Treating shoulder multidirectional instability with an open stabilization procedure has been reported to have good results. However, few studies exist of arthroscopic plication, especially in overhead athletes. The purpose of this study was to evaluate the clinical outcomes of arthroscopic pancapsular plication for multidirectional instability in overhead athletes.

Twenty-three athletes with symptomatic multidirectional instability were treated with arthroscopic pancapsular plication and evaluated at a mean follow-up of 36.3 months (range, 24-61 months). Mean patient age was 23.3 years (range, 19-33 years). Functional outcomes were evaluated with the American Shoulder and Elbow Surgeons (ASES) score, Constant shoulder score, and Rowe instability score. The degree of pain and range of motion were also recorded. All postoperative functional scores were rated good to excellent, with an average ASES score of 88.4 (range, 82-95), average Constant shoulder score of 88.1 (range, 81-100), and average Rowe instability score of 86.7 (range, 80-100). Five patients returned to the same level of competitive sports, and 18 returned to a limited level. All patients were satisfied with the stability postoperatively. No significant change was observed in postoperative range of motion, but patients who returned to a limited level of sports had lower functional scores and more pain than did those who fully returned to sports.

Arthroscopic pancapsular plication for treating multidirectional instability in overhead athletes can provide good stability. However, the low rate of return to a full level of overhead sports is a problem. Further evaluation of the benefits of this procedure for overhead athletes with symptomatic multidirectional instability is needed.
S


 Since 1980, multidirectional shoulder instability has been described as instability in >2 directions, and the pathoanatomy has been identified as capsular redundancy or inherent laxity of the shoulder capsule. Multidirectional instability can be a debilitating condition for athletes because shoulder instability renders athletes unable to meet the demands of sports activities. Although the first line of treatment is conservative, not all outcomes are satisfactory. Surgery is indicated if conservative treatment fails. Neer and Foster first described the open capsular shift procedure for treating multidirectional instability, and it has been confirmed to provide good results in many studies. In recent years, arthroscopic treatment for multidirectional instability has been reported. At first, arthroscopic thermal shrinkage was a popular technique because it was less invasive and easy. However, the high failure rate of the technique is a concern. In the late 1990s, arthroscopic capsular plication became another choice for treating multidirectional instability. Studies on this procedure have reported good results, but few clinical-based studies focused on overhead athletes.

The purpose of this study was to evaluate clinical outcomes after arthroscopic plication with the goal of shoulder joint volume reduction in multidirectional instability in overhead athletes.

MATERIALS AND METHODS

Patients with overhead sports participation and shoulder hyperlaxity on both sides were enrolled in the study. Pain and symptoms of instability occurred in the dominant shoulders (18 right shoulders and 5 left shoulders), which were operated on. All dominant shoulders revealed marked inferior (sulcus sign), posterior, and anterior translation greater than grade 2+. No patient had a positive impingement test in the dominant shoulder.

Patients with multidirectional instability were initially treated with physical therapy. Surgery was indicated in patients for whom physical therapy failed for >6 months and who had persistent symptoms. We retrospectively enrolled 25 shoulders in 25 patients (17 men and 8 women) treated for symptomatic multidirectional instability between 2004 and 2007. Two patients were lost to follow-up, leaving a final study group of 23 patients (15 men and 8 women). Average patient age was 23.3 years (range, 19-33 years). Average preoperative rehabilitation period was 9.5 months (range, 6-16 months). Follow-up was at least 2 years (mean, 36.3 months; range, 24-61 months). All procedures were performed by the senior author (H-L.M.). All patients experienced pain and instability during sports activities. Exclusion criteria included patients with only antero- inferior instability with Bankart or Bankart varied lesions, psychogenic voluntary shoulder dislocation, previous surgery, rotator cuff tears, superior labrum anterior and posterior lesions, and pathogenic of the long head of biceps tendon.

Preoperative magnetic resonance arthrography revealed that all patients had a patulous capsule with a large capsular volume (Figure 1). Pre- and postoperative physical examinations were performed by the operating surgeon, and follow-up functional questionnaires were completed by a senior surgeon (E-R.C.). All patients were evaluated at final follow-up using the American Shoulder and Elbow Surgeon (ASES) score, Rowe instability score, Constant shoulder score, and visual analog scale (VAS) for pain (0, no pain; 10, worst pain). Range of motion (ROM) in forward elevation, external rotation, and internal rotation were recorded preoperatively and at final follow-up.

SURGICAL TECHNIQUE

All patients underwent general anesthesia and were placed in the lateral decubitus position. Examinations of all shoulders revealed translation greater than grade 2+ in the inferior, posterior, and anterior directions, which matched preanesthesia findings. The arthroscopic procedure started from the standard posterior portal. The anterior portal was established via an outside-in technique at the superior margin of the rotator interval, whereas the anteroinferior portal was at the inferior margin of the rotator interval. The posterosuperior portal was established at the 7 o’clock position of the right shoulder for suture plication assistance. Diagnostic arthroscopy was performed in standard fashion to check the labrum, cuff, long head biceps, and capsule.

The capsule was abraded with an arthroscopic rascer to promote healing. Intra-articular capsular plication was performed using the curved suturing instrument from the Spectrum tissue repair system (Linvatec, Largo, Florida); the capsule was grasped and the sharp tip of the instrument was passed through the grasped capsule (approximately 1 cm) and through the labrum. This step began approximately 1.5 cm lateral to the glenoid.

Figure 1: Magnetic resonance arthrography of a 20 year-old man’s right shoulder showing a patulous capsule and large capsular volume.
rim. A 1-0 PDS (Ethicon, Somerville, New Jersey) was used as a shuttling relay to pass through the tissue via the instrument canal. Then a 2-0 Ethibond braided suture (Ethicon) was passed through the labrum and the capsule (Figure 2). A sliding, locking knot was used to fold the capsule over itself. The step was repeated from 3 to 10 o’clock to perform the pan-capsular plication, with a total 8 plication sutures (Figure 3).

Rotator interval and portal closure were performed in all patients using 2-0 Ethibond sutures, except the posterior portal closure, which was performed using 1-0 PDS. Intra-articular suture plication of the superior glenohumeral ligament and middle glenohumeral ligament was performed with the arm in external rotation. Anterior portals were closed with concomitant closure of the rotator interval, whereas posterior portals were closed with inside-out sutures.

After all plication, the humeral head was arthroscopically checked to be opposite the glenoid center. The stability was tested to make sure that the translation was less than grade 1+ in all directions.

The arm was placed in an abduction sling at 30° of abduction and neutral rotation for 6 weeks. Gentle passive ROM was started from the fourth week and active ROM was started from the sixth week postoperatively. Resistive ROM started from the eighth week postoperatively. Gentle exercise started from the fourth month, and more aggressive strengthening and overhead lifting began according to the recovery of ROM and strength. Return to previous sports activities was allowed 6 months postoperatively.

All patients were measured for all response variables, including demographic variables and important outcomes. Data were represented as mean and standard deviation for continuous response variables or percentages for discrete variables. Chi-square test was used to compare differences between 2 groups for each discrete variable, and Student’s t test was used for each continuous variable. SPSS version 17.0 (SPSS, Inc, Chicago, Illinois) was used to test the difference of the results. The P value was set at .05 before analysis for each test.

RESULTS

The 23 patients were evaluated at a mean follow-up of 36.3 months (range, 24-61 months). They competed in sports at the professional or amateur level (Table 1). No intra- or postoperative complications occurred. At last follow-up, no more than grade 1+ shoulder instability in the anterior, inferior, and posterior directions and no obvious shoulder dyskinesia were noted.25 Postoperative functional scores were rated good to excellent, with an average ASES of 88.4 (range, 82-95), average Constant shoulder score of 88.1 (range, 81-100), and average Rowe instability score of 86.7 (range, 80-100). No recurrence of shoulder instability (pop-out or go-out sensation) was reported, and all

Table 1

<table>
<thead>
<tr>
<th>Sport</th>
<th>No. of Patients</th>
<th>Level of Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Professional</td>
</tr>
<tr>
<td>Basketball</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Baseball</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Volleyball</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Pole vaulting</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Badminton</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
patients were satisfied with the stability postoperatively.

Five patients returned to the same level of competitive sports, and 18 returned to a limited level. No significant change occurred in pre- and postoperative ROM in either group (full vs limited return to sports) (Table 2). However, all patients with a limited return to sports reported tightness and pain during extreme external rotation and felt limited in reaching the full degree of ROM. Patients with a full return to sports reported little or no tightness and pain.

Thirteen patients had a minor frayed labrum–glenoid junction (labral lesion) (Figure 4). Although magnetic resonance arthrography was performed for all patients preoperatively, these labral lesions were not identified. Postoperative functional scores showed no significant difference between patients with and without labral lesions (Table 3).

**DISCUSSION**

Recently, improvements in the arthroscopic treatment of multidirectional instability have resulted in less perioperative morbidity than that found with an open technique.12-17 Cadaveric studies have shown that arthroscopic capsular plication can achieve the same volume reduction of the shoulder as open capsular shift.26 Volume reduction of the shoulder is the main goal when treating multidirectional instability. Reports have shown that overhead athletes experience a significant loss of internal rotation, a gain in external rotation, and a thickening of the posterior capsule in the dominant shoulder.27,28 The shoulders of overhead athletes undergo adaptive changes after repetitive training and competition. Although all patients in our series had bilateral shoulder hyperlaxity, only the dominant shoulder had symptoms of instability. This could be due to repetitive microtrauma or subluxation, which makes the unstable joint more sensitive and easier to injure. The goal of capsular plication is to eliminate joint instability by means of volume reduction; it does not change the adaptive qualities of the shoulder joint.

Shoulders with hyperlaxity are prone to injury and easily result in unidirectional instability. The hyperlax shoulder with unidirectional instability related to trauma always has labral pathology, such as a Bankart lesion. In our series, although no lesions of capsular detachment from the

![](image)

**Figure 4:** Arthroscopic image of a labral lesion in the posterior right shoulder.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Physical Examination Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motion</strong></td>
<td><strong>Return to Sports</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Full (n=5)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Pre</strong></td>
</tr>
<tr>
<td>Forward elevation, deg</td>
<td>178.0±4.47</td>
</tr>
<tr>
<td>Internal rotation, deg</td>
<td>86±5.48</td>
</tr>
<tr>
<td>External rotation, deg</td>
<td>112±8.37</td>
</tr>
</tbody>
</table>

Abbreviations: deg, degrees; Post, postoperative; Pre, preoperative.

*aMean±standard deviation.

*bStudent’s t test.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Functional Results at Last Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional Score</strong></td>
<td><strong>All Patients</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Yes (n=13)</strong></td>
</tr>
<tr>
<td>ASES</td>
<td>88.4±4.08</td>
</tr>
<tr>
<td>Constant shoulder</td>
<td>88.1±7.84</td>
</tr>
<tr>
<td>Rowe instability</td>
<td>86.7±11.14</td>
</tr>
<tr>
<td>VAS</td>
<td>2.5±1.04</td>
</tr>
</tbody>
</table>

Abbreviations: ASES, American Shoulder and Elbow Surgeons; VAS, visual analog pain scale.

*aStudent’s t test.

*bMean±standard deviation.

*cP<.05.
In previous reports on open surgery, the rates of return to sports ranged from 84% to 94% [5-8,30]; for arthroscopic surgery, the rates ranged from 85% to 100% [13-15,31,32]. In our study, 5 overhead athletes returned to the same level of competitive sports, and 18 returned to a limited level. Although our study focused on overhead sports, the rate of full return to sports is low. Postoperatively, all patients had good to excellent functional results and were all satisfied with their stability. However, the 18 patients with a limited return to sports reported tightness and pain during extreme external rotation. Their ROM was limited compared with their preoperative ROM. We compared the degree of ROM in forward elevation, internal rotation, and external rotation and found no difference between pre- and postoperative ROM in either group (full vs limited return to sports). The reason for this may be that because we evaluate ROM in the clinic, the static extreme degree of ROM can be reached; however, when the athletes are performing the extreme motion in sports competition, the sudden strength and torque in the shoulder exacerbates their discomfort and diminishes the power in their following motions. For overhead athletes, extreme external rotation is 1 of the most important motions in sports; with impaired ROM, sports performance is limited. The discomfort may be caused by many factors, such as scar tissue of the plication, small suture knots, tightened capsule after plication or rotator interval closure, or glenohumeral imbalance after plication. In our study, panchapsular plication provided good stability for multidirectional instability but was not enough for overhead athletes to return to full sports due to the restriction of extreme ROM.

The limitations of our study are similar to those of all retrospective study designs. No sufficient preoperative functional scores and no quantified objective evaluations for stability were obtained, and our sample size was small.

**CONCLUSION**

Arthroscopic panchapsular plication can provide good stability in overhead athletes with symptomatic multidirectional instability. However, the low rate of return to a full level of overhead sports is a problem. Further evaluation of the benefits of this procedure for overhead athletes with symptomatic multidirectional instability is needed.

**REFERENCES**


