Anterior Shoulder Instability in the Professional Athlete

Return to Competition, Time to Return, and Career Length

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Background: Anterior shoulder instability is a common condition in professional athletes, yet little is known about the success of surgery. Return to competition (RTC) is a metric indicative of a successful outcome for professional athletes who undergo anterior shoulder stabilization surgery.

Purpose: To determine the rate of RTC, time to RTC, recurrence rate, and length of career after surgery in professional athletes who had undergone surgical treatment for anterior shoulder instability.

Study Design: Case series; Level of evidence, 4.

Methods: We evaluated professional athletes who underwent surgical treatment for anterior shoulder instability by a single surgeon between 2007 and 2018. Data from patients' medical records, a patient data registry, basic search engines, sports websites, and individual team websites were used to determine length of professional play before injury, duration of career after surgery, and RTC level.

Results: Overall, 23 professional athletes (25 shoulders from 12 contact and 13 noncontact athletes) were identified. The mean age at the time of surgery was 24.3 ± 4.9 years (range, 16-35 years). Primary procedures included arthroscopic Bankart repair (76%; 19/25), open Latarjet (20%; 5/25), and bony Bankart repair (4%; 1/25). Of the 23 athletes, 22 returned to their previous level of competition (96%; 95% CI, 78%-100%). The mean time between surgery and RTC was 4.5 months (range, 3-8 months). There was no difference in time to RTC between contact and noncontact athletes (4.1 vs 4.4 months). There was no difference in RTC rates and time to return for players who received a Bankart repair versus a Latarjet procedure (4.6 vs 4.2 months). A total of 12 participants were still actively engaged in their respective sport at an average of 4.3 years since surgery, while 11 athletes went on to retire at an average of 4.8 years. Duration of play after surgery was 3.8 years for contact athletes and 5.8 years for noncontact athletes ($P > .05$).

Conclusion: In this series, professional athletes who underwent surgical shoulder stabilization for the treatment of anterior glenohumeral instability returned to their presurgical levels of competition at a high rate. No differences in RTC rate or time to RTC were observed for contact versus noncontact athletes or for those who received arthroscopic Bankart repair versus open Latarjet. However, contact athletes had shorter careers after surgery than did noncontact athletes.

Keywords: anterior glenohumeral instability; return to competition; professional athlete; Bankart; Latarjet

Anterior shoulder instability is a common sports injury that causes pain, physical limitation, and time away from sport.[28] In young athletes, the majority of anterior shoulder instability injuries occur after a traumatic event[35] and can range from microinstability, to subluxation, and to glenohumeral dislocation.[10] Most cases of anterior instability have Bankart lesions.[15,32] In more severe and recurrent cases, osseous deficiencies can occur. In college athletes, it is estimated that glenohumeral instability has an incidence as high as 0.12 per 1000 athlete-exposures, with higher rates in collision and contact sports.[34] Furthermore, young athletes participating in contact sports are highly susceptible to recurrent instability if treated nonoperatively[17,39] and demonstrate poor return-to-competition (RTC) rates.[17]

Because of the high rate of recurrent instability associated with nonoperative treatment[2,8,11,22] and the progressive injury to the anteroinferior capsulolabral ligamentous complex that occurs over time,[21,43,46,50] many athletes opt for surgical management. Two common types of surgical stabilization options are the arthroscopic Bankart repair and the Latarjet procedure. While the Bankart repair is

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strictly a soft tissue repair of the anteroinferior capsulolabral complex of the glenoid, the Latarjet procedure involves bony reconstruction through coracoid transfer to the anterior rim of the glenoid and is most often performed in cases of recurrent instability with glenoid bone loss.[1,6,9] Both procedures demonstrate similar RTC rates in the literature. For example, in a recent systematic review of young athletes,[23] arthroscopic Bankart repair and the Latarjet procedure had a 71% and 73% return to the same level of competition, respectively. There are some surgeons, however, who suggest that the arthroscopic Bankart repair has a limited and decreasing role and that the Latarjet procedure may be preferred in all cases of anterior shoulder instability.[6,51]

While studies have evaluated RTC rates after anterior shoulder stabilization in young recreational athletes in the general population, it is important to determine how surgery affects RTC rates and length of career in professional athletes. For these athletes, return to play and career length after surgery are among the most important metrics of success after surgical treatment for anterior shoulder instability. Additionally, there are significant financial ramifications for both individual players and teams. Treating professional athletes with anterior shoulder instability requires special attention, as they face unique pressures to return to their preinjury level of sport, usually as soon as is safely possible. It is thus important to recognize factors that place professional athletes at increased risk of delays in RTC and of failed treatment.

The purpose of this study was to describe the rate and time of RTC, the length of professional career after surgery, and the factors associated with RTC in professional athletes after shoulder stabilization surgery for anterior instability. Our hypothesis was that professional athletes would return to play at the same levels of competition at high rates. Additionally, we hypothesized that factors such as contact versus noncontact sport, years of professional play before surgery, and type of stabilization procedure performed would affect the rates and times to RTC as well as career length after surgical stabilization.

METHODS

Patient Selection and Characteristic Data

This study was approved pre hoc by an institutional review board for exempt analysis. A total of 23 consecutive professional athletes (25 shoulders) who were treated surgically between 2007 and 2018 for anterior instability by a single surgeon (P.J.M.) were identified from a prospective patient registry. Inclusion criteria were patients with a diagnosis of primary or recurrent anterior shoulder instability who underwent procedures of primary or revision Bankart repair with capsulorrhaphy, bony Bankart repair, or open shoulder Latarjet. In addition, patients who required secondary procedures of superior labral anterior to posterior (SLAP) repair, biceps tenodesis, and concomitant rotator cuff were included. Patients were excluded if they had retired from professional sports before their anterior shoulder stabilization procedure. "Professional" was defined as (1) training and competing full-time at the most elite or highest level of their respective sport and (2) receiving compensation for the specific sports participation.

Following the method used by Begly et al,[4] basic search engines (www.google.com), sports websites (www.espn.com), and individual team websites were used to determine the length of professional play before injury, duration of career after surgery, RTC level, time to RTC, and recurrence rates. Similar to previous authors on the subject,[4,41] we defined successful RTC as competing again for at least 1 game at the same level of competition as the preinjury level. If surgery and rehabilitation occurred during the offseason, return to competition was defined by the time point at which the treating surgeon cleared the athlete to return to full, unrestricted sports activities. For players who underwent bilateral anterior shoulder stabilization procedures, RTC was defined according to their return after each procedure.

Patient characteristics, surgical data, and patient outcomes were obtained from the medical records of the athlete. Clearance for return to full, unrestricted activity was determined from the medical records of the patients at routine clinical follow-up appointments. Operative data were obtained for each athlete, including specific procedures performed and intraoperative findings.

Clinical Assessment, Workup, and Indications

At the time of the initial examination, all patients underwent a detailed history and physical examination. All patients had clinical physical examination signs and symptoms of primary or recurrent anterior glenohumeral instability, including a positive anterior drawer test,[19] apprehension test,[38] relocation sign,[44] release test,[47]

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surprise test,[42] and/or load and shift test.[45] Additionally, all patients expressed decreased function and inability to play at the same level of professional sports because of their shoulder instability. These findings were corroborated with both radiographic imaging (anteroposterior/Grashey/axillary lateral radiographic views) and advanced imaging with minimum 1.5-T magnetic resonance imaging (MRI) to evaluate soft tissue integrity and concomitant pathology. In addition, all patients with recurrent anterior shoulder instability underwent computed tomography (CT) with 3-dimensional (3D) reformatting to thoroughly evaluate anterior glenoid bone loss to aid in the decision making regarding the procedure type for the patient.

Arthroscopic Bankart was performed in patients who had evidence of tearing of the anteroinferior capsulolabral complex with or without a Hills-Sachs lesion, and without glenoid bone loss, which was based upon preoperative evaluation, MRI, and intraoperative arthroscopy findings. If patients did have a Hill-Sachs lesion, it was evaluated as on-track or off-track according to Yamamoto et al[48] and Di Giacomo et al.[16]

The decision to perform an open Latarjet was made based on a history of soft tissue repair, consideration of the sport played, history of recurrent instability, and glenoid bone loss as measured according to the Gerber and Nyffeler[20] criteria, in which the length of the osteochondral defect in the sagittal plane on MRI was greater than the radius of the anteroposterior distance of a best-fit circle centered on the inferior two-thirds of the glenoid. All patients who had bone loss according to the Gerber and Nyffeler criteria underwent Latarjet. The projected glenoid track, as described by Mook et al,[30] was used in all cases, with the determination of the Hill-Sachs interval established by measuring the articular insertion of the rotator cuff to the medial extent of the Hill-Sachs on sagittal plane MRI scan.

Surgical Technique

Bankart Repair. In the setting of an isolated Bankart lesion, a repair was performed with an average of 4 suture anchors placed in the anteroinferior glenoid at approximately the 2-, 3-, 4:30-, and 5:30-clockface positions (right shoulder). If a SLAP lesion was also present (10 cases), an average of 3 suture anchors for the Bankart repair[26] and 2 additional suture anchors for the SLAP tear repair were used.[49] After the placement of the first suture anchor in the 5:30-clockface position, 1 limb of the suture was passed through the capsulolabral complex to shift the anteroinferior capsule in a superior and medial fashion. This process was repeated from inferior to superior until all anchors were placed and sufficient repair was achieved.

Latarjet Technique. The senior author's technique is modified from that described by Edwards and Walch,[18] which is a modification of the technique originally described by Latarjet.[24,25] A subscapularis split was used in all cases, and the capsule was also split in a similar plane from medial to lateral. The coracoid was positioned with the inferior surface along the glenoid neck, effectively increasing the glenoid track by the respective width of the coracoid. The coracoid was drilled with a 3.5-mm drill and the glenoid with a 2.5-mm drill. Two fully threaded 3.5-mm cortical screws were used for fixation in a lag-by-application method. The capsule, which had been split from medial to lateral, was then closed with the arm in 30° of abduction, 30° of forward flexion, and 30° of external rotation in a side-to-side manner of the inferior and superior. Shortening of the capsule was avoided.

Postoperative Rehabilitation

Rehabilitation After Arthroscopic Bankart. Rehabilitation after surgery was individualized based on the stability of the repair and tissue quality. After surgery, patients who underwent an arthroscopic Bankart were instructed to wear a sling for 4 weeks, and passive range of motion was permitted with forward elevation, internal rotation, and abduction. Passive external rotation was limited to 30° of external rotation for the first 4 weeks postoperatively. At 4 weeks after surgery, full active range of motion was allowed. At 7 weeks, the patient was allowed to begin resistance strengthening. When there was full and pain-free motion, the patient was allowed weight lifting, overhead sports, and contact sports. This typically occurred after 4 months. In all arthroscopic Bankart cases, unrestricted activity was permitted at 3.5 to 4 months, once full pain-free motion and strength were restored.

Rehabilitation After Latarjet. Postoperative rehabilitation after open Latarjet followed a protocol similar to that after Bankart repair, although active range of motion was usually permitted at 3 weeks. The patient was also instructed to wear a sling for the first 3 weeks, with passive range of motion tolerated in all directions except external rotation, which was kept below 30° for the first 3 weeks. Resistance strengthening began at 6 weeks. When full and pain-free motion was achieved, weight lifting was tolerated. Radiographs were obtained at routine postoperative appointments. A CT scan was obtained for 1 patient who was in the National Football League (NFL) Combine and needed to RTC early (3.5-4 months) to assess the coracoid-glenoid interface healing. In patients who underwent Latarjet or bony Bankart repair, unrestricted activity and return to full sports were permitted at 3.5 to 4 months, once full pain-free motion and strength were restored and if there was satisfactory evidence of radiographic healing. If the patient needed to return to sports and the radiographs were not convincing, a CT scan was obtained to confirm healing.

RESULTS

A total of 23 professional athletes (25 shoulders) with anterior shoulder instability were included in this study. The mean age at the time of surgery was 24.3 ± 4.9 years (range, 16-35 years); there were 20 male and 3 female participants. The cohort consisted of 5 NFL football players, 5 National

TABLE 1
Patient Characteristics

No. of patients	23
No. of shoulders	25
Age, y, mean ± SD	24.3 ± 4.9
Dominant shoulder	11 of 25 shoulders (44%)
Contact vs noncontact	12 contact, 13 noncontact
Traumatic vs atraumatic	21 traumatic, 4 atraumatic
Acute (<6 mo) vs chronic (>6 mo)	17 acute, 8 chronic
Prior surgeries (No. of shoulders)	4 of 25 (16%)[a]

[a]All prior procedures performed consisted of isolated arthroscopic Bankart repairs.

Hockey League hockey players, 4 professional skiers, 2 mixed martial artists (MMA), 2 motocross bikers, 2 Olympic figure skaters, 1 Major League Baseball player, 1 Formula One racer, and 1 Grand Prix equestrian rider (jumping). Overall, 12 shoulders were from athletes engaged in contact sports and 13 from athletes engaged in noncontact sports, and all were injured while the athletes were training or competing in their respective sports. There were 17 cases of acute, first-time instability events with less than 6 months of symptoms, and 8 cases from patients presenting with chronic shoulder instability with more than 6 months of symptoms and instability events. The dominant shoulder was injured in 44% of cases. Overall, 16% of the cases had undergone prior surgery (all arthroscopic Bankart repairs) to the same shoulder for anterior instability and thus were revision cases. The characteristics of the 25 shoulders are shown in Table 1.

Procedures and Intraoperative Findings

The procedures performed were as follows: arthroscopic Bankart repair (76%; 19/25), open Latarjet procedure (20%; 5/25), and arthroscopic reduction and internal fixation of a bony Bankart lesion (4%; 1/25). Of the 4 revision cases (all prior arthroscopic Bankart repair), 3 patients underwent Latarjet procedure and 1 patient received a revision arthroscopic Bankart repair. All patients who underwent an arthroscopic Bankart repair showed evidence of anteroinferior capsulolabral tearing on arthroscopy. None had glenoid bone loss that met the criteria of Gerber and Nyffeler.[20] Of the patients who underwent open Latarjet procedure, 2 had recurrent instability with glenoid bone loss after prior arthroscopic Bankart repair, 1 had recurrent instability with hyperlaxity and no glenoid bone loss after prior arthroscopic Bankart repair, and 2 had recurrent instability with glenoid bone loss and no prior surgical treatment. Primary and concomitant treatments are summarized in Table 2.

Anterior humeral translation was measured intraoperatively before treatment. Most shoulders (12/25) had severe (grade 2 or grade 3) translation as determined by the anterior load and shift test: patients either fully dislocated and spontaneously reduced (grade 2) or dislocated and remained dislocated, requiring manual reduction (grade 3). For those who underwent arthroscopic Bankart repair, the average number of anchors used was 4.6 (range, 3-8). There were 21 Hill-Sachs lesions, 21 shoulders with glenoid bone loss (all with >20% bone loss underwent Latarjet), 10 concomitant SLAP tears, 3 biceps pathologies, and 3 rotator cuff tears. According to the model proposed by Yamamoto et al[48] and Di Giacomo et al[16] on the influence of the Hill-Sachs lesion and its associated track, of those who underwent Bankart repair, 100% (16/16) of patients who had Hill-Sachs lesions had on-track lesions. Of those patients who had Hill-Sachs lesions and underwent Latarjet, 4 of 5 (80%) were off-track preoperatively. All 5 patients who underwent Latarjet were predicted to be on-track postoperatively using the model proposed by Mook et al.[30] The average glenoid bone loss (percentage defect) for all patients was calculated on MRI and was defined as the ratio of the defect width to the diameter of the best-fit circle on the inferior two-thirds of the glenoid; this value was found to be 4.9%. The average glenoid bone loss was 3.1% for patients who underwent Bankart repair and 26.5% for patients who underwent Latarjet. Of the 3 biceps tenodeses performed, 2 were for tenosynovitis and 1 was for biceps tendon instability. All intraoperative findings are summarized in Table 3.

TABLE 2
Treatments[a]

Arthroscopic Bankart repair	19
Open Latarjet	5
Arthroscopic bony Bankart repair	1 (glenoid rim fracture)
Concomitant procedures	
SLAP repair	10
Biceps tenodesis	3
Rotator cuff repair	2

[a]SLAP, superior labral anterior to posterior.

Return to Competition

In this series, 22 of 23 athletes returned to their previous level of competition (96%, 95% CI, 78%-100%). One professional baseball player with multidirectional hyperlaxity and unidirectional anterior instability who underwent a Bankart repair (4%; 1/25) had a traumatic dislocation event with recurrent instability. The patient was revised to an open Latarjet and was able to resume overhead throwing; however, during his recovery, he sustained an anterior cruciate ligament tear, which led to his not returning to Major League Baseball. Overall, the mean time of professional play before surgery was 5.9 years (range, 0.6-13 years). The mean time between surgery and RTC was 4.5 months (range, 3-8 months). Of the 23 athletes who were evaluated, 12 were still actively competing at the same level of competition at the time of data collection, at an average of 4.3 years (range, 1.3-7.8 years) since surgery. Of the patients who had retired (11/23), their average length of career after anterior shoulder stabilization surgery was 4.8 years. When the duration of play after surgery was stratified by contact and noncontact athletes, contact

TABLE 3
Intraoperative Findings[a]

Anterior humeral translation	
Mild (0-1 cm)	2 (8)
Moderate (1-2 cm)	9 (36)
Severe (≥2 cm glenoid rim)	12 (48)
Locked out	2 (8)
SLAP lesions	10 (40)
Hill-Sachs lesions	21 (84)
Bankart repair	16 of 16 (100) on-track preop
Latarjet	4 of 5 (80) off-track preop 5 of 5 (100) predicted on-track postop
Glenoid bone loss present	21 shoulders (84)

[a]Values are represented as n (%). postop, postoperatively; preop, preoperatively; SLAP, superior labral anterior to posterior.

athletes played for 3.8 years, while noncontact athletes played for 5.8 years after surgery. There was no difference in time to RTC between contact and noncontact athletes (4.1 vs 4.4 months, $P > .05$). Despite using a slightly more aggressive rehabilitation timetable with the Latarjet, with the numbers available, there was also no statistically significant difference in RTC rates and time to return for players who underwent Bankart repairs when compared with Latarjet procedures (4.6 vs 4.2 months, $P > .05$).

DISCUSSION

Successful RTC after an anterior shoulder stabilization procedure in both the contact and noncontact professional athlete has been inadequately evaluated. The results of this study demonstrate that anterior shoulder stabilization procedures in the professional athlete allow for a complete RTC, with 96% of patients in this cohort returning to the same level of competition. Furthermore, with the patients available for analysis and using the strict and clear indications for surgery as outlined in this study, both those who underwent arthroscopic stabilization with arthroscopic Bankart repair and those who underwent open Latarjet returned to competition at similar rates and had no differences in time to RTC. There was no difference in RTC rates and time to RTC when comparing contact and noncontact athletes, although contact athletes had shorter careers postsurgery than did noncontact athletes.

The risk of recurrent shoulder instability events is notably higher in the young and athletic population. Patients who are younger than 20 years and who actively participate in sports are at a 6-times increased risk of sustained recurrent shoulder instability events.[3,12,39] Professional athletes may feel the pressure to RTC and activity as soon as possible, as their livelihood is dependent on their participation and productivity. The teams may also want star athletes to return. However, in 1 study, athletes who attempted to return in season after nonoperative treatment with rehabilitation recurred at a rate of 73%, placing them at increased risk of attritional bone loss, progressive injury to the capsulolabral complex, and increased risk of long-term development of osteoarthritis.[17, 21, 33] The results from this case series demonstrate that anterior shoulder stabilization procedures in the professional athlete can reliably return the athlete back to competition at the same level of competition before surgery.

Whether returning to training or to active competitive play, professional athletes have both external and internal pressures to RTC safely and as soon as possible. In a paired matched analysis, Blonna et al[7] allowed noncontact athletes to return to sport 3 to 5 months after a Bankart stabilization procedure and 2 months after a Latarjet; conversely, in the contact athlete, athletes were allowed to return to activities 6 months after surgery regardless of the stabilization procedure type. Similarly, Ialenti et al[23] performed a systematic review showing that patients who underwent Bankart stabilization procedures on average took approximately 1 month longer to return to play when compared with those who underwent a Latarjet procedure (6.1 vs 5.3 months). With the utilization of early mobilization physical therapy protocols and close surveillance, the patients in our study were able to RTC at an average of 4.5 months. There was a trend for the Latarjet group to return earlier, but with the numbers available, there was no statistical difference. Furthermore, despite the status of the athlete as a contact or noncontact participant, there was no difference in time to RTC (4.1 vs 4.4 months). Although our patient population was at the elite level of sport and had the benefit of top rehabilitation professionals, support networks of health care providers, and resources aiding in daily rehabilitation (physical therapists, athletic trainers, physicians, coaches, and agents), a regimented physical therapy protocol emphasizing early mobilization allowed for safe RTC that was quicker than has been previously reported.

Return to the same level of competition or higher without recurrence of shoulder instability was the primary goal in the treatment of this specific patient population. Although the type of sport could conceivably influence return rates, multiple studies[13,27,29,37,40] have reported rates of 66%-100% for return to the same preinjury level of competition after arthroscopic Bankart anterior shoulder procedures. In a multicenter case series by Robins et al[37] of National Collegiate Athletic Association (NCAA) Division I American football players, an 82% return rate to the same level of play was found after arthroscopic Bankart repair. Similarly, Mazzocca et al[27] reported on a cohort of contact athletes, with 100% of the participants able to return to the same level of play at an average of 5.7 months after undergoing an arthroscopic Bankart repair. Athletes who undergo an open Latarjet procedure have returned to the same level of competition at comparable rates (65%-96%).[5,14,31,36] Most recently, Privitera et al[36] demonstrated a reliable 72% rate of return to the same level of sport in the contact athlete after Latarjet for primary anterior shoulder stabilization. These studies are consistent with our findings, where 96% of patients overall were able to successfully return to the same level of competition, after Latarjet as well as arthroscopic Bankart repair.

The management of professional athletes presents unique challenges in balancing a quick RTC while ensuring long-term stability and success. The reasoning behind the high RTC rate in this cohort is similar to that seen in NCAA Division I football athletes, where those with scholarships had higher rates of RTC than those who were not on scholarship.[37] A professional or scholarship athlete faces monetary pressure and external scrutiny from coaches, family, and fans that are not experienced by the recreational athlete. This added pressure can force these types of athletes to return more quickly, compromising rehabilitation after surgery and potentially forcing athletes to cope with persistent instability. There are also unique issues of timing that come into play when treating professional athletes. For example, if an important competition or event was going to occur, an athlete could decide to return sooner because of the uniqueness of the opportunity. How the injury and surgery relate to the timing of the individual's professional contract could also play a role. As both contact and noncontact athletes experience these same unique external pressures, this could explain why no significant differences in time to RTC were found between the 2 groups in this study.

Limitations

The current study has limitations associated with any small retrospective series of specialized patients. First, the focus of this study was to look at a specific common condition—anterior shoulder instability—in professional athletes and to determine rates of RTC and need for revision surgery. Although patients successfully returned to competition at a high rate (96%) in their respective sports, they may have had subsequent instability events that occurred without our knowledge. However, although some may have had recurrent symptoms, none underwent revision surgery. Despite these unknown factors, all the athletes in this series were able to return to their respective professional competition level. Inherent limitations exist when comparing procedures, as patients with more bone loss and prior surgery were selected for Latarjet compared with those presenting with initial complaints of shoulder instability, who most often underwent a Bankart repair.

Next, the RTC criteria were partially influenced by the senior author's aforementioned rehabilitation criteria. The specific inclusion criterion of participants being professional athletes was both a limitation and a strength of this study. Professional athletes require and demand the most of their bodies and thus the results may not be generalizable to the day-to-day athlete. To our knowledge, there is no series describing outcomes of shoulder instability procedures in this specific high-demand population. Finally, although the study involved a single condition, anterior shoulder instability, there were variations in the pathoanatomy encountered, which can add heterogeneity to the data. Although clear, pre hoc indications for the various procedures were defined, it is possible that there are other confounding variables that influenced the results and affected the comparisons across treatment groups.

CONCLUSION

Professional athletes who undergo surgical shoulder stabilization for the treatment of anterior glenohumeral instability, using the indications and surgical techniques as outlined in this study, return to their presurgical level of competition at high rates, can do so relatively quickly, and can have relatively long careers after surgery. No differences were seen between contact and noncontact athletes in patients who underwent anterior shoulder stabilization procedures. Furthermore, although the indications for the procedures were slightly different, there were no significant differences in RTC rates and time to RTC for athletes who underwent arthroscopic Bankart repair versus open Latarjet.

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