MRI and arthroscopic surgery: a combined breakthrough in management of shoulder pain

Precise hand function, as much as superior brain power, has earned man his place at the head of the evolutionary tree. Placement of the hands in the optimal functional position owes a debt to the enormous range of movement at the shoulder. However, this extended range is at the expense of stability, and man readily falls victim to a number of soft tissue syndromes of the shoulder that are painful and disabling.

The shoulder is formed by a complex system of five articulations. The main glenohumeral joint is a ball and socket joint with a relatively small area of bony contact enlarged by the cartilaginous glenoid labrum which enhances stability without restricting movement. The rotator cuff muscles 'tuck in' the humeral head to form a stable fulcrum for abduction. An important function of this tucking in is that the humeral head is lowered away from the acromion. If the rotator cuff is damaged by injury or degeneration, a poor fulcrum results in weak elevation and, in addition, the humeral head rides up to impinge on the supraspinatus tendon, causing a vicious cycle of pain, inflammation, and further damage to the rotator cuff. Magnetic resonance imaging (MRI) is widely credited as the major breakthrough in management of rotator cuff syndromes, but in reality it owes a large part of its success to the parallel development of arthroscopic surgery, which offers an opportunity for minimally invasive decompression.

MRI provides accurate and non-invasive assessment of the soft tissue components of the shoulder (figure), and has become the procedure of choice after plain radiography. T1 weighted images yield excellent anatomical definition; T2 weighted images offer poorer definition, but pathological processes show up conspicuously as 'bright' signals in relation to surrounding normal tissues, because of increased water/oedema or cellular content. With continued development of scanning sequences and techniques, MRI has proven accurate, particularly in the assessment of rotator cuff syndromes and subacromial impingement, but also in stenosis of the coracoacromial arch, and osteoarthritis of the glenohumeral and acromioclavicular joints.

A further refinement for evaluation of rotator cuff tears is fat suppressed MR arthrography. With intra-articular injection of gadopentetate dimeglumine, contrast fills the defect caused by a partial tear and enters the subacromial-subdeltoid space in full thickness tears. With no significant increase in morbidity, this technique allows the accurate differentiation of partial and small full thickness tears—a weak area in conventional MRI.

However, accurate assessment is only of value if it alters management. In days gone by, the substantial morbidity of open shoulder surgery made early intervention impossible. With the advent of arthroscopic techniques, MRI

Magnetic resonance imaging scans of the left shoulder: T1 weighted (left) and T2 weighted (right). The T1 weighted image clearly defines the anatomy and demonstrates a degree of impingement by the acromioclavicular joint on the supraspinatus tendon. There is no tear of the tendon itself, but the T2 weighted image shows an abnormal, white, signal at the insertion point, indicating the presence of tendinitis.
comes into its own. Preoperative assessment of the size of a full thickness rotator cuff tear is important to operative planning: small tears may be treated arthroscopically, larger ones may require open arthrotomy, and massive tears may be irreparable, or require a muscle flap transfer.  

Arthroscopic acromioplasty now offers much reduced perioperative morbidity, but a long term outcome equivalent to that achieved with open surgery. Early decompression in impingement syndromes relieves symptoms and avoids repeated microtrauma and degeneration of the rotator cuff, which could otherwise progress to complete rupture.

The role of MRI in assessing shoulder instability is still evolving. There are conflicting reports in the literature about its value in identifying labral tears. Legan et al found MRI to be accurate and reliable in predicting anterior tears, but less so for tears of the superior labrum. As these form the majority of surgically correctable cases, they concluded MRI to be a useful technique for evaluation of shoulder instability, even though it proved unreliable for the relatively uncommon posterior and inferior tears. In contrast, Green and Christensen found MRI insufficiently accurate in predicting the type and severity of labral lesions to be useful for surgical planning. Computed tomography arthrography remains likely to be more sensitive for purely labral lesions, although MRI arthrography would better depict the spectrum of other soft tissue derangement.

Caution must be exercised in assessment of the labrum. A wide range of morphology and signal has been reported in normal volunteers. Glenoid labral tears are being reported with increasing frequency—especially in athletes using overhead throwing techniques—but their significance and need for treatment remain controversial. Arthroscopic labral debridement is the current preferred treatment and seems to have a good initial outcome. However, longer term follow up reveals less good results. Labral tears may result from instability, and debridement in this situation is disappointing unless surgical stabilisation is also performed.

At this stage in the learning curve, it is too early to say which patients should undergo MRI. Arthroscopic surgery has given us a lower threshold for surgical referral and MRI may form part of the decision making process, but interpretation is by no means straightforward, and it is wise to confer with the surgeon in ‘question as to which investigation would be most helpful, and where it should be done.

In summary, recent advances in imaging and minimally invasive surgical techniques have enhanced our understanding of soft tissue syndromes of the shoulder. However, none of the techniques described replaces the need for careful clinical assessment by an experienced and knowledgeable clinician. Judgment use of diagnostic imaging must be thoughtfully evaluated in the light of symptomatology and physical findings, and careful consideration given to the appropriate option for intervention. Only then can we claim a breakthrough for medical science.

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