

Nonoperative management of idiopathic adhesive capsulitis

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Adhesive capsulitis of the shoulder is a common disorder, yet literature on its natural history is limited. This study examined patient characteristics, treatment patterns, and response to treatment of the disease in a large series of patients with this condition. Charts of 234 patients treated at our institution for adhesive capsulitis were reviewed retrospectively. The end points for the study were defined as resolution of symptoms with nonoperative treatment or operative treatment. A total of 105 shoulders in 98 patients were identified with follow-up to end point. Of these, 89.5% resolved with nonoperative treatment, including 17 (89.5%) of 19 diabetic shoulders. The average age of patients who went on to surgery was 51 years, whereas the average age of patients treated nonoperatively was significantly higher at 56. No significant difference was found for success of nonoperative treatment versus operative treatment or patient gender. All patients received nonsteroidal antiinflammatory medications, 52.4% received physical therapy without cortisone injection, and 37.1% received therapy with at least 1 corticosteroid injection. Duration of treatment in successfully nonoperatively treated patients averaged 3.8 ± 3.6 months. Patients who required surgery were treated with an average of 12.4 ± 12.1 months of nonoperative treatment. Initial forward elevation averaged $118^\circ \pm 22^\circ$ with average forward elevation at resolution of $164^\circ \pm 17^\circ$. External rotation improved from an average of $26^\circ \pm 16^\circ$ pretreatment to $59^\circ \pm 18^\circ$ posttreatment. With supervised treatment, most patients with adhesive capsulitis will experience resolution with nonoperative measures in a relatively short period. Only a small percentage of patients eventually require operative treatment. (J Shoulder Elbow Surg 2007;xx:xxx.)

Adhesive capsulitis is a common painful condition of the shoulder of unknown etiology. It is a disorder frequently encountered by most orthopedic surgeons, but literature about its natural history is limited. First described by Duplay in 1872 and named *frozen shoulder* by Codman in 1934, adhesive capsulitis is characterized by pain and restriction of both passive and active range of motion.^{9,12} The pathologic anatomy was described by Neviasser in 1945, who first coined the term *adhesive capsulitis* based on his findings and noted that it is characterized by inflammation of the synovial lining and capsule, leading to dense adhesion formation globally within the joint.²⁴

Nonoperative treatment is typically prescribed initially. This treatment includes benign neglect,^{10,23} oral nonsteroidal antiinflammatory drugs (NASIDs), oral corticosteroids,^{5,7} glenohumeral intraarticular corticosteroid injections,^{2,8,30} and physical therapy.^{15,23,25,34} Operative treatment is reserved for refractory cases and includes manipulation under anesthesia,^{1,11,13,28} arthroscopic capsular release,^{4,14,17,19,32,35} or open surgical release.²⁶ In addition, it has been noted that patients with diabetes mellitus and adhesive capsulitis are more recalcitrant to nonoperative management and have a higher incidence of requiring surgical management.³

Published reports on the natural history of patients with adhesive capsulitis are limited. Griggs et al¹⁵ reported that most patients with adhesive capsulitis can be treated successfully with a specific 4-direction shoulder-stretching exercise program. Diercks and Stevens¹⁰ showed that supervised benign neglect also yields better outcomes for adhesive capsulitis patients than intensive physical therapy.¹⁰

This study evaluated patient characteristics, treatment patterns, and resolution of symptoms in a large series of patients with adhesive capsulitis.

MATERIALS AND METHODS

Reviewed were 234 charts of patients with adhesive capsulitis treated between April 1997 and February 2005. From these charts, 98 patients (105 shoulders) were selected to be included in this Institutional Review Board–approved retrospective study. The criteria for inclusion in the study were (1) diagnosis of adhesive capsulitis and (2) treatment by 1 of 4 shoulder surgeons at our institution from 1997 to 2005. The exclusion criteria were (1) concomitant glenohumeral osteoarthritis, (2) concomitant rotator cuff

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1058-2746/2007/\$32.00

doi:10.1016/j.jse.2006.12.007

tear (all patients had magnetic resonance images [MRI] showing no tears), (3) previous ipsilateral shoulder surgery, fracture or dislocation, or infection, and (4) incomplete follow-up.

Patient demographics

Sixty-eight patients (69.4%) were women, and 30 (30.6%) were men. The average age of all patients was 55 years (range, 20-96 years). The average age of men was 58 years (range, 34-96 years), and the average age of women was 54 years (range, 20-82 years). The dominant shoulder was involved in 42 (40%) of the 98 patients, and 7 had bilateral involvement. Sixteen patients (19 shoulders; 18.1%) had diabetes mellitus, 9 (8.6%) were active smokers, and 25 (23.8%) reported a history of minor injury (not requiring medical treatment at the time of injury) to the affected shoulder at onset of symptoms. One patient had a Workers' Compensation claim pending.

Evaluation

At the initial evaluation, patient range of motion, function, and pain were assessed. The patient completed a shoulder assessment form, which included the Medical Outcomes Study Short Form 36 (SF-36), American Shoulder and Elbow Surgeons (ASES), and Simple Shoulder Test surveys. Health comorbidities, including diabetes mellitus, thyroid disorders, and cardiovascular disease, were determined, and a history of any previous shoulder disorders was ascertained.

The patients were evaluated by 1 of 4 shoulder surgeons at the initial visit. Active and passive range of motion, including forward elevation, external rotation at the side and in 90° abduction, and internal rotation, was assessed for both the affected and nonaffected shoulders. All patients had complete radiographic studies of the affected shoulder, including true anteroposterior, internal and external rotation, axillary, and scapular-Y views.

Study protocol and determination of failure

Average length of treatment for all patients was 4.7 months (range, 0.2-43.9 months). All patients received treatment consisting of oral NSAIDs medications and a standardized physical therapy program. An intraarticular corticosteroid injection was part of the treatment in 39 (37%) of the 105 shoulders. The mode of treatment was at the surgeon's discretion.

The patient was considered to have failed nonsurgical management for adhesive capsulitis when manipulation under anesthesia or arthroscopic release was recommended for improvement of the patient's symptoms. Operative indications included progressive worsening range of motion, failure to make progress after 3 consecutive visits, or residual functional impairment after 6 months or more of nonoperative treatment.

Outcome assessment

At the final evaluation, the patient's outcome was determined by measurement of range of motion, including forward elevation, external rotation at the side and in 90°

abduction, and internal rotation. This was compared with the initial evaluation of the same measurements. Pain was also assessed using the Visual Analogue Scale pain score.

Patients who could not or did not return for the final follow-up evaluation were contacted by telephone to determine their most recent status.

Statistical analysis

Statistical analysis was performed with the independent *t* test and the Pearson χ^2 test. A value of $P < .05$ was considered significant. SPSS 13 software (SPSS Inc, Chicago, IL) was used for statistical calculations.

RESULTS

Nonoperative group

Symptoms resolved in 94 (89.5%) of the 105 shoulders with nonoperative management, 55 shoulders (52.4%) resolved with physical therapy and NSAIDs alone, and 39 shoulders (37.1%) resolved with NSAIDs, physical therapy, and 1 or more intra-articular corticosteroid injections.

Patients were treated for an average of 3.8 months (range, 0.2-17.2 months). Length of treatment for patients receiving physical therapy only was an average of 3.3 months (range, 0.2-12.2 months), and length of treatment for patients receiving physical therapy and at least 1 corticosteroid injection was an average of 4.5 months (range, 0.7-17.2 months). This difference was not significant ($P = .12$).

Operative group

Patients who received surgical treatment for their adhesive capsulitis were treated nonoperatively for an average of 12.4 months (range, 1.8-43.9 months) before receiving surgery. This was significantly different from the length of treatment for the nonoperative group ($P < .05$).

Eleven (10.5%) of 105 shoulders required operative management. The average age of these patients was 51 years (range, 43-60 years). Six women and 4 men required surgery, none of which were smokers. In addition, only 2 (10.5%) of the 19 diabetic shoulders required surgery.

Final outcome with telephone call

Fifteen of the 98 patients required telephone contact to assess final outcome. These phone calls occurred between 15 and 121 months after they were initially evaluated by the physicians in this study. One of the 15 received surgical treatment with an outside physician; the remaining 14 were successfully treated nonoperatively. None of them reported recurrent symptoms of adhesive capsulitis at the time of the follow-up phone call.

Table I Initial and final average range of motion

Group	Patients (n)	Forward elevation (degrees)		External rotation (degrees)		Internal rotation	
		Initial	Final	Initial	Final	Initial	Final
Nonoperative treatment	94	118 ± 22	64 ± 17	26 ± 16	59 ± 18	L4 ± 3	T10 ± 4
Physical therapy only	55	118 ± 22	162 ± 20	26 ± 15	57 ± 18	L4 ± 3	10 ± 4
Physical therapy + injection	39	118 ± 24	167 ± 13	25 ± 18	60 ± 17	L4 ± 3	T11 ± 3
Operative treatment	11	97 ± 24	78 ± 23	5 ± 14	5 ± 6	L5 ± 2	Side ± 1

Table II Average end range of motion of affected shoulder compared with initial range of motion of unaffected shoulder

Group	Patients (n)	Forward elevation (degrees)		External rotation (degrees)		Internal rotation	
		Affected	Unaffected	Affected	Unaffected	Affected	Unaffected
Nonoperative treatment only	74	163 ± 18	175 ± 10	57 ± 18	71 ± 17	T10 ± 3	T7 ± 4

Range of motion

The initial and final range-of-motion values for the nonoperative and surgical groups are summarized in Table I. There was a significant difference ($P < .05$) in the initial range of motion between the nonoperative and operative groups for initial forward elevation and external rotation, but not internal rotation ($P = .13$).

A significant change occurred between the initial and final range of motion for forward elevation and external rotation, but not internal rotation, in the 2 nonoperative treatment groups. Average range of motion decreased from the initial evaluation to the preoperative evaluation for the surgical patient group. The decrease in forward elevation was identified in 8 (72.7%) of the 11 shoulders surgically managed. There was a significant difference ($P < .05$) between the initial and final forward elevation range of motion in the operative treatment group, as summarized in Table I.

The end range of motion for patients treated nonoperatively is listed in Table II and compared with the initial range of motion of the unaffected shoulder. There was a significant difference between the end range of motion of the affected shoulder and the contralateral shoulder range of motion for forward elevation, external rotation, and internal rotation ($P < .05$).

DISCUSSION

Adhesive capsulitis is a common disorder in which definitive treatment is still uncertain. This study shows that 90% of patients with idiopathic adhesive capsulitis can be treated successfully with a nonoperative regimen consisting of standardized physical therapy

supplemented by NSAIDs and intraarticular corticosteroid injections. The current study identified several factors associated with failure of nonoperative management, including young age and more severe initial range of motion.

Patients were significantly younger in the surgical group, with the average age of 51 years compared with an average of 56 years in the patients in the nonsurgical groups. It is unclear from this study whether this is due to a possible bias toward treating younger patients more aggressively or if younger age at initial presentation is a factor in poor prognosis. Younger patients may have higher expectations of function for their affected shoulder after treatment completion and may hope to regain more range of motion than older patients. Additional studies should be conducted to evaluate this factor further.

Patients who were initially evaluated with more limited range of motion of their shoulders were more likely to require surgical treatment. There was a significant difference between initial forward elevation and external rotation between the nonoperative and operative groups. Furthermore, most patients in the surgical group experienced a decrease in forward elevation range of motion from the initial presentation to the final (preoperative) evaluation. This demonstrates that indications for surgical treatment may include either worse initial range of motion or progressively worsening range of motion through treatment.

Traditionally, nonoperative management of adhesive capsulitis is recommended for a minimum of 6 months before operative intervention.^{20,22,25} The average duration of treatment in this study was 3.8 months, and 72% of the successfully treated nonop-

erative patients responded within 4 months of treatment. Patients in the surgical group were treated for an average of 12.4 months before they underwent surgical management of adhesive capsulitis. On the basis of these results, consideration should be given to operative intervention in patients who fail to respond within the first 4 months of treatment. The group successfully treated nonoperatively had an average of 5.1 ± 4.8 months of symptoms before initial presentation. Patients treated operatively averaged 9.1 ± 9.4 months of symptoms before presentation.

Prior studies show that adhesive capsulitis is more common in patients with diabetes than in the general population, with rates of 10% to 23%^{18,27,31,36} compared with 2% to 5%.^{16,27} Furthermore, the disease is often more persistent, and diabetic patients respond less readily to nonoperative treatment, thereby necessitating surgical management.^{15,18,21,26} This study is consistent with the previous studies in that 18% of the total study population had type 2 (noninsulin-dependent) or type 1 (insulin-dependent) diabetes mellitus. In addition, the youngest patient in this study had type 1 diabetes mellitus and was affected bilaterally. This study did not show, however, that diabetic patients were more likely to need surgical management. Only 2 of the 19 diabetic shoulders in this study required surgical management. Of the 17 shoulders treated nonoperatively, 8 were effectively treated with physical therapy alone, and 9 were treated with physical therapy and 1 or more intraarticular corticosteroid injections.

The current study followed up patients until discharge from routine follow-up and did not include longer-term data. Several studies have shown that although patients are satisfied with the outcome at the end of the treatment period and no longer had functional limitations, they retain a significant loss of range of motion in the affected shoulder compared with the contralateral, unaffected shoulder.^{6,15,29,33} The current study's data are consistent with these findings, noting that patients treated nonoperatively had a significant difference at the end of the treatment period in range of motion compared with the contralateral unaffected shoulder. It is unclear whether this is a permanent deficit or a factor owing to incomplete follow-up. Some patients were discharged when they felt satisfied with the progression of the treatment.

Griggs et al¹⁵ reported that most patients with adhesive capsulitis can be treated successfully nonoperatively with a specific 4-direction shoulder-stretching exercise program. In their study, 90% of patients treated with this method reported a satisfactory outcome, and 7% underwent manipulation under anesthesia or arthroscopic capsular release, or both. This is consistent with our study, in which 89.5% of patients had successful nonoperative treatment and 10.5% underwent surgical management. In addition, the current study found that in

the successfully treated group, satisfactory response was noted by the 4-month mark in most patients, which is consistent with a similar finding in the Griggs et al study at the 3-month mark.

Diercks and Stevens¹⁰ presented a series of patients treated with supervised neglect and a control group that received formal physical therapy. Their study found that a success rate of 89% was achieved with supervised neglect compared with 63% with formal therapy, where success was defined as Constant score of 80 or greater. Although the current study achieved an 89.5% success rate with formal therapy being a significant component of the nonoperative regimen, we also had a subset of patients who actually worsened with nonoperative treatment. In the Diercks and Stevens study, the authors hypothesized that intense therapy may be detrimental to recovery compared with simple observation of patients with adhesive capsulitis. Because we were unable to control for multiple physical therapists in the current study, it is difficult to ascertain whether the worsening of motion in this particular group of patients was due to patient-related or disease-related factors or, perhaps, differences in therapy rendered.

CONCLUSION

Most patients with idiopathic adhesive capsulitis can be successfully treated with a nonoperative treatment program consisting of a standardized physical therapy program alone or physical therapy with intraarticular corticosteroid injections. Patients are more likely to fail nonoperative treatment if they initially present with worse declines in range of motion, fail to progress within 4 months of nonoperative treatment, or experience declines in range of motion from initial presentation. In addition, diabetic patients with adhesive capsulitis can also be successfully treated nonoperatively.

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