Review Article

Shoulder Impingement Syndrome

Kenneth Hing-Sum Tsui

Abstract: Shoulder impingement syndrome is common in clinical practice. Knowledge of basic anatomy of the shoulder and mechanism of the disease process is essential for management. Non-steroidal anti-inflammatory drug has only very limited evidence of effectiveness. Subacromial steroid injection has some evidence of effectiveness but the optimal type of steroid, dosage, frequency and timing of injection is still unclear. Structured and supervised exercise programs have been shown to offer long-term benefit. Weight pendulum exercise and other simple exercises could be recommended to patients in the clinic setting. Orthopedic surgery is indicated for refractory cases of shoulder impingement syndrome.

Keywords: Anatomy, etiology, mechanism, painful arc, shoulder

Introduction

Shoulder pain is common in clinical practice. The prevalence of shoulder pain in the general population ranges from 6.9% to 34%. For people greater than 70 years of age, the prevalence of shoulder pain was reported to be 21% in one study. Forty percent of the population probably will suffer from shoulder pain at some point of their life time.

Impingement syndrome is one of the most common causes of shoulder pain and usually occurs in the middle-aged and elderly individuals.

Anatomy

To understand the shoulder impingement syndrome, it is essential to have some basic knowledge of the anatomy of the shoulder (Figures 1-3). The shoulder region is formed by three bones: scapula, humerus and the clavicle. The acromion is the upper outermost part of scapula which articulates medially with the clavicle to form the acromioclavicular joint. It also forms the upper part of the shoulder joint proper, the gleno-humoral joint. Underneath the acromion is the subacromial bursa which is

Figure 1. Posterior view of shoulder.

Figure 2. Anterior view of shoulder.

Figure 3. Rotator cuff muscles.
a cushion for the supraspinatus tendon. The coracoid process of the scapula points forward and is the site of attachment of the short head of the biceps muscle. Coracoacromial ligament links up the acromion and coracoid process for stability purpose. The long head of biceps muscle runs in the intertubercular groove of humerus and then becomes intracapsular. The rotator cuff muscles are supraspinatus, infraspinatus, teres minor and subscapularis. The tendon of suprasinatus forms the upper part of the shoulder joint; the tendon of subscapularis forms the anterior part of the shoulder joint; and the tendons of infraspinatus and teres minor form the posterior part of shoulder joint. The subscapularis is mainly for internal rotation of the shoulder.

The infraspinatus and teres minor are mainly responsible for external rotation of the shoulder. However, it is important to note that these three muscles on contraction also have a downward vector force. This prevents the upward movement of the head of humerus which would otherwise hit on the acromion above during shoulder abduction.

Clinical Feature and Mechanism

Shoulder impingement syndrome arises as a result of reduced spaces below the acromion and behind the coracoacromial ligament. The soft tissue structure in this space is being compressed by the two bony structures - the head of humerus and acromion. Impingement syndrome most commonly manifests as the painful arc syndrome (Figure 4). The initial stage of arm abduction is not painful. After abduction to about 45 to 60 degrees, patients would start to experience pain which intensifies as the arm abduction continues. After passing through 120 degrees of abduction, the movement becomes pain free again. Figure 5 explains this phenomenon. When a patient abducts his arm to about 60 degrees, the greater tubercle is directly below the acromion and the space is very limited. Soft tissue structure, most commonly the supraspinatus tendon and subacromial bursa would be nipped upon. After abduction to more than 120 degrees, the greater tubercle has moved more inward so that there is more space and pain subsides.2

Etiology

The cause of impingement may be structural or functional as listed in Table 1. Many a time, a combination of these factors coexists in the same patient.

Down-sloping acromial angle may be congenital or due to acquired posture. Subacromial spur and acromio-clavicular joint spur are not uncommon after the middle age. Calcium crystal deposition perhaps is more common in young adult and may be shown on plain radiographs. In supraspinatus muscle tendonitis, the inflammatory changes decrease the subacromial space and set up a viscous cycle. Functional factor with rotator cuff weakness is present in most patients. This can be the cause or consequence of the impingement. The rotator cuff muscles may be weak due to disuse or fatigue after overuse. The weakness of these muscles leads to a

Table 1. Causes of impingement syndrome

<table>
<thead>
<tr>
<th>Structural</th>
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<tbody>
<tr>
<td>Acromion : Down-sloping acromial angle</td>
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<tr>
<td>subacromial spurs</td>
<td></td>
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<tr>
<td>A-C Joint spurs</td>
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<tr>
<td>Tumoral calcinosis at supraspinatus</td>
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<tr>
<td>Fracture of greater tubercle</td>
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<table>
<thead>
<tr>
<th>Functional</th>
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<tr>
<td>Rotator cuff weakness/fatigue</td>
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<tr>
<td>Scapulothoracic weakness or instability</td>
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<tr>
<td>Joint hyperlaxity</td>
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SHOULDER IMPINGEMENT SYNDROME

decrease in their normal downward vector force so that the head of humerus moves cranially and reduces the subacromial space. Scapular movement also contributes to abduction of the shoulder joint after the initial 60 degrees of abduction. If the elevator of the scapula is weak, co-ordination of normal shoulder abduction will be affected and deconditioning of rotator cuff muscle will result. Impingement syndrome may then occur as a consequence.

Management

Impingement syndrome should be managed early. Severe irreversible complications will ensue if treatment is delayed (Table 2). The goal of management is to decrease pain and inflammation of the impinged structure and increase the subacromial space. The traditional treatment options include Non-steroidal anti-inflammatory drugs (NSAIDs), subacromial steroid injection, physiotherapy and surgery.

Table 2. Complication of impingement syndrome

<table>
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<tr>
<th>Subacromial bursitis</th>
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<tr>
<td>Rotator cuff tendinitis</td>
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<tr>
<td>Degenerative thinning and rupture of rotator cuff tendons</td>
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<tr>
<td>Frozen shoulder</td>
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Non-steroidal Anti-inflammatory Drugs

A Cochrane review showed only limited evidence of the effectiveness of NSAIDs in the treatment of shoulder impingement syndrome. Only one placebo-control study has ever been available but no benefit was demonstrated for NSAID treatment. Two studies compared NSAIDs with placebo subacromial injection and they demonstrated some beneficial effect with respect to pain when assessed four weeks after treatment. One has to weigh this mild treatment effect against the potential side effects of long-term NSAID therapy.

Subacromial Steroid Injection

The Cochrane review identified seven controlled studies with subacromial steroid injection. These studies had variation in the types and dosages of steroids used. The timing and the number of injections also varied. Only the results from two studies could be pooled together. There was improvement in both pain and range of movement as compared to lignocaine injection when assessed four weeks after the treatment. For the other five studies, two favored steroid injection, two showed no difference and one favored placebo in terms of therapeutic effects.

Taken these studies together, it could be concluded that there may be some but limited evidence of efficacy of subacromial steroid injection in the treatment of shoulder impingement syndrome. The optimal type and dosage of steroid, and the frequency of injection is still unclear.

The lateral or posterior approach can be used to inject the subacromial bursa; the lateral approach shown in Figure 6 is safer to perform. The patient is to be sitting up with relaxed shoulder and neck muscles. The lateral edge of the acromion is located and the space below its midpoint is marked. This is the point of entry and the angle of entry should parallel the patient's own acromial angle (average 50 to 65 degrees). The depth of injection varies according to the patient's subcutaneous tissue thickness and muscle development (2.5 cm in an asthenic patient to 7.5 cm to a very obese patient). The needle is advanced through the subcutaneous tissue and the deltoid muscle. Subtle resistance would be encountered when the needle comes to the deep deltoid fascia. A "giving way" sensation is appreciated when the subacromial bursa is entered. One should never inject under moderate to high pressure. If high injection pressure is encountered, try to rotate the needle 180 degree. If the tension remains high, reposition the needle by 0.5 cm increments or by altering the angle of entry by 5 to 10 degrees. I usually inject my patients with 40 mg of DepoMedrol mixed with 5 ml 1% lignocaine.

Figure 6. Subacromial bursa injection.
solution. A successful injection would result in more than 50 percent reduction in pain immediately due to the local anesthetic effect.

All the studies mentioned above did not report any significant side effects of local steroid injection to the subacromial bursa. The potential side effects of local steroid injection are listed in Table 3. Major complications are uncommon. In my personal experience of performing more than 200 subacromial injections in the past 8 years, infection and tendon rupture have not been encountered. Patients should be warned that there may be flare up of the pain in 24 to 48 hours' time due to local crystal reaction. Flushing or menstrual irregularity is usually very transient.

Table 3. Potential side effects of local steroid injection

<table>
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<tr>
<th>Side Effect</th>
<th>Incidence</th>
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<tr>
<td>Infection</td>
<td>1/14000 to 1/500000</td>
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<tr>
<td>Subcutaneous fat necrosis and skin atrophy (&lt;1/100)</td>
<td>Painful reaction: 24-48 hrs.</td>
</tr>
<tr>
<td>Tendon rupture: detection bias</td>
<td>Flushing</td>
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<tr>
<td>Menstrual irregularities</td>
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Physiotherapy

Various types of physiotherapy have been tried for the shoulder impingement syndrome.

Laser

There are three controlled studies for laser therapy. One showed significant improvement in term of pain, one demonstrated a trend of improvement in pain, but one did not show any benefit.

Ultrasound

Four controlled trials on ultrasound showed no benefit in the shoulder impingement syndrome. The only positive trial was on a group of patients with calcific tendonitis.

Exercise

Structured and supervised exercise therapy has been reported to be very useful in shoulder impingement. Programs included exercises to reduce mechanical subacromial stress, relearning of normal pattern of movement, specific endurance training to increase the nutrition of the collagen tissue, and simple exercises to prevent relapse. Patients were followed up and reassessed for a long period of time. Both pain and function has been shown to improve with exercise treatment.

Mobilization

Patients with shoulder impingement syndrome frequently develop stiff shoulders. Mobilization techniques on top of the exercise programs are advocated. Two studies on the use of glenohumoral posterior guide, glenohumoral anterior guide and long axis traction demonstrated additional benefits on pain control and mobility of the shoulder joints.

Acupuncture

There are five acupuncture studies which involve 328 patients reported in the literature. This form of treatment is not useful.

Practical Approach in Local Setting

My suggested plan of management of the shoulder impingement syndrome is listed in Table 4. The weight pendulum exercise is to ask the patient to hold a weight about 2.5 kg to 5 kg in standing or sitting position. The arm is allowed to swing back and forth or in a small diameter circle.

I would also teach my patients some simple but effective exercises in my clinic while they are waiting for the physiotherapy appointment (Figures 7-10).

Surgery

For refractory cases of shoulder impingement syndrome, surgery is indicated. In most cases, the orthopedic surgeons can perform arthroscopic therapeutic procedures.

Table 4. Management of impingement syndrome

- Posture: sit and stand high
- Restrict overhead and positioning, reaching and lifting
- Reduce inflammation
  - Local steroid injection
- Weight pendulum stretching exercise
- Discouraging arm sling which would lead to frozen shoulder
- Exercise program + mobilization +/- laser
- Surgery for resistant cases
without the need for open surgery. Surgery may include acromioplasty, resection of coracoaromial ligament, removal of osteophytes, resection of acromio-clavicular joint and resection of fibrotic subacromial bursa. The torn supraspinatus muscle tendon can also be repaired at the same setting as well.

References