acromion. Type I is flat, type II is curved and type III is hooked anteriorly. Although the curved configuration was the most common, the hooked configuration was associated markedly with full thickness rotator cuff tears. Yamamoto et al. suggested that repetitive contact and bending of the CAL may lead to degenerative changes, including proliferative acromial spurs. Fealy et al. studied the anatomic features of the CAL that may play a role in the development of the impingement. They identified two distinct ligament bands; an anterolateral and posteromedial band. Spurs were commonly found in the anterolateral band.

Intrinsic mechanism

The intrinsic factors that may lead to rotator cuff failure include diminished vascular supply, aging and excessive tensile forces. In a cadaveric study, Lohr and Uthhoff found a hypovascular or a critical zone close to the insertion of the supraspinatus tendon into the humeral head. They concluded that the poor vascularity of the tendon in this area could be a significant factor in the pathogenesis of degenerative rotator cuff tears. Benson et al. reported a study purporting to investigate the occurrence of tissue hypoxia and apoptosis at different stages of tendinopathy and tears of the rotator cuff. They reported evidence of apoptosis and hypoxic damage to the rotator cuff in shoulders with impingement and cuff tears.

Lastly, according to Budoff et al., based on the results of their study, primary failure of the rotator cuff mostly is caused by eccentric tension overload rather than by impingement from aberrant acromial morphology.

Clinical presentation

Patients usually complain of pain at night, exacerbated by lying down on the affected shoulder or sleeping with the arm overhead. The pain usually develops insidiously over a period of weeks to months and it is typically localized to the anterolateral acromion. The patient also complains of painful normal daily activities. However, acute pain and weakness may be seen following traumatic rotator cuff rupture.

Diagnosis

A thorough history, physical examination and appropriate imaging are crucial for accurate diagnosis of impingement.

Radiography

A standard series include anteroposterior (AP), outlet and axillary views. The outlet view provides visualization of acromial morphology and the axillary view demonstrates evidence of os acromiale, which may lead to secondary impingement.

The common radiographic findings related to impingement include acromioclavicular (AC) osteoarthritis, acromial osteophytes or sclerosis. Nevertheless, these findings may be present in asymptomatic individuals.

Additionally, recently, Mayerhofer et al. reported that acromial shape is not a good predictor of subacromial space narrowing. Moreover, the minimum acromiohumeral distance seems to better reflect the clinical status of patients with subacromial impingement, but without rotator cuff tears, than acromial shape.

Magnetic resonance imaging

MRI can provide details of potential sites of subacromial impingement.

Ossification of CAL or the presence of subacromial spur can be imaged in the sagittal oblique plane; in addition it is useful in evaluating the AC joint. Findings of subacromial bursitis include bursal thickness more than 3 mm, the presence of fluid medial to AC joint and the presence of fluid in the anterior aspect of the bursa.

Physical examination
A careful examination of the neck should be performed to rule out abnormalities of the cervical spine. Inspection and palpation of the shoulder need to be done, muscle strength and ROM need to be assessed.

Examining the subscapularis could be done using the lift-off test in which the patient places his hand behind the back and tries to push away the examiner's hand. Next, with the arms at the sides and the elbows flexed, the examiner resists the patient in internal rotation of the shoulder. The supraspinatus muscle strength test is performed according to the technique described by Jobe and Moynes. In this test, the physician resists abduction of the arm with the patient elevated to 90° and internally or neutrally rotated. The test is considered positive if the patient gives way. In infraspinatus muscle strength test, the elbow is flexed to 90° and the arm is adducted to the body in neutral posture. The examiner then applies an internal rotational force to the arm while the patient resists it.

There are two provocative tests that are highly sensitive for diagnosing SIS. Neer's sign elicits pain with maximum passive shoulder elevation and internal rotation while the scapula is stabilized. The second test is the Hawkins impingement sign, in which the arm is placed in 90° of forward flexion and then gently rotated into internal rotation. The end point of internal rotation is either when the patient experiences pain or when rotation of scapula is felt or observed by the examiner.

MacDonald et al. studied the diagnostic accuracy of the Neer and Hawkins impingement signs for the diagnosis of subacromial bursitis or rotator cuff tears. The Neer sign was found to have a sensitivity of 75% for the appearance suggestive of subacromial bursitis; this compared with 92% for the Hawkins sign. For rotator cuff tears, the sensitivity of the Neer sign was 85% and the sensitivity of the Hawkins sign was 88%. Specificity and positive predictive values for the two tests were low. The two tests had a high negative predictive value (96% for bursitis, 90% for rotator cuff tears) when they were combined. It was concluded that the Neer and Hawkins signs are sensitive for appearances suggestive of subacromial bursitis and rotator cuff tears with a high negative predictive value. However, they lack specificity in comparison with arthroscopic findings.

Treatment options
The natural course of SIS is poorly described; however evidence suggests that the condition is not self-limiting. Additionally, the most appropriate and beneficial form of treatment is widely debated.

Non-surgical management
Non-surgical management of SIS continues to be successful in many patients. The most common interventional modalities include modification of activities, the use of non-steroidal anti-inflammatory medications, subacromial injection of steroids and physical therapy programs.

Kuhn performed a systematic review of the literature to evaluate the role of exercise in treating rotator cuff impingement. The data demonstrated that exercise has statistically and clinically significant effects on pain reduction and improving function, but not on ROM or strength. Subacromial bursa injection has a diagnostic and therapeutic role as an adjunct to the rehabilitation program.

Kang et al. assessed the accuracy and effectiveness of subacromial injections. The shoulders were randomized to receive an injection of corticosteroids, local anaesthetic and contrast dye from one of three locations: anterolateral, lateral or posterior. The accuracy of the injection was evaluated by obtaining three radiographic views of the shoulder. In conclusion, the accuracy of injection was 70%. Clinical improvement did not correlate with accuracy; however, accuracy did reliably produce a positive impingement test. The treatment plan did produce significant improvement in shoulder function and pain level in the short term.

Dorrestijn et al. conducted a systematic review aiming to compare conservative versus surgical treatment for SIS. They included four randomized controlled trials (RCTs) in this review. No differences in the outcome between the treatment groups were reported for any of the studies. The conclusion was that no high quality RCTs are available to provide possible evidence for differences in the outcome; therefore, no confident conclusion could be drawn.

Surgical management
Operative intervention could be warranted when conservative treatment fails to alleviate the symptoms associated with SIS or complete cuff rupture is seen on MRI. Historically, open anterior acromioplasty that was described by Neer with resection of CAL and subacromial bursa achieved good long-term results.

Frieman and Fenlin followed 74 patients who underwent open acromioplasty with an average duration of follow up of 17 months. Excellent or good results were reported in 79% of patients.

However, nowadays, arthroscopic subacromial decompression with the release of the CAL has been proven to achieve similar results without violation of the deltoid insertion. Moreover,
the arthroscopic technique allows direct evaluation of the glenohumeral joint and integrity of the rotator cuff. Therefore, pathological conditions of the glenohumeral joint, rotator cuff and AC joint could be addressed at the time of the surgery. Davis et al. conducted a meta-analysis study aiming to compare arthroscopic versus open acromioplasty. They reported that arthroscopic and open acromioplasty had equivalent ultimate clinical outcomes, operative times and low complication rates. However, arthroscopic acromioplasty resulted in a faster return to work and fewer hospital inpatient days compared with the open technique.

Van Holsbeeck et al. reported on 53 patients treated by an arthroscopic decompression and 53 patients treated by an open decompression. After an average of 20.1 months for the arthroscopic acromioplasty group and 27.3 months for the open acromioplasty group, good or excellent results were 83.1% and 81.1%, respectively. In the arthroscopic decompression group, patient’s satisfaction was 88.3% compared with 94.3% in patients who underwent open decompression.

Norlin and Adolffson followed 162 patients who underwent arthroscopic subacromial decompression without rotator cuff repair for 10–13 years. They found that patients with isolated full-thickness supraspinatus tears had the best outcomes, followed by those with partial tears or intact cuffs. Furthermore, they concluded that arthroscopic subacromial decompression for impingement yields good long-term results.

Osewski and Depew reported on 61 patients with either stage II or III who underwent arthroscopic subacromial decompression and rotator cuff debridement with a minimum of 2 years follow up. They found that this technique is effective in the treatment of stage II impingement including partial thickness tear as well as in carefully selected patients with stage III who do not require the demands of strength or repetitive shoulder elevation.

Reviewing the literature reveals that there has been an on-going debate regarding the role of subacromial decompression for SIS. The debate has been focused on the necessary components of subacromial decompression. The decompression procedure has been described as bursectomy alone versus bursectomy and acromioplasty. Additionally, the controversy has been extended to whether decompression is necessary in the setting of rotator cuff repair. Soyer et al. studied the relationship between clinical outcomes and the amount of the acromion which was resected arthroscopically. The results showed that there was no correlation between the amount of the acromion resection and the improvement of constant's score. They concluded that the efficiency of arthroscopic decompression may not be only due to the amount of acromion resection.

Conclusion

SIS is one of the most common causes of shoulder pain. However, it has to be differentiated from other conditions affecting the shoulder; SIS is likely to be multifactorial and may involve both extrinsic compression and intrinsic degeneration factors. Conservative treatment is successful in most of the patients. Surgical treatment is used when conservative treatment fails. We recommend arthroscopic subacromial decompression as it has less surgical morbidities and it allows direct evaluation of the glenohumeral joint and the integrity of the rotator cuff.

References


