

# Arthroscopic Treatment of Multidirectional Shoulder Instability With Minimum 270° Labral Repair: Minimum 2-Year Follow-up

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**Purpose:** The purpose of this study was to analyze results of arthroscopic stabilization with labral repair in a subset of patients with multidirectional shoulder instability and frank labral tear. **Methods:** A review of 13 patients (10 male and 3 female; mean age, 27.2 years) with multidirectional instability involving a labral tear of 270° or greater requiring arthroscopic labral repair was performed at a mean follow-up of 56 months (range, 29 to 72 months). All patients were evaluated by use of the Short Form 12, Western Ontario Shoulder Instability Index, Simple Shoulder Test, American Shoulder and Elbow Surgeons score, and visual analog pain scale. Physical examination included range of motion, strength testing, and stability testing. **Results:** Of the 13 patients, 2 (15%) had recurrent instability after repair (subluxation or dislocation). Of the patients, 9 (69%) were completely satisfied, 2 (15%) were mostly satisfied, and 2 (15%) were completely unsatisfied. At final follow-up, the median scores were as follows: Western Ontario Shoulder Instability Index, 47.1; American Shoulder and Elbow Surgeons score, 96.7; Simple Shoulder Test score, 12; visual analog pain scale, 0; and Short Form 12 mental component/physical component, 57/44. There were no differences in range of motion compared with the opposite extremity. Cybex strength testing (Lumex, Ronkonkoma, NY) did show a statistically different difference in forward elevation ( $P < .005$ ). There were no complications, and no patient has undergone reoperation. **Conclusions:** Arthroscopic stabilization with labral repair in patients with multidirectional instability and a minimum 270° labral pathology provided good results (85%) in terms of pain relief and clinical stability at a minimum 2-year follow-up. **Level of Evidence:** Level IV, retrospective case series. **Key Words:** Multidirectional instability—Arthroscopy—Labrum—Outcome—Shoulder.

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The arthroscopic treatment of unidirectional anterior and posterior shoulder instability has been reported in the literature with promising results.<sup>1-8</sup> Multidirectional instability (MDI) includes a spectrum of pathology with both traumatic and atraumatic components. Atraumatic MDI of the shoulder is an un-

common and difficult-to-diagnose condition that is often initially treated conservatively with rehabilitation.<sup>9,10</sup> Outcomes of surgical stabilization of symptomatic multidirectional shoulder instability, refractory to nonoperative management, have been described by multiple groups of investigators, using a variety of open and arthroscopic surgical techniques, with good to excellent results being reported in 80% to 94% of cases.<sup>11-22</sup>

Initially identified by Neer and Foster<sup>23</sup> in 1980, MDI has been classified as instability in 2 directions<sup>24</sup> or 3 directions.<sup>21,25</sup> The classic pathoanatomy in MDI has been identified as a redundant capsule, usually seen in a patient with ligamentous laxity. After conservative management has failed, surgical treatment has consisted of capsular plication and/or an inferior capsular shift procedure.

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It has become apparent that multidirectional shoulder instability involves a spectrum of disease ranging from those with instability due to pure capsular laxity to those with MDI due to a frank labral tear.<sup>26</sup> Kim et al.<sup>19,27</sup> described a group of patients with postero-inferior multidirectional shoulder instability, all with labral pathology. Furthermore, although MDI has been traditionally regarded as an atraumatic process, many of these patients do present after some form of injury.

Overall, the surgical results of arthroscopic treatment of MDI have been less favorable than published reports of unidirectional anterior or posterior surgical stabilization. However, there are few published reports of arthroscopic treatment of MDI with concomitant labral pathology.<sup>19</sup>

The purpose of this study was to analyze results of arthroscopic stabilization with labral repair in a subset of patients with multidirectional shoulder instability and frank labral tear. Our hypothesis was that this subset of patients will have outcomes similar to those of patients with traumatic unidirectional instability treated with the traditional arthroscopic technique.

## METHODS

### Patient Selection

A retrospective review of operative reports and arthroscopic intraoperative images from 2,832 consecutive surgical cases of the senior author (A.A.R.) (August 1993 to December 2004) was conducted. The case logs were reviewed by 1 reviewer (J.M.A.). Patients' charts with a diagnosis of MDI preoperatively, intraoperatively, or postoperatively were evaluated. Fifteen patients were identified as meeting the study's criteria.

Inclusion criteria included a history and physical examination findings consistent with MDI as detailed either in the senior author's preoperative notes, on examination under anesthesia, or intraoperatively. MDI was defined in patients with a positive sulcus sign and instability in more than 1 direction including anterior, inferior, and posterior components, excluding patients with only anterior-inferior instability. Nonoperative treatment must have been considered to have failed, defined as continued pain and/or instability after a minimum 3 months of formal physical therapy. No patients had gross instability preoperatively. All subjects must have had a minimum 270° arthroscopic labral repair and a minimum 2-year follow-up. Exclusion criteria consisted of prior shoulder

surgery, concomitant open procedures, and thermal capsulorrhaphy.

### Surgical Technique

All patients underwent general anesthesia with an interscalene block and were placed on a beanbag in the lateral decubitus position. An axillary roll was placed under the shoulder, and all pressure points were padded. An examination under anesthesia was performed, identifying the pattern of instability as well as the presence of a sulcus sign, clicking, or crepitus.

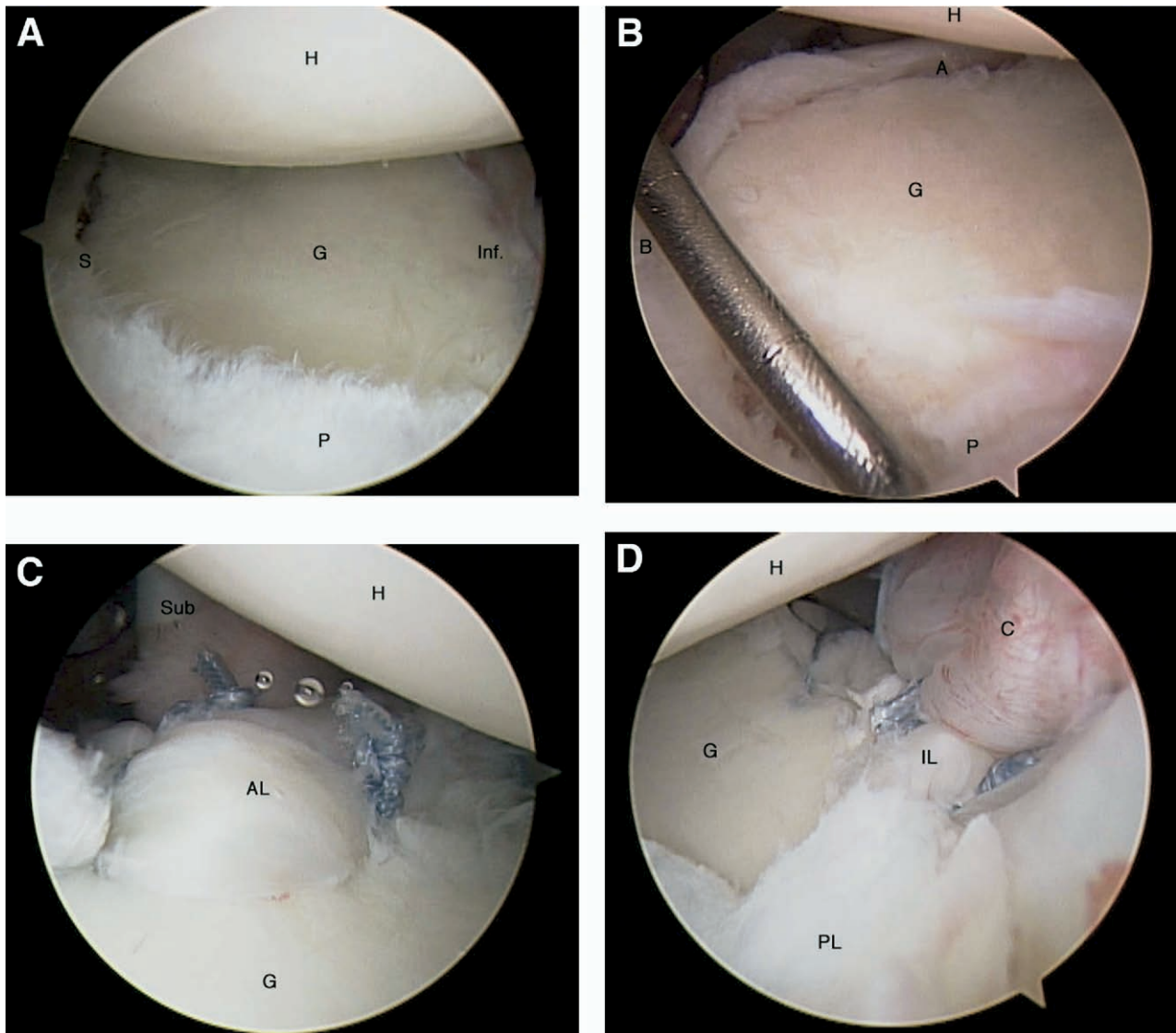
Surgical landmarks were outlined on the skin, and the arthroscopic procedure was initiated via a posterior portal, with the anterior portal established via an inside-out technique. Diagnostic arthroscopy was performed in standard fashion to evaluate the articular surface, glenohumeral ligaments, rotator cuff, biceps tendon, rotator interval, capsule, and labrum.

All labral pathology was addressed surgically with the use of suture anchors. When necessary, a postero-inferior portal was established at the 7-o'clock position and/or an antero-inferior portal was made to treat combined anterior laxity. Repair was carried out with combined labral repair and capsulorrhaphy with the use of bioabsorbable suture anchors single-loaded with nonabsorbable suture (Arthrex, Naples, FL) (Fig 1). Rotator interval closure was performed to further decrease overall capsular volume based on the senior surgeon's evaluation of the shoulder after completion of the labral repair.

Postoperatively, the patient's arm was placed in a slingshot brace in slight abduction and neutral rotation. The first 6 weeks of rehabilitation consisted of isometrics in the brace as well as grip-strengthening exercises. Light isometric exercises as well as active range-of-motion exercises with limits of forward flexion to 140°, external rotation of 40° with the arm at the side, and 45° of abduction were implemented from weeks 6 to 12. At 3 months, rotator cuff, deltoid, and scapulothoracic strengthening exercises were gradually advanced as tolerated. Eccentric exercises were begun at 16 weeks, with a gradual return to throwing activities or sports when indicated at 6 months.

### Outcome Measures

All patients were evaluated in the office by 1 examiner (J.M.A.) at a minimum of 2 years' follow-up by physical examination, Cybex strength testing (Lumex, Ronkonkoma, NY), shoulder range of motion with a goniometer, anterior apprehension test, posterior "jerk" test, lift-off test, and sulcus sign. Over-



**FIGURE 1.** Right shoulder in lateral decubitus position. All views are from a standard posterior portal. This patient's preoperative symptoms were associated with instability in the anterior, posterior, and inferior directions, necessitating an extensive 270° labral repair. (A) Pathology comprising 270° of glenoid labrum. There is extensive irregularity of the labrum, consistent with circumferential tearing. Note the absence of labral tissue inferiorly. (B) The surgical probe is in the anterior portal, evaluating the posterior-superior labrum, with the biceps on the left (not easily visualized in this picture). Labral pathology is noted from the anterior 3-o'clock position, coursing superiorly and posteriorly around the entire glenoid. Although only 180° can be seen in this picture, there is pathology in greater than 270° of the labrum. (C) Repaired anterior labrum by use of suture anchors, as viewed from the posterior portal, looking anterior and superior. (D) Posterior-inferior glenoid. The posterior-inferior labrum is repaired, incorporating the capsule, by use of 3 suture anchors. The capsule was included in this instance to further augment the labral repair. Capsular tissue incorporation was deemed necessary in this patient because of the poor quality of labral tissue inferiorly, coupled with preoperative findings of significant instability in the posterior-inferior direction. (H, humeral head; S, superior; G, glenoid; B, biceps; A, anterior; P, posterior; Inf, inferior; AL, anterior labrum; Sub, subscapularis tendon; PL, posterior labrum; IL, inferior labrum; C, capsule.)

all patient function was determined with the Short Form 12 survey, and shoulder function was evaluated with the Western Ontario Shoulder Instability Index (WOSI), American Shoulder and Elbow Surgeons (ASES) score, Simple Shoulder Test score, and visual

analog pain scale. Using a questionnaire, patients rated their satisfaction with the surgery. The answer choices were completely satisfied, mostly satisfied, somewhat satisfied, mostly unsatisfied, and completely unsatisfied. This questionnaire also evaluated

the patients' willingness to have the same surgery on the opposite side for a similar problem and asked them to describe any episodes of recurrent subluxation or dislocation. All nonparametric data were analyzed with the Wilcoxon signed rank test (level of significance,  $P < .05$ ).

**RESULTS**

We identified 15 patients who met the inclusion criteria for this study; however, 2 were lost to follow-up. Of the remaining 13 patients, 10 were male and 3 were female. The mean follow-up was 56.2 months (range, 29 to 72 months). The mean patient age was 27.2 years (range, 15 to 48 years). Of the 13 patients, 12 had a history of discrete trauma before the onset of symptoms. The 1 patient without overt trauma had no other associated signs of laxity and had an unknown etiology for MDI with labral pathology.

The chief complaint was shoulder pain associated with instability in 11 patients. The remaining 2 patients' chief complaint was instability. All patients had at least 270° of labral pathology. As per the intraoperative report, no patient had significant glenoid bone loss requiring reconstruction. Shoulder computed tomography scans were not obtained in any patients. The rotator interval was closed in 5 cases, and the mean number of sutures used for plication was 2.1

(range, 2 to 4). The mean number of suture anchors used was 7.7 (range, 3 to 14).

**Follow-up Outcomes**

Of the patients, 11 (85%) were completely or mostly satisfied (9 completely satisfied and 2 mostly satisfied) and 2 (15%) were completely unsatisfied.

With regard to physical examination, all patients were examined postoperatively by the same clinical orthopaedic surgery resident (J.M.A.) using a goniometer. Preoperative range-of-motion values were not compared with the postoperative data because those results were documented by a variety of examiners using approximations for range-of-motion assessment. Of the patients, 11 had no sulcus sign whereas 2 had a 2+ sulcus sign that had been noted preoperatively. No patients showed a positive sulcus sign for the contralateral shoulder. Posterior or anterior apprehension tests were positive in 2 patients. Forward elevation in the surgical extremity was 165°, as compared with 173° on the nonoperative side ( $P = .114$ ). The mean amount of external rotation in abduction was 81° on the operative side, as compared with 87° on the nonoperative side ( $P = .255$ ). The mean range of motion in internal rotation was 80° on the operative side, as compared with 84° on the nonoperative side ( $P = .207$ ) (Table 1, Fig 2). Cybex strength testing in

**TABLE 1. Physical Examination Findings**

Patient No.	Follow-Up (mo)	Forward Elevation (°)		Internal Rotation (°)		External Rotation (°)		Cybex Forward Elevation (°)		Liftoff	Sulcus Sign
		Index*	Contra*	Index†	Contra†	Index‡	Contra‡	Index§	Contra§		
1	50	165	160	65	85	95	70	9.2	9.4	—	0
2	68	160	165	90	80	60	90	9.6	10.7	—	0
3	29	170	175	70	80	90	90	12	12.1	—	0
4	45	175	175	80	80	70	70	10.8	13.0	—	0
5	64	165	175	55	90	85	110	4.9	5.8	—	0
6	66	158	162	92	90	92	94	4.5	3.4	—	0
7	53	170	175	85	90	80	92	13	13.6	—	0
8	69	180	180	90	90	85	85	11	12.2	—	0
9	72	170	175	80	85	80	65	11.3	13.3	—	0
10	53	175	180	90	80	72	90	10.1	12.7	—	0
11	72	180	180	80	80	90	90	13.4	13.2	—	0
12	40	160	175	80	85	70	90	8.5	10.7	+	2
13	50	110	175	80	80	95	95	1.9	5.0	+	2

Abbreviation: Contra, contralateral shoulder.

\* $P = .11$ .

† $P = .21$ .

‡ $P = .26$ .

§ $P = .005$ .

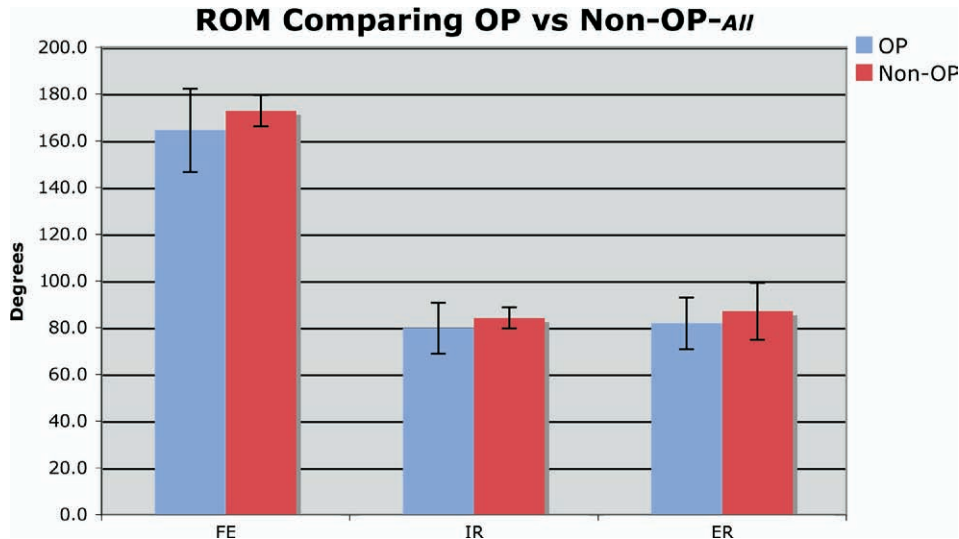


FIGURE 2. Range of motion in all patients. (OP, operative side; non-OP, nonoperative side; FE, forward elevation; IR, internal rotation; ER, external rotation.)

forward elevation did show a side-to-side difference ( $P = .005$ ).

The median WOSI score was 471 (range, 30 to 1,628); ASES score, 96.7 (range, 20 to 100); Simple Shoulder Test score, 12; and Short Form 12 scores, 57 for mental component and 44 for physical component. The median score on the visual analog pain scale was 0, with a range of 0 to 6.

Four patients had more than 2 recurrent subluxation or dislocation events. Two of these patients were completely satisfied as the recurrent subluxation events were not clinically significant because these episodes were rare, painless, and not affecting their jobs, activities of daily living, or recreational activities. The other two patients were completely unsatisfied, have the poorest ASES and WOSI shoulder scores, and have noted multiple subluxations postoperatively. Both of these patients are unhappy with their result, but they have not had revision surgery and they are able to achieve normal function with activities of daily living. No frank recurrent dislocation events have been noted in any patient (Table 2).

## DISCUSSION

Multidirectional shoulder instability is classically described in a patient with ligamentous laxity, rarely linked to trauma, and associated with capsular redundancy. When differentiating MDI from other forms of instability, Thomas and Matsen<sup>28</sup> coined the term *AMBRI*—atraumatic, multidirectional instability, bilateral, treated with rehabilitation—and if surgery is

necessary, an inferior capsular shift procedure is performed.

The mainstay of treatment for MDI has been physical therapy. Burkhead and Rockwood<sup>9</sup> treated 66 MDI shoulders with an exercise program, showing good to excellent results in 80% of these patients. Recently, Misamore et al.<sup>10</sup> treated 57 patients with MDI conservatively over a minimum period of 7 years. Overall, only 35% of patients (20/57) treated nonoperatively for MDI rated their shoulders as good to excellent. These recent results indicate that conservative management may not be as successful as previously described.

When rehabilitation fails, open or arthroscopic surgical treatment of MDI is indicated. Addressing the pathoanatomy is key to obtaining satisfactory results. Neer and Foster<sup>23</sup> first described the inferior capsular shift procedure to reduce capsular redundancy or laxity in the shoulder capsule, obtaining a 100% satisfaction rate. Cooper and Brems<sup>13</sup> had a 91% satisfaction rate using a similar technique. Results using variations of these open techniques by Pollock et al.,<sup>21</sup> Choi and Ogilvie-Harris,<sup>12</sup> Altchek et al.,<sup>29</sup> and Field et al.<sup>30</sup> showed a low recurrence rate (<10%) and good to excellent results greater than 88% of the time.

The treatment of MDI by use of arthroscopic techniques has the advantages of less postoperative pain and less surgical morbidity. Although most of these patient series are small, the outcomes of the arthroscopic technique approach those of open procedures. Duncan and Savoie<sup>14</sup> treated 10 patients with an arthroscopic inferior capsular shift procedure, and all

TABLE 2. Survey Results and Intraoperative Findings

Patient No.	Satisfaction	Would Undergo Surgery Again	VAS	SST	ASES	SF-12		WOSI	No. of Anchors	No. of Sutures for Plication	Trauma	Miscellaneous
						Physical	Mental					
1	CS	Y	0	12	100	37	46	140	4	3	Y	Associated HAGL lesion
2	CS	Y	0	12	100	46	59	179	5	2	Y	
3	MS	Y	1	12	92	44	59	482	7	2	Y	
4	CS	Y	0	12	100	43	51	140	14	0	Y	360° tear
5	CS	Y	3	11	82	34	60	471	3	2	N	RTI closure
6	CS	Y	0	12	100	56	27	593	8	2	Y	
7	CS	Y	0	11	98	53	32	140	7	3	Y	RTI closure
8	CS	Y	0	11	97	49	44	415	3	2	Y	RTI closure
9	CS	Y	2	12	90	46	57	799	6	2	Y	Loose body removal
10	MS	Y	5	9	58	44	59	975	12	0	Y	360° tear
11	CS	Y	0	12	100	45	62	30	4	2	Y	Preinjury laxity
12	CUS	N	6	10	60	42	49	1,182	6	3	Y	Preinjury laxity
13	CUS	N	2	1	20	39	58	1,628	3	4	Y	RTI closure

Abbreviations: VAS, visual analog pain scale; SST, Simple Shoulder Test; SF-12, Short Form 12; CS, completely satisfied; HAGL, humeral avulsion of glenohumeral ligament; MS, mostly satisfied; RTI, rotator interval; CUS, completely unsatisfied.

patients had satisfactory result based on the Neer system. McIntyre et al.<sup>31</sup> treated 19 patients arthroscopically for MDI, with 18 of 19 achieving good to excellent results. Of note, 7 patients had intraoperative anterior and posterior labral pathology. Treacy et al.<sup>22</sup> retrospectively reviewed their arthroscopic treatment of MDI in 25 patients with a minimum 2-year follow-up, showing satisfactory results in 88% based on the Neer system. Gartsman et al.<sup>17</sup> treated 47 patients with arthroscopic placement of suture anchors and capsular plication, as well as thermal capsulorrhaphy, with 85% returning to their preoperative level of sports participation.

The main difficulty when interpreting the results of these studies is the wide variation in patients with both traumatic and atraumatic cases and both labral and capsular pathology. Also, stability was not always used as the primary outcome variable. Furthermore, the incidence of recurrence was not always strictly defined, and the definition of recurrence was not clearly established.

Prior literature infrequently associated labral lesions with MDI. In one study Kim et al.<sup>19</sup> evaluated 31 patients with posteroinferior MDI, noting 11 (36%) with frank labral pathology. This has subsequently been termed “Kim’s lesion.”

Our study identified 13 patients with MDI and frank labral tears of a minimum of 270°. In this series all but 1 patient had some history of specific injury to the shoulder, and 11 of 13 had a chief complaint of pain

associated with instability. Thus, although these shoulders met the definition of MDI, they represent a specific subset of MDI patients with a history of trauma and frank labral tear. The 1 patient without a history of trauma had labral pathology of an unknown etiology. It is possible that an unrecognized trauma or multiple minor events could be the cause of the extensive labral tear. This patient had symptoms of pain and instability and the same minimum 270° labral pathology and was treated in the same manner as the traumatic patients, thus warranting inclusion in this study.

In our experience these patients respond well to anatomic labral repair with capsular retensioning. Furthermore, they represent a very different population than atraumatic MDI patients who have primarily capsular laxity and may have inherent collagen disorders. This study supports our hypothesis because our outcome with regard to recurrent instability is comparable to reports of arthroscopic stabilization for unidirectional instability.

Carreira et al.<sup>2</sup> prospectively evaluated 85 patients with traumatic unidirectional shoulder instability treated with arthroscopic labral repair, yielding a 90% success rate. Cole et al.<sup>3</sup> compared open and arthroscopic techniques of anterior shoulder instability at a minimum 2- to 6-year follow-up. There was a recurrence rate of 24% in the arthroscopic group. Overall, the success rates for unidirectional anterior shoulder instability treated with arthroscopic stabilization range

from 76% to 90%.<sup>2-4,6</sup> Our study yielded an 85% success rate with regard to overall satisfaction and pain relief. Reasonable expectations should be set, because some patients may still have mild degrees of instability.

Deficiencies in this study include the fact that is a retrospective review. The relatively low number of patients can be expected, given the rarity of this subset of multidirectional shoulder instability patients, coupled with the strict inclusion criteria. There are also multiple potential sources of bias including selection bias, sample bias, and observer bias.

Another limitation of this study consisted of patients not being treated uniformly. The number of anchors used ranged from 3 to 14, depending on the extent of the labral pathology and associated laxity. In addition, 5 patients had rotator interval closures. The function of the rotator interval is controversial; the suture plication techniques are varied,<sup>32,33</sup> and the indications for closure are poorly defined. Recently, an article by Provencher et al.<sup>34</sup> has suggested that arthroscopic interval closure does not significantly increase posterior or inferior stability of the shoulder. Currently, the senior surgeon rarely performs interval closure and usually only in the atraumatic setting of capsular laxity. Clearly, the role of the rotator interval and the indications for its closure are still evolving.

Finally, we determined our success rate to be 85% with regard to patient satisfaction, defining failure as clinically significant instability or lack of pain relief. It could be argued that any recurrent instability should be defined as a failure. In this group, of the 4 patients (30%) who had recurrent instability episodes, 2 had excellent pain relief, were satisfied with their outcome, and stated that the instability events were not clinically significant.

## CONCLUSIONS

Arthroscopic stabilization with labral repair in patients with MDI and a minimum 270° labral pathology provided good results (85%) in terms of pain relief and clinical stability at a minimum 2-year follow-up.

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