A longitudinal study of patients with multidirectional instability of the shoulder with seven- to ten-year follow-up

Gary W. Misamore, MD,a Peter I. Sallay, MD,a and William Didelot, MD,b Indianapolis, IN

The purpose of our study was to evaluate the long-term outcomes of patients with multidirectional instability of the shoulder initially treated with rehabilitation exercises. Sixty-four patients were treated for atraumatic multidirectional instability of the shoulder between 1987 and 1990. Preliminary evaluation was performed 2 years after initiation of treatment, and final evaluation of the patients was performed at a mean of 8 years after initiation of treatment. At the preliminary evaluation, 5 patients were lost to follow-up. Of the remaining 59 patients, 20 had undergone surgical treatment for stabilization of their shoulder. Of the 39 nonsurgically treated patients, 19 continued to have significant pain, and 18 continued to have significant instability of their shoulder. Of the 59 patients, 28 subjectively rated their shoulder condition as better or much better after conservative treatment. At the final evaluation, 2 more patients were lost to follow-up, and 1 additional patient had had surgical treatment. Thus, of the 57 patients available for final follow-up, 36 had received nonsurgical care, and 21 had undergone surgical treatment. Of the 36 nonsurgically treated patients, 23 rated their shoulders as good or excellent with regard to pain, and 17 were good or excellent with regard to instability. By the modified Rowe grading scale, 5 of 36 patients had excellent results, and 12 had good results. The remaining 19 patients were rated as having poor results. Only 8 patients reported that their shoulders were free of all pain and instability. Overall, of the entire group of 57 patients evaluated between 7 and 10 years after initiation of care, 17 had a satisfactory outcome from nonsurgical management based on stability and Rowe scores, 23 had good or excellent results with regard to pain, and 20 subjectively rated their shoulders as good or excellent.

This review revealed a relatively poor response to nonsurgical treatment of multidirectional instability in this population of young, athletic patients. (J Shoulder Elbow Surg 2005;14:466-470.)

The natural history of multidirectional instability (MDI) of the shoulder has not been clearly established. Most patients presenting with MDI are adolescents or young adults. In contrast, older adults rarely present with a clinical picture of MDI. This would imply that MDI may spontaneously improve with advancing age. This could be related to decreased laxity in the joint, decreased activity demands, or some other unknown factors. Hovelius et al6 documented a similar phenomenon in patients with traumatic anterior dislocation. They noted that 22% of the shoulders that had recurrent instability spontaneously stabilized over time.

Prior studies of MDI have suggested that a rehabilitation program is the preferred initial treatment.3,5,7,8 In 1956 Rowe10 reported that most patients with atraumatic shoulder instability responded favorably to an exercise program during short-term follow-up. Neer and Foster8 recommended at least 1 year of physical therapy before considering surgery. Matsen et al7 underscored the differences between traumatic and atraumatic forms of instability and emphasized the importance of rehabilitation in atraumatic cases. Numerous other publications have included discussions about the treatment of MDI and have suggested that conservative care is successful in most cases.1,2,4,11,12 However, none of these authors has supported their statements by presenting data specifically detailing the results of nonsurgical treatment of patients with MDI. In 1992 Burkhead and Rockwood3 reported the results of a physician-directed rehabilitation program for patients with involuntary shoulder instability. They reported good or excellent results at a mean follow-up of 48 months in 88% of patients with MDI. However, in that report, it is not possible to determine any specific details about the MDI patients, such as age, specific symptoms, duration of symptoms, and magnitude of shoulder joint laxity. The MDI patients are reported only as a subgroup of a larger population of patients.

The purpose of this study was to evaluate the
long-term outcome of a defined group of patients with MDI treated initially with a course of rehabilitation exercises. It was our intent to answer several questions pertaining to the conservative care of these patients. Do patients comply with their rehabilitation regimen for an extended period of time? What is the status of the patient's shoulder at short-term follow-up? What is the condition of the shoulder at longer-term evaluation? Are there any predictive variables that correlate with the success or failure of conservative treatment?

**MATERIALS AND METHODS**

We followed up 64 consecutive patients diagnosed with atraumatic MDI of the shoulder from 1987 through 1990. Individuals with the following conditions were excluded: traumatic onset, symptoms and signs of unidirectional instability, radiographic evidence of bony injury, psychiatric conditions, previous surgery, and asymptomatic hyperlaxity. There were 21 male and 43 female patients. Their mean age was 16 years (range, 9-30 years) at the time of symptom onset. At the time of initial presentation, the mean age was 18.6 years (range, 13-34 years). Bilateral symptoms of pain or instability were present in 52 patients. The most severe involvement was in the dominant extremity of 42 patients. Of the original 64 patients, 5 were lost to follow-up at the 2-year assessment and 2 more at final follow-up.

At the time of initial evaluation, 55 of 64 patients were participating in the following sports: tennis (3), volleyball (10), football (7), baseball (8), swimming (12), basketball (2), and other (13). The remaining 9 patients were not involved in sports.

Patients underwent a focused history and physical evaluation. All patients complained of insidious onset of pain and/or instability with activity, and no patient reported a significant traumatic injury. Twenty-three complained of intermittent parasthesias in the upper extremity.

The shoulder examination included palpation for tenderness, assessment of range of motion, manual muscle strength testing, impingement assessment, and instability assessment. The load-and-shift test and the sulcus sign were used to evaluate laxity of the shoulder joint (Table I). The apprehension sign and relocation maneuver were used to demonstrate anterior instability. The diagnosis of MDI was based on at least a grade 2 translation, with reproduction of the patient’s feeling of instability in at least 2 directions. Pain alone during laxity testing was not considered sufficient to make the diagnosis of instability.

After the diagnosis of MDI was established, all patients were enrolled in a physical therapy program and were placed on a home exercise program. For a variety of reasons, a small subgroup of patients were also treated at regular, frequent intervals by a physical therapist during the initial period of the rehabilitation program. The long-term goals of the treatment program were to improve the strength, stamina, and coordination of the shoulder musculature so that the joint kinematics was enhanced to a point that dynamic control of the glenohumeral joint was adequate to compensate for the excessively lax ligamentous restrains. Phase I of the rehabilitation program consisted of relative rest from provocative activities, analgesics, and gentle range-of-motion exercises to reduce pain in the affected shoulder. As shoulder pain subsided, patients were advanced to phase II of the rehabilitation program, which consisted of rotator cuff and parascapular muscle strengthening exercises. Patients were instructed in a program of slowly progressive strengthening to be performed daily at home. Aggressiveness and progression of exercises were determined individually for each patient based on the condition of the shoulder and the response to each exercise. All exercises were performed only to the tolerance of the patient, with the eventual goal of exercises being done for short periods (approximately 15 to 20 minutes) 3 times daily in a relatively pain-free manner. Often, patients only tolerated light isometric exercises initially. As the condition of the shoulder allowed, they were advanced to resistive exercises with the use of rubber tubing, progressing to tubing of greater resistance as the shoulder condition improved. Gradually, light dumbbell weights were added to the exercise program. Throughout phase II, patients were taught to perform exercises for both the rotator cuff and the scapular stabilizing muscles. Rotator cuff exercises included strengthening in internal and external rotation, flexion, extension, and abduction. Patients were initially instructed to perform these exercises by slow and controlled movement with the arm close to the side. As the shoulder condition improved, rotational exercises were also performed with the arm in abduction, and the speed of muscular contraction was increased. Patients were instructed to emphasize both the concentric and eccentric phases of the exercises equally. For strengthening of the scapular muscles, they were instructed on exercises for retraction, elevation, and depression of the scapula. Initially, they performed exercises without resistance simply to improve postural control of the scapula and then gradually performed rowing exercises and shrugs with the use of elastic tubing and light weights. In addition, pushups were performed as tolerated as the shoulder condition improved. Although these exercises were taught and coordinated by physical therapists experienced in shoulder rehabilitation, this exercise program was similar to the orotherapy rehabilitation program described by Burkhead and Rockwood. Phase III involved sports-specific exercises if appropriate. Phase IV involved returning to sports or work. Patients were encouraged to continue their home exercise program indefinitely to prevent a relapse of symptoms. They were evaluated by

**Table I Evaluation of glenohumeral translation**

<table>
<thead>
<tr>
<th>Load-and-shift test*</th>
<th>Sulcus sign†</th>
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<tbody>
<tr>
<td>Grade 1 Transl. humeral head up to but not over glenoid rim</td>
<td>1 cm of translation</td>
</tr>
<tr>
<td>Grade 2 Movement of humeral head over glenoid rim that spontaneously reduces</td>
<td>2 cm of translation</td>
</tr>
<tr>
<td>Grade 3 Dislocation of glenohumeral joint</td>
<td>3 cm of translation</td>
</tr>
</tbody>
</table>

*Movement of the center of the humeral head relative to the glenoid in the anterior and posterior directions.†Inferior subluxation of the humerus relative to the lateral acromion.
the therapists at variable intervals depending on the condition of the affected shoulder and the patient's ability to perform exercises independently. Patients were examined by a physician at 4- to 6-week intervals until their symptoms improved or their condition reached a plateau. Surgery was considered an option in those who did not improve after 3 to 6 months of continuous physical therapy.

Results of treatment were initially tabulated at a mean of 2 years after initiation of therapy. Patients were surveyed regarding their compliance with the physical therapy program and, if compliant, how long they faithfully continued to adhere to the prescribed rehabilitation regimen. They were also asked to rate their pain, instability, range of motion, strength, and improvement in their most symptomatic shoulder. They graded their pain and instability on a scale of 0 to 10. A score of 0 to 2 was considered to indicate a good or excellent result, 3 to 5 indicated a fair result, and a score greater than 5 indicated a poor result. Limitations imposed on daily activities, work, and sports were assessed by grading as follows: none, minor, moderate, or severe. Patients were asked to compare the overall status of their shoulder with their status on initial presentation as follows: much better, better, same, or worse. Patients were again surveyed at a mean of 8 years (range, 84-122 months) after their initial visit. The same survey was repeated, with the addition of the modified Rowe instability grading system (Table II). All assessments were done subjectively by the patients. No follow-up examinations were performed for objective assessment of joint laxity for the purpose of this study.

Statistical analysis included the 2-tailed Student t test, analysis of variance for continuous variables, and the χ² test for categoric variables. P values < .05 were considered statistically significant. Stepwise linear regression analysis was conducted to identify those variables that predicted whether a patient was treated surgically or nonsurgically. Variables examined included sex, age, involved side, unilateral versus bilateral, pain rating before and after physical therapy, instability rating before and after physical therapy, duration of physical therapy, subjective benefit of therapy, grade of laxity, and difficulties performing daily activities.

RESULTS

Two-year evaluation

At a mean of 2 years after initiation of treatment, 59 of 64 patients were available for follow-up evaluation. We performed surgery on 6 patients for stabilization of their shoulder, and 14 other patients underwent surgery elsewhere. The remaining 39 patients received nonsurgical treatment only. Of those 39 patients, 20 had good or excellent results with regard to pain relief. Twenty-one had good or excellent results with respect to stability, and twenty-eight reported that the shoulder condition was better or much better. Twelve patients were able to participate in their previous sport.

Assessment revealed that all patients were initially compliant with their exercise program. The mean duration of the initial physical therapy was 4.3 months, with a range of 1 to 12 months. The majority of patients who improved with physical therapy did so within 3 months of the initiation of treatment. The patients who eventually underwent surgery had performed exercises for a mean of 6.1 months, which was longer than in those patients who did not receive surgical treatment (3.4 months). Linear regression analysis failed to identify any variable as significant in predicting the success of physical therapy.

Eight-year evaluation

At a mean follow-up of 8 years (range, 7-10 years), evaluation was performed on 57 of the original 64 patients. One patient had received surgical treatment for the shoulder condition subsequent to the 2-year follow-up. Of the 36 remaining patients treated nonsurgically and available for follow-up evaluation, 29 reported no further treatment for their shoulder instability. Seven continued to perform shoulder therapy exercises subsequent to the 2-year follow-up because of persistent or recurring symptoms, but no patient was continuing the exercise regimen at the time of final evaluation. Twenty-eight reported persistent problems with their shoulders, and eight reported no residual symptoms. Twenty-three had good or excellent results with regard to pain relief, and seventeen had good or excellent results with regard to stability. Twenty reported that the shoulder condition was better or much better. On the basis of the modified Rowe grading system, the results of 5 patients were excellent and the results of 12 were good. Seven had given up all sporting activities because of the condition of their shoulders, whereas nine had made lifestyle or employment changes to accommodate their instability symptoms.

There was no difference between the patients who

<table>
<thead>
<tr>
<th>Function</th>
<th>Dimension Points</th>
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<tbody>
<tr>
<td>No limitation in sports or work</td>
<td>50</td>
</tr>
<tr>
<td>No limitation in work, slight limitation in overhead sports</td>
<td>35</td>
</tr>
<tr>
<td>Moderate limitation in overhead sports and work</td>
<td>20</td>
</tr>
<tr>
<td>Marked limitation in work and sports</td>
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</table>

<table>
<thead>
<tr>
<th>Stability</th>
<th>Dimension Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>No symptoms of instability</td>
<td>30</td>
</tr>
<tr>
<td>Instability with strenuous sports or work</td>
<td>15</td>
</tr>
<tr>
<td>Instability with daily activities</td>
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</table>

<table>
<thead>
<tr>
<th>Motion</th>
<th>Dimension Points</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Slight motion loss without limitations</td>
<td>5</td>
</tr>
<tr>
<td>Moderate motion loss with limitations</td>
<td>0</td>
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Excellent = 90–100; Good = 75–89

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underwent surgery and those who continued conservative treatment with regard to age, sex, or duration of symptoms. However, statistically significant differences were noted with regard to unilateral compared with bilateral involvement, pain and instability ratings after physical therapy, difficulties with daily activities, benefit of therapy, grade of laxity, and duration of physical therapy. Linear regression analysis revealed that unilateral involvement, higher grades of laxity, and difficulties performing daily activities were predictive variables associated with surgical treatment.

DISCUSSION

Upon studying the literature on MDI, one is struck by the relative paucity of both clinical reviews and basic science studies concerning the subject. Of the few articles published, most are either review articles or reports of the results of surgical treatment. The patient groups are small and nonhomogeneous, follow-up is short, and there is often a lack of clarity in precisely defining the study population. Results of nonsurgical treatment are not specifically addressed in these reports. In this report, we have attempted to study a uniform population of young, active patients with atraumatic, involuntary MDI over a relatively long time frame (7-10 years).

Before one can interpret a clinical study on treatment outcomes, it is important to understand the natural history of the disorder. Unfortunately, the natural history of MDI has not been clearly documented. It is assumed that most patients with atraumatic MDI spontaneously improve, because the condition is rarely observed in older individuals. Therefore, the treatment of MDI must be measured against the standard of the untreated process. Although this study documents the course of patients over a relatively long time frame, it cannot be considered a natural history study for two reasons. First, the follow-up is still too short to document the complicated effects of advancing age on the disorder. Second, all patients were initially instructed on physical therapy exercises and, therefore, cannot be considered untreated. Conversely, this report should not be interpreted as a definitive study of the results of conservative treatment. Although all patients participated in a physical therapy program on a short-term basis, none of them was still performing a home exercise program at final follow-up. In addition, 21 patients received surgical treatment during the study period. Therefore, it is not possible to project what the condition of their shoulders may have been without surgery. Nevertheless, we believe that this study is useful in documenting what eventually happens to patients who present with MDI to a referral practice and are initially treated nonsurgically with a regimen of rehabilitation exercises.

All of our patients performed physical therapy exercises faithfully initially; however, compliance rapidly waned once patients felt that they had improved or plateaued and once they were no longer regularly followed up by the therapist or physician. In our opinion, this is representative of the majority of our patients who fall prey to human nature. Although we cannot comment on the effect of a more formal, long-term exercise program, it is interesting to note that the patients who eventually chose surgery persisted with their exercises for a mean of 6 months. In fact, those patients who were treated surgically seemed to benefit less from strengthening exercises, having persistent pain and instability despite a longer course of therapy, as compared with their conservatively treated counterparts. Although age, sex, and duration of symptoms were not statistically different between the two groups, the power of these calculations is limited because of the small number of patients in each group.

Burkhead and Rockwood reported a high degree of success treating a group of atraumatic MDI patients with orthotherapy. At a minimum of 2 years’ follow-up, the authors reported good or excellent results in 88% of patients with a physician-directed home exercise program. In contrast, our study demonstrated that at both the 2-year follow-up and the 8-year follow-up, many patients had significant pain and instability or had elected to undergo surgical treatment. At early follow-up, 39 of 59 patients (66%) had been treated with surgery or had fair or poor ratings for their shoulders. At 7 to 10 years’ follow-up, 40 of 57 patients (70%) had been treated surgically or had fair or poor ratings for their shoulders. Only 30% had a good or excellent result based on the modified Rowe score.

There are several possible explanations for the differences in results between this review and that of Burkhead and Rockwood. Although the rehabilitation programs are similar, we may have not been as successful in teaching our patients the importance of their exercise program, thus failing to instill in them the desire to be compliant on a long-term basis. Our patient population was also significantly younger than that of Burkhead and Rockwood. The age range for our patients was 13 to 34 years, with a mean age of 19 years. Burkhead and Rockwood reported no range, but the mean age was 27 years. Because this condition may spontaneously improve with age, a younger group of patients may be expected to not fare as well as an older patient group. Many of our patients were also involved in aggressive sports that placed great demands on their shoulders. In addition, all patients in this study had significant laxity (grade II or greater) in their affected shoulder. Thus, we may not have selected the group of patients most likely to succeed with conservative care.
A significant shortcoming of this study, and an additional possible reason why our results fall short of those of Burkhead and Rockwood, is the lack of control regarding surgical and nonsurgical treatment before the time of final follow-up. Of the 21 patients treated surgically in our study, only 6 had surgical treatment recommended and performed by us. The other 15 patients sought orthopaedic consultation and surgical treatment elsewhere during the study period. Clearly, this could potentially impact the results significantly, as we were unable to determine the results of long-term conservative treatment for that group. One could argue that, if surgery had not been performed, these patients may have eventually improved either spontaneously or with more prolonged rehabilitation and the final results of conservative care would have been much improved.

Our data suggest that most patients who improve with the exercise program do so fairly quickly, usually responding within 3 months. Burkhead and Rockwood similarly found that patients treated successfully tended to respond within 5 weeks and maximized their stability in about 3 months. Most of the patients in our series who did not respond within 3 months did not seem to improve with further time and therapy.

Our data demonstrate that there are several variables that seem to predict a poor response to conservative treatment. Patients who had unilateral involvement, those who had difficulties performing routine daily activities, and those with higher grades of laxity on examination had a greater chance of eventually requiring surgical treatment.

Because of the limitations of this uncontrolled, retrospective, noncomparative review, we must be cautious in making conclusions from the data. Nevertheless, we did learn that many of our patients were not compliant with the recommended rehabilitation program over a long period of time. It was our observation that most of the patients who responded favorably to conservative treatment showed a positive response within 3 months of beginning a rehabilita-

REFERENCES