Failed subacromial decompression. Risk factors

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 Articles

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1. Introduction

Subacromial impingement syndrome is a common cause of anterior shoulder pain. In 1972, Neer was the first to describe open acromioplasty and its outcomes [1]. In 1983, Ellman reported an arthroscopic method for performing acromioplasty [2]. The principle was to achieve subacromial decompression by removing the bursa, resecting the undersurface of the anterior acromion, and severing the coraco-acromial ligament. Today, acromioplasty is almost consistently performed as an arthroscopic procedure and remains widely used, although perhaps less often in isolation. Published studies of outcomes after isolated acromioplasty have produced fairly consistent results, with success rates of 77% to 90% [3, 4]. Nevertheless, the finding in some studies that over 25% of patients experiencing residual pain may call into question the effectiveness of isolated acromioplasty in ensuring pain relief. Studies have shown that risk factors for failed acromioplasty include inappropriate patient selection and technical errors [5–7].

We performed a retrospective study with the dual objective of determining whether isolated arthroscopic acromioplasty is effective in ensuring pain relief and of identifying factors that predict failure.
2. Material and methods

We conducted a retrospective multicentre (four centres) study for a symposium held by the French Society for Arthroscopy (Société française d’arthroscopie) in 2013. Investigators in the four centres reviewed the data from patients who underwent isolated arthroscopic acromioplasty between 2007 and 2011 for any reason. Patients in whom acromio-clavicular co-planing was performed concomitantly were included but those who underwent acromio-clavicular resection, a procedure on the long head of biceps tendon, or a procedure on the rotator cuff tendons were excluded. The data sources were the medical records, surgical report, responses to a questionnaire administered during a telephone interview, and radiographs obtained before surgery and at last follow-up. Pain was assessed using a Visual Analogue Scale (VAS). The radiographs were used to determine the acromio-humeral interval, thickness of the acromion, and shape of the acromion according to Bigliani and to Park (Figs. 1–4).

Failure of the acromioplasty procedure was defined as a VAS pain score greater than 3/10 6 months after the procedure and at last follow-up.

Pain intensity was the primary outcome measure for the statistical analysis. Fisher’s exact test was used to compare groups. Values of $P \leq 0.05$ were considered statistically significant. We identified factors predicting failure by computing the odds ratios (ORs) with their 95% confidence intervals (95% CIs).
Table 1

<table>
<thead>
<tr>
<th>Age</th>
<th>% Failures</th>
<th>Odds ratio</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50 years</td>
<td>11</td>
<td>1</td>
<td>0.11</td>
</tr>
<tr>
<td>50–65 years</td>
<td>29</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>&gt; 65 years</td>
<td>11</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>0.58</td>
</tr>
<tr>
<td>Male</td>
<td>25</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>41</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Workers’ compensation</td>
<td>16</td>
<td>1</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>No</td>
<td>69</td>
<td>11.9</td>
<td></td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>Reason for acromioplasty</th>
<th>No of patients</th>
<th>% Failures</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-thickness distal or intermediate tear</td>
<td>6</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>Irreparable tear</td>
<td>6</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Superficial partial-thickness (&lt;50%) tear</td>
<td>18</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Tendinopathy with no tear</td>
<td>62</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Isolated subacromial bursitis</td>
<td>8</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Calcific tendinopathy type C</td>
<td>8</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Deep partial-thickness (&lt;50%) tear</td>
<td>8</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

NS: non-significant.

3. Results

During the study period, 108 patients (one shoulder per patient) met the study inclusion criteria. Among them, 60% were women (male/female ratio, 0.4). Mean age at surgery was 52 years (range, 27–76 years). The dominant shoulder was involved in 63% of cases and the shoulder injury was recognised as a work-related injury or occupational disorder in 24% of patients. All patients had failed to respond to medical treatment given for longer than 6 months, 70% had received a preoperative subacromial test injection of a delayed-action corticosteroid, and 75% had received preoperative rehabilitation therapy.

The acromioplasty procedure was performed on a day-case basis in 1 patient. The remaining 107 patients spent a mean of 2.5 nights in the hospital.

Mean time from surgery to last follow-up was 45 months (range, 14–82 months). The failure rate was 29% (31/108 patients). The 31 patients with failed acromioplasty had a mean VAS pain score of 6 and a mean Subjective Shoulder Value (SSV) of 57, although only 25% of them used analgesics daily. Of these 31 patients, 52% reported pain at the same site as before surgery. Anterior subacromial pain was reported by 68% of patients and posterior and cervical pain non-specific for subacromial impingement by half the patients.

Neither age nor gender was significantly associated with failure by univariate analysis. In contrast, receiving workers’ compensation benefits because of the shoulder disorder was very significantly associated with failure (OR, 11.9; P < 0.001) (Table 1). No statistically significant associations were demonstrated between the reason for acromioplasty and failure of the procedure (Table 2). The most common reason for acromioplasty was isolated subacromial bursitis with rotator cuff tendinopathy but no tears (69% of patients). This diagnosis was associated with a 29% failure rate. A superficial partial-thickness (<50%) tear in the supraspinatus was associated with good outcomes, although the improvement was slow to develop (persistent pain was reported by 72% of patients after 6 months versus only 17% at last follow-up; thus, the failure rate was 17%). In the group with partial-thickness (<50%) tears of the deep aspect of the rotator cuff, the failure rate

Table 3

<table>
<thead>
<tr>
<th>% of patients</th>
<th>% Failures</th>
<th>Odds ratio</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete division of the coraco-acromial ligament</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>18</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>82</td>
<td>33</td>
<td>4.42</td>
</tr>
<tr>
<td>Acromial release to the lateral deltoid muscle fibres</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>96</td>
<td>29</td>
<td>1.22</td>
</tr>
<tr>
<td>Co-planing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>78</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>22</td>
<td>67</td>
<td>9.2</td>
</tr>
</tbody>
</table>
was 75%, and 3 patients in this group required revision surgical repair. A preoperative subacromial test injection was performed in 70% of patients. Failure to respond to the injection was not significantly associated with failure of the acromioplasty procedure.

Co-planing performed concomitantly with the acromioplasty procedure was a highly significant predictor of failure (67% failure rate; OR, 9.2; \( p < 0.001 \)) (Table 3).

The comparison of radiographs obtained preoperatively and at last follow-up showed a mean 20% decrease in anterior acromial thickness and a mean 20% increase in the acromio-humeral interval. The degree of anterior acromial resection was not significantly associated with failure of the acromioplasty procedure (Table 4).

The shape of the acromion assessed according to Bighliani (Fig. 3) and/or Park (Fig. 4) was not significantly associated with acromioplasty failure.

4. Discussion

The 29% acromioplasty failure rate in our population is higher than in earlier studies, which demonstrated success rates ranging from 77% to 90% after isolated arthroscopic acromioplasty [3,4]. Our study has several limitations. The design was retrospective, and the numbers of patients varied widely according to the reason for acromioplasty (tendinopathy with no rotator cuff tear, partial-thickness tears of the deep or superficial cuff, irreparable tears, and type C calcifications). In addition, we used a more stringent definition of failure compared to other studies. For example, in a similar retrospective study of 105 patients, Klintberg et al. obtained an 88% success rate but specified that only half the patients were completely free of pain [4]. Using pain as the primary outcome measure, Ketola et al. found no significant difference after 2 years between patients treated with arthroscopic acromioplasty and those treated medically [8], thus challenging the effectiveness of acromioplasty.

Many factors acting at various steps of the acromioplasty procedure can cause treatment failure. At the diagnostic stage, strong evidence must be obtained that subacromial impingement is the source of the pain. However, accurately diagnosing subacromial impingement syndrome is difficult even for experienced clinicians. The diagnosis rests on a converging set of findings from the clinical examination and diagnostic investigations, and appropriate patient selection exerts a major influence on the outcomes. Magaji et al. [9] reported that the outcomes of acromioplasty were best in the group that exhibited the following four criteria: pain in the mid-arc of abduction, consistently positive Hawkins test, response to a subacromial corticosteroid injection, and radiological evidence of impingement. Outcomes were less favourable in the groups meeting only two or three of these criteria [9]. We found no association between the result of the corticosteroid injection test and acromioplasty failure. However, several prospective studies consistently showed that this test is an excellent diagnostic and prognostic tool [10,11].

The second cause of failure lies in the indication for the acromioplasty procedure. Dopirak and Ryu reported poorer outcomes in patients with shoulder stiffness or osteoarthritis and in those with untreated symptomatic acromio-clavicular arthropathy or unfused acromion [5]. They also reported that one reason for failure was the presence of an undiagnosed concomitant regional disorder as the source of pain, such as tendinopathy of the long head of biceps tendon or a tear in the upper third of the subscapularis. Lashgari et al. confirmed that poor patient selection was among the causes of failure and added neck pain and peripheral neurological disorders as alternative sources of pain [6]. We identified several other causes of failure, most notably receiving workers’ compensation benefits for the shoulder disorder, which was associated with a 70% failure rate (18 of 26 patients). Arcand et al. reported similar results [12]. Furthermore, we found that acromioplasty in patients with superficial partial-thickness tears produced good results but that these were slow to develop. In contrast, deep partial-thickness tears were associated with a 75% failure rate and a need in some patients for revision repair surgery. This finding has not been clearly reported in earlier studies, which failed to separate deep and superficial partial-thickness tears. Another condition associated with a high failure rate was type C heterogeneous calcific tendinopathy, a finding that has not been reported previously.

The third cause of failure is related to the operative technique. Co-planing performed concomitantly with acromioplasty was associated with a 67% failure rate in our study and with an odds ratio for failure of 9.2. Previously reported data on the effects of co-planing are conflicting. Cadaveric and biomechanical studies show that the inferior incision performed to open the acromio–clavicular joint for co-planing destabilises the joint [13,14]. Based on a clinical study, Barber [15] advocated co-planing, as no differences in the clavicular symptoms were apparent between the groups managed with removal of inferior clavicle osteophytes, partial resection of the distal clavicle to the level of the acromion, or complete resection of the acromio-clavicular joint. In contrast, Fischer et al. reported a 39% rate of secondary acromio-clavicular symptoms when co-planing was performed concomitantly with acromioplasty and advocated an all-or-none approach consisting in either no procedure on the acromio-clavicular joint and distal clavicle or complete resection [16]. Khrairazi et al. suggested a more subtle strategy based on a retrospective study of 1482 patients divided into two groups based on whether surgery consisted in isolated acromioplasty or in acromioplasty with co-planing or acromio-clavicular resection. The rate of re-operation for acromio-clavicular symptoms was 1.5% in both groups. The authors concluded that co-planing or acromio-clavicular resection should not be performed routinely in patients without acromio-clavicular joint symptoms [17].

Finally, excessive or inadequate acromial resection may be among the causes of failed acromioplasty. Inadequate resection results in persistent impingement and excessive resection in acromial fractures [5]. These two extremes are rare in clinical practice. No clear recommendations are available regarding the optimal thickness of bone to be removed or the posterior extent of the resection. Our results are in agreement with a study by Soyer et al., showing no association between the amount of acromial resection and the outcomes [7].

5. Conclusion

Isolated acromioplasty is effective in 75% of cases. Published data on this point are fairly consistent. However, acromioplasty should not be viewed as a default procedure: instead, the patients must be selected based on valid and well-defined criteria. Although we found no significant differences across reasons for acromioplasty, the outcomes seem poorer in patients with heterogeneous calcific tendinopathy or deep partial-thickness rotator cuff tears.
We recommend the utmost caution when co-planing is performed concomitantly with acromioplasty and when the patient receives workers' compensation, since these two factors are associated with significantly higher failure rates.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References