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ORIGINAL ARTICLE

Can we improve the indication for Bankart arthroscopic repair? A preliminary clinical study using the ISIS score

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KEYWORDS

Anterior shoulder instability;
 Arthroscopy;
 Bankart

Summary The objectives of this study on arthroscopic treatment of chronic anterior shoulder instability were the collection of the current practices for this indication, their development as reported in the literature, and the analysis of preliminary results on a multicenter prospective series of Bankart arthroscopic procedures undertaken using a common technique on patients selected based on the Instability Severity Index Score (ISIS). This procedure predominates in the English-speaking world, whereas the Latarjet protocol is preferred in France. The choice between the two seems to be cultural since neither technique could be demonstrated to be superior in an analysis of 171 responses to an Internet questionnaire in this study. The literature reports disappointing results in the Bankart arthroscopic procedure and recent articles have researched the predictive factors for its failure. Eleven centers prospectively included 125 patients from 1 December 2007 to 30 November 2008. The inclusion criteria were recurrence

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of anterior instability and an ISIS less than or equal to four points out of 10. All the selected patients underwent capsuloligamentous reinsertion with a common minimal technique of at least three anchors and four sutures with the same postoperative protocol. At a mean follow-up of 18 months, four patients (3.2%) had experienced recurrence. For the 84 patients reexamined at 1 year, the Walch-Duplay and Rowe scores were, respectively, 88.4 and 87.8 points out of 100. Subjectively, 88.1% of the patients declared they were satisfied and would undergo the intervention again. This study confirmed the use of the ISIS as a consultation tool. Only continuation of the study with a minimum follow-up of 3 years will allow us to validate the lower limit of the ISIS below which this technique could be proposed provided that it respects the technical prerequisite of at least four capsuloligamentous sutures.

Level IV: Prospective nonrandomized series.

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Introduction

The recurrence of an instability accident is the main complication of a first anterior glenohumeral dislocation, limiting physical and sports activity because of apprehension of a new accident. Three types of anatomical-physiological factors are responsible for this recurrence: patients and their activity, their tissue predisposition, and the anatomical lesions created by the primary dislocation. None of these factors alone explains chronic anterior shoulder instability and recurrence is related to the combination of one or several of them. The results of open stabilization techniques have been reported in a number of publications. Even though the definition of recurrence is not unequivocal, Bankart anatomical repair of the lesion or the pedicled osteomuscular transfer techniques run a risk of recurrence on the order of 8% [1,2,3,4]. The objective of arthroscopic techniques is to equal these results while incurring less tissue damage, better recuperation of mobility, and less arthrogenic risk.

The first arthroscopic stabilization was described by Johnson in 1986 [5]. Since then, the literature has reported the technical progress and results that have long been disappointing [6,7]. In 1993, Coudane and Molé reported an overall recurrence rate of 14.6% (range, 10–40%) for a multicenter series of 316 cases reviewed with a follow-up of 24.6 months. This series was heterogeneous in terms of the techniques used, which still included a high number of transglenoid sutures and staples [6]. In 2000, Boileau and Lafosse reported a 13.9% recurrence rate for 209 patients reviewed at more than 3 years. The techniques were still heterogeneous but the authors stipulated the clinical and lesional criteria that were used in a later analysis of the predictive factors of recurrence [8].

Arthroscopic techniques struggle to reproduce the results obtained with the open technique. In the literature, the prospective studies comparing the two techniques report variable results. The recurrence rate after arthroscopy oscillate from 0 to 70% and is generally higher than the rate in groups of patients undergoing open surgery [9–13]. The value of these studies remains limited because only rare studies are controlled and randomized [9,13]. They use imprecise preoperative criteria for the choice of techniques and sometimes use obsolete techniques.

This shortcoming has led some authors to conduct meta-analyses of the publications on this subject [3,14,15].

Lenters et al. only retained 18 articles that could be analyzed of the 2108 consulted [14] and Hobby et al., 62 [3]. Lenters et al. confirm the theoretical advantage of less tissue damage of the arthroscopic techniques, which obtain a better Rowe score. Like Hobby et al., their conclusions on the risk for recurrence strictly favor open stabilization techniques in comparison to transglenoid sutures and arthroscopic stapling [3,14]. This advantage over suture or rivet anchoring was also unambiguous in the Lenters et al. study, although more relative for Hobby et al., providing hope that they may become reference techniques provided that the indication criteria for these techniques have been thoroughly considered, the weak point underscored by the meta-analyses. The search for predictive factors of instability recurrence after arthroscopic treatments has been the last step in this long development. In 2005, Calvo et al. published the first score based on the failures of 61 arthroscopic transglenoid sutures. They identified the predictive factors for recurrence such as age less than 28 years, diffuse ligament laxity, greater than 15% glenoid bone substance loss, and resuming a contact sport. These criteria are grouped in a score that contra-indicates the arthroscopic techniques when it exceeds two points [16]. In 2006, Boileau et al. found the same recurrence factors based on the analysis of 91 anchored suture failures. They associated failure with a Hill-Sachs humeral groove defect, anterior or inferior glenohumeral laxity, and identified a technical factor related to providing fewer than four labroligamentous sutures [17]. This study allowed Balg and Boileau to propose a more comprehensive score in 2007 including the type of sport, based on simple clinical and radiological criteria that can be evaluated at the first consultation: the Instability Severity Index Score (ISIS) [18].

Before the clinical study, an Internet questionnaire was sent to the members of the European, American, and South African Arthroscopy Societies. Members were questioned on their usual practices for chronic anterior shoulder instability: the number of procedures per year, the preferred technique, their prioritization of the criteria for indication (age, sport, bony lesions, laxity, others). The responses of 171 are reported in Table 1. With the precautions related to the limited number of responses given by motivated surgeons, it seems that the Latarjet procedure remains the preferred French practice, but only in the country of its designer, M. Latarjet [19]. The Bankart arthroscopic

Table 1 The most frequently performed anterior glenohumeral stabilization procedures reported by 171 surgeons who responded to the Internet questionnaire. For "World", the total exceeds 100% because the responses included combined techniques, notably Bankart, never done alone, contrary to the French technique.

Preferred procedure	France (n = 70) (%)	World (n = 101) (%)
Open Latarjet	72	8
Open Bankart	1.5	6
Arthroscopic Bankart	25	90
Others	1.5	4
Total	100	108

procedure is only used as a preferential technique by one-quarter of the French members. This proportion increases to one-third if the surgeon performs more than 30 shoulder instability surgeries per year. Conversely, the Bankart procedure predominates in English-speaking countries. No ranking of the indications criteria could be demonstrated in France or the rest of the world. The choice between the two procedures therefore probably remains cultural, and no surgeon from an English-speaking country stated using first-line Latarjet stabilization.

The objectives of the clinical study were to:

- demonstrate that the results of the Bankart procedure using a common arthroscopic technique on patients selected by the ISIS were not inferior to those of conventional open procedures;
- evaluate the functional recuperation of the operated patients.

Material and methods

This was a prospective, multicenter, observational study with long-term follow-up. Eleven centers (Table 2) included patients from 1 December 2007 to 30 November 2008. The inclusion criteria were recurring anterior instability accidents and an ISIS less than or equal to four points out of 10 (Table 3). The exclusion criteria were primary dislocation or revision of an earlier intervention, voluntary or multidirectional instability, a painful shoulder with no instability felt, and the intraoperative observation of rotator cuff lesion or humeral avulsion of the anteroinferior glenohumeral ligament (HAGL). The preoperative workup included plain AP X-rays with internal, neutral, and maximum external rotation. Throughout the inclusion period, all centers used a common arthroscopic technique based on a minimum of four anterior capsulolabral sutures supported by at least three anchors. Sutures had to be tightened by knots rather than impaction. The operator was free to complete with one or several inferior or anterior sutures, or closing the rotator cuff interval. The number of sutures was noted as well as temporary traction of the capsule via the anterosuperior TOTS (temporary outside traction suture) approach [20]. The patients' elbow was immobilized against the body for 21 days and then, the patient underwent rehabilitation.

Table 2 Eleven study centers.

Centers	Operators and investigators
Aix-en-Provence Annecy	F. Kelberine, J. Bradel L. Lafosse, B. Toussaint, M. Gutiérrez Aramberry
Grenoble Le-Havre Lille Mérignac CHU of Nice	J. Barth O. Courage, S. Sfez S. Audebert S. Guillo P. Boileau, N. Brassart, C. Pélégri
CHU of Paris–Ambroise-Paré	P. Hardy, F. Lespagnol, V. Beauthier
CHU of Paris-Saint-Antoine Paris	G. Nourissat C. Charousset, L. Bellaïche
CHU of Rennes	H. Thomazeau, M. Ropars, F. Cueff

The follow-up criteria were collected prospectively at 3, 6, 12 months and 2 years. The main outcome criterion was recurrence of an instability accident defined by an identical subluxation or dislocation to the preoperative episodes. This event was noted, whatever the date of occurrence, at the next follow-up and was considered a failure of the technique. The secondary outcome criterion was functional recuperation of the shoulder evaluated by the Duplay-Walch and Rowe scores [21,22] (Tables 4 and 5). Beginning at the 1-year consultation, this criterion was considered as having been satisfied if functional recuperation scores had been noted within 1 month before or 2 months after the planned date of the prospective re-evaluation. Otherwise, the functional scores were recorded for the date of the previous visit or on the date of the next planned visit, if it had taken place. The qualitative variables were expressed as percentages and the quantitative variables in means, ranges, and medians if they differed clearly from the means. The statistical analysis was done with SPSS 13.0. The study proposal had been approved by the Ethics Committee of the Rennes University Hospital (approval 09-7) and authorization was obtained from the Commission (CNIL) (approval 909464).

Results

Three hundred twenty-eight medical files of anterior shoulder instability were examined during the inclusion period. Ninety-one patients (28%) had an ISIS greater than four points for a theoretical population of 237 cases (72%) presenting the inclusion criteria (score ISIS \leq 4). Of these 237 patients, 125 patients made up the cohort operated on with a minimum of three anchors and four sutures (Table 6). One hundred twelve patients were not included because a HAGL or rotator cuff lesion was observed intraoperatively (nine cases) or because the minimum technical protocol was not followed or abandoned intraoperatively, notably because of osseous lesions (nine cases) or because an open technique was chosen by the patient (20 cases) or the

Table 3 Instability Severity Index Score (ISIS): in this study, the indication for arthroscopic Bankart was suggested for an ISIS of four points out of 10 or less, i.e., one point above the score recommended by its promoters [18,23].

Age at surgery	≤ 20	2
	> 20	0
Sports level	Competition	2
	Recreational or none	0
Preoperative sport	Contact or forced abduction-external rotation	1
	Other	0
Shoulder hyperlaxity ^a	Yes	1
	No	0
Hill-Sachs lesion on AP X-ray	Visible in lateral rotation	2
	Invisible in lateral rotation	0
Loss of subchondral bone contour on AP X-ray contour in neutral rotation	Yes	2
	No	0
	Total calculated	/ 10

^a Hyperlaxity is defined by external rotation with the elbow against the body $\geq 85^\circ$ and/or an asymmetrical hyperabduction test result greater than 20° .

Table 4 Walch-Duplay Functional Score [21].

<i>Sport (/25 points)</i>	Ou	<i>Daily activity (if no sport)</i>
Return to the same level in the same sport	+25	No discomfort
Decrease level in the same sport	+15	Slight discomfort during forceful movements
Change in sport	+10	Slight discomfort during simple movements
Stop sport	0	Severe discomfort
<i>Stability (/25 points)</i>		
No apprehension	+25	
Persistent apprehension	+15	
Feeling of instability	0	
True recurrence	-25	
<i>Pain (/25 points)</i>		
No or pain during certain climatic conditions	+25	
Pain during forceful movements or when tired	+15	
Pain during daily life	0	
<i>Mobility (/25 points)</i>		
Pure frontal abduction against a wall: symmetrical	+25	
IR limited to < 3 vertebrae		
ER2 limited to < 10% of opposite side		
Pure frontal abduction against a wall < 150°	+15	
IR limited to < 3 vertebrae		
ER2 limited to < 10% of opposite side		
Pure frontal abduction against a wall < 120°	+5	
IR limited to < 6 vertebrae		
ER2 limited to < 50% of opposite side		
Pure frontal abduction against a wall < 90°		
IR limited to < 6 vertebrae		
ER2 limited to < 30% of opposite side		
<i>Total out of 100 points</i>		
Excellent: 91–100 points		
Good: 76–90 points		
Medium: 51–75 points		
Poor: < 51 points		

Table 5 Rowe score [22].

Function (/50 points)	
No limitation in work or sports	50
No limitation in work, slight limitation in sports	35
Moderate limitation in overhead work and in sports	20
Marked limitation and pain	0
Pain (/10 points)	
None	10
Slight	5
Severe	0
Stability (/30 points)	
No recurrence, apprehension, or subluxation	30
Apprehension when placing arm in certain positions	15
Subluxation (not requiring reduction)	10
Apprehension test positive and/or recurrence	0
Mobility (/10 points)	
Normal and symmetrical	10
< 25% ER1, IR or flexion of opposite side	5
> 25% ER1, IR or flexion of opposite side	0
Total (/100 points)	
Excellent: 90–100 points	
Good: 75–89 points	
Medium: 51–74 points	
Poor: < 50 points	

operator (74 cases) preoperatively. The mean age of the 125 patients was 30.2 years (range, 16.5–59.8 years; ± 28.5) with age before surgery distributed as follows: 15% under 20 years, 21% 20–25 years, 20% 26–30 years, and 44% over 30 years. The mean time between the first episode of instability and surgery was 5 years (range, 0.2–24 years; ± 3.3)

Table 6 Distribution of ISIS values for 328 patients operated in 11 centers during the inclusion year. The greyed cells indicated potential arthroscopic Bankart indications ($ISIS \leq 4$; $n = 237$) and the right column the 125 procedures performed making up the study’s cohort. This table demonstrates the greater caution of the operators in the arthroscopic Bankart procedure in patients with ISIS equal to three and especially four points.

ISIS (point)	Complete group ISIS 0–10 $n = 328$	Procedures performed ISIS ≤ 4 $n = 125$
0	29 (9%)	20
1	44 (13%)	30
2	50 (15%)	29
3	71 (22%)	35
4	43 (13%)	11
5	33 (10%)	
6	27 (7%)	
7	16 (5%)	
8	9 (3%)	
9	2 (1%)	
10	4 (2%)	

and there were two accidents in 14% of the cases, three to five in 42%, and over five in 44% of the cases. Seventy-three percent of the patients participated in sports, 75% of them recreationally. The mean external rotation with the elbow against the body was 67.5° (range, 20–100°) and inferior hyperlaxity was observed in 39.2% of the cases (positive asymmetric Gagey test $> 20^\circ$). The bone criteria were negative in 94% for the glenoid and 82% for the groove defect of the humeral head. The ISIS distribution was ISIS 0: 16%, ISIS 1: 24%, ISIS 2: 23%, ISIS 3: 28%, and ISIS 4: 9%. During the intervention, a complementary posterolateral approach was used in 4% of the cases, a TOTS approach in 24% of the cases, and inferior or anterior capsular tightening in 51 and 70% of the cases, respectively.

Four patients presented recurrence of their instability accident (3.2%) at a mean follow-up of 18 months (range, 12–23 months). Their clinical profile is reported in Table 7.

The functional scores were validated at 1 year for 84 patients. The Walch-Duplay score was 88.4 points (range, 0–100 ± 90 points) and the Rowe was 87.8 points (range, 0–100 ± 95 points). Subjectively, 88.1% of the patients declared they were satisfied and would undergo the intervention again. There were nine cases of stiffness with five persisting at 1 year as well as one case of axillary motor involvement and one case of distal dysesthesia, both regressive.

Discussion

The goal of this prospective study was to validate a safety indication of Bankart arthroscopic repair by selecting patients who were then operated using a technique comprising four anterior and inferior sutures. The major limitation of this preliminary report is the 18-month follow-up period, too short to assess shoulder stability, the main criterion of success for this intervention. Boileau et al. showed that recurrences occurred after 1 year, with four cases of recurrence out of 14 after 2 years in their series [17]. A relative bias is the non-systematic use of the Bankart arthroscopic procedure, whereas an ISIS less than or equal to 4 was an indication for this technique. As shown in Table 6, certain operators preferred a Bankart technique, either endoscopic or open, when the ISIS was equal to four points, even three points, or by patient or surgeon choice. The strong point of the study is the homogenous cohort of 125 patients selected based on identical preoperative criteria ($ISIS \leq 4$) and operated in 11 centers with a common minimal surgical technique (minimum of three anchors and four sutures) even if standardization of the surgical technique did not include directives as to the ratio between the labral and capsular sutures.

This study first provided an analysis of the profile of patients operated on for anterior shoulder instability over 1 year in 11 hospital centers. Three-quarters of them (237/328) had an ISIS less than or equal to 4, corresponding to the inclusion criteria of the present study. If this limit is lowered to three points, as Boileau et al. suggest, the rate of potential indications for the Bankart endoscopic protocol would remain at 59% of the 328 patients operated, re-inforcing the value of this technique in its indications and practice [23] (Fig. 1).

Table 7 Radiological and clinical profile of four patients presenting instability recurrence at mean follow-up of 18 months.

	Patient 1	Patient 2	Patient 3	Patient 4
Age at surgery	23	32	33	25
Sport	No	Recreational	Recreational	No
Anterior or inferior laxity	Yes	Yes	No	No
Loss of glenoid bone substance	No	No	No	No
Hill-Sachs lesion visible in rotation	Yes	Yes	Yes	No
Preoperative ISIS e	3	3	2	0
Capsuloplasty	No	No	Yes	No
TOTS	No	No	Yes	Yes
Time to recurrence (months)	6	12	6	18
Injury	No	Yes	No	Yes
Type of recurrence	Subluxation	Dislocation	Subluxation	Dislocation

TOTS: temporary outside traction suture.

The 3.2% recurrence rate may seem reassuring. This should be tempered by the insufficient follow-up period (18 months), but it is nonetheless lower than the rate reported by Boileau et al. at the same follow-up time for 91 patients who were not selected preoperatively [17]. These patients continue to be monitored for relapses occurring within 1–5 years, and the study’s final objective is to determine whether the choice of the ISIS limit at four and not three points [23] would show recurrence rates lower than 5% at a minimum follow-up of 3 years. At this stage, the number of four recurrences out of 125 patients is too low for statistical analysis. These four patients did not have a particularly at-risk profile. None had an ISIS at 4 and two of them had a score lower than 2. The only common risk factor found for three of the four patients was the existence of a Hill-Sachs lesion visible in lateral rotation.

The high values of the Walch-Duplay and Rowe scores are explained by the low recurrence rate and the insufficiently long follow-up. At this stage of the study, they are higher than those of other Bankart arthroscopic procedures on non-selected patients and reviewed with a longer follow-

up [16,17]. These scores are identical to those in Bankart series but with longer follow-up periods [24].

Conclusion

Bankart arthroscopic repair predominates in the English-speaking world but seems to be used by a minority of operators in France. Its weaknesses are probably related to the fact that it alone cannot treat all of the factors contributing to recurrence, constitutional or lesional. This study has confirmed the simplicity of the use of the ISIS as a tool for consultation that allows selecting patients on the basis of the identification of its predictive factors for recurrence. Despite encouraging preliminary results, only pursuing the study and obtaining results at a minimum follow-up of 3 years can validate the lower limit of the ISIS below which this technique could be proposed with an acceptable failure rate and on the condition that the technical prerequisite of three anchors for four sutures.

Conflicts of interest statement

No conflict of interest.

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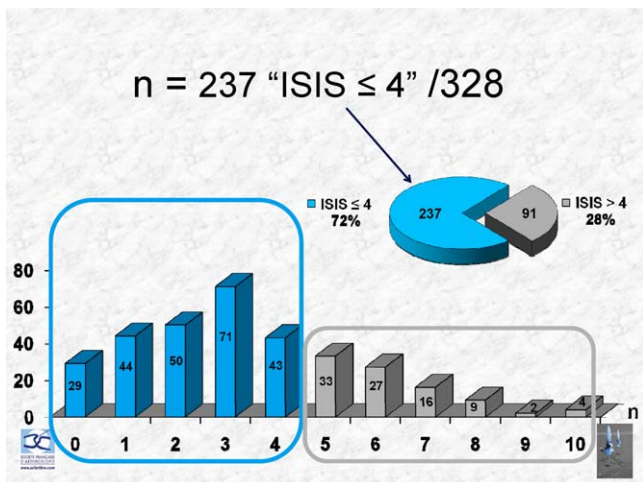


Figure 1 ISIS distribution of 328 patients operated on during the inclusion year in the 11 centers participating in the study: 72% of patients had a score ≤ 4 points and 59% ≤ 3.

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