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Return to play after arthroscopic treatment for shoulder instability in elite and professional baseball players

Jin-Young Park, MD, PhD[a], Jae-Hyung Lee, MD[a,*], Kyung-Soo Oh, MD[b], Seok Won Chung, MD[b], Jung-joo Lim, MD[a], Young Min Noh, MD[c]

[a]*Center for Shoulder, Elbow and Sports, NEON Orthopaedic Clinic, Seoul, Republic of Korea*
[b]*Department of Orthopaedic Surgery, Konkuk University Hospital, Seoul, Republic of Korea*
[c]*Department of Orthopaedic Surgery, Dong-A University Hospital, Pusan, Republic of Korea*

Background: This study evaluated the clinical outcome of arthroscopic treatment for anterior shoulder dislocation in elite and professional baseball players.
Methods: This study included 51 baseball players who underwent arthroscopic Bankart repair between 2008 and 2015. The follow-up duration was set at 24 months or longer, based on clinic visit or telephone survey. After surgery, players who played in 1 or more official games were considered to have returned to play (RTP), and those who participated in more than 10 official games were considered to have solidly returned to play (sRTP). The RTP and sRTP rates were analyzed by player position (pitcher, catcher, and in-fielder), and the period of RTP after surgery (rehabilitation period) was investigated.
Results: Of 51 baseball players (mean age, 20.9 years), 14 were pitchers, 6 were catchers, and 31 were in-fielders. Pitchers showed 64% RTP and 57% sRTP, catchers, 83% RTP and 83% sRTP, and in-fielders, 90% RTP and 90% sRTP. The overall RTP and sRTP rates were 82% and 80%, respectively. The average RTP period after surgery (rehabilitation period) was 8.4 months, with 9.6, 9.1, and 7.4 months for pitchers, catchers, and in-fielders, respectively.
Conclusions: The RTP after arthroscopic Bankart repair shows favorable results, with the nonthrowing shoulder and in-field position yielding the best results. Players undergoing arthroscopic Bankart repair and the surgeon should be aware of the possible outcomes based on the throwing/nonthrowing arm and various positions.
Level of evidence: Level IV; Case Series; Treatment Study

Keywords: Bankart; baseball; dislocation; return to play; pitcher; infielder

Shoulder dislocation in baseball is rare compared with other contact sports (football, hockey, wrestling).[9] However, because the shoulder is an unstable joint,[12] under circumstances of collision, sliding toward the base, and other forceful abduction and external rotation of the glenohumeral joint, dislocation of the shoulder joint may occur frequently.

The Konkuk University Medical Center Institutional Review Board approved this study (IRB No.: KUH1060159).

*Reprint requests: Jae-Hyung Lee, MD, Center for Shoulder, Elbow and Sports, NEON Orthopaedic Clinic, Gangnamgu, Nonhyundong, 111-13, Novel Build, 4th Flr, Seoul, Republic of Korea.
E-mail address: medos97@naver.com (J.-H. Lee).

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Controversies exist regarding treatment options for those with first-time glenohumeral anterior dislocation, but many reports have supported arthroscopic stabilization of anterior instability. Rowe et al[11] described a 90% recurrence rate in those with first-time dislocation of the shoulder joint who were younger than 20 years and emphasized operative treatment, especially in athletes. Kirkley et al[6] compared rehabilitation and arthroscopic stabilization in patients with a first traumatic anterior shoulder dislocation, and the recurrence rate was 47% and 15.9% in those who underwent conservative treatment and arthroscopic stabilization, respectively. Furthermore, in the study of Bottoni et al,[4] patients who were treated nonsurgically showed 75% recurrent instability, whereas those treated with surgery showed 11.1% recurrent instability. McLaughlin et al[8] presented the considerations when operating on a first-time dislocation on the dominant shoulder, which has a 90% recurrence rate. In the study of Arciero et al,[1] young athletes with a first-time shoulder dislocation in the nonsurgical group showed an 80% recurrence rate.

To date, no study has reported outcomes of arthroscopic stabilization of anterior dislocation in baseball players. We hypothesized that arthroscopic treatment of shoulder dislocation in baseball players would have different outcomes among positions and between the throwing and nonthrowing shoulder involved.

Materials and methods

Study participants

This study included 51 baseball players, consisting of 40 elite players (20 college and 20 high school) and 11 professional players, with a mean age of 20.9 years (range 19-27 years), who underwent arthroscopic Bankart repair between 2008 and 2015. The follow-up duration was set at 24 months or longer, based on clinic visit or telephone survey. All 51 patients had anterior dislocation, and an anterior Bankart lesion was proven by magnetic resonance arthrogram. The inclusion criterion was a baseball player with a first-time dislocation with anterior Bankart lesion treated by arthroscopic repair. Exclusion criteria were <2 years of follow-up, dislocation >2 times, repaired superior labrum anterior and posterior (SLAP) lesions, and bony Bankart lesions. Type I SLAP lesions were ignored, and the patients were included in the study, whereas type II (unstable peel-back), III, or IV SLAP lesions were repaired, and the patients were excluded from the study.

The clinical outcomes of the players were adopted and modified from those set by Makhni et al.[7] After surgery, players who played in 1 or more official game were considered to have returned to play (RTP), and those who appeared in >10 official games were considered to have solidly returned to play (sRTP). The RTP and sRTP rates were analyzed based on player position (pitcher, catcher, and in-fielder), and the period of RTP after surgery (rehabilitation period) was investigated.

Surgical technique

Surgery was performed by a single senior surgeon. The same surgical procedure was performed in all patients. After general anesthesia, patient was placed in lateral decubitus with the arm in a 7-kg traction device (3-point shoulder distraction system; Arthrex, Naples, FL, USA). All patients had more than grade 2 anterior translation, as assessed under general anesthesia. Arthroscopic examination revealed torn anterior labral lesions in all 51 patients. All portions of the torn labrum were freed, and the full width of the labrum was reattached to healthy débrided glenoid with a bleeding bone bed. The anchors were positioned at 5:30, 4:30, and 3:30 o'clock positions, and the 2:30 position was used when an additional anchor was needed. Bio Mini-Revo suture anchors (ConMed Linvatec, Largo, FL, USA) and GRYPHON T BAR Anchor with Orthocord (DePuy Mitek, Raynham, MA, USA) were used in all cases.

Postoperative rehabilitation

Postoperatively, each patient's arm was kept in a sling that allowed 30° of abduction for 5 to 6 weeks. Isometric exercise of the scapular muscles, grip power strengthening, and elbow range of motion exercise were allowed during the first 5 to 6 weeks of immobilization. Rehabilitation exercise was started at 5 to 6 weeks, which involved gentle passive forward flexion using a pulley. An external rotation exercise using a stick was introduced 9 to 10 weeks postoperatively. Strengthening exercises with TheraBand (Akron, OH, USA) and light weight lifting were permitted at 12 weeks. Daily activity without restriction was allowed 5 to 6 months postoperatively, and return to sports (including contact and collision sports) was allowed according to different positions and throwing/nonthrowing arm. All of the players were trained with highly experienced athletic trainers.

Statistical analyses

The statistical values were analyzed using SPSS 10.1 software (IBM, Armonk, NY, USA). The RTP and sRTP between the throwing and nonthrowing shoulder were examined using the Fisher exact test. Linear-by-linear association parameters were used to identify correlations among the 3 groups (pitcher, catcher, and in-fielder). Statistical significance was set at $P < .05$.

Results

Of 51 baseball players, 40 elite players (20 college, 20 high school) and 11 professional players (mean age, 20.9 years), 14 were pitchers (5 throwing arm and 9 nonthrowing arm), 6 were catchers (4 throwing arm and 2 nonthrowing arm), and 31 were in-fielders (11 throwing arm and 20 nonthrowing arm; Tables I and II).

Table I Throwing vs. nonthrowing shoulder*

Level of play	Throwing (No.)	Nonthrowing (No.)	Total (No.)
Professional	4	7	11
College	8	12	20
Below college	8	12	20

* The follow-up duration was at least 24 months, and mean age was 20.9 years old (range 19-27 years).

Table II Positions*

Level of play	Pitcher (No.)	Catcher (No.)	In-fielder (No.)	Total (No.)
Professional	2	2	7	11
College	5	2	13	20
Below college	7	2	11	20

* The follow-up duration was at least 24 months, and mean age was 20.9 years old.

The overall RTP and sRTP rates were 82% and 80%, respectively. In the throwing arm, pitchers showed 20% RTP and 0% sRTP; catchers, 75% RTP and 75% sRTP; and in-fielders, 82% RTP and 82% sRTP. In the nonthrowing arm, pitchers showed 89% RTP and 89% sRTP; catchers, 100% RTP and 100% sRTP; and in-fielders, 95% of RTP and 95% sRTP. In pitchers, the total RTP and sRTP were 64% ($P < .023$) and 57% ($P < .003$), respectively; in catchers, 83% ($P > .99$) and 83% ($P > .99$), respectively; and in in-fielders, 90% ($P < .281$) and 90% ($P < .281$), respectively. Only the RTP and sRTP in the pitcher's group showed a statistically significant difference between the throwing and nonthrowing groups. The RTP and sRTP rates between the throwing and nonthrowing arms were 65% and 94%, respectively, and 60% and 94%, respectively. There were no differences in the RTP and sRTP rates, except for pitchers with shoulder dislocation in the throwing arm. One player (pitcher, throwing arm) pitched 1 official game but retired afterward (Tables III–V).

In the throwing shoulder, statistically significant results were found for the RTP ($P < .026$) and sRTP ($P < .004$) rates among the various positions, whereas the nonthrowing shoulder showed no statistical significance.

The average RTP period after surgery (rehabilitation period) was 8.4 months, with 9.6, 9.1, and 7.4 months for pitchers, catchers, and in-fielders, respectively (Table VI).

Discussion

RTP after anterior shoulder dislocation, without surgery, puts the affected shoulder at great risk for recurrent instability.[14] According to reports, Bankart repair in athletes has favorable results, whether open or arthroscopic procedure.[2,5] Although anterior shoulder dislocation in baseball is an uncommon injury compared with other collision sports, the mechanisms of injury causing dislocation are very similar, because it should be treated as players participating in contact or collision sports. Petrera et al[10] compared the outcomes of arthroscopic Bankart repair in collision and noncollision athletes. They found that the dislocation recurrence rate in collision athletes was 9% (2 of 22 patients) and that no redislocations occurred in 21 noncollision athletes. In addition, Yamamoto et al[15] reported that the recurrence rate of Bankart repair in contact athletes was 2-times higher in the open group and 3-times higher in the arthroscopic group than in the noncontact athletes.

Table III Return to play*

Position	Throwing shoulder			Nonthrowing shoulder			Total RTP	*P*
	Total (No.)	RTP (No.)	RTP rate (%)	Total (No.)	RTP (No.)	RTP rate (%)	(%)	
Pitcher	5	1	20	9	8	89	64	<.023
Catcher	4	3	75	2	2	100	83	>.99
In-fielder	11	9	82	20	19	95	90	<.281
Correlation (groups)	$P < .026$			$P < .571$				

Total (No.), total number of players; *RTP (No.)*, number of players who returned to play (1 or more official games); *RTP rate (%)*, RTP (No.)/Total (No.) × 100.
* Overall RTP : 82%.

Table IV Solid return to play*

Position	Throwing shoulder			Nonthrowing shoulder			Total sRTP	*P* value
	Total (No.)	sRTP (No.)	sRTP rate (%)	Total (No.)	sRTP (No.)	sRTP rate (%)	(%)	
Pitcher	5	0	0	9	8	89	57%	<.003
Catcher	4	3	75	2	2	100	83	>.99
In-fielder	11	9	82	20	19	95%	90	<.281
Correlation (groups)	$P < .004$			$P < .571$				

sRTP, solidly returned to play; *Total (No.)*, total number of players; *sRTP (No)*, number of players who returned to play (≥10 official games); *sRTP rate (%)*, sRTP (No.)/Total (No.) × 100.
* Overall sRTP: 80%.

Table V Throwing arm vs. nonthrowing shoulder

Outcome	Throwing shoulder			Nonthrowing shoulder			Total rate (%)
	Total (No.)	(s)RTP (No.)	Rate (%)	Total (No.)	(s)RTP (No.)	Rate (%)	
RTP	20	13	65	31	29	94	82
sRTP	20	12	60	31	29	94	80

(s)RTP, solid return to play (≥10 official games) or return to play (≥1 or more official games).

Table VI Period of rehabilitation until return to play*

Position	Throwing shoulder (mo)	Nonthrowing shoulder (mo)	Average (mo)
Pitcher	13	8	9.6
Catcher	11.5	7.1	9.1
In-fielder	8.2	6.5	7.4

* Average period of return to play after surgery was 8.4 mo.

In this report of 51 players, 10 did not return to solid play, with 8 having shoulder dislocation in their throwing arm (dominant) and 2 in their nonthrowing arm (nondominant). Among the 8 players whose throwing arm was involved, 5 were pitchers, 1 was a catcher, and 2 were in-infield players. All of the pitchers failed to reach previous pitching velocity. They also had pain and lost control of the ball; however, 1 pitcher returned and played 1 official game but retired afterward. The catcher and 1 in-fielder had no restriction on their activities of daily living but experienced pain on throwing. Another in-fielder had another traumatic event, leading to arthroscopic revision Bankart repair. In 2 players whose shoulder dislocation involved their nonthrowing arm, 1 was a pitcher and the other was an in-fielder. The pitcher quit due to academic studies, and the in-fielder was released from the team immediately after surgery and worked as a coach.

Those whose injury involved the nonthrowing arm could not return to sports due to reasons other than previous athletic performance level. The difference between the involvement of the throwing and the nonthrowing arm is significant, with pitchers showing the lowest RTP and sRTP.

There were no significant differences in range of motion between 2 groups after surgery. We noted that even after surgery, involvement of the throwing arm led to poor outcomes, especially in pitchers, due to continuous stress and fatigue at the reconstructed glenolabral complex.[3] The reason for loss of precise control is not well understood, but lack of proprioception is thought to be the main cause. There is no definite suggestion to improve this matter, and further study is needed.

Muscle strength was not the factor for poor outcomes in the dominant arm. Because they were all elite and professional athletes, RTP was delayed until the players reached certain level of strength, most of whom were checked with the Cybex (Medway, MA, USA) muscle strength analyzer. The correlation between nondominant and dominant arm in muscle strength is not known. There were no differences in range of motion among pitchers, catchers, and in-fielders. Ide et al[5] reported that the complete return rate in overhead-throwing athletes (68% [17 of 25]) was lower than that in nonoverhead athletes (90% [27 of 30]), which supports the findings of our study.

Stone et al[13] proposed from a systematic review study that unrestricted RTP can be achieved with an average of 23.2 weeks, regardless of contact and noncontact sports. Watson et al[14] noted that the time range for RTP after surgical stabilization takes 4 to 6 months, which may be longer in some cases. The average RTP period investigated in this study was 8.4 months. In detail, the RTP period after surgery in the throwing arm was 13, 11.5, and 8.2 months in pitchers, catchers, and in-fielders, respectively, and in the nonthrowing arm was 8, 7.1, and 6.5 months in pitchers, catchers, and in-fielders, respectively. Our results demonstrate a longer RTP period, but we believe that the difference comes from the strict calculation of the RTP when the player participated in an official game.

Our study has several limitations. First, the RTP and sRTP representing the outcome values are unclear. For baseball players, other statistical measures, such as earned run average, walks plus hits divided by innings pitched, batting average, and wins above replacement can be applied.

Second, the players involved in this study played at different levels. The rehabilitation strategy and environment between professionals, college players, and under college students are very different, which can affect rehabilitation performance and RTP.

Third, not all patients visited the clinic 24 months after surgery, and some were analyzed with a telephone survey.

Lastly, this was a retrospective study, which was not controlled. We could not balance the number of players between those with throwing and nonthrowing arm involvement or among the positions.

Conclusion

The RTP after arthroscopic Bankart repair shows favorable results, with the nonthrowing shoulder and in-field position yielding the best results. Players undergoing

arthroscopic Bankart repair and the performing surgeon should be aware of the possible outcomes according to the throwing/nonthrowing arm and various positions (pitcher, catcher, and in-fielder).

Disclaimer

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