Evaluation of functional outcomes and complications following modified Latarjet reconstruction in athletes with anterior shoulder instability

Toby J Colegate-Stone, Christelle van der Watt and
Joe F de Beer

Abstract

Background: The optimal management of anterior shoulder instability in athletes continues to be a challenge. The present study aimed to evaluate the functional outcomes of athletes with anterior shoulder instability following modified Latarjet reconstruction through assessing the timing of return to sport and complications.

Methods: Retrospective assessment was performed of athletes ($n = 56$) who presented with recurrent anterior shoulder instability and were treated with modified congruent arc Latarjet reconstruction over a 1-year period. Rugby union was the predominant sport performed. Pre-operative instability severity index scores were assessed. Postoperative complications were recorded as was the time taken for the athlete to return to sport.

Results: Arthroscopic evaluation revealed that 86% of patients had associated bony lesions affecting the glenohumeral joint. The overall complication rate relating to the Latarjet reconstruction was 7%. No episodes of recurrent shoulder instability were noted. Of the patients, 89% returned to competitive sport at the same level as that prior to surgery. The mean time post surgery to returning to full training was 3.2 months.

Conclusions: The modified congruent arc Latarjet procedure facilitates early rehabilitation and return to sport. These results support our systematic management protocol of performing modified Latarjet surgery in contact sport athletes with recurrent anterior instability.

Keywords

Athletes, latarjet, shoulder instability, sport

Date received: 29th September 2014; accepted: 26th February 2015

Introduction

The optimal management of anterior shoulder instability in athletes continues to challenge the community.^{1–4} Probably the most significant complication following either arthroscopic Bankart repair or Latarjet type surgery is recurrent dislocation. Contact sports such as rugby union are a risk factor for recurrent instability because the forces conferred across the glenohumeral joint during tackling are known to be up to 2000 N.^{5–8} Athletes have a special need for an early return to sports following injury because delay may lead to both financial and training impediment. The high recurrence rates seen in arthroscopic Bankart repair in the presence of significant glenoid bone loss, Hill–Sachs lesions or with combined glenoid and humeral bony

deficiencies has led the march towards performing non-anatomic repairs with coracoid bone blocks, such as the Latarjet procedure.^{1,9}

The Latarjet procedure offers the benefits of improved shoulder stability through a combination of effects. The large coracoid bone graft restores and extends the glenoid articular arc, whereas the conjoint tendon acts as a dynamic sling on the inferior subscapularis and anteroinferior capsule when the arm is

Cape Shoulder Institute, Cape Town, South Africa

Corresponding author:

Toby Colegate-Stone, 21 Cedars Road, Barnes, London SW13 0HP, UK.
Email: tobycolegatestone@yahoo.com
Tel: +07977 531559.

abducted and externally rotated.^{1,2,4} However, this procedure is more invasive than arthroscopic Bankart repair, with several studies reporting high complication rates of up to 30%.¹⁰

The present study aimed to evaluate the functional outcomes of athletes with anterior shoulder instability following modified Latarjet reconstruction through assessing the timing of return to sport and complications.

Materials and methods

Patient selection

The present study was a single centre retrospective cohort review of athletes who presented to a single specialist shoulder surgeon with recurrent anterior shoulder instability and who were treated with the modified congruent arc Latarjet procedure over a 1-year period. Patients were excluded from the study if there was evidence of hyperlaxity, voluntary instability or pre-existing osteoarthritis.

The study comprised 56 patients (50 males and six females, average age 24 years, age range 16 years to 42 years). On pre-operative examination, all patients had positive anterior apprehension and relocation tests. Recurrent anterior instability was defined as two or more dislocations, the presence of recurrent subluxations or a painful unstable shoulder with associated soft tissue or bony loss.

The mechanism for the first episode of instability was trauma in all cases, with injury when playing rugby being the most common. Of the patients, six (11%) played professional level rugby at international and national levels; the remainder played at regional club or local standards. Rugby Union was the most common sport in the population (Table 1). The average number of dislocations was 5.6, with the dominant side

being affected in 55%. Nine of the patients had had previous failed arthroscopic Bankart repair of whom seven had had their surgery performed elsewhere. The two patients who had recurrent instability following failed arthroscopic surgery at the study centre were both non-rugby athletes. Three patients had other past medical history comprising of hypertension, hypercholesterolaemia and ankylosing spondylitis.

Pre-operative assessment

All patients had comprehensive pre-operative radiographic evaluation with anteroposterior (AP) views and axillary glenohumeral views according to the protocol set out by Bernageau et al.¹¹ The radiography also helped to facilitate scoring of the patient using the instability severity index score (ISIS).² This is a simple six-question scoring system based on prognostic factors derived from a pre-operative questionnaire, physical examination and AP radiographs. The factors assessed are: age at surgery, competitive level of athlete, type of sport, shoulder hyperlaxity and radiographic signs of glenohumeral lesions. It was originally devised to help to distinguish between patients who would benefit from an arthroscopic anterior stabilization using suture anchors and those who required open Latarjet stabilization. A score of more than 6 points corresponded to a recurrence risk of 70% with arthroscopic surgery.²

Surgical technique

Each patient in this series first underwent a diagnostic arthroscopy for the purpose of quantifying bone loss and identifying concomitant pathology. On the glenoid side, any Bankart lesions with or without glenoid bone loss were identified, whereas, on the humeral side, any Hill–Sachs lesions were also recorded.

Following this, a modified congruent arc Latarjet procedure was performed through a standard deltopectoral approach, as described previously.² The cephalic vein was protected and retracted laterally with the deltoid. The coracoid was exposed from its tip to the insertion of the coracoclavicular ligaments at the base of the coracoid. The coracoacromial ligament was sharply dissected from the lateral aspect of the coracoid, and the pectoralis minor tendon insertion on the medial side of the coracoid was removed along with a small piece of attached bone using an osteotome. The musculocutaneous nerve was identified and dissected on the medial aspect of the coracoid and a protective vascular sling passed about it. A curved osteotome was then used to perform an osteotomy of the coracoid just anterior to the coracoclavicular ligaments at the coracoid base. The conjoined tendon was left attached to the coracoid graft. The coracoid graft was then rotated on its

Table 1. Sports undertaken by athletes in study population.

Sport performed	Percentage of study population
Rugby Union	71% (n = 40)
Mountain biking	11% (n = 6)
Trail running	7% (n = 4)
Football	5% (n = 3)
Cricket	2% (n = 1)
Swimming	2% (n = 1)
Jujitsu	2% (n = 1)

longitudinal axis by 90°, such that the original medial surface was facing the glenoid neck. The coracoid graft surfaces were then dissected clear of fascial tissue and the sides chamfered with a saw blade. This fashioned the original medial side of the coracoid graft to have maximal exposure of cancellous bone. Two preparatory uncortical drill holes were then made. The glenohumeral joint was then accessed through a subscapularis split at the junction of its superior and middle thirds. The plane between the lower subscapularis and anterior joint capsule was developed and a capsular flap was made starting 1 cm lateral to the rim of the glenoid. The plane was developed over the glenoid neck with subperiosteal sharp dissection. The anterior glenoid neck was then prepared to be the recipient bed for the coracoid bone graft. Accurate positioning of the bespoke coracoid bone graft was then performed such that the original medial surface of the coracoid (where the pectoralis minor insertion had been) was now flat against the glenoid neck. The coracoid surface was lined up against the glenoid such that there was a congruent arc and the surfaces had virtually the same radius of curvature. The block was secured having completed drilling across the glenoid side through the preparatory drill holes with two partially threaded cortical screws, each with a washer (Fig. 1). The capsule was then repaired to the native glenoid using a suture anchor, making the coracoid graft an extra-articular structure and preventing its articulation directly with the humeral head. Finally, a standard closure was performed.

Rehabilitation

Postoperatively, all patients were initially placed in a sling for comfort. All patients were encouraged to mobilize their shoulder with pendulum movements as pain allowed. At 2 weeks post surgery, the intensive physiotherapy programme was initiated. The primary

aim was to achieve as complete range of movement as possible and the secondary aim was to work on muscle activation patterning with particular regard to the scapular and rotator cuff. These exercises formed the first part of a circuit of exercises for the athlete to perform, which were continued throughout their rehabilitation, with additional exercises starting as time progressed. At 6 weeks, horizontal and upright rowing exercises with the forearm pronated were initiated. This was alongside increased aerobic conditioning in the gym. By week 7, strength pattern training was initiated with slow eccentric and concentric shoulder exercises. Strength training was then increased from week 8 with additional exercises using an Olympic bar weighing 20 kg to facilitate bench press, triceps and biceps curls, upright rowing and chest pulls. By week 10, the athlete was started on overhead and shoulder height cable exercises and, if progressing well, was able to return to light non-contact training with their squad. By week 11, additional weight training with Olympic lifts exercises were employed and a trial of contact sessions was allowed. By week 12, all exercises were continued and, if medically cleared, athletes were allowed to return to full contact and match sessions. The decision for an athlete to formally return to sport was made on a case-by-case basis dependent on their progress along their rehabilitation pathway.

Postoperative functional assessment

All patients had routine initial follow-up at 3 weeks and subsequent follow up at 3 months. Any signs of wound infection were recorded, as was the neurovascular status. An assessment of any postoperative complications was made. Any episode of further instability was noted as were any related re-operation for any aetiology.

Further telephonic follow-up at 1 years post surgery was performed to ascertain their ongoing status. This permitted questioning regarding all and any episodes of recurrent instability, whether they were able to return to sports and also the timing of this.

Results

Arthroscopic findings and ISIS

Glenohumeral arthroscopy allowed the cohort to be sub-stratified into three groups: those with a soft tissue Bankart type injury only, those with a unipolar bony injury (either bony Bankart type or humeral Hill–Sachs lesion) and those with a bipolar lesion (bony Bankart type and humeral Hill–Sachs lesions). The latter group represented the highest proportion of patients in the study (Table 2). The average ISIS value in all the patients in the series was 4.2. A bony

Figure 1. Postoperative radiographs following modified congruent arc Latarjet reconstruction in the (a) lateral and (b) anteroposterior view.

Table 2. Distribution arthroscopically assessed lesions within the glenohumeral joint of athletes with anterior shoulder instability.

Characteristics of arthroscopically assessed lesions		Frequency	ISIS value of subgroup
Soft tissue Bankart only		7% n = 4	2.5
Unipolar bony injury	Bony Bankart only	20% n = 11	4.2
	Hill-Sachs and soft tissue Bankart only	7% n = 4	
Bipolar bony injury (Bony Bankart & Hill-Sachs)		66% n = 37	4.3

ISIS, Instability Severity Index Score.

Bankart type injury was defined as an anterior labral tear with associated anterior glenoid bone deficiency.

Complications and re-operations

The overall complication rate for the study was 7%. In total, four patients experienced postoperative complications, all of which were transient with full resolution being achieved in each case. The complications were: one musculocutaneous nerve paresis that fully recovered by 3 weeks, one wound haematoma that settled with expectant management, one wound infection secondary to *Staphylococcus warneri* that settled following wound washout and oral antibiotics and one patient who broke a screw and required its removal. This patient failed to comply with the rehabilitation programme and experienced a broken a screw following an attempt to catch a cricket ball at 3 weeks post surgery. This patient was in turn revised and subsequently strictly adhered to the programme with a successful outcome. There were no other wound or neurovascular complications in any of the other patients.

Functional outcomes

There was no recurrence of shoulder dislocation or subluxation noted in any of the patients. Of the patients, 89% returned to their previous sports at the same level as prior to surgery. The mean time from surgery to returning to full training including contact sessions was 3.2 months (range 1.5 months to 6 months). Of the professional athletes, all of whom were rugby players, there was a 100% return to sport at mean of 3.4 months (range 3 months to 5 months) following their surgery.

Discussion

All athletes want to return to their sport as quickly as possible. The impact on a professional athlete of not

being able to train or compete is potentially catastrophic not only with regard to the loss of their playing position, but also the financial implications that it carries. Being able to offer information to athletes regarding the likelihood of returning to their sport, as well as the timing of this, undoubtedly provides reassurance, helps to mitigate against some of the inevitable inconvenience of the injury and aids their rehabilitation timetable.

The present study has demonstrated that, by using the described modified congruent arc Latarjet procedure, early rehabilitation and return to sport is possible.² Of all the patients in the study, 89% were back to their chosen sport at an average of 3.2 months and, for the professional athletes, 100% were back to sport at 3.4 months.

Numerous studies have reported a high recurrence rate following arthroscopic stabilization of up to 15% even when performed by specialist surgeons in high volume centres.¹² Athletes, especially those involved with contact sport such as rugby, often have several other poor prognostic factors regarding recurrent instability following arthroscopic stabilization. This includes their young age at presentation and the presence of associated bony lesions to the glenoid and humeral head.^{1,2,5} In the presence of significant bony deficiencies, the recurrence rate has been described as high as 67%.¹ By contrast, Latarjet surgery, or surgery of a similar character, has lower rates of recurrent instability, with reports from high volume centres of approximately 1% to 5%.^{2,7,10,13,14} For the surgeon, appropriate procedure selection is vitally important because the issues surrounding re-operation for failed index surgery are of heightened significance when managing athletes.

The potential for high complication rates following Latarjet surgery, as reported in some studies to be up to 30%, is often cited as the main disadvantages to the surgery. In the present study, the overall complication rate was 7% with a re-operation rate of 3.6%.

This is in keeping with several other good long-term studies.^{4,7,15,16,17}

The overall rate of return to sport in the present study was 89% and there was a 95% return to playing rugby. This rate of return to sport compares favourably to that reported by Neyton et al. (65%)⁷ and similar to those described by Bonneville et al. (97%)¹⁸ and Larrain et al. (84%)¹⁶. However, the mean time taken to return to sport at 3.2 months improved upon that seen in any of these other studies.

There are several points worth noting relating to our surgical technique that are relevant when considering our results because these aided the expedited rehabilitation and return to sport, as well as the low complication rate. Specifically, this relates to the intra-operative management of the bony coracoid graft, the tendon and capsule. The coracoid bone blocks were fashioned to have a large surface area of cancellous bone on the side that was seated on the glenoid. The block was also sufficiently long to take two cortical screws that each produced bicortical hold with respect to the glenoid. Such conditions are optimal for bony union, with the block itself positioned to be congruent with the arc of the glenoid, increasing the jump distance for any potential dislocation. The subscapularis tendon was horizontally split and not released again facilitating quicker tendon healing. The capsule was retained and lateralized in our technique. This layer helped to protect the joint surface as it promoted the coracoid bone block to an extraarticular position. Another hypothetical benefit of the capsular lateralization is the potential for greater external rotation to be achieved. This effect however still remains to be proved or validated. However, an improved external rotation can aid the throwing action and in turn an athlete's rehabilitation. The strength of the repair lends itself to initiating early physiotherapy exercises. By 2 weeks post repair, this included horizontal and lateral rowing in pronation, defunctioning and protecting against biceps.

The complication rate of 7% seen in the present study is low compared to the 30% rate quoted in a recent systematic review.¹⁰ All complications seen in the present study were transient and no recurrent instability was noted despite the high demand of the patients treated. Admittedly, however, these results are limited to 2 years following surgery. The potential for neurological injury is always a concern and measures taken in our technique helped to mitigate against this. In particular, prior to taking the coracoid block, the musculocutaneous nerve was always dissected and stimulated to ensure its integrity during coracoid harvest and mobilization. The axillary nerve was not routinely seen but is known to lie approximately 1.5 cm away from the inferior edge of the glenoid so retraction in this area must be judicious.

The present study has several potential weaknesses, including the lack of long-term follow up and the study design comprising a single centre retrospective study. The potential for developing osteoarthritis was not addressed, although it is an accepted risk of Latarjet surgery. This risk is known to be relatively small, Hovelius et al.¹² reported that, at 15 years following Latarjet reconstruction, 14% of patients had moderate or severe osteoarthritis, although this was no different from that seen following Bankart surgery. A further weaknesses of the present study is the fact that the athletes assessed did not all perform the same sport; this attenuates the homogeneity of the study population and, in turn, has an effect on the demands placed on the shoulder when they returned to sport. Also, the use of validated outcomes scores may have improved the ability to assess their recovery. However, it is worth considering that, to athletes, the outcome of whether or not they can return to sport is one of real functional value. Such patient-derived outcomes are of obvious relevance.

Latarjet reconstruction has been advocated in patients with associated glenohumeral bony lesions such as the 'inverted pear' glenoid,² and has been demonstrated to have low recurrence rates of approximately 1%.^{2,4,7,17,19,20} The present study echoes these findings, demonstrating no further instability in the athletes managed with Latarjet surgery, even in those returning to contact sports. Latarjet surgery was not restricted to those with pre-existing significant bone loss or high ISIS scores but was undertaken in all patients with recurrent anterior instability, regardless of the nature of their bone and soft tissue pathology. The four patients in the present study who had soft tissue injuries only, with associated low ISIS scores, were professional or high-level athletes involved in contact sports. Tailoring the management of an athlete is clearly essential for successful outcomes and, although arthroscopic Bankart surgery undoubtedly has a place, there is a notable risk of recurrent instability in contact athletes subsequent to surgery.^{1,5} If there are episodes of recurrent instability, it may well be accompanied with additional bony and cartilaginous loss, which, in turn, could lead to a more deleterious outlook for their prognostic and sporting chances. Clinically assessing the point at which return to sport may be safely undertaken can be difficult. The approach described in the present study is a pragmatic attempt to enhance the recovery; however, an earlier return than that set out in the programme must be approached judiciously. In our centre, a significantly earlier return than that set out in the rehabilitation programme was also assessed with computerized tomography to check the establishment of bony union.

In conclusion, the present study has demonstrated the benefits of modified congruent arc Latarjet surgery with

low rates of complication at the same time as facilitating a rapid rehabilitation, with 89% of athletes returning to sport at a mean of 3.2 months. These results support our systematic management protocol of performing such a modified Latarjet reconstruction in contact sport athletes with recurrent anterior instability.

Acknowledgements

This paper was submitted and presented at the BESS annual conference in Nottingham 2014.

Declaration of conflicting interests

None declared.

Funding

No funding was required for this research.

References

- Burkhart SS and De Beer JF. Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion. *Arthroscopy* 2000; 16: 677–94.
- Burkhart SS, De Beer JF, Barth JR, Cresswell T, Roberts C and Richards DP. Results of modified Latarjet reconstruction in patients with anteroinferior instability and significant bone loss. *Arthroscopy* 2007; 23: 1033–41.
- Hovelius L and Saeboe M. Neer Award 2008: arthropathy after primary anterior shoulder dislocation – 223 shoulders prospectively followed up for twenty-five years. *J Shoulder Elbow Surg* 2009; 18: 339–47.
- Young AA, Maia R, Berhouet J and Walch G. Open Latarjet procedure for management of bone loss in anterior instability of the glenohumeral. *J Shoulder Elbow Surg* 2011; 20: S61–9.
- Balg F and Boileau P. The instability severity index score. A simple pre-operative score to select patients for arthroscopic or open shoulder stabilisation. *J Bone Joint Surg Br* 2007; 89: 1470–7.
- Headey J, Brooks JH and Kemp SP. The epidemiology of shoulder injuries in English professional rugby union. *Am J Sports Med* 2007; 35: 1537–43.
- Neyton L, Young A, Dawidziak B, Visona E, Hager JP, Fournier Y and Walch G. Surgical treatment of anterior instability in rugby union players: clinical and radiographic results of the Latarjet-Patte procedure with minimum 5-year follow-up. *J Shoulder Elbow Surg* 2012; 21: 1721–7.
- Usman J, McIntosh AS and Fréchède B. An investigation of shoulder forces in active shoulder tackles in rugby union football. *J Sci Med Sport* 2011; 14: 547–52.
- Latarjet M. Treatment of recurrent dislocation of the shoulder. *Lyon Chir* 1954; 49: 994–7.
- Griesser MJ, Harris JD, McCoy BW, Hussain WM, Jones MH, Bishop JY and Miniaci A. Complications and re-operations after Bristow-Latarjet shoulder stabilization: a systematic review. *J Shoulder Elbow Surg* 2013; 22: 286–92.
- Bernageau J, Patte D and Bebeyre J. Interet du profile glenoidien dans le luxations recidivantes de l'épaule. *Rev Chir Orthop* 1976; 62: 142–7.
- Boileau P, Villalba M, Héry JY, Balg F, Ahrens P and Neyton L. Risk factors for recurrence of shoulder instability after arthroscopic Bankart repair. *J Bone Joint Surg Am* 2006; 88: 1755–63.
- Allain J, Goutallier D and Glorion C. Long-term results of the Latarjet procedure for the treatment of anterior instability of the shoulder. *J Bone Joint Surg Am* 1998; 80: 841–52.
- Hovelius LK, Sandstrom BC, Rosmark DL, Saebo M, Sundgren KH and Malmqvist BG. Long-term results with the Bankart and Bristow-Latarjet procedures: recurrent shoulder instability and arthropathy. *J Shoulder Elbow Surg* 2001; 10: 445–52.
- Hovelius L, Sandström B, Olofsson A, Svensson O and Rahme H. The effect of capsular repair, bone block healing, and position on the results of the Bristow-Latarjet procedure (study III): Long-term follow-up in 319 shoulders. *J Shoulder Elbow Surg* 2012; 21: 647–60.
- Larrain MV, Montenegro HJ, Mauas DM, Collazo CC and Pavon F. Arthroscopic management of traumatic anterior shoulder instability in collision athletes: analysis of 204 cases with a 4 to 9-year follow-up and results with the suture anchor technique. *Arthroscopy* 2006; 22: 1283–9.
- Hovelius L, Sandstrom B and Saebo M. One hundred eighteen Bristow-Latarjet repairs for recurrent anterior dislocation of the shoulder prospectively followed for fifteen years: study II – the evolution of dislocation arthropathy. *J Shoulder Elbow Surg* 2006; 15: 279–89.
- Bonnevalle N, Mansat P, Bellumore Y, Mansat M and Bonnevalle P. Surgical treatment of anterior shoulder instability in rugby players: clinical and radiographic results with minimum five-year follow-up. *Rev Chir Orthop Reparatrice Appar Mot* 2008; 94: 635–42.
- Hovelius L, Sandstrom B, Sundgren K and Saebo M. One hundred eighteen Bristow-Latarjet repairs for recurrent anterior dislocation of the shoulder prospectively followed for fifteen years: study I-clinical results. *J Shoulder Elbow Surg* 2004; 13: 509–16.
- Walch G and Boileau P. Latarjet-Bristow procedure for recurrent anterior instability. *Tech Shoulder Elbow Surg* 2000; 1: 256–61.