TREATMENT OF CHRONIC ROTATOR-CUFF IMPINGEMENT
BY ARTHROSCOPIC SUBACROMIAL DECOMPRESSION

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We report a prospective study of 49 patients who had arthroscopic subacromial decompression for chronic rotator-cuff impingement. All patients were assessed preoperatively and at 3, 6 and 12 months using the modified UCLA shoulder score.

The dominant arm was affected in 35 patients, but only 13 recognised overuse as a cause of their shoulder pain. Before operation, the UCLA shoulder score was poor or fair in all patients. After three months only 28% of patients had satisfactory relief of symptoms but at one year 85% of patients examined had a good or excellent result. Patients with calcific tendonitis recovered more quickly; 93% reported a good result at six months.

We conclude that arthroscopic subacromial decompression is an effective form of treatment, but that patients should be warned that recovery from surgery may be prolonged.

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The expression 'impingement of the rotator cuff' was used by Neer\textsuperscript{1} who described changes in the rotator-cuff tendon due to abrasion and pressure from the anterior edge of the acromion and the coracoacromial ligament. He later delineated three stages of rotator-cuff disease from reversible inflammation (stage I) to full-thickness tear of the tendon (stage III).\textsuperscript{2} Stage-II changes were described as chronic inflammation and fibrosis, possibly including partial-thickness tears of the cuff. These are common findings at operations for decompression in patients with persistent symptoms which have not responded to conservative treatment.

The underlying causes of rotator-cuff impingement may be subdivided into intrinsic disorders of the rotator cuff and extrinsic pressure from the coracoacromial arch. In intrinsic disorders, the tendon is thickened and inflamed at areas of calcification, swollen at the site of partial cuff tears, or covered by a chronically inflamed and indurated subacromial bursa. In extrinsic cases, the shape of the acromion,\textsuperscript{1,3} the attachment of the coracoacromial ligament\textsuperscript{4-6} and changes in the acromioclavicular joint\textsuperscript{7} have been implicated. It is often stated that in most instances overuse of the affected arm is the basic cause of impingement.\textsuperscript{8,9}

Our study aimed to identify common factors which may point to the underlying cause of the chronic impingement syndrome in patients who were selected for arthroscopic subacromial decompression. The effectiveness of this procedure and rate of recovery after surgery were also assessed to identify factors which influence the outcome.

PATIENTS AND METHODS

We have used arthroscopic subacromial decompression since 1989 for chronic rotator-cuff impingement. As the technical demands of this procedure need time to be acquired this study was started after experience of two-and-a-half years.

We defined rotator-cuff impingement as inflammatory changes in the rotator cuff and the overlying subacromial bursa which had produced shoulder pain with loss of function and increased pain on elevation of the arm above shoulder level. This may develop after injury or overuse; a very similar clinical picture can arise due to a calcific deposit in the substance of the tendon.

We treated 49 patients with chronic rotator-cuff impingement after the failure of a minimum of six months of conservative treatment. A detailed clinical history was recorded; this included the onset of symptoms, with specific reference to evidence of any injury, overuse or unusual use of the affected arm, and shoulder function and hand dominance, with detailed information about normal work and leisure activities. On the basis of this information
patients were considered to be either manual or non-manual workers. Regular sporting activities were recorded as overhead (tennis, swimming, volleyball) or non-overhead (bowls, golf, football, rugby). There were 31 men and 18 women with a mean age of 39.3 years (24 to 65). The dominant side was affected in 35 of the 49 patients. Thirty patients had a manual occupation and 31 regularly played overhead sports. A history of trauma at the onset of symptoms was given by 13 and of unusual overuse of the arm in 13. The other 23 patients reported the gradual onset of shoulder pain without injury or overuse. Symptoms had been present for over a year in 45 patients and between six and 12 months in four.

**Previous treatment.** All the patients had had previous treatment. We obtained details of anti-inflammatory medication, steroid injections and the type of physiotherapy (Table I). Methods of physiotherapy varied widely, but were broadly grouped into symptomatic relief by heat or ultrasound and rehabilitation by mobilising and strengthening exercises.

All patients were examined by the senior author (RWN). Rotator-cuff inflammation was diagnosed by tenderness on the surface of the cuff anterior to the edge of the acromion, pain on abduction above the shoulder with or without a painful arc, and a positive impingement sign on abduction and internal rotation of the glenohumeral joint with the shoulder girdle stabilised by the examiner’s hand. Patients with pain thought to arise from the glenohumeral joint, acromioclavicular joint or the neck were excluded, as were those with full-thickness cuff tears. The glenohumeral joint was carefully assessed in an attempt to exclude rotator-cuff impingement secondary to glenohumeral instability. If there was any doubt about the diagnosis of impingement the tests were repeated after the injection of 5 ml of 1% lignocaine into the subacromial bursa. The reduction or abolition of pain was considered to be a reliable indicator of a rotator-cuff disorder.

Radiographs obtained were a standard anteroposterior view, an anteroposterior view with 20° of caudal tilt and a lateral scapular view. The presence and size of soft-tissue calcification, acromial shape (type I flat, type II curved, type III hooked) and degenerative changes in the acromioclavicular joint were recorded. If the clinical history or examination suggested the possibility of a cuff tear, an arthrogram or MRI of the shoulder was performed.

Before surgery, patients were advised to begin or continue on anti-inflammatory medication if possible and those who had never had a steroid injection into the subacromial space were offered one using 40 mg of methylprednisolone with 10 ml 0.5% bupivacaine. After this, if the patient had partial but incomplete remission of symptoms, the injection was repeated once after six weeks. Physiotherapy concentrated on rehabilitation of shoulder function; this included avoidance of movement and positions which caused pain, glenohumeral mobilisation with stretching in horizontal flexion, internal rotation and extension, and rotator-cuff strengthening exercises using exercise springs and rubber bands.

After six months of supervised non-surgical treatment, persistent pain and signs of rotator-cuff impingement were the indication for arthroscopic subacromial decompression. Preoperative assessment of function was performed by a physiotherapist (CP) using the modified UCLA shoulder score, which allocates points for pain, function, movement and patient satisfaction and has a maximum score of 35 points. Patients with a score of less than 27 were recorded as having a fair or poor function. Those with 27 points or more had a good or excellent outcome. The same physiotherapist examined patients at three, six and 12 months after surgery, and a record was made of weeks absent from work and from sport, and the number of hours of physiotherapy.

**Operative technique.** Under general anaesthesia, with the patient in the lateral decubitus position, between 8 and 12 lb (3.9 to 5.4 kg) of skin traction were applied to the limb. A posterior portal was used to inspect the glenohumeral joint before subacromial decompression. Through the same skin incision, the arthroscope was then placed into the subacromial space, with inflow irrigation through a wide-bore cannula inserted parallel to the arthroscope through a supplementary posterior portal. This gave excellent distension of the bursa without obstructing the arthroscope or shaver, and did not need an arthroscopy pump. The shaver was inserted through an anterolateral portal, and a soft-tissue resector blade was used to remove adhesions and to expose the anatomical landmarks of the undersurface of the acromion. For calcific deposits, the rotator cuff was probed to locate the swelling. This was needled and the deposit removed by curettage.

Decompression was performed using a combination of a soft-tissue resector blade and an olive-shaped acromioplasty bur. Punches were used to excise the coracoacromial ligament. Acromioplasty was performed by removing the anterior edge of the acromion until it was flush with the anterior aspect of the clavicle. The amount of bone excised from the undersurface of the acromion varied, but in patients with definite ‘spurring’ of the anterior edge of the acromion, at least 5 mm were resected.

After operation, a sling was advised but patients were encouraged to use their arms and to discard it as soon as possible. All patients were given a programme of shoulder mobilisation exercises which emphasised glenohumeral

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**Table I.** Methods of treatment before referral to the shoulder clinic

<table>
<thead>
<tr>
<th>Method</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-inflammatory agents</td>
<td>18</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>44</td>
</tr>
<tr>
<td>Steroid injections</td>
<td></td>
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<td>1</td>
<td>20</td>
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<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
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<td>&gt;3</td>
<td>7</td>
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rotation and avoided repeated abduction movements. After re-examination at three weeks, those who were having difficulty with shoulder mobilisation attended physiotherapy for supervised mobilising and strengthening exercises.

RESULTS

Radiographs showed calcification within the rotator cuff in 18 shoulders; in 13 of these the maximum dimension was greater than 1 cm. The acromial shape was judged to be type I or type II in 44 shoulders and type III in five. There was osteoarthritis of the acromioclavicular joint with spur formation in eight shoulders.

Before surgery the UCLA shoulder score was less than 27 in all 49 patients (Fig. 1). Forty-four were examined after three months and 17 (39%) then had a score of 27 or more. After six months, 38 patients were examined and 27 (71%) had a score of more than 27 points. One year after surgery, only 34 patients were available for examination and 29 (85%) had a score greater than 27 points. The considerable loss to follow-up means that these differences could be regarded only as trends.

Of the 18 patients who had radiological evidence of tendon calcification (Fig. 2) 15 were examined at three months and eight (53%) had a good result. At six months, 14 of the 15 patients (93%) examined and one year after surgery all 12 patients who were examined had good results.

At all time intervals (Table II) a greater proportion of the patients with tendon calcification who attended for re-examination had satisfactory results. This appeared to be independent of the size of the calcium deposit.

After one year there was a good or excellent result in 16 (89%) of 18 manual workers and in 11 (78%) of 14 non-manual workers. Of 22 patients who had participated in regular overhead sports 21 (96%) had a good result at one year compared with 8 of 11 patients (73%) who did not play such sports. The average duration of absence from work in manual workers was 12.8 weeks compared with 7.2 weeks for non-manual workers. Patients who participated in overhead sport returned to these activities after an average of 22 weeks. After operation 16 patients had needed physiotherapy to improve glenohumeral movement, but the longer-term outcome in this group was no different.

DISCUSSION

Disorders of the rotator cuff occur in all adult age groups, but impingement is more common before the age of 50 years, with rotator-cuff tears seen more often in later life. The shape of the acromion has been postulated as a principal cause of impingement. Edelson examined 750 dry scapulae and 80 cadaver shoulders, and found that hooking of the acromion was never present under the age of 30 years. He concluded that the firm fibrous tissue at the attachment of the coracoacromial ligament under the acromion may contribute to impingement in younger patients. By contrast, Nicholson et al in a longitudinal study of 420 scapulae found that ‘flat, curved and hooked’ acromia were equally distributed in all age groups; formation of an anterior spur was a separate entity which arose from the attachment of the coracoacromial ligament. They considered that acromial shape contributed to impingement, and

![Figure 1](image1.png)

**Fig. 1** Total number of patients reviewed at each time interval with the proportion of good/excellent results (UCLA score ≥ 27 points) and poor/fair results.

![Figure 2](image2.png)

**Fig. 2** Percentage of patients with and without calcium deposits within the tendon and with good or excellent results (UCLA score ≥ 27 points).

| Table II. Number of patients with and without calcium deposits and with a UCLA score >27 at 3, 6 and 12 months postoperatively, by number and percentage |
|---------------------------------|-----------------|-----------------|-----------------|
| Calcium deposit                | No calcium deposit | p value*       |
| 3                              | 8/15 (53)        | 9/29 (31)      | 0.001           |
| 6                              | 14/15 (93)       | 13/23 (71)     | 0.05            |
| 12                             | 12/12 (100)      | 17/22 (77)     | NS              |

* chi-squared test
that spur formation is age-related and independent of the original morphology of the acromion.

Only 10% of the shoulders examined in our study had clear radiological evidence of a type-III (hooked) acromion, although in the sagittal plane variable degrees of curvature made it difficult to differentiate type II from type III. Small differences in radiological projection can create illusions. In our opinion true ‘spurring’ of the anterior edge of the acromion is an age-related change, and in younger patients the coracoacromial ligament itself seems to be a major factor, particularly when the acromion is ‘flat’. In such patients we often found that the coracoacromial ligament formed a pronounced ridge on the undersurface of the acromion and seemed to be attached more laterally. Resection of the ligament alone in these patients cleared the subacromial space and achieved decompression of the rotator-cuff tendon.

Calcium deposits within the rotator-cuff tendon presumably cause tendon swelling and inflammation. Bosworth classified such calcification by the size of the deposit as small (under 0.5 mm), medium (0.5 to 1.5 mm), and large (over 1.5 mm), finding that small deposits were of little clinical significance, but those larger than 1.5 mm were likely to cause symptoms. De Palma classified calcific tendinitis into acute, subacute and chronic according to the duration of symptoms. In our patients the calcium deposit was smaller than 1 cm in five patients and larger than 1 cm in 13, but only one patient had symptoms for less than one year. Arthroscopic decompression, with needling and curettage of the deposit, gave a good outcome at one year.

In our study only 13 patients reported overuse of their arm as a cause of shoulder pain, but the dominant arm was involved more often, suggesting that relative overuse may be one causal factor. Patients with thickening of the attachment of the coracoacromial ligament on the undersurface of the acromion, may have an increased risk of impingement after repeated use of the arm at or above shoulder level.

Decompression by anterior acromioplasty and excision of the coracoacromial ligament is an effective means of treating symptomatic impingement which has not responded to adequate conservative treatment. The wish to avoid damage to the deltoid origin led to the development of minimally invasive techniques, guided by arthroscopy. This is technically demanding, but has been shown to give comparable results to open decompression. In our series less than 28% of patients had satisfactory relief at three months after surgery, but this increased to about 70% by six months and 85% of those reviewed at one year had minimal pain. These results compare well with previous retrospective studies, but show the importance of warning patients that recovery may be prolonged.

Three men and two women reviewed after 12 months had poor outcomes. Their mean age was ten years older, and none had tendon calcification. It seems possible that partial thickness or intratendinous tears of the rotator cuff had not been detected and were persistent sources of pain and dysfunction.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES


