[Orthopaedics]

Systematic Review of Rehabilitation Versus Operative Stabilization for the Treatment of First-Time Anterior Shoulder Dislocations

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Context: Primary anterior shoulder dislocation is a frequent injury in young active patients. Traditionally, conservative nonoperative primary treatment has been advocated for a majority of first-time dislocators, whereas operative stabilization has been reserved for recurrent dislocators or those involved in strenuous physical activity. Currently, no consensus exists on whether to treat a first-time anterior shoulder dislocation surgically.

Objective: (1) To provide clinical recommendations regarding the therapeutic intervention for first-time anterior shoulder dislocators and (2) to determine if there is sufficient Level 1 or 2 evidence available for the establishment of a uniform, optimal treatment protocol.

Data Sources: A systematic review of prospective randomized controlled trials with human participants was performed. PubMed, the Cochrane Database of Systematic Reviews, and secondary references were appraised for studies published between 1994 and 2009.

Study Selection: Inclusion criteria were English-language Level 1 or 2 studies involving the treatment of primary anterior shoulder dislocation. Exclusion criteria included non-English-language articles; Level 3, 4, or 5 studies; and studies examining treatment of recurrent/posterior shoulder dislocation or diagnoses other than primary anterior shoulder dislocations.

Data Extraction: Each author conducted an independent quality appraisal of the included studies, identifying strengths, weaknesses, and biases, then reached consensus regarding their values.

Results: Five randomized controlled trials were included, and they supported the use of operative management in a focused population. No long-term follow-up data were available describing the effects of surgical intervention or the development of osteoarthritis. Each study design had weaknesses that decreased the validity of the findings.

Conclusions: While limited, the available evidence from randomized controlled trials supports operative stabilization as a reasonable alternative to nonoperative treatment for primary acute shoulder dislocation in young, active adults participating in highly demanding physical activities. Recommendations on the optimal surgical intervention cannot be provided. There is no conclusive evidence available to determine whether operative stabilization or conservative rehabilitation is superior for other patient or injury types.

Keywords: systematic review; primary anterior shoulder dislocation; treatment

The shoulder joint is the most commonly dislocated joint in the human body with an incidence rate of 17 of 100 000 each year.[13] Acute anterior dislocation is the most common type of shoulder dislocation, constituting 96% of all shoulder dislocations.[20,37] A study documented an overall adjusted incidence of primary traumatic shoulder dislocation as 8.2 of

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100 000 person years, whereas the incidence of all traumatic shoulder dislocations, initial and recurrent, was estimated to be at least 11.2 of 100 000 person years.[9] The same study estimated the prevalence of traumatic shoulder dislocations, expressed in terms of a cumulative incidence rate, to be 0.7% for men and 0.3% for women up to the age of 70 years.[9]

The populations experiencing the highest incidence rates of shoulder dislocation comprise young men between 21 and 30 years old and elderly women between 61 and 80 years old.[13] Young men and women usually experience shoulder dislocation as a result of trauma, especially on the sports field, whereas the elderly are more likely to suffer a dislocation as a result of falling on an outstretched hand.[13] Subsequently, the shoulder is less stable and more susceptible to redislocation, especially in active young adults. Numerous recurrence rates, some as high as 94%, have been reported for anterior shoulder dislocation.[2,12,13,15,26,29,31] In a prospective 25-year follow-up study (the longest of its kind), Hovelius et al found that approximately half of all patients between the ages of 12 and 25 years who had undergone nonoperative treatment experienced subsequent recurrence.[15] The cost of this initial injury and consequent recurrences can be substantial with regard to time lost from sports and activities of daily living, quality of life, and monetary expenses.

Although the nature and extent of damage secondary to shoulder dislocation varies, there are frequent injury patterns, such as the classical Bankart lesion (an injury to the anterior glenoid labrum)[3] and the Hill Sachs lesion (a compression fracture of the humeral head).[32] Early studies examining the underlying pathophysiology behind recurrent anterior shoulder dislocations and treatment centered on the Bankart lesion.[3] Open surgical techniques employed to treat the labral lesion have been successful.[28,30] In a long-term follow-up study, Rowe et al reported a 3.5% recurrence rate in patients who underwent open Bankart repair after anterior shoulder dislocation, and the group advised against postoperative joint immobilization.[28] Eventually, arthroscopic techniques were developed to provide a less invasive treatment option for anterior shoulder dislocations. Several studies have investigated the role of arthroscopic shoulder stabilization in first-time acute dislocations.[1,5,7,22] The surgical goal of these early arthroscopic investigations was to correct the Bankart lesion, but they did not address concurrent capsular pathology. At this early stage, the arthroscopic techniques, although improving, did not rival the gold-standard open techniques described by Rowe.[28]

Current treatment encompasses both conservative and surgical approaches, each preceded by reduction of the acute dislocation. Traditional nonoperative primary treatment has been advocated, including immobilization with subsequent rehabilitation[14,25,38] and arthroscopic lavage.[37] Other studies have supported immobilization of the shoulder in external rotation.[17,18] Historically, surgical intervention has been reserved for chronic recurrence or instability.[5] However, given the high rate of recurrence, especially in young physically active adults, there is significant controversy surrounding the management of primary anterior dislocation and whether surgical stabilization of primary dislocation is warranted. Arciero et al first popularized the issue of operative versus nonoperative treatment when they examined arthroscopic trans glenoid repairs versus nonoperative treatment in military cadets and had successful results with operative treatment.[1] Although many authors agreed on patient parameters that would be amenable to surgery for first-time dislocations, including age, degree of athletic participation, and patient quality of life, there is still no consensus on whether to surgically stabilize all first-time dislocators.[4]

METHODS

Search Strategy

A systematic review was performed of Level 1 and Level 2 English-language prospective randomized controlled trials (RCTs) with human participants. PubMed, the Cochrane Database of Systematic Reviews, and secondary references were appraised for studies published between 1994 and 2009 that met the inclusion criteria. Reference lists of retrieved articles were screened for additional publications.

Study Selection

The publications had to meet the following selection criteria:

Study design: RCTs had to compare operative with conservative rehabilitative treatment for primary anterior shoulder dislocation. Studies focusing on recurrent anterior shoulder dislocation or posterior shoulder dislocation were excluded. Level 1 studies were priority, although Level 2 evidence was included in the review.

Participants: Patients were limited to those with acute primary anterior shoulder dislocation, as confirmed by physical examination and radiography or magnetic resonance imaging. All age groups were included.

Interventions: All studies compared operative treatment with conservative rehabilitative treatment. Conservative treatment included immobilization or arthroscopy without stabilization or Bankart repair, and all conservative treatment options were followed by a rehabilitation protocol.

Outcome measures: The review included all outcome measures for shoulder function or pain, including Disabilities of the Arm, Shoulder, and Hand score; Western Ontario Shoulder Instability score; Oxford score; Constant score; Single Assessment Numeric Evaluation score; L'Insalata score; and American Shoulder and Elbow Surgeons score.

Exclusion criteria: Studies were excluded if they were non-English-language studies, Level 4 or 5 studies, or studies examining the treatment of recurrent/posterior shoulder dislocation or diagnoses other than primary anterior shoulder dislocations.

We used these criteria to independently select the relevant articles for this review by reading all titles and abstracts retrieved by the search strategy. We reviewed the abstracts found from the search for evidence of a direct comparison between conservative rehabilitation versus operative stabilization of first-time anterior shoulder dislocations. We then arrived at a consensus for including 5 studies in this review. We then obtained the complete articles and conducted a manual cross-reference. Finally, we independently critically appraised the final selected articles to classify the study design as a measure of the level of evidence.

Methodological Quality Assessment

All publications were assessed according to a methodological quality list for the assessment of RCTs (Table 1),[10] which was modified to better fit this study. The requirement of blinding patients or health care providers to the intervention was excluded because blinding was not possible in this type of RCT. Each assessment criterion was graded as *positive/yes* (+), *negative/no* (–), or *unclear* (?). A quality score was calculated for the selected studies by summing the positive answers. Item E or G was answered only if D or F, respectively, was scored negatively. The maximum attainable score was 9. Studies were considered to be methodologically high quality when at least 7 items scored positively, whereas a score of 4 to 6 was considered medium quality and 0 to 3 was low quality. We discussed the quality appraisal and reached consensus regarding the strengths, weaknesses, and value of the included studies.

Data Extraction

We extracted data from the selected studies on the study population, description and standardization of interventions, outcome measures, and results. Primary outcomes included the following: recovery, defined as return to preinjury level of activity (sports or work); reinjury or recurrence (including subsequent surgery); subjective instability; and results from validated shoulder rating scales. Secondary outcomes include the following: range of movement, complications, patient satisfaction, stiffness, and strength. A systematic review was performed because meta-analysis was not possible, owing to the diversity in outcome measures among the included studies and the differing presentations of data (median scores, mean scores, relative risk ratios). We chose to summarize the results by means of a qualitative analysis.

RESULTS

Study Selection

The PubMed search resulted in 109 citations. One more citation was found in the Cochrane database. Citation tracking identified no other studies. The title or abstract, or both, was used to exclude 97 articles, and 7 were retrieved for a more detailed evaluation. Next, 1 review[10] was excluded because it is a Cochrane database review of RCTs on the topic. Consequently, 6 articles describing 5 RCTs met our inclusion criteria.[5,19,22,23,27,36] Two articles[22,23] described the same trial, of which 1 reported the long-term outcomes (average, 75-month follow-up).

Methodological Quality and Risk of Bias

Table 1 presents the quality assessment results. The quality assessment scores of the 5 trials ranged from 6 to 9. According to our cutoff values for quality, 3 trials were classified as high quality and 2 as medium quality (see Table 2). Several methods by which the trials were carried out had the potential to inflict bias on the results. The small sample sizes yielded susceptibility to random bias. Whereas treatment group allocation was randomized in all trials, it was only concealed in the Kirkley and Robinson studies. There was insufficient information to judge whether allocation was concealed in the Wintzell study. Treatment allocation was not concealed in the Bottoni trial, which used social security numbers to assign patients. Blinding of outcome assessors was reported in detail in the Kirkley study and mentioned briefly in the Robinson trial. However, none of the other trials referred to assessor blinding, although Wintzell et al used an independent assessor.

Another potential source of bias was the data analysis. Intention-to-treat analysis was not detailed in the Bottoni or Jakobsen trials. The intention-to-treat approach is often inadequately applied, and its misuse is a potential source of bias. Patient baseline characteristics, percentage of patients available for follow-up, clinical appropriateness of outcome measures, and length of follow-up were comparable and sufficient in all 3 trials. However, all the patients in the Bottoni study were active military personnel who certainly placed more burdens on their shoulders as compared to the study participants enrolled from the civilian public in the other trials. This is a potential source of bias because, as Bottoni stated, "studies performed at the military academy . . . are not a true representation of the general population because of the rigorous physical demands placed on the cadets and their more strict compliance with rehabilitation."[5]

Data Extraction and Analysis

Table 2 presents the characteristics of the selected studies, including intervention descriptions, population characteristics, outcomes assessed, treatment effects, follow-up periods, and study quality. All studies randomized participants between conservative rehabilitation and operative treatment. The 5 selected studies included 288 patients, most of whom were young active males. Each RCT was limited to patients with primary anterior shoulder dislocation as verified by physical examination and radiograph[20,22,27,36] or magnetic resonance imaging[5] after reduction. Table 2 details exclusion criteria. Each trial directly compared 2 treatments: operative and conservative rehabilitation. Surgery entailed arthroscopic repair in 3 trials (Kirkley,[22,23] Bottoni,[5] Robinson[27]), open repair in 1 trial (Jakobsen[19]), and arthroscopic lavage in the

Table 1. Results of the methodological quality assessment for all included randomized controlled trials.[a]

	Randomized Controlled Trial				
Item	**Kirkley[22,23]**	**Bottoni[5]**	**Wintzell[36]**	**Jakobsen[19]**	**Robinson[27]**
A. Was the treatment allocation randomized and concealed?	+	–	?	?	+
B. Was the outcome assessor blinded to the intervention?	+	–	?	?	+
C. Were the groups similar at baseline?	+	+	+	+	+
D. If not, were adjustments made in the analysis for differences of prognostic indicators at baseline and/or for confounding variables?	NA	NA	NA	NA	NA
E. Was a sufficient proportion (≥ 80%) of included patients available for the full length of follow-up?	+	+	+	+	+
F. If not, was selective loss to follow-up excluded?	NA	NA	NA	NA	NA
G. Was an intention-to-treat analysis included?	+	–	+	–	+
H. Were the interventions clearly defined?	+	+	+	+	+
I. Were the inclusion and exclusion criteria for study entry clearly defined?	+	+	+	+	+
J. Were the outcome measures suitable to measure clinically relevant differences in treatment effects?	+	+	+	+	+
K. Was the follow-up duration adequate to measure clinical differences between treatment modalities (≥ 1 year)?	+	+	+	+	+
Quality score[b] (%)	9 (100)	6 (66)	7 (77)	6 (66)	9 (100)

[a]+, positive or yes; –, negative or no; ?, unclear; NA, not applicable.
[b]Minimum, 0; maximum, 9.

other (Wintzell[36]). Arthroscopic stabilization was performed using bioabsorbable tacks in the Bottoni trial and sutures and anchors in the Robinson trial, whereas Kirkley et al employed trans glenoid sutures and K-wires. Open repair was carried out using Mitek anchors in the Jakobsen study.[19] Postoperatively, both treatment groups in all 5 studies were immediately immobilized with subsequent rehabilitation. The immobilization varied between the trials in that sling use for up to 1 week was optional in the Wintzell trial, whereas it was required for a set amount of time in the other trials, ranging from 1 week[19] to 4 weeks.[5] This flexible interpretation of the term *immobilization* employed by the Wintzell group potentially affects the validity of the study's results.

Primary Outcomes

By long-term follow-up, all but 1 person in both groups of the Kirkley trial indicated that they had returned to all or most of their preinjury sports or activities. All the cadets in the Bottoni study returned to active duty, and all patients in the Robinson trial returned to preinjury levels of work and sports by 2-year follow-up. Although these 3 sets of results were homogeneous, those of the Wintzell study differed significantly in that only 73.1% and 65.2% of patients in the operative and nonoperative groups, respectively, had reached preinjury participation levels in work and sports by 1-year follow-up.[36] Results from all 5 trials showed that rates of redislocation and subluxation were significantly less frequent in the operative stabilization group. Robinson et al described the number needed to treat in order to prevent all recurrent instability and radiographically proven redislocation (3.2 and 4.7, respectively). Kirkley et al, Wintzell et al, and Robinson et al reported that shoulder redislocations occurred further from the time of primary treatment in the operative stabilization group when compared to the conservative rehabilitation group.[23,27,37] However, this result was not congruent with that of Jakobsen et al, who found that 2 patients in the operatively stabilized group and 3 patients in the conservatively rehabilitated group suffered recurrent dislocation between 2 and 10 years after initial dislocation.[19] Moreover, subsequent surgical intervention for instability was carried out significantly less often in the operatively stabilized groups.

Shoulder functional assessment measures were analyzed in all 5 trials. Bottoni et al employed the Single Assessment Numeric Evaluation[34,35] and L'Insalata[24] shoulder indexes, whereas Kirkley et al used the Western Ontario Shoulder Instability index.[21] Similarly, Wintzell et al used the Rowe[28] shoulder score. Jakobsen et al utilized the Constant score, whereas Robinson et al used the Disabilities of the Arm, Shoulder, and Hand and Western Ontario Shoulder Instability indexes. The differences in the mean Single Assessment Numeric Evaluation (88 and 57) and L'Insalata scores (94 and 73) between treatment groups were statistically significant and supported better outcomes in the operative stabilization group.[5] Likewise, differences in Disabilities of the Arm, Shoulder, and Hand and Western Ontario Shoulder Instability indexes at 24-month follow-up were significantly better in the operative stabilization group, although no difference was found until that time point.[27] At 79-month follow-up, the differences in scores between groups on the Western Ontario Shoulder Instability were no longer statistically significant, although the values from the operative stabilization group still supported better functional outcomes.[23]

Secondary Outcomes

Only 2 trials assessed objective instability by a positive apprehension test, and the result was significantly less common instability in the operatively stabilized treatment groups.[19,36] Range of motion was mentioned by all but 1 trial. Kirkley et al reported 5 measures of range of movement, but only differences in forward flexion reached statistical significance (mean, –4.56%; 95% confidence interval, –8.99% to 0.13% of normal).[10] The clinical significance of this difference is uncertain. Kirkley et al also focused on the trend for limited external rotation in the operatively stabilized group. Bottoni et al found a similar average loss of external rotation in the 2 groups (4° and 3°). Meanwhile, Robinson et al mentioned no significant difference in range of movement between treatment groups. Aside from a septic joint in 1 patient who had arthroscopic intervention in the Kirkley study, erythema and swelling in 1 patient in each group of the Robinson study, and adhesive capsulitis in 3 patients also in the Robinson trial, there were no treatment complications reported. Results regarding patient satisfaction showed that significantly fewer operatively stabilized patients (11% operative group, 75% conservative group) expressed dissatisfaction with the results.[5,10] The Robinson trial is the first of its kind to incorporate an economic analysis of direct treatment costs, and it showed that arthroscopic stabilization, although initially more expensive than a conservative rehabilitation approach, is more cost-effective at 2-year follow-up.[27] There were no data conveying stiffness or muscle strength. Long-term complications, such as osteoarthritis, were not reported.

DISCUSSION

This study, based on information up to and including May 2009, extensively reviewed the world literature (English language) with a systematic approach. Although our search for trials was comprehensive and systematic, we may have failed to locate other trials.

Although the number of study participants (n, 288) is limited, the focus populations of the 5 trials are similar. All patients had sustained a primary acute anterior shoulder dislocation, and the majority were young active males with the highest risk of recurrence.[13] Given the specific characteristics of the study participants, it would be inappropriate to extrapolate the data to other populations. Although all 5 trials compared operative intervention and conservative rehabilitation, the types of surgery differed, as did the duration of immobilization and rehabilitation.

The interpretation of the Bottoni, Kirkley, and Wintzell trials is limited by the inability of the studies to discern the therapeutic effects of the Bankart repair from those of the arthroscopic examination and lavage. A study design in which both groups had surgical incisions significantly reduced the potential for bias in the Jakobsen and Robinson trials. These 2 studies controlled for the independent therapeutic effects of arthroscopic examination and lavage, thereby increasing the validity of the results from all 5 trials. Note that 2 studies, Jakobsen et al and Robinson et al, employed arthroscopic intervention and, in the case of the latter, joint lavage of all patients before randomization. This means that the treatment group of the Wintzell study is effectively receiving the same therapy as the conservatively managed group in the Robinson study. Robinson et al and Jakobsen et al employed this treatment practice because arthroscopic intervention itself, along with joint lavage, may have independent therapeutic effects that reduce redislocation by promoting healing,[38] delaying the patient's return to full physical activity,[36,37] or improving patient compliance with rehabilitation protocol.[36,37] Although Wintzell et al[36,37] found a therapeutic effect of arthroscopic lavage on the recurrence rate of dislocation, these results were not replicated by Jakobsen et al,[19] who employed arthroscopic lavage in the conservatively rehabilitated group.

The results lent support to the operative stabilization of young active patients presenting with primary acute anterior shoulder dislocation. Operative stabilization significantly reduced subsequent surgical intervention, whereas nearly half the nonoperatively treated patients eventually underwent later surgery. Although different functional assessment measures were used in the trials, the results were statistically in favor of operative treatment. In addition to the limited number of complications, the results provide support for operative stabilization, which may result in a more complete and long-lived return to demanding physical activity.

Questions

Several important questions deserve deliberation before endorsing surgical stabilization as the recommended treatment for primary anterior shoulder dislocation.

Table 2. Study characteristics.

Study: Kirkley[22,23]
Participant characteristics: General population presenting to emergency departments at University of Western Ontario and University of Calgary. Women, men: 5, 35. Mean age (range) years: 22.4 (16-30). Patients were stratified by age into 2 groups: 16-22 years, 23-30 years.
Exclusion criteria: Associated fracture, except Hill Sacks or Bankart lesion. History of multidirectional instability or evidence of multidirectional instability in other shoulder. Neurovascular compromise of affected limb. Deemed unfit for surgery. Unwilling to follow up for 5 years.
Interventions (n, patients): Operative stabilization (19): arthroscopic stabilization by transglenoid suturing within 4 weeks of injury; then, 3 weeks sling immobilization before rehabilitation program. Conservative rehabilitation (21): 3 weeks sling immobilization before rehabilitation program.
Follow-up: 32 months[22]: operative, 19 of 19 (100%); conservative rehabilitation, 19 of 21 (90.4%). 79 months[23]: operative, 16 of 19 (84.2%); conservative rehabilitation, 15 of 21 (71.4%).
Treatment effect (operative, conservative rehabilitation): Rate of redislocation: 32 months,[22] 15.9%, 47% ($P = .03$); 79 months,[23] no additional dislocations. Western Ontario Shoulder Instability (% of normal): 32 months,[22] 86.3, 69.8 ($P = .03$); 79 months,[23] 86.0, 74.8 ($P = .17$). Disabilities of the Arm, Shoulder, and Hand: 79 months,[23] 95.8, 94.1 ($P = .57$). American Shoulder and Elbow Surgeons: 79 months,[23] 94.7, 93.5 ($P = .73$). Return to preinjury sports/work[23]: 18 of 19, 20 of 21. Range of motion[23]: Trend for limitation of external rotation in operative group. Complications[22]: 1 septic joint. Number of subluxations[23]: 5, 2. Subsequent surgical stabilizations[23]: 2 of 19 (10.5%), 7 of 19 (36.8%).
Study quality: High (100%). Strength of Recommendation Taxonomy, Level A.
Study: Bottoni[5]
Participant characteristics: Active duty military personnel at US Army Medical Center, Honolulu, Hawaii. Women, men: 0, 24. Mean age (range) years: 22.4 (19-26).
Exclusion criteria: Tuberosity or other concomitant fracture. Neurologic injury. History of shoulder injury. Previous subluxation. Dead arm syndrome.
Interventions (n, patients): Operative stabilization (10): arthroscopic Bankart repair using bioabsorbable tacks after systematic diagnostic arthroscopy within 10 days of injury; then, 4 weeks of sling immobilization before supervised rehabilitation. Conservative rehabilitation (14): 4 weeks of sling immobilization before rehabilitation program.
Follow-up: Operative: 9 of 10 (90%); mean duration (range), 35 months (17-56). Conservative rehabilitation: 12 of 14 (85.7%), mean duration (range): 37 months (16-56). Examined: weekly during first 8 weeks, monthly to 6 months, then every 6 months.
Treatment effect (operative, conservative rehabilitation): Treatment failure (recurrence, symptomatic subluxation, or instability preventing return to full active duty or necessitating additional surgical stabilization): 11.1%, 75%. Single Assessment Numeric Evaluation Score: 88 (range, 60-100), 57 (range, 46-98) ($P < .02$). L'Insalata Score: 94 (range, 65-98), 73 (range, 46-92) ($P < .02$). Return to full active duty: 9 of 9, 12 of 12. Range of motion: No statistically significant difference. Complications: None. Patient satisfaction: excellent, 67%, 25%; good, 22%, 0%; poor, 11%, 75%. Subsequent surgical stabilizations: 1 of 9 (11%), 6 of 12 (50%).
Study quality: Medium (67%). Strength of Recommendation Taxonomy, Level A.
Study: Wintzell[36]
Participant characteristics: General population presenting to Soder Hospital, Stockholm; St. Goran's Hospital, Stockholm; Gavle Hospital, Gavle; Uppsala University Hospital, Uppsala, Sweden. Women, men: 14, 46. Mean age (range) years: 24 (16-30).
Exclusion criteria: Fracture of the greater tubercle. Previous shoulder disease on affected side. Joint laxity. Bony Bankart lesion > 6 × 15 mm on standard anteroposterior and lateral radiographs. Drug abuse. Nonconsent.
Interventions (n, patients): Operative stabilization (30): arthroscopic lavage within 10 days of injury (mean, 8 days; range, 4-10 days); then, rehabilitation program. Conservative rehabilitation (30): optional sling for 1 week; then, movement without restriction and rehabilitation program.

(continued)

Table 2. (continued)

Follow-up: Operative: 30 of 30 (100%). Conservative rehabilitation: 30 of 30 (100%). Examined: 1 month, 6 months, 1 year, and 2 years (30 patients). Initial 30 patients were recruited from Soder Hospital. The additional 30 patients came from the remaining hospitals. All 60 patients followed to 1 year, whereas the 30 from Soder Hospital remained for 2-year follow-up.
Treatment effect (operative, conservative rehabilitation): Rate of redislocation: 13.3%, 43.3%. Rowe score: Excellent or good, 24 of 30 (80%); 12 of 30 (40%). Constant score: 91 units (range, 76-100), 87 units (range, 70-100) ($P > .05$). Instability (positive apprehension test): 7 of 30 (23.3%), 17 of 30 (56.7%). Return to preinjury sports/work: 73.1%, 65.2%. Complications: none. Subsequent surgical stabilizations: 0 of 30 (0%), 4 of 30 (13.3%).
Study quality: High (78%), Strength of Recommendation Taxonomy, Level A.
Study: Jakobsen[19]
Participant characteristics: General population presenting to 13 hospitals. Women, men: 14, 62. Mean age (range) years: 21.5 (15-39).
Exclusion criteria: History of previous shoulder problems. Fracture of the greater tubercle. Nonconsent.
Interventions (n, patients): Operative stabilization (37): open Bankart repair using Mitek anchors under general anesthesia within 7 days of dislocation; then, immobilization in fixed sling for 2 days followed by 7 days in nonfixed sling and, ultimately, 12-week rehabilitation regimen. Conservative rehabilitation (39): arthroscopic diagnosis followed by 2 days immobilization in fixed sling; then, 7 days immobilization in nonfixed sling and subsequent 12-week rehabilitation protocol.
Follow-up: 24 months: operative, 37 of 37 (100%); conservative rehabilitation, 39 of 39 (100%). 10 years: operative, 36 of 37 (97.3%); conservative rehabilitation, 39 of 39 (100%).
Treatment effect (operative, conservative rehabilitation): Rate of redislocation: 24 months, 2.7%, 53.8%; 10 years, 9%, 62%. Constant Shoulder Score: no significant difference. Instability (positive apprehension test): 7%, 39% ($P = .014$). Load-and-shift test: 4% (grade I), 39% (grade I or II) ($P = .009$). Subjective assessment (Oxford score): 70%, excellent or good; 74%, unsatisfactory. Complications: none. Subsequent surgical stabilizations: 1 of 36 (2.8%), 19 of 39 (48.7%).
Study quality: Medium (67%). Strength of Recommendation Taxonomy, Level A.
Study: Robinson[27]
Participant characteristics: General population presenting to the emergency department at the Royal Infirmary of Edinburgh, United Kingdom. Women, men: 6, 82. Mean age (range) years: 24.8 (15-35).
Exclusion criteria: Dislocation not caused by substantial external force. Associated fracture. Other axial or appendicular musculoskeletal injury. Presentation after 2 weeks of primary dislocation. Contraindications to general anesthesia. Age younger than 15 or greater than 35 years. Evidence of cognitive impairment. Nonconsent. Nonlocal residence precluding follow-up.
Interventions (n, patients): Operative stabilization (45): arthroscopic joint lavage and Bankart repair using sutures and anchors within 14 days of dislocation; then, sling immobilization for 6 weeks postdislocation followed by 6-week rehabilitation program. Conservative rehabilitation (43): arthroscopic joint lavage only; then, sling immobilization for 6 weeks postdislocation followed by 6-week rehabilitation program.
Follow-up: 24 months: operative, 42 of 45 (93.3%); conservative rehabilitation, 42 of 43 (97.7%). Examined: 6 weeks, 3 months, 6 months, 1 year, and 2 years.
Treatment effect (operative, conservative rehabilitation): Rate of redislocation: 7%, 29% ($P = .001$). Number of subluxations: 0, 4. Functional outcome (Western Ontario Shoulder Instability and Disabilities of the Arm, Shoulder, and Hand): Significant difference only at 24 months. Range of movement: no significant difference. Return to preinjury sports/work: no significant difference in days of work missed or timing of return to work/sport. Complications: erythema and swelling over portal sites: 1, 1. Adhesive capsulitis: 2, 1. Patient satisfaction (expectations met): 94.1%, 74.8% ($P < .001$). Subsequent surgical stabilizations: 3 of 42 (7.1%), 15 of 42 (35.7%). Cost-effectiveness (overall cost in US$): $4897 (range, $4492-$5302), $6216 (range, $5284-$7146) ($P = .012$).
Study quality: High (100%). Strength of Recommendation Taxonomy, Level A.

Who should undergo operative stabilization of a primary anterior shoulder dislocation? Patients who require a full return to a high level of fitness and functioning to perform their jobs, as well as those who are at an increased risk of reinjury should undergo operative stabilization. This includes young active patients, specifically those participating in contact sports and strenuous physical activity (ie, professional athletes and military cadets). Analysis of the number needed to treat[27] suggests that a significant degree of overtreatment would take place if all young patients with primary anterior shoulder dislocation are operatively stabilized. Perhaps some indicators for a higher patient motivation can be drawn in the future to expand recommendations of surgical intervention for highly motivated individuals.

How does operative management affect long-term outcomes—specifically, the risk for and progression of osteoarthritis? We do not know. The longest follow-up to date is presented by Kirkley et al, who presented reassuring results with regard to functional shoulder outcomes.[23] Regarding the effects of initial stabilization on the later development of osteoarthritis, there is no evidence to support shoulder stabilization surgery for the purpose of preventing glenohumeral osteoarthritis. Hovelius et al[14] reported that moderate to severe osteoarthritis was relatively uncommon (9%) 10 years after an anterior dislocation of the shoulder. Moreover, the degree of osteoarthritis did not seem to be related to the number of dislocations or whether or the patient had undergone surgical stabilization. However, the surgical techniques used in this study significantly restricted motion, which has been correlated with osteoarthritis of the shoulder joint.[8,11]

Hovelius et al (unpublished data, American Shoulder and Elbow Surgeons open meeting, 2008) reported that mild, moderate, and severe dislocation arthropathy was found radiographically in 29%, 9%, and 17% of shoulders, respectively, after 25 years of follow-up for primary anterior shoulder dislocation in young patients. In addition, Hovelius et al[16] noted a slightly lower prevalence of radiographically evident arthropathy in a follow-up study comparing Bankart repair to Bristow-Latarjet repair. Both Taylor et al and Cameron et al have reported associations between shoulder instability and the presence of chondral and osteochondral lesions.[6,33] The presence of glenohumeral osteoarthritis, particularly on radiograph, does not necessarily translate into clinically significant osteoarthritis. More long-term studies are needed to define the relationship between the early onset of radiographically or arthroscopically diagnosed arthritic changes and clinically significant osteoarthritis. Currently, there remains a need to determine whether surgery affects the development of osteoarthritis or other chronic shoulder disorders. These pathologies are also likely to depend on the type of surgery.

Is there a role for nonoperative management in this high-risk group? The recurrence rate in this target patient population occurs at a statistically significantly higher rate when compared with patients in the same demographic population treated with operative stabilization. Nonoperative treatment of primary anterior shoulder dislocation also incurs the risk of further damage to the shoulder joint, which will likely necessitate future surgical intervention. Initial reports suggest that immobilization in external rotation after primary anterior dislocation may reduce the risk of recurrent instability,[17,18] although the degree of benefit appears to be smaller than that after operative stabilization. Certainly, timing should play a role, such as when to treat athletes midseason. In certain circumstances, it may be reasonable to rehabilitate and finish the season as long as the high risk of recurrence is considered in the decision tree.

Limitations

A major limitation of this review is that only 5 RCTs comparing operative and nonoperative therapeutic regimens have been conducted for this common shoulder injury. In fact, Kirkley et al described a lack of power in their study.[23] A possible explanation for this could be that patients with primary anterior shoulder dislocation do not want to risk being randomized to nonoperative treatment. There is also a potential for systematic bias to infringe on the validity of the evidence. For example, effective concealment of treatment allocation was not confirmed in the Wintzell study. Therefore, the available data must be interpreted with caution. The Jakobsen and Robinson trials are limited in that they were unable to create control groups with patients managed nonoperatively. In addition, limited data on cost-effectiveness of varying treatments are available from the 5 RCTs. This information is indispensable for the decision-making process of care providers. That is, in the short-term, surgery is more expensive than conservative treatments, but it can be more cost-effective than conservative treatments with a shorter patient sick leave.

Recommendations

To answer the question of whether operative stabilization for primary anterior shoulder dislocation is more effective than conservative treatment, more high-quality RCTs are needed. These trials should use outcome measures that quantify improvement of shoulder function and reduction of pain that are valid, reliable, and responsive in these study populations. Proper power analysis is needed to determine sample size. Follow-up should be at least 2 years, and it would be important for studies to provide data on cost-effectiveness and the long-term development of osteoarthritis in joints treated surgically and nonsurgically.

CONCLUSIONS

Although limited, the available evidence from RCTs supports operative stabilization for primary acute shoulder dislocation in young active adults participating in highly demanding

Clinical Recommendations

SORT: Strength of Recommendation Taxonomy
A: consistent, good-quality patient-oriented evidence
B: inconsistent or limited-quality patient-oriented evidence
C: consensus, disease-oriented evidence, usual practice, expert opinion, or case series

Clinical Recommendation	SORT Evidence Rating
Consider operative treatment for primary acute shoulder dislocation in young active adults participating in highly demanding physical activities.[5,20,23,24,28,37]	A
There is no conclusive evidence available to determine whether operative or nonoperative treatment is superior for other patient or injury types.[5,20,23,24,28,37]	A

For more information about the SORT evidence rating system, see www.aafp.org/afpsort.xml and Ebell MH, Siwek J, Weiss BD, et al. Strength of Recommendation Taxonomy (SORT): a patient-centered approach to grading in the medical literature. *Am Fam Physician.* 2004;69:549-557.

physical activities. Recommendations on the optimal surgical intervention cannot be provided. There is no conclusive evidence to determine whether operative or nonoperative treatment is superior for other patient or injury types. Recurrence rates are age related and may be associated with higher energy injuries. Postreduction immobilization in internal rotation does not affect recurrence, but postreduction immobilization in external rotation appears to decrease recurrence.

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