A preoperative scoring system to select patients for arthroscopic subacromial decompression

Harvinder Pal Singh, FRCS Ed (Orth) *, Saurabh Sagar Mehta, FRCS Ed (Orth), Radhakant Pandey, FRCS (Orth)

Department of Orthopaedics, University Hospitals of Leicester NHS Trust, Leicester General Hospital, Leicester, UK

**Background:** This study investigated the clinical and radiographic factors that influence outcome after arthroscopic subacromial decompression (ASAD) for shoulder impingement syndrome. The goal was to develop a new preoperative scoring system to identify patients who would have a prompt and sustained benefit from ASAD.

**Methods:** We prospectively reviewed 112 consecutive patients with impingement syndrome who subsequently underwent ASAD. The Oxford Shoulder Score (OSS) was recorded preoperatively and 3 and 12 months postoperatively. A statistically significant improvement in OSS at 3 months after surgery was considered a good outcome.

**Results:** The variables associated with good outcome were shoulder pain with overhead activities, persistent symptoms for more than 6 months, symptoms persistent despite a 3-month course of supervised physiotherapy, consistently positive Hawkins test result, radiologic changes of impingement on both acromion and humerus in the subacromial region, and improvement for more than 1 week after a steroid injection. These 6 criteria were combined into a single score for this study, termed the **preoperative score (PrOS)**. Sixty-two patients who had been symptomatic for 1 year with a preoperative score of 5 to 6 showed significant improvement in OSS at 3 months after surgery ($P < .001$). Thirty-eight patients with a score of 3 to 4 had no statistically significant improvement in OSS at 3 months but had a further slight improvement at 1 year. Twelve patients with a score of $\leq 2$ had no significant improvement in OSS at 3 months or 1 year.

**Conclusion:** This scoring system can identify patients who would have a prompt benefit from ASAD. The impact of surgery in patients with a PrOS of $\leq 4$ points is questionable.

**Level of evidence:** Level I, Prospective Design, Prognosis Study.

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It is generally agreed that a period of rehabilitation and physical therapy is advisable for shoulder impingement syndrome, whereas failure to respond to sustained conservative management and continuing severe shoulder pain with functional restriction are indications for surgery. At this stage, a prompt and sustained relief of symptoms after surgery would certainly be of value to the patient and form an effective outcome measure.

In most painful conditions, clinicians expect prompt relief of pain after surgery once the offending cause has been removed. After joint replacement surgery, once arthritic surfaces are replaced, patients perceive the most improvement in their health status in the first 3 months after surgery that is reflected in the patient’s reported health questionnaire. A subsequent sustained relief in symptoms over time after surgery points against the placebo effect.

ASAD has been found to be an effective operation in appropriate patients. It would, however, be useful to have a guide that could help clinicians identify a patient who could receive a prompt and sustained relief in symptoms from ASAD after initial failure of preoperative conservative management. We propose a new preoperative scoring system to identify such patients who would benefit from ASAD.

**Material and methods**

In this prospective clinical outcomes study, a consecutive cohort of 122 patients referred to our outpatient clinics from their general practitioners with shoulder pain with overhead activities between 2005 and 2010 was reviewed. We assessed these patients for signs and symptoms of impingement. They had an anteroposterior and lateral radiograph of the shoulder (outlet views are not routine protocol in our hospital) and a shoulder ultrasound or magnetic resonance imaging scan to exclude rotator cuff tears and glenohumeral and acromioclavicular joint arthritis. All patients received at least a 3-month course of physiotherapy supervised by a qualified therapist. The patients received a subacromial steroid and local anesthetic injection. If the patients continued to have symptoms or the symptoms recurred despite at least 6 months of nonoperative treatment (physiotherapy and subacromial injection), they were then offered ASAD.

We reviewed these patients in the preassessment clinics 2 weeks before surgery to verify that ASAD was still required, and the senior author performed the Hawkins test again. The patients were also asked to complete the new Oxford Shoulder Score (OSS). The factors affecting the outcome after ASAD have been studied before. We reviewed the clinical records and radiographs of the patients for each of the following criteria: age, gender, hand dominance, vocation, shoulder pain with overhead activities, time since persistent symptoms, response to a course of supervised physiotherapy, consistently positive Hawkins test result, presence of radiologic changes of sclerosis and osteophyte formation on both the acromion and the humeral head in the subacromial region suggestive of impingement (Fig. 1), and presence of improvement for more than 1 week after a steroid injection after accounting for the initial relief in symptoms from the local anesthetic.

Ten patients improved while awaiting surgery and were excluded from this study. Subsequently, 112 patients underwent standard ASAD in the lateral decubitus position under general anesthesia and nerve block. The senior surgeon (R.P.) recorded the surgical findings in the patients’ case notes. Postoperatively, collar and cuff support was applied; patients were discharged within 24 hours with oral analgesia and advised to mobilize the arm as pain permits once the nerve block wears off. A physiotherapist provided these patients with a set of graded shoulder exercises to be performed at home. We followed up these patients in outpatient clinics at 3 months and 1 year postoperatively. The OSS was completed at each visit to evaluate outcome, and any complications were noted.

A statistically significant improvement of more than 12 points in the OSS (1 point improvement in each item) between the score before surgery and the score at 3 months after surgery was considered a good outcome. In a recent article, the minimal important clinical change was reported as 6 points (slight improvement) in the OSS. We, however, preferred a change of 12 points as this criterion will be more robust. We selected follow-up at 3 months as this allowed the patients time to recover from the initial symptoms of surgical trauma. It was noted that the preoperative variables for subacromial impingement that could predict the outcome after ASAD were age (<45 years/more), gender (male/female), hand dominance (dominant/nondominant), vocation (manual/nonmanual), shoulder pain with overhead activities (presence/absence), time of persistent symptoms (<6 months/more), response to a course of supervised physiotherapy (yes/no), consistently positive Hawkins test result (yes/no), altered shoulder kinematics associated with dysfunction of the rotator cuff and scapular muscles (yes/no), capsular tightness (yes/no), presence of radiologic changes of impingement on both the acromion and greater tuberosity in the subacromial region (yes/no), and presence of improvement for more than 1 week after a steroid injection (yes/no). We carried out univariate logistic regression analyses with each of the 12 possible predictive variables and the binary variable of good outcome (statistically significant improvement in OSS). Multivariate logistic regression analyses
were also performed. All 12 explanatory variables were initially included, and a stepwise model was used to find a subset of variables that could be combined to predict good outcome. Statistical analysis of the data recorded was performed with the Statistical Package for Social Sciences, version 16 (SPSS Inc, Chicago, IL, USA). As the data were not normally distributed, nonparametric tests were used. Statistical significance was taken at .05.

Results

The 112 patients who underwent ASAD were included in this study. There were 68 men and 44 women with a mean age of 48 years (38-75 years). Mean time to surgery from the start of symptoms was 1.2 years (1.0-1.5 years). Mean follow-up was 3.4 years with a minimum follow-up of 1 year after surgery. There were no major surgical complications.

Univariate logistical analysis of all the cases revealed that 6 criteria (Fig. 2)—shoulder pain with overhead activities (rest pain excluded), persistent symptoms for more than 6 months, symptoms persist despite at least a 3-month course of supervised physiotherapy, consistently positive Hawkins test result, radiologic changes of impingement on both acromion and humerus in the subacromial region, and improvement for more than 1 week after a steroid injection—were statistically significant factors associated with a good outcome (Table I). We combined these 6 clinical and radiologic criteria into a single score (preoperative score, PrOS), with each of the 6 criteria accounting for 1 point (Fig. 3).

Sixty-two patients with PrOS of 5 or 6 had a significant improvement in the OSS at 3 months after surgery ($P < .001$). Median OSS for the group with PrOS of 5 or 6 changed from 18 preoperatively to 38 at 3 months and improved to 45 at 1 year; however, the other groups showed no significant improvement at 3 months (Fig. 4). The patients with PrOS of 5 and above had been symptomatic preoperatively for about a year despite nonoperative measures and had a prompt response to surgery within 3 months.

The 38 patients with a PrOS of 3 or 4 showed no significant improvement in OSS at 3 months ($P = .09$), with a small improvement at 1 year after surgery; however, there still remained a significant difference between the group with PrOS of 5 or more compared with this group. The patients with PrOS of 4 did better than patients with scores of 3 at 1 year. The 12 patients with PrOS of $\leq 2$ fared the worst (Fig. 3), with no improvement in OSS at both 3 months and 1 year after surgery.

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**Figure 2** Scoring criteria to select patients likely to have prompt and sustained relief in symptoms after arthroscopic subacromial decompression.

**Figure 3** Patients can be scored into outcome groups on the basis of the number of positive clinical and radiologic criteria as in Figure 2.
All patients with PrOS of 5 and 6 showed scuffing of the undersurface of the acromion, (coracoacromial ligament), and rotator cuff (“kissing lesion”). Six shoulders showed small partial-thickness cuff tears, which were not repaired. On multivariate analysis, the presence of radiologic changes of impingement on both the acromion and humerus (Fig. 1) was the most consistent feature associated with good outcome \((P < .001)\) after surgery, followed by improvement for more than 1 week after a steroid injection \((P = .02)\).

At arthroscopy, the decompression of the osteophyte from the acromion and the presence of typical scuffing of the supraspinatus tendon and coracoacromial ligament (impingement lesion) correlated with good outcome after surgery, although this finding is difficult to classify.

**Discussion**

The purpose of this study was to present and to validate a new scoring system to identify patients with shoulder impingement who are likely to have prompt and significant improvement in outcome scores after ASAD. The patients with PrOS of 5 or more showed statistically significant improvement in OSS after ASAD promptly at 3 months and continued to improve until 1 year after surgery. These patients had failed to have improvement of clinical symptoms despite more than 1 year of conservative management. Excision of the acromion spur, release of the coracohumeral ligament, and débridement of bursal tissue during ASAD removed the mechanical cause for symptoms, and patients’ symptoms improved promptly at 3 months. This agreed with other studies in which, after joint replacement surgery or surgery for other painful conditions, patients’ symptoms and quality of life scores showed the greatest improvement in the first 3 months after surgery when the arthritic bone surfaces were replaced.\(^1\) Even in studies comparing arthroscopic acromioplasty and conservative management, the scores show a greater improvement at the earlier stages of treatment, with greatest improvement seen at 3 months after surgery.\(^1\)

All patients who had surgery showed improvement in OSS between 3 months and 1 year after surgery. However, in patients who did not show significant improvement promptly within 3 months, it is uncertain if this improvement at 1 year can be attributed solely to surgery as these patients continued to receive physical therapy.\(^2\) This modest improvement in these patients could have occurred without surgery after a protracted period of therapy as they did not show the significant improvement immediately after surgery. However, the group with PrOS below 2 suffered the worst outcome despite surgery, with no improvement in OSS postoperatively.

We are uncertain about the group with PrOS of 3 or 4, and it is difficult to predict if they indeed benefited from surgery. The patients with PrOS of 4 did better than patients with PrOS of 3. If these patients fail to improve despite an adequate period of conservative management, we would be guarded in the recommendation of surgery; in our study, the effect of surgery is questionable, with no improvement in OSS at 3 months and only a little improvement at 1 year. This is slight improvement per the criteria outlined in a recent study.\(^2\) We think that if this were true impingement, the symptoms should improve promptly and not take a year to improve, as in joint replacement surgery, for which the improvement in pain is prompt postoperatively. Patients with a PrOS \(\leq 2\) fared the worst as they did not improve significantly even at 1 year compared with other patients, especially compared with patients with PrOS 5 and above. Our results would suggest that ASAD is not effective in patients with PrOS of \(< 2\).

We included 6 criteria in the PrOS for identifying good outcome after ASAD (Fig. 2). The reason for inclusion of these criteria in the analyses is the hypothesis that the cause of true impingement syndrome is mechanical, with impingement of the rotator cuff tendons between acromion and the proximal humerus.\(^1\) Many different shoulder conditions can cause symptoms or pain in the shoulder with

![Average Oxford Shoulder Score in the 3 groups before surgery (left) and at 3 months (middle) and 1 year (right) after surgery.](image-url)
overhead activity, like rotator cuff tendinosis, cuff tear, calcific tendinitis, and acute or chronic subacromial bursitis. However, the criterion of pain only with overhead activities is likely to exclude other severe restrictions of shoulder movements, like frozen shoulder, osteoarthritis of glenohumeral joints, large rotator cuff tears, and capsular tightness.

Certain acute shoulder conditions do resolve within 6 months with or without intervention. An acute flare-up of calcific tendinitis or periarthritis/capsulitis will usually improve significantly in time. Capsular tightness could also improve with time, or the patient seeks treatment and physiotherapy can improve the symptoms. Neer also recognized that shoulder stiffness can be associated with impingement and that disability may resolve with improvement or resolution of the stiffness. Symptoms persisting for more than 6 months are likely to indicate the presence of mechanical factors not likely to improve spontaneously.

It has been shown before that a patient’s response to a subacromial injection may predict the ultimate outcome. A good response is defined as a greater than 50% reduction in pain after injection. More than half of the patients, however, may have recurrence of symptoms 6 weeks after injection. It is important to document a good response to steroid injection in the subacromial space. It is difficult to quantify what is a positive response to steroid injection, and the reason to include response at 1 week as one of the predictive criteria is to eliminate the effect of immediate relief in symptoms due to the numbing influence of local anesthetic with some carryover effect.

Goals of the physical therapy treatment during the acute phase of shoulder impingement syndrome are to relieve pain and inflammation, to prevent muscle atrophy, to re-establish nonpainful range of motion, and to normalize arthrokinematics of the shoulder complex. Joint mobilization is also a means of therapy for shoulder disease and includes inferior, anterior, or posterior glides in the scapular plane. In general, conservative measures are pursued for at least 3 to 6 months or longer if the patient is improving. If the patient remains significantly disabled and has not improved after 6 months of conservative treatment, the clinician would consider surgical intervention.

Recent questions have been raised about the usefulness of ASAD compared with exercise programs in the management of impingement syndrome. Haahr et al found no difference between surgery and physiotherapy for subacromial impingement at 1 year in their randomized controlled trial of 84 consecutive patients. Of the 43 patients in the conservative treatment group, 6 patients had requested surgery within the study period. The authors recommended that there is a need for stratification of these patients into subgroups, based on severity of their disability, before treatment is recommended.

It is our experience that the impingement syndrome has a mechanical component as the pain is generally felt in the mid-arc region of forward elevation and not so much at rest. Hence, the changes of sclerosis and osteophyte formation seen on radiographs are important diagnostic criteria. However, the changes should be present on both the acromion and humerus in the subacromial region and not just on the acromion or the humerus. None of the patients who scored ≤2 had any of these significant radiologic changes.

There are limitations to this study. This is an observational study with no comparative group. However, one could argue that the patients acted as their own comparator because they had conservative management for more than a year without relief before undergoing ASAD, when their symptoms improved within 3 months. The intention was to identify factors associated with good outcome after ASAD in patients with impingement. We have few patients with scores of 3 or below. We have reviewed only the patients who had been referred by general practitioners with symptoms of shoulder impingement. This could indicate a selection bias, but the criteria selected are likely to be present in all patients diagnosed with impingement syndrome. A similar study in the community confirming the influence of these predictive variables in patients with shoulder pain will be useful. We used the new OSS rather than the Constant score that has patient-reported items in addition to the physical findings recorded by the clinician, but the OSS is short, practical, reliable, valid, and sensitive to clinically important change. The OSS has also been validated against the Constant score. We continue to develop this scoring system to assess its reliability and repeatability in larger study populations.

**Conclusion**

Our results show that this is an effective scoring system for impingement syndrome in identifying the patients who would benefit from ASAD. Patients with PrOS of 5 or 6 are likely to have a prompt, significant improvement in outcome score with surgery. We suggest that the impact of surgery in patients with 3 or 4 points is uncertain. In patients with scores of ≤2, we recommend caution if ASAD is being contemplated. In these patients, the diagnosis may have to be reconsidered, or longer nonoperative treatment could be advised.

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