Shoulder impingement

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Introduction

Shoulder impingement syndrome is probably the most common painful condition of the shoulder. Dynamic compression of the rotator cuff tendons in the subacromial space with arm elevation causes inflammation and pain.

Three types of shoulder impingement occur: subacromial, posterior and subcoracoid. Subacromial impingement is by far the most common, while the latter two are rare and will not be discussed further.

Clinical aspects

The patient with subacromial impingement complains of night pain and pain with certain movements, e.g. abduction of the arm. On examination pain is felt through a range of 60° - 120° when the arm is elevated (the painful arc). Neer's sign,[1] elicited by stabilising the scapula and abducting the arm to above 90°, is positive. Neer's test,[1] where local anaesthetic is injected into the subacromial bursa, relieves the symptoms.

Pathophysiology

Neer[1] described three progressive stages of shoulder impingement: (*i*) stage 1 — reversible oedema and haemorrhage about the rotator cuff, typically affecting patients below 25 years of age; (*ii*) stage 2 — fibrosis and tendinosis in the rotator cuff, usually seen in patients between the ages of 25 and 40 years; and (*iii*) stage 3 — tendon rupture and subacromial spurs occurring in the older patient.

The basis for the shoulder impingement syndrome is the restricted space that exists between the coracohumeral arch above and the humeral head and tuberosities below. The rotator cuff tendons, biceps tendon and the coracohumeral ligament pass through this space. The subacromial bursa aids in passage of these structures. Compression of these structures is also minimised by a normal acromioclavicular joint, a coracoacromial arch that allows free passage of the rotator cuff mechanism and normal capsular laxity. Laxity may be increased or decreased, and both may cause secondary impingement due to altered biomechanics of the shoulder during movement.

Anterior instability allows the humeral head to translate anteriorly with mechanical impingement of the supraspinatus tendon on the coracoacromial arch. The supraspinatus tendon is vulnerable to injury because of a relatively avascular critical zone near the site of attachment of the tendon to the greater tuberosity and anatomical variations in the anterior excursion and slope of the acromion and the shape of its inferior margin.[2]

Rotator cuff calcification

Rotator cuff calcification affects about 7% of the population and is a common mechanical cause of subacromial impingement. The calcification may also cause pain, tenderness, swelling and restricted movement. The cause of the calcification is unknown, but may be related to metabolic abnormalities and trauma. The calcification is most commonly in the supraspinatus tendon, but may involve the bursa or infraspinatus, teres minor, subscapularis, biceps and pectoralis major tendons. The following sequence of rotator cuff calcification may occur: (*i*) silent (asymptomatic deposition of calcium hydroxyapatite); (*ii*) mechanical phase (tendinous calcification causes elevation of the bursa with subacromial bursitis, subbursal or intrabursal rupture); or (*iii*) adhesive periarthritis. There is no significant correlation between the size of the calcification, radiographic appearance and the clinical symptoms. Irregular, poorly defined calcification is associated with acute flares of pain, while well-defined calcification is not.[2-4]

Classification of shoulder impingement

Several attempts at classification of impingement have been made. Matsen[5] classifies causative factors of impingement into two groups, viz. structural and functional factors. Structural factors relate to AC joint (osteophytes and congenital anomalies), acromion (shape, os acromiale or osteophytes), coracoid process (congenital or post-traumatic), sub-

acromial bursa (inflammation or thickening), rotator cuff (calcification, thickening or post-traumatic thickening) or humerus (congenital or fracture with varus malunion or superior malunion of the greater tuberosity). Functional factors include abnormalities in position or motion of the scapula, disruption of the mechanism leading to normal depression of the humeral head, capsular laxity and capsular stiffness. Fu and associates[6] also divided impingement disorders into two groups, namely primary and secondary impingement. Primary impingement occurs mainly in non-athletic persons and is related to alterations in the coracoacromial arch. Secondary impingement occurs mainly in athletes involved in sports requiring overhead movement of the arm and related to either glenohumeral or scapular instability.

X-ray views — shoulder impingement

A standard impingement series should include the following: (*i*) AP shoulder with internal rotation; (*ii*) AP shoulder with external rotation; (*iii*) true AP shoulder; (*iv*) Neer's supraspinatus outlet view (Fig. 1); and (*v*) axial view.

AP shoulder with internal rotation

This view shows the greater tuberosity in profile and is important to demonstrate a fracture of the greater tuberosity in a patient who has fallen on the tip of the shoulder.

AP shoulder with external rotation

This view shows the posterolateral aspect of the humeral head in profile and demonstrates the Hill-Sachs deformity of the humeral head after a dislocation.

Fig. 1. Outlet view. Type 3 or hooked acromion (arrow).

True AP shoulder

This view shows the glenohumeral joint space optimally. The blade of the scapula is at 90° to the primary beam.

Neer's supraspinatus outlet view

This view demonstrates the type of acromion as well as bony causes of supraspinatus impingement, e.g. acromial spur formation. An os acromiale may also be seen.

Axial view

This view demonstrates the relationship of the glenoid and the humeral head. Abnormalities of the acromion, coracoid and AC joint are well demonstrated.

Additional views

1. Westpoint view: the anteroinferior aspect of the glenoid rim is well assessed for the presence of a bony Bankart lesion or calcification suggesting a chronic soft tissue injury.

2. Angled AP view of the acromion: AC joint osteophytes, os acromiale and a type 3, hooked acromion can be demonstrated.

3. Bicipital groove view: osteophytic spurs or calcification causing biceps tenosynovitis may be seen.[7]

Review of local opinions in shoulder impingement reporting

A questionnaire was sent to a group of 35 radiologists and orthopaedic surgeons. They were asked to comment on the style of reporting acceptable in their working environment and relevance of the standard impingement series of the shoulder.

Respondents varied in their response to the need for mentioning positive or negative findings in the report. They most often commented on the width of the subacromial space and the presence or absence of acromial spurs. The orthopaedic surgeons made special note of the importance of bony spurs. The AC joint, glenohumeral joint, rotator cuff calcification and bone texture were all part of the routine radiological assessment.

One observer made a very important statement: 'My philosophy in reporting shoulder films is to ensure that even if the X-rays are not available at the time of performing a subsequent examination, e.g. shoulder MRI or ultrasound, the report of the X-rays should be detailed enough to give one a good mental picture. Ideally the X-rays should be available before a scan.'

Recommended report on shoulder impingement series

Prior to dictating a meaningful report, the radiologist assesses the following features on the films.

The acromion

1. Profile: types 1, 2 and 3. High association between rotator cuff tears and type 3 acromions.
2. Os acromiale.
3. Lateral downsloping of the acromion.
4. Acromial osteophyte formation.

Acromioclavicular joint

Acromioclavicular joint arthrosis and osteophyte formation may be the primary cause of the patient's pain, or may cause supraspinatus impingement or subacromial bursitis.

Greater tuberosity and glenohumeral joint

Sclerosis and irregularity of the greater tuberosity is associated with chronic impingement. Assess for fractures, Hill-Sachs deformity and loose bodies.

Acromiohumeral interval (AHI)

AHI less than 1 cm with a break in the 'Shenton line' of the shoulder implies rotator cuff dysfunction (weakness or tear).

Rotator cuff calcification

Position of the calcification is important. It may follow acute trauma or represent the result of ischaemic tendinosis after chronic impingement (Fig. 2).

Fig. 2. Calcification in supraspinatus tendon (arrow) with subbursal rupture.

Post-traumatic osteolysis

This is a post-traumatic inflammatory arthritis and is cured by debridement.

A suggested normal report is as follows: 'The acromioclavicular and glenohumeral joints are normal. There is no rotator cuff calcification or bony spur formation'.

With the appropriate films and a knowledge of the implications of the various radiological findings, positive findings are conveyed by the report and may establish the cause of the painful shoulder.

References

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