Research Article

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Effects of Rehabilitation in Bankart Lesion in Non-athletes: A report of three cases

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Abstract: A Bankart lesion is a common traumatic sports injury of the glenohumeral joint. When the shoulder is dislocated, the connective tissue surrounding the joint may tear or rupture. This study aimed to describe the initial dislocation, treatment, medical treatment, rehabilitation outcomes at 3 and 8 months, and return to daily life for three patients. Patient 1 was a 28-year-old male office worker who enjoyed fitness and weight training. His injury was sustained by a fall from his bicycle and subsequent performance of pull-up exercises. Surgery was recommended for repair of the anterior and inferior labrum tear. Reassessment of the surgery was performed after 2 months of rehabilitation. The patient was asked to exercise once a week at a rehabilitation center and to perform home-based exercises. In the first 2 months, the main exercise consisted of range of motion (ROM) exercises and stretching. Thereafter, muscle strengthening, using tubing, equipment and body weight exercises, and proprioceptive exercises were performed to gradually improve muscle strength and for return to daily activities. ROM progressively increased, with recovery of normal range at 2 months post-surgery. However, pain decreased only slightly, with a visual analog score of 6 out of 10 at 2 months post-surgery. At 8 months, the pain was bearable, without causing discomfort. Muscle strength remained almost unchanged initially but gradually recovered, although with a residual deficit of 20–30% in flexion, adduction and internal rotation. Considering the prolonged rehabilitation after surgery, future studies are warranted to analyze the long-term effects of non-surgical therapies by accumulating more cases and developing effective exercise rehabilitation programs.

Keywords: Bankart lesion, Non-surgical treatment, Rehabilitation, Strength

1 Introduction

Diseases that frequently involve the shoulder are generally classified as traumatic or degenerative in nature. Degenerative diseases include rotator cuff tears and adhesive capsulitis, while traumatic diseases include Bankart lesions and superior labrum anterior and posterior lesions [1-3]. A Bankart lesion is an injury to the labrum caused by shoulder dislocation [4]. When the anterior and inferior ligaments and labrum are damaged, dislocation occurs, with the direction of dislocation being anterior or anterior and inferior in >90% of cases [5].

The most frequent treatment for a Bankart lesion is orthopedic reduction of the dislocation and surgical repair, with suturing to stabilize the labrum when the extent of the tear is significant. However, the repair can result in limitation of normal functional activities of the shoulder [6]. The implementation of non-surgical treatment prior to surgery is often limited by the risk for recurrent dislocation. However, although athletes undergo a Bankart repair to return to their sport, the pros and cons of surgery over a conservative treatment should be carefully considered for non-athletes [7].

We do know that after a first traumatic dislocation, recurrence can occur more easily, leading to habitual instability [8]. Muscle strengthening, stabilization exercises and neuromuscular control are important components of a rehabilitation program to support injured ligaments and tendons in the area of dislocation as to reduce pain and lower the risk for recurrent dislocation [9]. However, several factors might limit the effectiveness of rehabilitation, with prolonged shoulder pain, which can last several weeks to months after a dislocation, likely being the most

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important factor. It is also important to consider the often low motivation of patients, particularly those who are non-athletes, in persisting in a program of rehabilitation over the longer term. Therefore, there is a need to evaluate the longer-term follow-up of a program of rehabilitation after a Bankart lesion.

Our aim in this study was to describe the approach and outcomes of a program of rehabilitation, for a relatively long period of observation, for three patients who sustained a Bankart lesion. Large studies to investigate the outcomes of a conservative rehabilitation-based management of a Bankart lesion are difficulty to establish due to the incidence rate of traumatic dislocations of the shoulder, estimated at 23.9 cases per 100,000 people in the United States, between 2002 and 2006 [10]. It is further estimated that the incidence rate is lower in Korea, as both the overall population and the proportion of the population of athletes is much lower than in the United States, although specific statistics for Korea are not available. In this way, although limited to the detailed reporting for three cases (two with a 3-month following and one with an 8-month follow-up), our study still makes a significant contribution to this body of knowledge. All three patients were non-athletes, and the program of rehabilitation was designed to promote a return to activities of daily living, recreation and sport, through a focus on high level of shoulder function (rather than rapid repair of the Bankart lesion). For these three patients, we followed our basic principle of failure of progression with conservative treatment as an indication for surgical repair. This principled approach reduces both personal and national health care costs, and recognizes conservative treatment as a reasonable choice, considering the physical discomfort and the need for a period of inactivity after surgery.

2 Methods

Patient 1 was a 28-year-old left-handed man (height, 170 cm; weight, 65 kg) who participated in recreational sports and regular exercise. After a fall from his bike, 6 months prior, the patient continued with his daily routine, without any treatment, with only a report of shoulder discomfort. However, his shoulder pain progressed several months later after performing pull-up exercises. He immediately complained of an onset of severe pain, with a sensation of tearing in his right shoulder while executing a rapid downward motion during pull-ups. He was assessed in urgent care, and 3 weeks later, surgery was recommended based on magnetic resonance imaging (MRI) findings of an anterior and inferior labrum rupture, diagnosed as a Bankart lesion. Anesthetic injections failed to improve the pain. As well, the patient sought consultation at a tertiary care hospital for treatment options as an alternative to surgery.

2.1 Initial treatment

On examination, shoulder flexion was possible (150°), but with discomfort, with external rotation limited to 40°. He was unable to generate sufficient force for reliable strength assessment. Magnetic resonance imaging confirmed an inferior labrum tear, which was not considered to be severe. The patient was referred to rehabilitation, with re-evaluation for surgery plan for 2 months later.

2.2 Treatment at 2-months

Pain decrease gradually with rehabilitation, but persisted, although there was no complain of shoulder instability or recurrent dislocation. The patient recovered his ROM, with *good* improvement in pain with overhead movements. Caution was recommended to avoid recurrence of subluxation, and the patient was scheduled for follow-up 3 months later.

2.3 Treatment at >5 months

After three months of rehabilitation, pain was largely resolved and with a nearly full strength recovery. The patient reported no shoulder discomfort on daily activities.

2.4 Rehabilitative exercise program

The rehabilitation program consisted of exercises prescribed by the surgeon and supervised by a medical specialist during hospital-based session, and augmented by a home program of exercise. Follow-up visits were scheduled initially at 1-month, and then every other week up to 3 months. After these initial 3 months of the program, follow-up sessions were held on a monthly basis for assessment and to review exercises. After 6 months of conservative treatment, the need for surgery was no longer evident, as the patient had recovered his ROM and strength, with no discomfort on activities of daily living. Continuation of a home program of exercise was recommended.

The progression of the program of exercises was as follows. During the first month, the focus was on passive and active ROM exercises (flexion and external/internal rotation). ROM exercises were performed as tolerated, >3 times per day. In the second phase of the program, initiated at month 2, light-intensity strength exercises using resistance tubing, along the four principal directions of shoulder movement: flexion, extension, and external/internal rotation, were recommended External rotation was performed with caution to protect the anterior soft tissue structures of the shoulder. Resistance of tubing (TheraBand®) exercise was gradually increased (from red through black), as tolerated. Strengthening consisted of 10 trials, held for 5 s, in each direction, with the set repeated 2-3 times per day. Static weight-bearing exercises were performed in neutral position, and in positions of 45° and 90° of abduction, to enhance shoulder stability. The following muscles were targeted for activation to enhance shoulder stability: anterior deltoid, upper fibers of the pectoralis major and long head of the biceps. Caution was taken with abduction movements and postures to 90° to prevent combined movements into external rotation (which would increase the risk of recurrent dislocation). Racket sports and exercises requiring overhead motion were prohibited.

In the third phase of the program, initiated at month 5, resistance training using weight machines was introduced, including chest, shoulder, and butterfly bench press. Pull-ups and latissimus dorsi pulldown exercises were prohibited, as these can negatively affect the Bankart lesion. Resistance training was initiated at few repetitions, with low weight, performed at slow speeds and through a restricted ROM, progressing to increasing repetitions, higher weight, and greater speed. Large-angle joint movements with resistance were performed by exerting power slowly. The fourth and final phase of the program was initiated at 8 months; latissimus dorsi pulldowns were introduced, as this exercise targets the same muscles as used in a pull-up, without applying whole body weight to the shoulder. Push-ups on a gym ball and plyometric exercises were introduced to enhance dynamic shoulder stability, and functional exercises were further targeted.

2.5 ROM and strength assessment

ROM was measured using a hand-held goniometer. Forward flexion was measured with the patient sitting on a chair, leaning back to stabilize the trunk. The ROM was measured from the resting position of the arm along the side of the trunk to the maximum point of forward elevation, with the elbow maintained in a position of extension. External/internal rotation was measured with the shoulder in neutral position and the elbow in a position of 90° of flexion. The ROM was measured as the excursion of the hand in the horizontal plane, controlling for scapular movement.

Patient-reported pain, during exercise and activities of daily living, was measured using the 10-point visual analog scale (VAS), with anchors at '0' (no pain) and '10' (severe pain) [11].

Strength was measured isometrically using a hand-held dynamometer (PowerTrack II, USA). Strength measures for flexion, internal rotation and adduction were obtained with the shoulder in a neutral anatomical position, with the patient in a sitting position. For adduction and flexion, the dynamometer was placed at the distal humerus to reduce the level arm, and at the distal forearm for internal rotation. All strength measures were held isometrically for 5 s, and repeated twice, with the highest value recorded. If the difference between the measurements was >2 kg, a third trial was performed. In the later phases of the program (at 8 months), strength was measured isokinetically (all ranges – flexion/extension, abduction/adduction, and internal/external rotation) using a Cybex 770 position (Humac Norm, USA). The highest of 4 measurements was recorded, ensuring sufficient practice before recording for measurement reliability.

Ethical approval: The research related to human use has been complied with all the relevant national regulations, institutional policies and in accordance the tenets of the Helsinki Declaration, and has been approved by the authors' institutional review board or equivalent committee.

Informed consent: Informed consent has been obtained from all individuals included in this study.

3 Results

3.1 Patient 1

On initial assessment, flexion and external rotation were 10° and 25° lower, respectively, than those of the uninjured shoulder. At 2 months, these ranges had recovered to near normal values at 160° and 50°, respectively. The initial VAS pain score of 8/10 decreased to 6/10 at month 2, decreasing further to 2/10 at 5 months. Strength improved from the first to the last visit, as follows: flexion, 10.2 to 25.0 kg; adduction, 12.5 to 22.0 kg; and internal rotation, 8.4 to 17.9 kg. The isometric force remained 20% lower at the final visit, compared to the uninjured shoulder. Isoki-

netic strength testing performed at month 8 indicated residual deficits in shoulder strength of 15% in external rotation, 6% in abduction, 20% in flexion, 19% in internal rotation, and 28% in adduction.

The final decision to avoid surgery was based on the following reasons. Foremost was the absence instability and recurrent dislocation, despite the structural defect in the labrum, attesting to the compensation provided by the musculature. Second, the patient did not report discomfort or pain when performing activities of daily living. Lastly, the risk for recurrence was deemed to be low, as the patient was not involved in high risk activities for falls or vigorous upper limb movements.

3.2 Patient 2

The patient was a 22-year-old student at military college. He had sustained a right shoulder dislocation 2 years prior while boxing, reporting self-reduction by moving his arm. This initial incidence was followed by repetitive subluxations. Although one surgeon recommended surgical repair of the labrum tear, the patient sought consultation for conservative treatment at a tertiary care hospital. The aim of rehabilitation was to improve shoulder stability. At the onset of the program, there was no limitation in the ROM of flexion, external rotation, and internal rotation. In the absence of recurrent subluxation, the patient reported little pain on daily activities (VAS 3-4/10). The rehabilitation plan consisted of ROM, tubing, light-intensity resistance exercise, and functional exercise training, as prescribed for Patient 1. Tubing exercises were progressed over the first month, with no increase in pain or recurrent subluxation, despite the patient continuing military training and physical activity. Subsequently, his VAS score decreased further 2-3/10. Machine resistance training and functional exercises were introduced, with a program for progression provided to the patient. Follow-up at this point was recommended on a 'per need' basis, as the patient had no pain and no limitations in his activities of daily living, military training and exercise.

3.3 Patient 3

Patient 3 was a 64-year-old farmer who had sustained a traumatic left shoulder injury 3 years prior in a traffic accident, with a near full-thickness tear of the supraspinatus tendon being diagnosed. After a 3-month program of exercises, with no surgical intervention, the patient did not report any pain with his occupational activities. However, 2 months prior, he had sustained a left shoulder dislocation, when grabbing a column to prevent a fall during a slipping event, with the shoulder being forced into a position of abduction and hyperextension. Reduction was performed at the emergency department. The patient subsequently sought consultation at a tertiary hospital because of persisting shoulder discomfort. There was no evidence of significant structural change on magnetic resonance imaging (MRI) from those obtained at the time of the first admission (after reduction). No should instability was detectable on physical examination. Due to the report of pain, the patient was referred to a program of rehabilitation. On the initial assessment, the patients reported a VAS score of 6/10, with a flexion range of 100° and external rotation range of 20°. The patient was given a program of ROM, avoiding hyperextension and external rotation to protect against increasing instability. At 1 month, the VAS score had decreased to 4-5/10, and ROM had increased to 120° of flexion and 35° of external rotation. The patient was provided with home exercise program for 2 months, which included tubing resistance exercises for strength, and wall push-ups for shoulder stability. The patient was instructed to follow-up as needed, as he was able to perform all his activities of daily living, and high impact and vigorous activities were not anticipated.

4 Discussion

We report on the longer term follow-up of non-athlete patients who participated in a conservative program of rehabilitation for a Bankart lesion resulting from traumatic shoulder dislocation. Generally, Bankart lesions are managed with a non-surgical approach, unless there is indication due to functional instability or recurrent dislocation [7].

There is a controversy regarding the need for surgery after a first dislocation, with a general consensus that surgical repair might be a better choice for athletes <30 years of age or those involved in high impact sports or sports requiring vigorous upper limb movements [12]. The controversy regarding the benefit of surgical repair, even in younger athletes, stems from findings of a rate of recurrence >15% in young adults, athletes, and individuals with high activity levels, despite surgery [1,6,8]. It is important to note that there is the potential for the labrum to sustain repeated tears with recurrent subluxations. As the labrum is a primary restraint of the shoulder joint, stabilizing the position of the head of the humerus within the glenoid fossa of the scapula, surgical repair is indicated

Table 1. Results of range of motion and visual analog scales in Patient 1

		Flexion (degree)	External rotation (degree)	Visual analog scale at rest (point)	Visual analog scale during exercise (point)
Initial	Left	165	65	3	4
	Right	150	40	7	8
2 months	Left	165	65	0	0
	Right	160	50	5	6
5 months	Left	165	65	0	0
	Right	165	60	3	3
8 months	Left	165	65	0	0
	Right	165	60	1	2

Table 2. Results of strength tests in Patient 1

		Flexion (kg)	Adduction (kg)	Internal rotation (kg)
Initial	Left	26.5	27.0	21.4
	Right	10.2	12.5	8.4
2 month	Left	27.5	29.5	22.0
	Right	15.0	17.2	12.5
5 month	Left	27.4	29.0	21.5
	Right	20.2	20.1	15.3
8 month	Left	29.0	30.1	23.5
	Right	25.0	22.0	17.9

Table 3. Result of isokinetic strength tests at 8 months in Patient 1

	Extension	Flexion	Internal rotation	External rotation	Abduction	Adduction
Left (Nm)	56	54	43	27	46	62
Right (Nm)	56	43	35	23	43	45
Deficit (%)	0	-20	-19	-15	-6	-28

to prevent recurrent subluxation and dislocation [13]. However, we demonstrate that a conservative program of exercise, including ROM, strengthening and stabilizing exercises, can be effective, so long as high risk activities (such as pull-up exercises and high impact activities) are avoided. Our conservative approach was effective in reducing pain and preventing recurrent subluxation/dislocation. We used a combination of supervised and home exercises, and found that patients remained motivated to pursue their program. Motivation to pursue exercises is an important consideration when deciding between a conservative or surgical approach to the management of a Bankart lesion.

In our conservative approach, the primary goals, initially, were to decrease pain and increase ROM. Only once these goals were obtained did we introduce light-intensity strength exercises, progressing to proprioceptive (stabilizing) exercises, higher-intensity strengthening and functional training until full recovery and return to activities of daily living without discomfort [14]. We were careful to avoid ROMs in combined external rotation/extension and abduction at 90°, as well as overhead activities, such as pull-up, to protect the soft tissue structures of the anterior shoulder [15]. Our initial focus on ROM is consistent with research that has shown an increase in fibrosis and pain with immobilization after shoulder dislocation, resulting in increased instability over time [16]. Furthermore, more recent research has shown that even external rotation can be performed up to 30° in the initial phase, without increasing the risk of recurrence [15,17].

Strengthening has been recommended to improve shoulder instability [18]. Resistance exercises using tubing can be effectively and safely implemented early on in the course of clinical recovery from a traumatic shoul-

der dislocation, with progression in resistance as tolerated. In our program, we advocated for shorter duration of isometric hold (5 s), with exercises performed twice a day to increase the volume of exercise, rather than increasing the resistance which would engage the deltoid for stabilization. For higher resistance exercise later in the rehabilitation process, we used weight machines (rather than free weights) as these enhance control and stabilization of the should. We did prohibit movements with a large external rotation component (such as latissimus dorsi pull-ups, overhead pull-up motion, chest press, or bench press). It is known that long-term performance of pull-up and biceps exercises can negatively impact the stability of the labrum [19-20]. Moreover, a forward stooped posture, which brings the head of the humerus anteriorly on the glenoid cavity, negatively impacts on the scapulo-humeral rhythm, which can limit range of shoulder motion when using weight machines for strengthening [21]. Our program also included a component of dynamic stabilization exercises, using proprioception and upper limb weight-bearing exercises on a gym ball. Even though a ±10% between-arm difference is considered normal, we recommend careful follow-up observation should be performed.

While conservative management of a Bankart lesion appears to be feasible, the resulting increase in strength and stabilization cannot prevent against recurrent subluxation/dislocation under unpredictable conditions, including occupational activities, recreational activities (such as skiing), and everyday activities, such as sudden lifting. Ultimately, the labrum is a fibrous, non-vascularized tissue which, thus, has not capacity for self-healing. As exposure to high impact and unpredictable conditions are more likely to occur over time in young individuals and athletes, surgical repair of the labrum could be important to avoid the pain and additional tissue trauma due to recurrent subluxation/dislocation.

The limitations of our study need to be acknowledged. Foremost, we cannot confirm the added benefit of the rehabilitation program, if any, to the natural recovery. Moreover, a no-intervention control group, needed to clarify this issue, would not be ethically feasible. We also report on only three cases, with all three having been recruited through a hospital. We also did not consider the cost of the rehabilitation program, both in terms to direct financial cost and human resources due to the need for supervision and expert exercise prescription, compared to surgical management. Future studies are needed to address these issues, and to determine the most effective rehabilitation protocol. With regard to a cost analysis, cooperation among medical institutions regarding costs is needed to facilitate the design and implementation of large-scale study. Moreover, the inclusion of other modes of training (such as Pilates, TRX suspension training) in the rehabilitation program needs to be considered and evaluated in terms of effectiveness and cost.

5 Conclusion

Rehabilitation exercises for the above mentioned cases, which included the three patients who experienced discomfort after dislocation, were conducted for either 8 months or 3 months. Based on our results, we propose that an initial program of rehabilitation, with frequent follow-up, should be tried prior to selecting surgical repair. However, future studies are needed to provide high quality evidence to inform practice.

Conflict of interests: The authors do not declare a conflict of interest

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