

## Systematic Review

# The Treatment of Traumatic Anterior Instability of the Shoulder: Nonoperative and Surgical Treatment

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**Purpose:** Traumatic anterior instability of the shoulder is a common condition associated with a high recurrence rate in young patients. The role of nonoperative versus operative treatment and the optimal surgical approach for this condition is debated. The purpose of this study was to review the literature for the latest evidence comparing outcomes of treatment for traumatic anterior instability of the shoulder. **Methods:** A systematic review of the literature was performed to identify studies comparing operative versus nonoperative treatment for traumatic anterior shoulder instability and studies comparing open versus arthroscopic stabilization for traumatic anterior shoulder instability. **Results:** Surgical treatment was associated with a significantly lower rate of recurrent instability at 2 years of follow-up (7% v 46%) and at longer-term follow-up (10% v 58%) for first-time traumatic anterior shoulder dislocation, all in younger patients. The rates of recurrent instability were roughly equal after arthroscopic stabilization with suture anchors and open stabilization with anchors (open, 8.2%; arthroscopic, 6.4%). **Conclusions:** Rates of recurrent instability after a first-time anterior shoulder dislocation, particularly in young active male patients, are reduced by surgical intervention compared with nonoperative treatment. If surgical treatment is indicated, an arthroscopic approach using suture anchors appears to have similar results in terms of recurrent instability to an open approach using suture anchors. **Key Words:** Arthroscopic—Bankart—Open—Immobilization—Stabilization—Suture anchor.

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**T**raumatic anterior shoulder instability is a common problem facing the orthopaedic surgeon. The glenohumeral joint is the most common major joint to dislocate, at a rate of 11.2 per 100,000 per year,<sup>1</sup> and more than 90% of traumatic shoulder dislocations are anterior.<sup>2</sup> The challenge with this condition is the high rate of recurrence, particularly among younger patients. Traditionally, initial treat-

ment for anterior shoulder instability is reduction of the glenohumeral joint (if necessary) and a trial of nonsurgical treatment using a period of immobilization in a position of internal rotation, in conjunction with physical therapy to allow for gradual restoration of motion and strength.<sup>3</sup> This approach has been shown to be associated with a high rate of recurrence, particularly among younger patients. For example, Marans et al.<sup>4</sup> reported a 100% recurrence rate in 21 pediatric patients treated with immobilization after traumatic anterior shoulder dislocation.

If patients fail this approach with recurrent dislocations or persistent symptomatic subluxation, the next step in the treatment algorithm is surgical stabilization<sup>3</sup> with an open Bankart repair and/or a capsular shift.<sup>5-8</sup> With the advent of arthroscopy and advances in arthroscopic equipment and techniques, arthroscopic stabilization has been described using a variety of fixation techniques, including transglenoid su-

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tures,<sup>9,10</sup> staples,<sup>11,12</sup> and bioabsorbable tacks.<sup>13,14</sup> Suture anchors have recently become the preferred methodology for fixation during arthroscopic shoulder stabilization.<sup>15,16</sup> Suture anchors allow for more anatomic stabilization, placing the labrum back in the glenoid rim with very secure fixation. A recent retrospective study comparing suture anchors to transglenoid sutures for fixation during arthroscopic shoulder stabilization concluded that suture anchors are superior, leading to significantly lower rates of recurrence.<sup>17</sup>

Several studies have compared the results of early surgical treatment of first-time traumatic anterior dislocation compared with nonoperative treatment.<sup>18-22</sup> According to a recent review by Kuhn,<sup>23</sup> there is Level I evidence to support the conclusion that arthroscopic stabilization surgery reduces the rate of recurrence after initial anterior shoulder dislocation. With regard to open versus arthroscopic stabilization, we are aware of 3 published meta-analyses.<sup>24-26</sup> These studies include a variety of evidence, including lower level published reports and unpublished abstracts. Furthermore, these analyses included a variety of different fixation techniques, including transosseous sutures, tacks, and suture anchors in their comparison groups. While this may have been done because the authors could not identify an adequate number of studies using similar fixation methods, it limits the relevance of the results in terms of a specific technique. Because suture anchors should be considered the current gold standard for fixation in shoulder stabilization, we elected to focus our systematic review on studies in which this fixation was used. By limiting our systematic review of surgical treatment to comparisons of open and arthroscopic techniques using suture anchors, the findings should be specific to that technique.

The purpose of this systematic review was to address the treatment of traumatic anterior shoulder instability, specifically 2 aspects of treatment: (1) the utility of surgical treatment versus nonoperative treatment in a first time dislocator, and (2) the utility of open stabilization versus arthroscopic stabilization in the treatment of traumatic anterior shoulder stabilization, focusing primarily on techniques using suture anchor fixation.

## METHODS

We identified all published studies in English addressing the treatment of traumatic anterior shoulder instability. We then focused on inclusion criteria for our 2 areas of interest. First, we identified studies

comparing surgical treatment to nonoperative treatment for first-time traumatic anterior shoulder dislocation. We then identified comparisons of open surgical treatment to arthroscopic surgical treatment using suture anchors for anterior shoulder instability. Studies were excluded if any fixation other than suture anchors was used, if a bone block type of procedure was used, or if components of instability other than anterior were present.

A search of the Medline database on PubMed from 1966 to May 2008 was performed using the terms “Bankart” or “shoulder and instability” (or “shoulder” and “closed treatment” or “nonoperative treatment”). In addition, the citations from previous review articles comparing arthroscopic with open treatment of shoulder instability were reviewed. These articles were then collected and reviewed to determine if they were suitable for inclusion in this review.

## RESULTS

The PubMed search identified 2,494 articles. We identified 6 articles that related to our issue of immediate surgical stabilization versus nonoperative treatment for first-time anterior shoulder dislocation (Table 1). Two of these articles represented the early and late results in the same cohort, and these data were included accordingly.<sup>19,21</sup>

We identified 20 articles that compared arthroscopic treatment of anterior shoulder instability with open treatment (Table 2). However, suture anchors were used for the arthroscopic stabilization in only 8 of these studies. These 8 studies were used as the basis for our analysis because no additional studies were identified from additional sources.

Comparing surgical to nonsurgical treatment in first-time dislocators, surgical treatment was associated with a significantly lower rate of recurrent instability at 2 years of follow-up (7% v 46%; Table 3). At

**TABLE 1.** Description of Studies Comparing Surgical to Nonoperative Treatment Following First-Time Anterior Shoulder Dislocation

Study	Year	Design	Level of Evidence
Arciero et al. <sup>18</sup>	1992	Prospective cohort	IV
Bottoni et al. <sup>19</sup>	2002	Prospective RCT	I
Kirkley et al. <sup>20</sup>	2005	Prospective RCT	I
Kirkley et al. <sup>21</sup>	1999	Prospective RCT	I
Jakobsen et al. <sup>22</sup>	2007	Prospective RCT	I
Yanmis et al. <sup>27</sup>	2003	Prospective cohort	IV

Abbreviation: RCT, randomized, controlled trial.

**TABLE 2.** Description of Studies Comparing Arthroscopic Stabilization With Suture Anchors to Open Stabilization With Suture Anchors

Study	Year	Design	Level of Evidence
Bottoni et al. <sup>28</sup>	2006	Prospective RCT	I
Fabbriciani et al. <sup>29</sup>	2004	Prospective RCT	I
Guanche et al. <sup>30</sup>	1996	Retrospective cohort	III
Kim et al. <sup>31</sup>	2002	Case control	III
Paladini et al. <sup>32</sup>	2005	Cohort	IV
Rhee et al. <sup>33</sup>	2006	Cohort	IV
Tjoumakaris et al. <sup>34</sup>	2006	Retrospective cohort	III
Wang et al. <sup>35</sup>	2005	Retrospective case control	III

Abbreviation: RCT, randomized, controlled trial.

longer-term follow-up, including studies with 3- to 10-year results, recurrent instability remained significantly lower in the surgically treated patients (10% v 58%). The mean age in all of these studies was under 24 years, and most of the patients were in their teens and twenties. Only 1 study included patients in their thirties in both cohorts, while another study included some patients in their early thirties in the nonoperative cohort.

Comparing arthroscopic stabilization with suture anchors to open stabilization with anchors, the rates of recurrent instability were roughly equal (open, 8.2%; arthroscopic, 6.4%; Table 4). Results in terms of range of motion and outcome scores were also roughly equal between the 2 techniques.

## DISCUSSION

Traumatic anterior shoulder instability is a common problem with an accepted treatment algorithm of ini-

tial nonsurgical treatment, with surgical stabilization indicated after recurrent instability. Open stabilization is considered the gold standard for surgical treatment of this problem. Our review suggests that early surgical stabilization has the advantage of a significantly lower recurrence rate for young active patients. However, early surgical intervention will result in some patients having unnecessary surgery and further research is necessary to establish prognostic factors that can stratify patient risk in order to identify individuals most likely to benefit from surgery. Furthermore, arthroscopic stabilization using suture anchors appears to be comparable to open stabilization although, again, there may be certain subsets of patients, for example contact athletes,<sup>33</sup> who would benefit from open stabilization.

Long-term studies of shoulder dislocation treated conservatively have clearly shown that not all patients will need surgical intervention. At 10 years of follow-up, Hovellius et al.<sup>36</sup> showed in a cohort of 245 patients with anterior shoulder dislocations treated conservatively with immobilization or a sling that 52% of patients did not have another dislocation, although 70% of the patients who were 12 to 22 years of age at the time of their initial dislocation suffered at least 1 additional dislocation. Overall, 23% of patients had recurrent instability that led them to undergo operative treatment, with 34% of the patients 12 to 22 years of age at the time of their initial dislocation, and 38% of the patients 12 to 16 years of age, eventually requiring surgical stabilization. Most patients who were 12 to 22 years of age underwent surgery within 5 years of their initial dislocation, whereas the older patients tended to undergo surgery more than 5 years after their initial dislocation. Robinson et al.<sup>37</sup> reported a similar over-

**TABLE 3.** Summary of Results in Studies Comparing Operative Treatment to Nonoperative Treatment Following First-Time Anterior Shoulder Dislocation

Study	Total No. of Patients (M/F)		Mean Age, yr (Range)		Mean Follow-Up, mo (Range)		Recurrence		Outcome Score		
	Con	Surg	Con	Surg	Con	Surg	Con	Surg	Scale	Con	Surg
Arciero et al. <sup>18</sup>	15	21	19.5 (18-21)	20.5 (18-24)	23 (15-39)	32 (15-45)	>80%	20%	N/A	—	—
Bottoni et al. <sup>19</sup>	12 (12/0)	9 (9/0)	23 (19-26)	21.6 (19-26)	37 (16-56)	36 (16-56)	75%	11%	SANE	57	88
Kirkley et al. <sup>20</sup>	15 (14/1)	16 (13/3)	22.7	23.3	79 (51-102)		60%	20%	WOSI	75	86
Kirkley et al. <sup>21</sup>	21 (19/2)	19 (16/3)	22.8	22.1	36 (22-54)	32 (18-51)	47%	16%	WOSI	68	84
Jakobsen et al. <sup>22</sup>	39 (32/7)	37 (30/7)	20 (15-31)	23 (15-39)	120		62%	8%	Oxford	74% U	70% E/G
Yanmis et al. <sup>27</sup>	32 (28/4)	30 (30/0)	22 (19-32)	21 (18-26)	40 (18-63)	33 (10-60)	38%	3%	Constant	71	92
Totals*	113	113					58.4%	9.7%			

Abbreviations: Con, conservative; E/G, excellent/good; F, female; M, male; N/A, not applicable; SANE, single assessment numeric evaluation; WOSI, Western Ontario Shoulder Instability Index; U, unsatisfactory.

\*Includes the long-term study by Kirkley et al.<sup>20</sup>

TABLE 4. Summary of Results in Studies Comparing Arthroscopic to Open Stabilization

Study	Total No. of Patients (M/F)		Mean Age, yr (Range)		Mean Follow-Up, mo (Range)		Recurrence		Rowe Score	
	Arth.	Open	Arth.	Open	Arth.	Open	Arth.	Open	Arth.	Open
Bottoni et al. <sup>28</sup>	32 (31/1)	29 (29/0)	25 (20-40)	25 (19-42)	28.5 (24-48)	30 (24-48)	3.1%	3.4%	92	86
Fabbriciani et al. <sup>29</sup>	30 (24/6)	30 (26/4)	25 (19-33)	27 (21-30)	24	24	0%	0%	91	87
Guanche et al. <sup>30</sup>	5	12					20%	8%	N/A	N/A
Kim et al. <sup>31</sup>	58 (50/8)	30 (26/4)	27 (16-51)	28 (18-47)	33 (26-42)	49 (41-60)	10.2%	10.0%	93	90
Paladini et al. <sup>32</sup>	37 (33/4)	22 (18/4)	28 (16-53)	29 (15-47)	48		9%	8%	83	82
Rhee et al. <sup>33*†</sup>	16	32	20 (16-29)	20 (16-29)	72(30-136)		25%	12.5%	87	89
Tjoumakaris et al. <sup>34‡</sup>	69 (56/13)	24 (16,8)	30 (17-68)	28 (15-40)	39 (24-57)	56 (34-77)	1.4%	4.2%	N/A	N/A
Wang et al. <sup>35§  </sup>	18	17	35	23	N/A (26-45 m)		5.6%	23.5%	N/A	N/A
Total	266	196					6.4%	8.2%		

Abbreviation: Arth, arthroscopic (stabilization); N/A, not applicable.

\*Only 1 female in the entire study population. It was not disclosed if the patient was in the arthroscopic or open arm of the study.

†The mean age of the entire study population was 20 years (range, 16-29 years).

‡Mean American Shoulder and Elbow Surgeon score: open, 90 ± 11; arthroscopic, 90 ± 16.

§Only standard deviation was reported (arthroscopic SD, 8 years; open SD, 14 years).

||Mean American Shoulder and Elbow Surgeon score: open, 86 ± 13; arthroscopic, 90 ± 13.

all recurrence rate of 56% at 5 years of follow-up among a cohort of 252 patients 15 to 35 years of age, but a much higher recurrence rate of 87% among patients 15 to 20 years of age at the time of their initial dislocation. Patient age is clearly an important prognostic factor, but other issues, particularly patient activity level and specific sport participation, may provide further prognostic value to help determine which patients would benefit from early surgical intervention.

A recent prospective study by Sachs et al.<sup>38</sup> investigated factors that might predict recurrent instability. At an average follow-up of 4 years in a cohort of 131 patients, about a third of shoulders had recurrent instability (33), and only 22% underwent surgical stabilization, although patients who participated in contact or collision sports or used their arm at or above chest level in their occupation were much more likely to undergo surgery (49%). Patients 12 to 19 years of age at the time of their initial dislocation had a much higher rate of recurrent instability (56%) and slightly higher rate of surgical stabilization (28%). In logistic regression analysis, being under 25 years of age at the time of the initial dislocation was clearly associated with a higher risk of subsequent instability, while occupational use of the arm at or above chest level was very close to statistical significance ( $P = .066$ ), and higher pain on initial dislocation and participation in collision/contact sports also approached significance. They concluded that surgical stabilization was not warranted in the acute setting after a traumatic shoulder dislocation.

However, a recent Cochrane review supports the conclusion that early surgical intervention is warranted in certain patient populations. In 2004, Handoll<sup>39</sup> reviewed surgical versus nonsurgical treatment for acute anterior shoulder dislocation. They identified five studies including 239 patients and reported a 68% to 80% reduction in the relative risk for recurrent instability after surgical compared with nonsurgical treatment. Patients who underwent surgical treatment had significantly higher outcome scores, and approximately half of all patients initially treated nonoperatively eventually underwent surgery. Three of their studies are included in our review; we also included some nonrandomized comparisons that they excluded, and they included a couple of abstracts that we excluded. They also included a study comparing arthroscopic lavage with nonoperative treatment for first-time dislocation. Nevertheless, they reached a similar conclusion that surgical stabilization is warranted for "young adults, usually male, engaged in highly demanding physical activities who have sustained their first acute traumatic shoulder dislocation."

The type of nonoperative treatment may be important. There has been growing interest in whether immobilizing the upper extremity in external rotation has an effect on treatment efficacy.<sup>40-46</sup> Despite a number of publications regarding this topic, there is a paucity of comparative studies to review as a basis for clinical decision-making. Kuhn<sup>23</sup> concluded that Level II evidence exists to support the conclusion that postreduction immobilization in external rotation may reduce recurrence, while Level I evidence suggests that im-

mobilization in internal rotation does not reduce recurrence. A recent Cochrane review on this topic could only find one "flawed quasirandomized trial" comparing postreduction immobilization in external rotation to immobilization in internal rotation.<sup>47</sup> No significant differences in terms of return to activity or recurrent instability or dislocation were found, and similar numbers of patients discontinued their immobilization within 1 week of treatment in both treatment arms.<sup>44</sup> Prospective randomized, controlled trials with adequate power are needed to better understand the clinical significance of immobilizing the arm in external rotation versus internal rotation after traumatic anterior shoulder dislocation.

Earlier reviews comparing arthroscopic stabilization to open stabilization have suggested that arthroscopic stabilization leads to inferior results, particularly in terms of recurrent instability. The review by Freedman et al.<sup>24</sup> focused on arthroscopic repairs using transglenoid sutures or bioabsorbable tacks. Their results are not comparable to the findings in this current study, which focuses on suture anchor fixation. A later meta-analysis by Mohtadi et al.<sup>25</sup> reported Mantel-Haenszel odds ratio for recurrent instability and return to activity in favor of open stabilization compared to arthroscopic stabilization. Suture anchors were used for fixation during open stabilization in 9 of their 11 included studies, while only 3 of the 11 studies used suture anchors for fixation during the arthroscopic stabilization.

A review by Lenters et al.<sup>26</sup> again reported a significantly higher rate of recurrent instability after arthroscopic stabilization (relative risk, 2.37;  $P < .00001$ ), even when using suture anchors (relative risk, 2.25;  $P = .01$ ). Six of the studies included in this meta-analysis compared arthroscopic stabilization to open stabilization using suture anchors. Four of these 6 studies were abstracts, not published results, at the time they conducted their meta-analysis. One of those 4 abstracts has since been published and is included in our analysis. The other 3 abstracts were the only studies which showed a higher rate of recurrent instability after arthroscopic stabilization using suture anchors. The 3 published studies showed equal or lower rates of recurrent instability among the patients treated using arthroscopic stabilization. Nevertheless, this review concluded that arthroscopic repair using suture anchors is associated with a higher rate of recurrent instability than open repair using suture anchors.

The same review also reported a lower rate of return to work and/or sports after arthroscopic repair (relative risk, 0.87;  $P = .03$ ). They did not

report any results for return to work and/or sports after repair using suture anchors, because most of these studies do not include these data. However, similar to our results, they did report higher Rowe scores associated with arthroscopic techniques, both overall and when limiting the analysis to suture anchor techniques.

Our review attempted to compare published studies in English that used similar techniques. By including the results from using open techniques with suture anchors to arthroscopic techniques with suture anchors, this systematic review controls for fixation method and can focus on the influence of varying the surgical approach. Including studies with a variety of fixation methods and different surgical approaches makes the analysis less compelling.

Comparing open to arthroscopic stabilization, patient age also confounds the analysis. In a study by Wang et al.,<sup>35</sup> the patients treated with arthroscopic stabilization were slightly older than the patients treated with open repair. Given the significantly higher rates of recurrence among younger, more active patients, this selection bias skews the results in favor of arthroscopic treatment independent of the actual treatment effect. If this study is removed from our analysis, the rates of recurrent instability remain similar (open, 6.7%; arthroscopic, 6.5%).

Nonrandomized trials are also likely to introduce significant bias, particularly if the surgeon selected the treatment. In this case, arthroscopic patients are likely to be older, less active patients with pathology more amenable to arthroscopic treatment (ie, no bone loss). Younger, more active patients with more significant pathology such as a bony Bankart lesion which are at higher risk for redislocation would be more likely to get open stabilization. Level III and IV studies are likely to suffer from this selection bias. Taking this into account and limiting our systematic review to include the 2 Level I studies (Bottoni et al.<sup>28</sup> and Fabbriani et al.<sup>29</sup>) still leads to the same conclusion: open and arthroscopic stabilization using suture anchors have similar rates of recurrent instability. Because these studies did have relatively short follow-up periods (2 yr), longer-term Level I studies comparing these 2 techniques are needed.

Previous reviews reported a lower rate of return to work and sport after arthroscopic surgery. We were unable to draw any conclusions regarding return to activity, because only 1 of the studies we reviewed included these data. Future investigations should include this parameter as one of the outcome variables of interest.

There are a number of limitations to the current study. With regard to the effect of immediate surgical treatment for anterior shoulder dislocation, we could not control for patient age, which obviously has a tremendous impact upon the rate of recurrence. The use of different outcome scales across different studies limits the ability to compare the results. There is a lack of data on patient activity following the different treatment protocols; for example, surgically treated patients may limit their activity because of pain or apprehension in the postoperative period, which may contribute to the lower rate of recurrence.

### CONCLUSIONS

Rates of recurrent instability after a first-time anterior shoulder dislocation, particularly in young active male patients, are reduced by surgical intervention compared to nonoperative treatment. If surgical treatment is indicated, an arthroscopic approach using suture anchors appears to have similar results in terms of recurrent instability to an open approach using suture anchors.

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