



Early surgical treatment of first-time anterior glenohumeral dislocation in a young, active population is superior to conservative management at long-term follow-up

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Abstract

Purpose To compare the long-term effectiveness of non-operative treatment with immediate arthroscopic surgical stabilization in young, active patients after first-time anterior glenohumeral dislocation.

Materials and methods Consecutive patients aged 15–25 years who suffered primary traumatic anterior glenohumeral dislocation were enrolled in this prospective, non-randomized investigation. In total, 160 patients were enrolled—64 opted for surgical stabilization (group A), while 96 opted for conservative treatment (group B). At final follow-up of over 6.5 years, 60 patients in group A (96.7% males, age 22.8 ± 3.2) and 70 patients in group B (90.0% males, age 20.8 ± 2.9) were evaluated with physical examination, patient-reported outcome measures (PROMs), and radiological studies. Recurrence and return to sport (RTS) data were collected, and variables were compared between groups.

Results Recurrence rate in group A was 13.3% at mean latency of 3.3 ± 1.9 years, compared to 71.4% at mean latency of 2.1 ± 1.5 years in group B ($P < 0.001$ for both recurrence rate and latency). In group A, 70.0% of patients RTS at the pre-injury level, versus 41.4% of patients in group B ($P < 0.001$). Patients in group A scored significantly higher on all PROMs (all $P < 0.001$) and had significantly less osteoarthritis ($P = 0.004$), when compared to group B.

Conclusion Acute surgical stabilization of first-time anterior shoulder dislocation in young, active patients is more effective than conservative treatment at long-term follow up, based on lower recurrence rate, better RTS, and higher patient-perceived improvement.

Keywords Anterior shoulder dislocation · Shoulder instability · Bankart repair · Glenohumeral joint · Conservative management

Introduction

Anterior glenohumeral dislocation is a common condition, with an incidence of 11.2/100,000 patients per year and a prevalence of 2 to 8% in the general population [1, 2]. This rate may be even higher in the most affected subjects, who are young, sport-active men [2]. While instability of the shoulder

can be secondary to chronic overuse, such as in overhead athletes, the majority of cases are traumatic [3]. Recurrence is frequent after the first traumatic episode, with incidence ranging from 10 to 96% [4–7]. One of the most important risk factors is the age of the patient, and the majority of recurrent episodes occur in those younger than 25 years of age [4, 5, 8, 9]. Despite how often these injuries occur, the most effective treatment for primary anterior shoulder dislocation in young, active patients is still debated.

In a milestone study of 229 primary dislocations treated non-operatively, Hovelius et al. demonstrated that 72% of patients younger than 22 years had at least one recurrent episode of instability, whereas 27% of patients older than 30 years suffered recurrence [4]. Moreover, other authors have reported high risk of treatment failure with the non-operative approach, with recurrence rates as high as 92 to 96% [6, 7]. As such, there has been increasing interest in the role of arthroscopic/

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surgical stabilization after first-time anterior shoulder dislocation in young, active patients. Several authors have reported positive results—indeed, in a recent review of 31 studies including 2813 anterior dislocations in patients aged 18 years or younger, Longo et al. reported a statistically significantly lower recurrence rate in those treated surgically versus those treated conservatively (odds ratio [OR] 12.71, 95% CI 4.88 to 33.10; $P < 0.00001$) [10]. However, the majority of previously performed studies on this topic have short-term follow-up, and few investigations to date have examined long-term results of acute stabilization for first-time anterior glenohumeral dislocation.

During the past years, specially before 2005, the initial management of these patients has been non-operative, consisting of reduction, immobilization, and rehabilitation.

Therefore, the objective of this prospective, non-randomized investigation started in 2005 was to compare the long-term effectiveness of non-operative treatment with immediate arthroscopic surgical stabilization in young, active patients after first-time anterior glenohumeral dislocation. We hypothesized that (1) the rate of re-dislocation would be significantly lower in the surgically treated group, and that (2) arthroscopic stabilization would result in superior functionality based on better to sport and scores on patient-reported outcome measures (PROMs).

Materials and methods

Patient selection

Institutional review board (IRB) approval for this investigation was obtained from the University of Rome, La Sapienza. Informed consent was obtained from all individual participants included in the study. All consecutive patients who sustained a traumatic anterior glenohumeral dislocation between 2005 and 2015 were considered for inclusion. Inclusion criteria were first episode of traumatic anterior glenohumeral dislocation; age between 15 and 25 years; pre-injury involvement in sport activities; no history of previous dislocation, instability, subacromial impingement, or previous surgery on the index arm; and absence of associated injuries, including glenoid or tuberosity-associated fractures.

After detailed counseling from the surgeon about the risks and benefits of conservative or surgical treatment, as well as magnetic resonance imaging (MRI) and a second office visit within the first week after the dislocation, each patient made the decision between an operative or conservative management strategy. All patients underwent MRI (Siemens Magnetom Sonata 1.5T Tech Specs; Siemens, Munich, Germany) of the affected shoulder within seven days from the first trauma.

Surgical technique (group A)

All patients were placed in lateral decubitus position under general anaesthesia. The surgery was performed through standard arthroscopic portals (posterior, anterior-superior, and anterior-inferior). First, the senior surgeon performed an accurate inspection of the glenohumeral joint to detect associated lesions. After identifying the capsulo-labral (Bankart) lesion, the surgeon performed re-insertion of the labrum with use of two or three suture anchors (FASTak 2.8 mm, Arthrex), according to the extension of the lesion. The Suture Lasso (Arthrex) device was used to pass the wires through the labrum to perform the repair. All associated lesions (superior labrum anterior to posterior [SLAP] tears, loose bodies, posterior band of inferior glenohumeral ligament [IGHL] lesions) were treated.

At the end of the procedure, the surgical arm was placed in a sling and swathe brace and positioned in adduction and internal rotation.

Post-operative protocol

From surgery to four weeks post-operatively, the operated arm was immobilized in the sling and swathe cast in adduction and internal rotation. From four to eight weeks post-operatively, patients gradually increased the degree of abduction and flexion of the operated shoulder and began isometric and isotonic muscular strengthening. From eight to 12 weeks, post-operatively, patients were allowed full range of motion, and underwent advanced muscular strengthening with resistance bands. Progressive return to sport activities and complete muscular strengthening began at 12 weeks post-operatively. Return to sport was allowed after 4 months for non-contact activities and after five months for contact sports.

Conservative management (group B)

In the first 28 days following injury, patients in group B had the injured arm immobilized in the sling and swathe cast in adduction and internal rotation. From two to six weeks, patients were allowed gradual increases in abduction and flexion of the operated shoulder and began isometric and isotonic muscular strengthening. From seven to ten weeks, patients were allowed full range of motion and began advanced muscular strengthening with resistance bands. Progressive return to sporting activities, as well as complete muscular strengthening, began at 11 weeks. Finally, return to sport was allowed at 12 weeks post-injury.

Follow-up

All patients were evaluated at one, two, three, four and six months and at minimum two year follow-up with the following measures:

- Rowe score
- Disabilities of the Arm, Shoulder and Hand (DASH) scale
- American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form
- Western Ontario Shoulder Instability (WOSI) Index
- Range of Motion (ROM) examination

Finally, a radiological evaluation was also performed in all patients at the final follow-up.

Statistical analysis

Continuous variables were described as mean \pm SD. Comparisons across groups were made with Student's *t* tests for continuous variables and chi-square analysis for categorical variables. The level of significance was set as $P = 0.05$ for all analyses. All statistical analysis was performed with SPSS version 11.5.1 (Chicago, IL, USA).

Results

Included patients

Of the 642 patients considered for enrollment in this study, 160 were allocated to either surgical (group A, 64 patients) or conservative management (group B, 96 patients). Sixty patients in group A and 70 patients in group B were available for analysis at final follow-up (Fig. 1). Demographic information of the two groups is displayed in Table 1. The two groups were demographically similar in all variables, with the exception of age. However, the absolute difference was only 2.0 years (group A 22.8 ± 3.2 years vs group B 20.8 ± 2.9 years, $P < 0.001$). Table 2 displays the breakdown of pre-injury sports participation for both groups. Soccer was the most common sport in both groups. Mean time to final follow-up in group A was 82.3 months (range 24–134), or approximately seven years, while mean time to final follow-up in group B was 103.6 months (range 24–149), or approximately 8.5 years.

In group A, the following associated lesions were detected during arthroscopy: 18 type 2 SLAP tears (30%), which were treated with suture anchor repair; 20 cases (33.3%) of laxity of the posterior band of the inferior glenohumeral ligament (IGHL), which were re-tensioned with absorbable polydioxanone suture wire; and two intra-articular loose bodies (3.33%) caused by a chondral lesion of the humeral head, which were removed. Anatomical variants on the medium

glenohumeral ligaments were found on two shoulders, one with a Buford complex (1.7%) and one with a sub-labral hole complex (1.7%). Both of these were associated with the detachment of the inferior labrum. No cuff tears were found in any shoulder.

Recurrence and return to sport

In group A, the recurrence rate at final follow-up was 13.3% (8 of 60 patients) and mean time to recurrence was 3.3 ± 1.9 years, compared to a recurrence rate of 71.4% in group B (50 of 70 patients) at mean latency 2.1 ± 1.5 years. Differences in recurrence rate ($P < 0.001$) and time to recurrence ($P < 0.001$) were both statistically significant between groups. A second surgical procedure was performed in four patients in group A (6.7%), and 32 patients in group B (45.7%) underwent surgical stabilization due to recurrent dislocations ($P < 0.001$). Of note, there were no instances of post-operative infection, mobilization of anchors, or neurovascular damage in group A.

At final follow-up, 56 patients in group A (93.3%) returned to sporting (RTS) activities. Of these, 42 patients (70.0%) RTS at the same level as prior to their primary dislocation event. In group B, 62 patients (88.6%) RTS, and 29 of these (41.4%) RTS at the same level. While the overall number of patients who RTS did not differ significantly between groups ($P = 0.350$), the number who RTS at the pre-injury level was significantly different ($P = 0.001$).

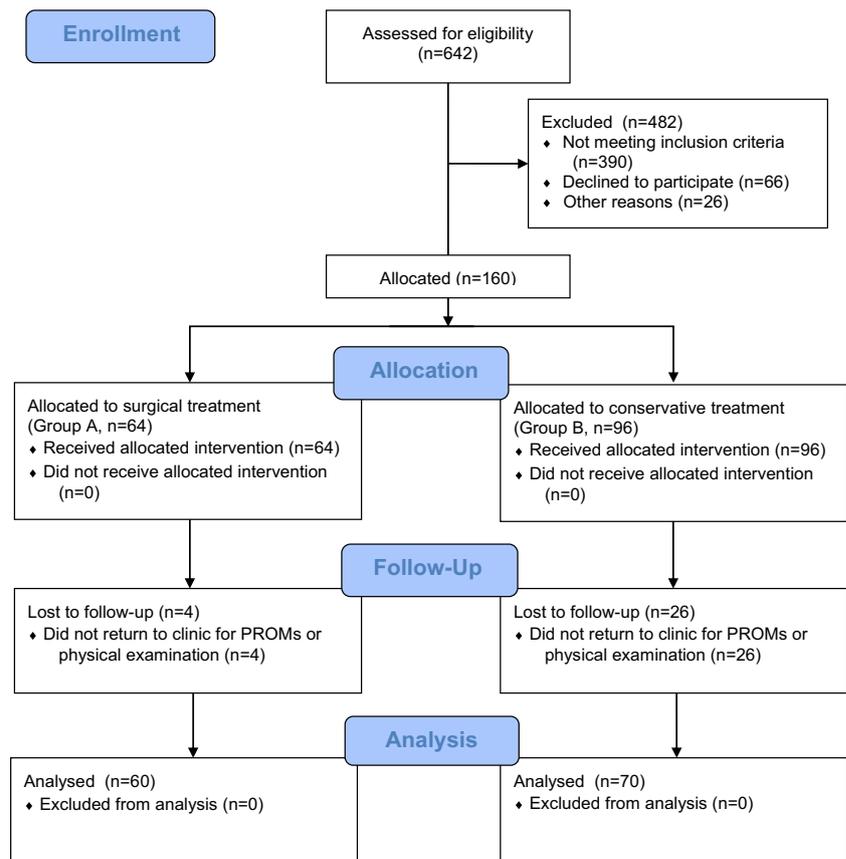
PROMs and radiological findings

Patients in group A scored significantly better than did patients in group B on all patient-reported outcome measures (PROMs), including the Rowe, WOSI, ASES, and DASH tools (all $P < 0.001$). Additionally, in group A, the majority of patients had no signs of osteoarthritis (42 of 50 patients, 70.0%), and no patients had severe arthritis. However, in group B, only 28 patients (40.0%) had no signs of osteoarthritis, and there were three cases of severe OA (4.3%). Table 3 summarizes all outcome measures at final follow-up.

Discussion

The results of this investigation support the utilization of surgical treatment over conservative management for first-time anterior shoulder dislocation in young, active patients, based on long-term follow-up of approximately seven years. We found that 71.4% of patients treated conservatively suffered re-dislocation, compared to only 13.3% in those treated operatively. Additionally, we found that those treated operatively had significantly higher rate of RTS at the pre-injury level (70.0 vs 41.4%), better scores on validated PROMs, and less osteoarthritis.

Fig. 1 CONSORT flow diagram of patients included in this investigation



Several previous investigations have corroborated our primary findings. Indeed, in a recent review of 15 investigations, Wasserstein et al. report that recurrence following non-surgical management ranged from 19 to 88% and was 47% when data were pooled only from level I studies. Moreover, they found that recurrence approached 80% in males aged < 20 years, which even exceeds the rate established by the

present investigation in a demographically similar cohort [11]. In an analogous review of arthroscopic Bankart repairs for acute dislocation, Adam et al. reported a pooled failure rate of 13.7% (range 7.7 to 19.6%) based on 12 studies with mean follow-up of 39.2 months [12]. The present investigation

Table 1 Patient demographics for surgically and conservatively managed groups

	Group A (n = 60)	Group B (n = 70)	P value
Age, year	22.8 ± 3.2	20.8 ± 2.9	< 0.001*
Gender			
Male, n (%)	58 (96.7)	63 (90.0)	0.136
Females, n (%)	2 (3.3)	7 (10.0)	
Laterality			
Right, n (%)	36 (60.0)	36 (51.4)	0.327
Left, n (%)	24 (40.0)	34 (48.6)	
Dominant, n (%)	40 (66.7)	35 (50.0)	0.056
Non-dominant, n (%)	20 (33.3)	35 (50.0)	
Pre-injury sporting level			
Professional, n (%)	12 (20.0)	12 (17.1)	0.074
Amateur, n (%)	16 (26.7)	32 (45.7)	
Recreational, n (%)	32 (53.3)	26 (37.1)	

*Statistical significance ($P < 0.05$)

Table 2 Sporting activities of patients in each group

Variable	Group A (n = 60)	Group B (n = 70)
Soccer	26	30
Fencing	2	0
Surfing	2	0
Beach volleyball	2	4
Martial arts	6	8
Basketball	4	0
Sailing	4	0
Rugby	2	2
Weightlifting	6	6
Swimming	2	6
Motorcycle	2	6
Horseback riding	2	0
Running	0	2
Artistic gymnastics	0	2
Volleyball	0	2
Tennis	0	2

Table 3 Outcomes at final follow-up. PROM scores are presented as mean \pm SD

	Group A (n = 60)	Group B (n = 70)	P value
<i>Recurrent dislocations, n (%)</i>	8 (13.3)	50 (71.4)	< 0.001*
<i>Time to re-dislocation, year</i>	3.3 \pm 1.9	2.1 \pm 1.5	< 0.001*
<i>Subsequent surgeries, n (%)</i>	4 (6.7)	32 (45.7)	< 0.001*
<i>RTS overall, n (%)</i>	56 (93.3)	62 (88.6)	0.350
<i>RTS at same level, n (%)</i>	42 (70.0)	29 (41.4)	0.001*
<i>Patient-reported outcome measures</i>			
Rowe	94.2 \pm 5.3	75.3 \pm 5.5	< 0.001*
WOSI	94.5 \pm 4.0	76.5 \pm 5.2	< 0.001*
ASES	94.1 \pm 4.4	83.7 \pm 3.7	< 0.001*
DASH	5.2 \pm 5.0	20.9 \pm 7.0	< 0.001*
<i>Osteoarthritis</i>			
None, n (%)	42 (70.0)	28 (40.0)	0.004*
Mild changes, n (%)	13 (21.7)	32 (45.0)	
Moderate changes, n (%)	5 (8.3)	7 (10.0)	
Severe changes, n %	0 (0.0)	3 (4.3)	

*Statistical significance ($P < 0.05$)

established an almost identical recurrence rate of 13.3% at mean follow-up of approximately seven years in the operative group, implying that recurrence rate may plateau after approximately three years following surgery. Conversely, Hovelius followed 257 conservatively managed patients for 25 years and found that recurrence increased up to ten years of follow-up but that 29% of shoulders with \geq two previous recurrences had stabilized after 25 years [13]. Given that patients suffering anterior dislocation are most often young and active, it is our opinion that ten years of increasing instability is unacceptable in this population. This finding adds additional support for the utilization of acute surgical stabilization.

An important consideration in clinical decision-making involves weighing the risks of recurrent dislocations prior to eventual surgical stabilization. Marshall et al. have reported that patients who have multiple dislocations prior to surgery have four times higher rate of post-operative instability (OR 4.14) and six times higher rates of subsequent surgery (OR: 6.01), when compared to those who have only one pre-operative dislocation event [14]. In a prospective, multi-center analysis, Rugg et al. have also reported that first-time dislocators who underwent surgical stabilization had lower rates of glenoid bone loss ($P = 0.043$) compared to those who had multiple pre-operative dislocations. Additionally, those initially treated with surgery were less likely to have bony Bankart lesions (OR: 3.26, $P = 0.024$) or biceps pathology (OR: 6.27, $P = 0.013$) [15]. As such, arthroscopic Bankart repair in the acute phase may decrease the probability of developing secondary lesions (osseocartilaginous lesions of the glenoid margin, large posterosuperior Hill-Sachs lesions, excessive capsular-ligamentous laxity, etc) that can significantly compromise joint stability. In the present study, we found that

45.7% of patients in group B eventually required a surgical procedure due to recurrence. These patients may have benefited from earlier arthroscopic stabilization, and it is the recommendation of the authors to offer first-time dislocators early surgical intervention in effort to avoid later complications and improve long-term prognosis.

Studies on patient expectations for treatment of shoulder instability indicate that RTS is a primary concern, with one investigation reporting that 95% of patients expected to RTS at their pre-injury level [16, 17]. The present investigation found that 70.0% of surgery patients were able to RTS at the same level, compared to just 41.4% in the conservatively managed group. We allowed surgical patients to RTS at four months post-operatively for non-contact sports, and at 5 months post-operatively for contact sports, while those treated conservatively were able to RTS following a progressive three month rehabilitation program. There is currently no consensus as to the appropriate time for RTS. However, most providers agree that athletes should have minimal pain, symmetric bilateral strength, sport-specific range of motion capability [18]. Owens et al. have suggested a treatment algorithm for in-season athletes suffering dislocation, which indicates surgery for those with large bony Bankart lesions, those near the end of the season, and those who fail two to three weeks of conservative management [19]. However, Buss et al. has reported a rate of 1.4 recurrent instability episodes per season per athlete, among patients who RTS in the same season after non-operative treatment. In another study on collegiate athletes, Dickens et al. report that those who underwent surgical stabilization were 5.8 times more likely to complete the next season without recurrence, and 90% of first-time dislocators were able to RTS [20]. Given these results, in conjunction

with the aforementioned dangers of repeated dislocations and the findings of the present study, conservative management and hurried RTS may not be an advisable treatment strategy when considering the athlete's long-term prognosis.

This study is not without limitations:

Firstly, this investigation was non-randomized. We believe that even if, on the one hand, methodological and statistical non-randomization can be interpreted as a limitation of the study, on the contrary, in this case it could even be seen as a strength. The decision to not randomize patients to refer them to conservative or surgical treatment was initially dictated by an ethical criterion. The distribution of the two groups of patients is almost homogeneous in terms of age, sex, BMI, and sports level, but not due to expectations about functional activity and the return to sport at the time of the trauma.

Most athletic patients—that spend most of their time practicing sports—chose surgical treatment. Patients with a less developed attitude to sporting activities or more involved in studies tolerated the possibility of a recurrence. This is demonstrated by the fact that about 50% of patients who have suffered a subsequent episode of dislocation without hearing the need to resort to surgery opted for conservative treatment. If a part of these patients, who would have reduced their sports activities over time for other reasons (study, career, character), had been shifted in the surgical group, they would have undoubtedly further reduced the already good recurrence rate of 13.4%. Conversely, the inclusion of a group of sports patients in the conservative group would certainly have favored an increased risk of recurrence.

Secondly, those enrolled in the surgical group had some associated lesions which were also treated, though there were no instances of rotator cuff tears. We were unable to fully assess the presence of associated lesions in the conservatively managed group, as they did not undergo diagnostic shoulder arthroscopy. Additionally, several patients in group B were lost to follow-up, and data regarding their recurrence rate, PROMs, and RTS were unavailable for analysis.

Strengths of the study: all patients were treated by the same senior author (ADC); always the same surgical technique; the number of patients included in the study and the average follow-up are consistent.

Nonetheless, the long-term, prospective nature of our study instills confidence in our primary findings. Ultimately, we conclude that acute surgical stabilization of first-time anterior shoulder dislocation in young, active patients is more effective than conservative treatment at long-term follow up, based on lower recurrence rate, better RTS, and higher patient-perceived improvement.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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