Latarjet as a primary and revision procedure for anterior shoulder instability – A comparative study of survivorship, complications and functional outcomes in the medium to long-term

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Abstract

Background: This retrospective study aims to compare the outcome of the Latarjet procedure when used as a primary or revision procedure for recurrent anterior gleno-humeral instability.

Methods: One hundred and ninety-seven patients underwent 205 open Latarjet procedures during the period 2006–2015 (mean follow-up 5.6 years). Sixty shoulders had failure of a previous stabilisation requiring revision to the Latarjet procedure. Outcomes were measured using the Western Ontario Shoulder Instability Index and Quick Disabilities of the Arm, Shoulder and Hand score. Survival analyses were performed using Kaplan–Meier curves, and multiple linear regression modelling was utilised to identify predictors of functional outcome ($p < 0.05$).

Results: Two shoulders had recurrent dislocations in the cohort of 205 (1.0%). Six shoulders underwent further surgery for non-instability complications (2.9%). There were no significant differences in the clinical or functional outcome between patients undergoing a primary Latarjet procedure and those who required revision of a failed soft-tissue stabilisation. Ninety-two per cent of patients were satisfied with their shoulder following surgery. Patient-reported instability and satisfaction was significantly associated with poorer functional scores.

Discussion: The Latarjet procedure successfully prevents recurrent anterior instability and is associated with high levels of satisfaction. Patient-reported outcome measures suggest no difference between primary and revision procedures.

Keywords

shoulder, instability, Latarjet

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Introduction

Recurrent instability, functional impairment and risk of secondary degeneration of the shoulder are common complications associated with anterior dislocation of the gleno-humeral joint.¹ Minimally invasive procedures, such as the arthroscopic Bankart repair with capsular shift (ABR), can provide good restoration of shoulder stability in the majority of patients.^{2,3} However, a significant proportion of patients will suffer a recurrence and experience ongoing instability. Burkhart and De Beer⁴ recognised the importance of traumatic gleno-humeral bone deficiency in failure of stabilisation, reporting a recurrence rate of 89% versus

6.5% in patients with and without significant bone defects, respectively. Young age, degree of glenoid bone loss, the presence of an engaging Hill–Sachs lesion and anatomical hyperlaxity have all subsequently

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been shown to be significant independent predictors of recurrence following ABR.^{2,5}

The inherent fallibility of arthroscopic stabilisation in such high-risk patients has led to increasing focus on alternative operations which provide anterior glenoid augmentation such as the Latarjet procedure. Comparisons between ABR and the Latarjet technique have suggested superiority of the latter procedure in terms of re-dislocation rate⁶ but these findings have been limited by small cohorts, limited follow-up and unclear patient selection criteria.⁷ Few studies have tried to quantify longer-term functional outcomes using validated scoring tools. Furthermore, the current literature provides little distinction between the Latarjet procedures when used as a primary or revision stabilisation operation. Accordingly, there remains great uncertainty in the shoulder community on the utilisation of the Latarjet procedure, even in the context of failed arthroscopic stabilisation and/or associated bone defects.⁸

The aim of this study was to compare the mid- to long-term functional outcome, complications and survivorship of patients who have been treated with the Latarjet procedure. Secondary objectives were to compare the success when used as a primary or revision stabilisation procedure for recurrent anterior shoulder instability.

Materials and methods

A consecutive series of 197 patients (205 unstable shoulders) were treated with the Latarjet procedure by a single surgeon in a tertiary referral centre during the period 2006–2015. Approval was obtained from NHS Lothian's audit department and research ethics service.

Treatment protocol

All patients were diagnosed with recurrent traumatic anterior GH instability (recurrent episodes of anterior dislocation or subluxation) based upon clinical assessment and radiologic review. The treatment protocol following diagnosis involved plain film radiographs and computed tomographic (CT) imaging with three-dimensional reconstructions of the glenoid. Examination under anaesthetic and diagnostic arthroscopy was performed in all patients prior to proceeding with the open Latarjet in a single setting. This allowed quantification of glenoid bone loss as described by Burkhardt et al.⁹ The indications for Latarjet were as follows:

1. Evidence of significant glenoid bone loss measuring greater than 20%^{9,10};

2. Arthroscopic evidence of an engaging Hill–Sachs lesion when the arm was placed in 90° abduction and external rotation⁴;
3. Failure of a previous open or arthroscopic soft-tissue stabilisation procedure for recurrent anterior traumatic instability.

All patients were treated using a standard deltopectoral approach. The coracoid graft was harvested and decorticated using a motorised burr. The anterior glenoid was exposed by splitting the subscapularis and anterior capsule horizontally. Two fully threaded 3.5mm lag screws were used to secure the coracoid graft flush with the decorticated anterior glenoid, after which the capsule and subscapularis were repaired anatomically.¹¹ The routine post-operative regimen involved immobilisation in a broad-arm sling for three weeks after surgery before beginning gentle passive range of motion exercises, under the guidance of specialist physiotherapists. Clinical and radiological review was carried out at three weeks, three months, six months and at one year post-operatively. Patients were discharged following completion of physiotherapy and confirmation of coracoid union at 12 months on antero-posterior and axillary view radiographs. Any clinical concerns of non-union, such as ongoing pain, and/or radiographic non-union were investigated with CT scanning.

Data collection and follow-up

The current address of all patients was obtained using the hospital's electronic TRAK CareTM (InterSystems Corp, Cambridge, MA, USA) system. If no current postal address or telephone details could be identified, subjects were considered lost to follow-up. All of the remaining patients were contacted via postal questionnaire or telephone to ascertain if they had developed recurrent dislocation, underwent further surgery or had any other unexpected complications. In addition, all patients currently living within the country could have their clinical progress reliably tracked electronically, with evidence of subsequent dislocations or surgical failures being sought from the Carestream Picture Archiving and Communication System (PACS) (Kodak Carestream Health, Rochester, New York, USA) as all health-boards across the country use the same interconnected network.

Clinical data relating to the index dislocation and subsequent management including operative intervention, complications and date of discharge were collected retrospectively. Recurrent dislocation was defined as any radiologically proven dislocation after the Latarjet procedure. Revision for recurrent symptomatic instability, without radiographic dislocation, was

included as potential reason for failure. The presence of recurrent symptomatic instability, with or without radiographic dislocation, was collected from a combination of patient self-reporting, hospital records and the nationwide radiological PACS network. Self-reported instability was defined as whether the patient had any feelings of instability within their affected shoulder regardless of position or activity undertaken.

We used two validated patient-reported outcome measures (PROMs) to retrospectively assess function in this patient group. The Western Ontario Shoulder Index (WOSI) score was utilised as it is a disease-specific, widely used and has the best rating of psychometric properties.¹² The Quick Disabilities of Arm, Shoulder and Hand (Quick DASH) score was used to provide a comprehensive region-specific assessment of disability. Details regarding any recurrent instability, with or without dislocation, and/or further operations were sought at this time. Finally, data regarding overall patient satisfaction were collected through the same postal questionnaire using a Likert five-point scale (Appendix 1).

Data analysis

Statistical analysis was performed using SPSS (version 22 for Windows; IBM). Data were tested for normal distribution before using the Student's t-test for parametric data or the Mann–Whitney U test for nonparametric data. Differences between categorical data were assessed by using the Chi-square test. Survival analyses were performed using Kaplan–Meier curves with 95% confidence intervals, with censoring for loss to follow-up, repeat dislocation, subjective instability and/or revision surgery. Multiple linear regression modelling was utilised to assess the effect of sex, age and previous surgery as predictors of functional outcome. The level of statistical significance was set at a p value of <0.05.

Source of funding

No external funding was used for this study.

Results

Two hundred and five shoulders were treated with the Latarjet procedure during the period 2006–2015 (mean time from surgery to follow-up 5.6 years (72.2 months; range 2–11 years). The mean age at index dislocation was 23.3 years with an average of five recurrent dislocations reported prior to surgery (range 2–31). The mean age at surgery was 27.9 years and the patient group were predominantly male (187 males:18 females).

The mean time from index dislocation to Latarjet procedure was 4.4 years (53 months).

In 60 shoulders, the Latarjet procedure was performed after failure of a previous soft-tissue surgical stabilisation procedure. Comparative data relating to hand dominance, age at index dislocation and primary stabilisation are summarised in Table 1. Nine patients were unable to be included in clinical or functional follow-up studies (Figure 1).

Complications, failures and survivorship

There were two radiologically proven dislocations following the Latarjet procedure in a cohort of 205 shoulders (1.0%), each occurring in primary stabilisations. Both recurrences occurred within two years of surgery and arose in patients with documented epilepsy who had a generalised seizure. Both patients underwent closed reduction and further physiotherapy. One patient underwent an Eden–Hybinette procedure as a further revision stabilisation operation with no further dislocations. The other patient was treated with continued non-operative management as he had poor compliance with anti-epileptic medications and a history of substance misuse.

Six shoulders underwent further surgery for complications other than recurrent instability (2.9%) (Table 2). Four shoulders required antibiotic treatment for superficial infection. One shoulder was noted to have pre-existing evidence of a degenerative supraspinatus tendon on pre-Latarjet arthroscopy and subsequently developed a tear, necessitating arthroscopic repair. There was one coracoid non-union, identified on plain radiographs, which was clinically asymptomatic, and the patient declined further treatment of this. There were no deep infections, neurovascular injuries or venous thrombo-embolic episodes identified in either cohort. No patients underwent further surgery in the form of joint replacement for glenohumeral osteoarthritis. During the period of follow-up, one patient died from unrelated causes. The overall rate of any further surgery was 3.4% and of all complications was 6.3%.

Using dislocation and/or revision of the Latarjet procedure as clinical end-points, the cumulative survival was 99.0 %. Kaplan–Meier plots showed no significant difference in the survival of either primary or revision procedures when using dislocation or revision as primary end-points (log rank $p=0.358$). When taking subjective instability, without frank dislocation, into account the overall cumulative survival was 87.8% with no significant difference in survival on Kaplan–Meier plots (primary 88.3% versus revision 86.7%, log rank $p=0.809$) (Figure 2 and Table 3).

Table 1. Summary of study cohort demographics (shoulders).

	Total (205)	Primary (145)	Revision (60)
Gender			
Male	187 (91.2%)	133 (91.7%)	54 (90%)
Female	18 (8.8%)	12 (8.3%)	6 (10%)
Side			
Right	98 (47.8%)	68 (46.9%)	30 (50%)
Left	107 (52.2%)	77 (53.1%)	30 (50%)
Affected			
Unilateral	189 (92.2%)	132 (91%)	57 (95%)
Bilateral	16 (7.8%)	13 (9%)	3 (5%)
Average age at index dislocation (years)	23.3	24	21.1
Mechanism of injury			
Mechanical fall	26 (12.7%)	23 (15.9%)	3 (5%)
Sporting	88 (42.9%)	63 (43.4%)	25 (41.7%)
Other trauma	37 (18%)	26 (17.9%)	11 (18.3%)
Seizure	13 (6.3%)	11 (7.6%)	2 (3.3%)
No injury/unknown	45 (22.2%)	22 (15.2%)	19 (31.7%)
Index procedure			
Arthroscopic stabilisation	45 (22%)	0	45 (75%)
Open stabilisation, e.g. Bankart repair	15 (7.3%)	0	15 (25%)
Open Latarjet	145 (70.7%)	145	0

Patient-reported functional outcome scores

PROMs data were collected for 156 of a possible 205 shoulders (76%) (Figure 1). The mean time from surgery to assessment of PROMS was 5.6 years (2–11 years). The majority of respondents were male (87.8%) and had undergone a primary Latarjet procedure (76.9%). One in five respondents (19.9%) was no longer participating in any form of sporting exercise and 10.9% of respondents were not currently working.

The median WOSI score for the entire cohort was 339 (IQR 55.5; range 0–2003) and the median Quick DASH score was 2.5 (IQR 10.0; range 0–67.5). There were no significant differences observed between overall Quick DASH Disability Symptoms scores or total WOSI scores of the primary or revision groups ($p=0.32$ and 0.73 , respectively) (Table 4). Analysis of

the symptom-specific WOSI scores identified no statistical difference in the prevalence of instability, weakness, pain with overhead activities, pain at rest and stiffness (Table 5).

Factors influencing functional outcome

Twenty-one patients (13.5%) reported a subjective feeling of instability with no dislocations (14 primary versus 7 revision stabilisations, $p=0.26$). Patient gender, age at surgery, and the time between index dislocation and surgery were not significant predictors of self-reported instability (Table 6). The median Quick DASH score and total WOSI score demonstrated significantly poorer outcome in patients with self-reported instability ($p<0.0001$). Using linear regression analysis, the WOSI proved to have a greater influence on

Figure 1. Flow diagram of cohort study. PROM: patient-reported outcome measure.

self-reported instability than the Quick DASH ($p = 0.006$, OR 1.03 (CI 1.00–1.04)). There were no observed differences in the duration of time following Latarjet procedure and prevalence of self-reported instability ($p = 0.08$).

Ninety-two per cent of patients described themselves as either ‘Highly Satisfied’ or ‘Satisfied’ with their surgery, whereas 12 respondents were either ‘Dissatisfied’ or ‘Highly Dissatisfied’ with their treatment outcome (7.7%) (Figure 3). There was no difference in the overall rate of satisfaction between primary and revision stabilisations ($p = 0.47$). Patient gender, age at surgery, and the time between index dislocation and surgery were not significant predictors of satisfaction (Table 7). The median Quick DASH and WOSI scores were significantly poorer in patients who were dissatisfied ($p < 0.0001$ and $p < 0.0001$, respectively). Using linear regression analysis the WOSI proved to have a greater influence on patient satisfaction than the Quick DASH ($p = 0.04$, OR 1.04 (CI 1.01–1.06)).

Discussion

Whether used as a primary or revision stabilisation operation, the Latarjet procedure can successfully prevent further dislocation in the majority of patients with

recurrent anterior instability. We observed a recurrent dislocation in 1% of the study population, consistent with rates reported in the current literature. Bhatia et al.⁷ performed a systematic review of the clinical outcome following Latarjet procedure and identified a recurrence rate of 0–8% (range of follow-up 6 months to 14.3 years). More recently, Zimmerman et al.⁶ demonstrated a long-term recurrence rate of approximately 3% in primary cases; however, it should be noted that the author’s stated selection criterion for the Latarjet procedure was glenoid bone loss greater than 50%.

Our findings support the theory that restoration of stability with the Latarjet remains steady over time.¹³ Conversely, ABR stabilisation procedures have been shown to fail progressively.⁶ Systematic appraisal of the literature surrounding the Latarjet procedure has been limited by relatively small cohorts, variation in surgical technique and little differentiation or active comparison between primary and revision stabilisations.^{7,14–16} Schmid et al.¹⁷ described the outcome of 49 shoulders which had been revised to the Latarjet following failure of a previous stabilisation, identifying pre-revision pain as a predictor for lower levels of subjective satisfaction. Similar to our results, there were no reported dislocations in their cohort, supporting the use

Table 2. Clinical outcome of Latarjet procedure.

	Total (205)	Primary (145)	Revision (60)
Mean follow-up	72.2 months (5.6 years)	69.3 months (5.4 years)	81.2 months (6.3 years)
Re-dislocation	2 (1.0%)	2 (1.4%)	0
Revision of Latarjet	1 (0.5%)	1 (0.7%)	0
Further surgery			
Removal of metalwork	1 (0.5%)	1 (0.7%)	0
Arthrolysis	1 (0.5%)	1 (0.7%)	0
Wound washout	1 (0.5%)	1 (0.7%)	0
Excision of scar	1 (0.5%)	1 (0.7%)	0
Rotator cuff repair	1 (0.5%)	0	1 (1.7%)
Removal of loose body	1 (0.5%)	1 (0.7%)	0
Total further surgery	7 (3.4%)	6 (4.1%)	1 (1.7%)
Complications			
Coracoid non-union	1 (0.5%)	1 (0.7%)	0
Infection			
Superficial	4 (2.0%)	2 (1.4%)	2 (3.3%)
Deep	0	0	0
Neurovascular injury	0	0	0
DVT/PE	0	0	0

DVT: deep vein thrombosis; PE: pulmonary embolism.

of the Latarjet after a failed soft-tissue surgical stabilisation.

Both recurrences arose in patients with epilepsy who had suffered a generalised seizure. With only 13 patients in our entire study population having documented epilepsy, this reflects a recurrence rate of 15% in this sub-group. This is perhaps unsurprising, given the acknowledged associations between severe bone loss and seizure related gleno-humeral instability.¹⁸ Raiss et al.¹⁹ reported on 12 epileptic patients (14 shoulders) treated with the Latarjet procedure, identifying a recurrence rate of 43%. These findings support the view that medical management is the most important method of reducing recurrent dislocation in these high-risk patients, and therefore the Latarjet procedure should only be performed in patients with well-controlled seizure activity.

Although re-dislocation appears to be rare following the Latarjet procedure, 13.5% of respondents in our

study reported a subjective feeling of instability. These findings are in-keeping with previously reported rates of subjective instability in both primary⁶ and revision¹⁷ patients (11 and 14%, respectively). Similar rates have also been identified in high-risk patient groups, such as collision athletes, with a documented rate of recurrent instability without dislocation in 14%.²⁰ Whilst the reasons for this remain unclear, patients with self-reported instability had significantly poorer functional outcomes for both primary and revision Latarjet. It is interesting to note that patients undergoing ABR, a more anatomic repair, had significantly higher rates of instability and poorer satisfaction at long-term follow-up when compared to the Latarjet.⁶

Despite low levels of recurrent dislocation and high PROM scores, one in five patients reported that they no longer undertook sporting activities. This is in contrast to Rossi et al.,²¹ who reported on the outcomes of the

Figure 2. Kaplan–Meier survival plot open Latarjet – dislocation, subjective instability and revision.

Table 3. Summary of Kaplan–Meier survival plot open Latarjet – dislocation, subjective instability and revision.

Cumulative survival time				Total (205)		Primary (145)		Revision (60)		Sig
Mean	Std error	95% CI lower bound	95% CI upper bound	Survive	Events	Survive	Events	Survive	Events	Log rank
124.4	2.864	118.8	130.1	180 (87.8%)	25 (12.2%)	128 (88.3%)	17 (11.7%)	52 (86.7%)	8 (15.4%)	0.809

CI: confidence interval; Sig: significance.

Table 4. Comparison of DASH and WOSI scores – Normal population versus primary or revision procedures.

	Mean Normative Population Values (% of Normal) (22) (26)	Primary (IQR, Min-Max)	Revision (IQR, Min-Max)	Significance (p < 0.05)
DASH	14.38	2.5 (11.7, 0.67.5)	2.5 (8.1, 0–30)	0.317
WOSI	82.7 (96.1%)	339 (53.0, 0–2003)	390 (63.6, 0–1237)	0.734
A – Physical	43.8 (95.6%)	149 (24.8, 0–952)	135 (26.9, 0–594)	0.748
B – Sports & Recreation	9.2 (97.7%)	48 (11.7, 0–384)	62 (11.8, 0–292)	0.602
C – Lifestyle	17.3 (95.7%)	37 (9.8, 0–380)	24 (9.4, 0–220)	0.669
D – Emotions	12.5 (95.8%)	40 (11.9, 0–287)	64 (16.9, 0–244)	0.261

DASH: Disabilities of Arm, Shoulder and Hand; IQR: interquartile range; WOSI: Western Ontario Shoulder Index.

Table 5. Summary of reported residual symptoms on WOSI.

	Primary n=119 (IQR, Min-Max)	Revision n=34 (IQR, Min-Max)	Total n=153 (%) (IQR, Min-Max)	Significance (p<0.05)
Instability/apprehension	8 (2.9, 0–96)	8 (3.7, 0–71)	8 (3.1, 0–96)	0.462
Weakness/Fatigue	17 (4.3, 0–96)	18 (3.4, 0–90)	18 (4.1, 0–96)	0.860
Pain over head	9 (2.6, 0–96)	8 (2.4, 0–82)	9 (2.6, 0–96)	0.899
Pain at rest	7 (1.8, 0–96)	10 (2.3, 0–90)	8 (1.9, 0–96)	0.345
Stiffness	14 (3.6, 0–96)	16 (2.8, 0–72)	14 (3.1, 0–96)	0.854

IQR: interquartile range; WOSI: Western Ontario Shoulder Index.

Table 6. Self-reported instability.

	Yes (n=21) (IQR, Min-Max)	No (n=135) (IQR, Min-Max)	Significance (p <0.05)
Age	28.0 (12.5, 18–56)	26.0 (12.0, 16–80)	0.141
First dislocation to Latarjet (months)	26.0 (55.0, 0–98)	38.5 (63.8, 0–336)	0.206
Latarjet to PROM (months)	65.0 (49.5, 23–128)	61.0 (47.5, 21–123)	0.077
DASH	10.0 (17.3, 0–67.5)	2.5 (7.5, 0–52.5)	P<0.0001*
WOSI	733 (41.7, 0–2003)	296 (52.9, 0–1388)	P<0.0001*
Primary	14	107	
Revision	7	28	0.258
Male	19	121	
Female	2	14	1.00

DASH: Disabilities of Arm, Shoulder and Hand; IQR: interquartile range; PROM: patient-reported outcome measure; WOSI: Western Ontario Shoulder Index.

Latarjet procedure in competitive athletes, identifying that only 4% did not return to sports. These authors identified psychological factors such as loss of confidence and fear of further shoulder injury as the primary factors for this change. However, when considering collision-only sports, Privitera et al.²⁰ reported that up to one in four patients reduced their competition level, changed sports or stopped participating in sports altogether. Age, gender, level of sport and degree of glenoid bone loss did not appear to predict return to sport. We hypothesise that in our cohort, which included patients who undertook occasional or almost no sporting activities regularly, the presence of symptomatic recurrent instability, without frank dislocation, may have contributed to psychological factors which can influence the decision to participate in sporting activities. We recommend counselling individual patients about

these potential consequences when discussing the relative merits and negatives of this procedure.

Griesser et al.¹⁵ performed a systematic review of complications and re-operations after the Latarjet procedure, reporting an overall complication rate of 30%. These authors defined complication as ‘any untoward adverse event, morbidity or mortality that was not anticipated prior to surgical intervention’. Using their criteria,¹⁵ the overall rate of complication following the Latarjet procedure in our cohort was 6.8%. Assessment of non-instability related complications such as infection, neurovascular injury and graft non-union in our cohort was consistent with those reported in wider reviews of the current literature.^{7,14,15}

The WOSI is disease-specific, has excellent psychometric properties and can directly correlate to the DASH score.¹² Although previous studies have

Figure 3. Overall patient satisfaction and outcome score. DASH: Disabilities of Arm, Shoulder and Hand; WOSI: Western Ontario Shoulder Index.

Table 7. Overall satisfaction.

	Yes (n=142) (IQR, Min-Max)	No (n=12) (IQR, Min-Max)	Significance (p <0.05)
Age	26.0 (11.8, 16–80)	33.0 (19.0, 23–54)	0.074
First dislocation to Latarjet (months)	38.5 (65.3, 0–297)	30.0 (51.0, 4–336)	0.471
Latarjet to PROM (months)	62.0 (43.8, 21.0–128.0)	59.0 (49.5, 23.0–91.0)	0.247
DASH	2.5 (10.0, 0–52.5)	17.5 (22.5, 2.5–67.5)	P<0.0001*
WOSI	336 (52.4, 0–1388)	872 (45.4, 45–2003)	P<0.0001*
Primary	112	8	0.470
Revision	31	4	
Male	127	11	
Female	15	1	1.00

DASH: Disabilities of Arm, Shoulder and Hand; IQR: interquartile range; PROM: patient-reported outcome measure; WOSI: Western Ontario Shoulder Index.

assumed that a perfect score equalled a healthy shoulder, it has since been shown that the majority of outcome measures demonstrate less than perfect scores for normal individuals.^{22,23} The absolute WOSI score lowers significantly to near normal levels within one

year and this improvement is maintained at least two years post-Latarjet procedure.^{24,25} However, it has been argued that follow-up of less than two years was inadequate for assessing shoulder instability.⁶ With a mean follow-up of 5.6 years, our cohort study demonstrated

overall median WOSI scores close to 84% of 'normal' (84% versus 78%, respectively).

Overall disability is close to normal following the Latarjet procedure when performed as either a primary or revision stabilisation²⁶ (Table 4). Although the Quick DASH score is not disease-specific, it can comprehensively assess disability and may be of greater use in the clinical setting than the WOSI.²² Therefore, it may be appropriate to counsel patients that the Latarjet procedure is good at preventing recurrent dislocation but that most patients may never feel that their shoulder is perfect or 'normal'.

Limitations

There are limitations to this study. We acknowledge an inherent selection bias, as patients were selected for the Latarjet procedure in a non-randomised fashion and treatment was influenced by the findings at initial arthroscopy. In addition, clinical findings at initial presentation and during the immediate post-operative follow-up appointments were collected retrospectively.

There was one death and another eight patients (4%) were considered truly lost to follow-up as they were not traceable or refused to participate in the study. Therefore, basic information relating to shoulder stability and subsequent surgery was available for 95% of the cohort. In the worst-case scenario, if all patients were considered hypothetically to have potentially suffered a dislocation then our reported dislocation rates would be 4 and 6.7% for primary and revision stabilisations, respectively. With a young and working-age population, it is perhaps inevitable that the PROMs were complete for only 77% of the study population. This could result in a reporting bias of those who chose to respond.

Finally, we did not perform further clinical or radiological assessment of each patient after discharge, unless the patient was having problems related to their affected shoulder. This may lead to under-diagnosis of coracoid non-union or gleno-humeral arthritis. However, given the employment of validated markers of shoulder instability and upper limb disability, we feel this is appropriate to objectively quantify patient outcome in this cohort. Addressing concerns regarding increased risk of arthropathy following the Latarjet was out with the scope of this study; however, results from Scandinavia have demonstrated that the degree of arthropathy was consistent with the natural history of anterior GH instability.^{27,28} Future long-term studies may yield important information regarding the risk posed from this procedure.

The Latarjet procedure, when performed as a primary or revision stabilisation, can prevent recurrent dislocation in the majority of patients and remains

stable over time. However, approximately 1 in 10 patients will describe ongoing instability without experiencing recurrent dislocations. The implications of these findings require further research from future prospective studies.

The overall risk of operative complication is low when performed by a high-volume surgeon. Ongoing subjective instability is associated with poorer WOSI and Quick DASH scores. PROMs have shown that both treatment groups can achieve shoulder stability and overall disability levels which are close, but not equal to the normal population.

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Ethical Review and Patient Consent

Completion and return of postal questionnaires was voluntary and written informed consent was obtained from the patient(s) for their anonymised information to be published in this article. Permission to perform this specific study was sought from the South-East Scotland Research Ethics Service and the NHS Lothian MSK Audit department. The Elective Orthopaedic Research Database used to collect patient-reported outcome data in our local hospital has been given a favourable ethical opinion from the South-East Scotland Research and Ethics Committee (16/SS/0026). As this particular study was a review of current and past practice concerning a healthcare issue, it did not require any further formal NHS ethical review under the terms of the Governance Arrangements for Research Ethics Committees.

Guarantor

CMR.

Contributorship

LZY: Conceived study, data collection, data analysis, manuscript formulation. JAN: Data collection, data analysis, manuscript formulation. CMcC: Data collection, data analysis, manuscript formulation. DJM: Data collection, data analysis, manuscript formulation. CMR: Conceived study, data collection, data analysis, manuscript formulation. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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