Rotator cuff tears

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Abstract

Rotator cuff tears are a common cause of pain and weakness in the shoulder. We describe the anatomy and function of the normal rotator cuff, before an overview of cuff tears, with reference to their incidence and pathogenesis. Finally, we discuss clinical presentation, examination findings, treatment options and the prognosis of cuff tears. The authors of this article hope to enable the reader to understand rotator cuff disease, assess patients with suspected rotator cuff tears and discuss the basic treatment options with patients.

Keywords Arthroscopy; cuff arthropathy; rotator cuff tear; shoulder pain; subacromial impingement

Introduction

The term rotator cuff disease describes a spectrum of conditions that present with varying degrees of pain and weakness. In addition, many rotator cuff tears are completely asymptomatic and never present to healthcare professionals. Rotator cuff tears are described as either acute post-traumatic, chronic degenerative (most common) or acute-on-chronic post-traumatic (a new symptomatic extension of an existing asymptomatic tear).

Anatomy and function of the rotator cuff

The rotator cuff consists of four muscle-tendon units (Figure 1): the muscles arise from the scapula and their tendons insert onto the proximal humerus. Supraspinatus and infraspinatus arise from their respective fossae on the posterior surface of the scapula and insert onto the greater tuberosity. They are innervated by the suprascapular nerve, which arises from the upper trunk of the brachial plexus (C5/6). The teres minor originates from the middle third of the lateral border of the scapula and inserts onto the inferior facet of the greater tuberosity. Its nerve supply is from the posterior branch of the axillary nerve, a terminal branch of the brachial plexus. Finally, the subscapularis extends from the anterior surface of the scapula to the lesser tuberosity and humeral neck immediately medial to the long head of biceps tendon. The subscapularis receives its nerve supply from the upper and lower subscapular nerves arising from the posterior cord of the brachial plexus.

During shoulder abduction the rotator cuff muscles act together to stabilize the humeral head within the glenoid in a process known as concavity compression. In addition, the subscapularis and the posterior cuff (infraspinatus/teres minor) help to balance the anterior and posterior translation of the humeral head. The four rotator cuff muscles work in concert, in that most of the cuff is working with all activities. This said, classically each muscle-tendon unit maintains its own function, which forms the basis of strength testing in a clinic environment:

- supraspinatus – abduction of the glenohumeral joint (GHJ)
- infraspinatus and teres minor – external rotation of the GHJ
- subscapularis – internal rotation of the GHJ.

Epidemiology

The prevalence of rotator cuff disease increases with age; MRI scanning reveals partial or complete tears of the rotator cuff in only 4% of patients aged less than 40 years compared with 54% of patients over 60 years. Templehof et al demonstrated using ultrasound, that 13% of the population in the fifth decade, 20% in the sixth decade, 31% in the seventh decade and 51% in the eighth decade had an asymptomatic rotator cuff tear. More than half of these asymptomatic cuff tears will progress in size and become symptomatic within 3 years.

Pathogenesis

The pathogenesis of rotator cuff tears is complex and multifactorial. Broadly speaking, there are intrinsic and extrinsic factors affecting the rotator cuff tendons. Codman originally described the intrinsic theory that rotator cuff disease was due to degeneration of the tendon itself within a critical zone of hypovascularity, located 1 cm from the insertion of supraspinatus on the humeral head. Here, an area of the tendon exists which is vulnerable to degeneration and due to its poor blood supply, has impaired healing characteristics.

The extrinsic theory is that the supraspinatus tendon is compressed and damaged between the acromion, the coracoacromial ligament and the humeral head; so-called subacromial impingement. In reality it is likely that rotator cuff tears occur due to a combination of both theories with contributions from age-related degeneration and acute injuries. As such, rotator cuff disease is often seen as a continuum from subacromial impingement to partial or full thickness rotator cuff tears, prior to developing arthritis.

Clinical assessment

The presence of a rotator cuff tear can often be detected through careful history taking and carrying out a thorough examination. This diagnosis is then confirmed or refuted by ultrasound scanning or magnetic resonance imaging (MRI) if needed.

History

Patients with degenerative rotator cuff tears often present with insidious onset of shoulder pain and weakness. Pain is frequently brought on by loading activities away from the side of the body or over shoulder height. Classically, patients localize the pain to the insertion of the deltoid on to the acromion and radiating down the lateral side of the shoulder. They also may rub the side of the shoulder with the flat of the hand whilst describing the

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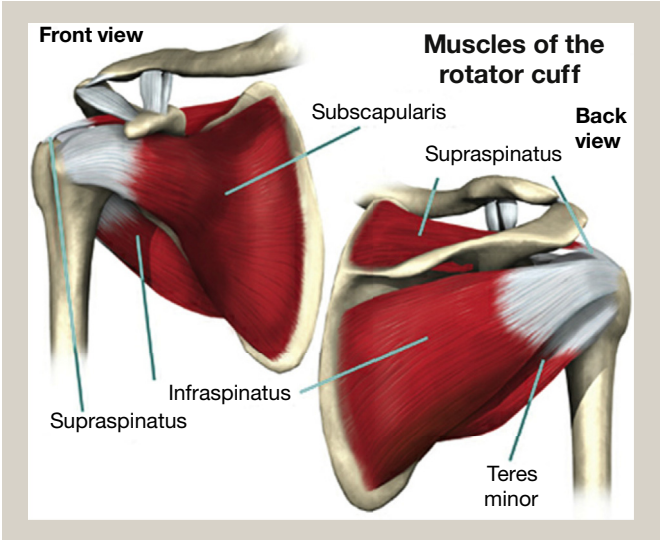

Figure 1 Diagram showing the anatomy of the rotator cuff muscle-tendon units.

pain, though they rarely have any specific points of tenderness. In the presence of larger tears, patients may well complain of reduced range of movement in the shoulder. Initially active movements are reduced, but as the condition progresses passive movements also reduce secondary to capsular contractures. Finally, mechanical symptoms of catching or clicking are relatively common from within either the subacromial space or the glenohumeral joint due to altered mechanics of the shoulder.

Many patients present with a background of intermittent mild shoulder pain that suddenly increases following trivial injury, which would suggest completion of a partially torn or diseased tendon. In addition, many patients are referred following trivial trauma with a painful shoulder, where an ultrasound scan has revealed a cuff tear. It is highly likely in these cases that the cuff tear was a pre-existing degenerative asymptomatic cuff tear. In these cases, it is vital that the patient understands that their symptoms may in fact be due to a secondary condition rather than the cuff tear in isolation. Less frequently younger patients present with truly acute tears occur following a high-energy injury such as a shoulder dislocation. In these patients, instability may become a problem secondary to loss of cavity compression, so it is vital that rotator cuff function is assessed once the initial pain from the injury has subsided.

Examination

The clinical examination allows the clinician to confirm the suspected findings elicited from the history to aid diagnosis, but also make relevant observations in considering any surgical intervention. Initially both active and passive range of movement must be assessed. Passive stiffness is a relative contraindication to rotator cuff repair as although the cuff may heal, the functional outcome will be poor. The supraspinatus and infraspinatus are inspected from the back where muscle wasting is seen in long-standing and larger tears. The individual muscles of the rotator cuff should be isolated and assessed for weakness – abduction of the shoulder in the plane of the scapula for supraspinatus, external rotation for infraspinatus and teres minor, and internal rotation for subscapularis.

Investigations

Radiographs of the shoulder should be obtained in all patients presenting with shoulder pain in order to assess for any evidence of arthritis, avascular necrosis or tumours, which may mimic the symptoms of a rotator cuff tear. It is important to assess for any proximal migration of the humeral head, suggesting a chronic rotator cuff tear, which is often large and may not be amenable to repair. The inferior aspect of the humeral head should be level with the inferior glenoid; Figure 2 shows at least 1 cm of proximal migration of the humeral head.

Preoperatively, a rotator cuff tear can be visualized through the use of ultrasound or MRI. Ultrasound has the advantage of being relatively cheap, easily available and easy to use with adequate training. The tear location, type and size can be described, but the information provided is highly dependent on the operator, such that tears may be reported that are subsequently not found at the time of surgery and visa versa. MRI may give additional information on the quality of the rotator cuff muscles as atrophy and fatty infiltration can be seen; evidence that the tear may be longstanding and more difficult to repair or even be irreparable.

Differential diagnosis

Differential diagnoses include simple subacromial impingement pain, calcific tendonitis and early glenohumeral arthritis. Subacromial impingement typically occurs in younger patients; the weakness observed from impingement is secondary to pain rather than a cuff tear. This can be confirmed by performing Neer's test; examining the shoulder both prior to and following an injection of local anaesthetic into the subacromial space. If normal cuff strength resumes following injection, it suggests impingement rather than a significant cuff tear. Cuff arthropathy (Figure 3) can be ruled out by the presence of a normal shoulder X-ray, and deposits of calcific tendonitis are frequently visible on the X-ray if not the ultrasound scan.

Classification

The majority of cuff tears involve the supraspinatus and infraspinatus tendons. These tears are described as posterosuperior cuff tears. Anterosuperior tears are less common and typically extend anteriorly through the supraspinatus tendon to involve the 'rotator interval' (the space between supraspinatus and subscapularis through which the long head of biceps becomes intra-articular) and/or the subscapularis tendon. It is important to classify rotator cuff tears to document their size and location, and to enable preoperative planning. There are many classification systems described for this condition but those most useful in clinical practice are shown in Table 1. They describe systems to evaluate tear size, degree of cuff retraction and chronicity/disuse.

The massive retracted cuff tears associated with significant muscle atrophy are less likely to be repairable, and even if repairable have the poorest prognosis. The likely natural history of rotator cuff tears is that approximately 50% increase in size with time, partial-thickness tears progress to full-thickness tears and small full-thickness tears eventually become massive full-thickness tears.