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Efficacité d'un protocole d'auto-rééducation immédiate après butée coracoïdienne selon Latarjet : à propos de 265 cas

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DE CHIRURGIE DE L'EPAULE ET DU COUDE

par

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Efficacité d'un protocole d'auto-rééducation immédiate après butée coracoïdienne selon Latarjet : à propos de 265 cas

RESUME :

Introduction : Aucune étude ne rapporte précisément les résultats cliniques des amplitudes articulaires et ne détaille le protocole de rééducation réalisé après butée coracoïdienne selon Latarjet (BCL).

Hypothèse : Les patients qui réalisent le protocole d'auto-rééducation dès le post-opératoire immédiat recouvrent leurs amplitudes préopératoires à 3 mois sans complications liées l'auto-rééducation.

Matériel et Méthodes : 265 épaules ont été opérées par le même chirurgien par BCL à ciel ouvert. Les patients ont effectué des exercices d'auto-rééducation dès le premier jour postopératoire. Les suivis à 1 et 3 mois ont évalué la récidive d'instabilité, les complications, la douleur, l'élévation antérieure active (EAA), l'élévation antérieure passive (EAP), la rotation externe (RE) et la rotation interne (RI).

Résultats : La différence médiane entre la mobilité pré-opératoire et à 3 mois était de 0° (-60° à 90°) pour l'EAA, 0° (-60° à 30°) pour l'EAP, 10° (-50° à 60°) pour la RE et 0 de niveau vertébral (-11 à 10) pour la RI. Seuls 13 patients (5%) n'avaient pas suivi le protocole d'auto-rééducation au cours du premier mois postopératoire, mais y avaient adhéré pour les deux mois suivants. À un mois, ces patients avaient significativement plus de douleur ($p < 0,001$) et moins d'amélioration de l'EAA ($p < 0,001$), de l'EAP ($p < 0,001$), de la RE ($p = 0,001$) et de la RI ($p < 0,001$). À 3 mois, ils ont continué à avoir significativement plus de douleur ($p = 0,033$) et moins d'amélioration de l'EAA ($p = 0,023$) et de la RI ($p < 0,001$).

Discussion : Les patients ayant respecté le protocole recouvrent leurs mobilités préopératoires à 3 mois sans complications. Les patients n'ayant pas adhéré au protocole immédiatement ont eu plus de douleur et de moins bons résultats fonctionnels. L'auto-rééducation immédiate s'est révélée être indépendamment associée à une meilleure récupération et n'a provoqué aucun événement indésirable.

Mots-clés : instabilité antérieure gléno-humérale, butée coracoïdienne, Latarjet, auto-rééducation, amplitudes articulaires.

Niveau de Preuve : IV - étude rétrospective

Efficacy of immediate self-rehabilitation protocol after open Latarjet procedures: a retrospective case series of 265 shoulders

ABSTRACT

Background: No study specifically reports the clinical results on the range of motion and details the rehabilitation protocol after open Latarjet procedures (OLP).

Hypothesis: Patients who followed the self-rehabilitation protocol recover their preoperative mobilities at 3 months with no adverse events related to self-rehabilitation.

Material and Methods: 265 consecutive shoulders treated by the same surgeon for anterior instability by OLP with immediate self-rehabilitation. Patients performed self-rehabilitation exercises at home from the first postoperative day. Follow-ups at 1 and 3 months evaluated recurrence of instability, postoperative complications, pain, anterior forward elevation (AFE), passive forward elevation (PFE), external rotation (ER) and internal rotation (IR).

Results: The difference between mobility before surgery and at 3 months was 0° (range, -60°– 90°) for AFE, 0° (range, -60°– 30°) for PFE, 10° (range, -50°– 60°) for ER, and 0 spine segments (range, -11 – 10) for IR. Only 13 (5%) shoulders had not followed the self-rehabilitation protocol during the first postoperative month but adhered to it for the next two months. At 1 month, these patients had significantly more pain ($p<0.001$) and less improvements in AFE ($p<0.001$), PFE ($p<0.001$), ER ($p=0.001$) and IR ($p<0.001$). At 3 months, they continued to have significantly more pain ($p=0.033$), and less improvement in AFE ($p=0.023$) and IR ($p<0.001$). Of the 237 shoulders assessed radiographically at 3 months, 229 (97%) shoulders had complete bone fusion and none had displacements or screws failures.

Discussion: Patients who followed the self-rehabilitation protocol recover their preoperative mobilities at 3 months without complications. Patients who did not adhere to immediate self-rehabilitation had more pain and less improvement in mobility. Furthermore, immediate self-rehabilitation was found to be independently associated with better recovery and did not cause any adverse events.

Keywords: anterior shoulder instability, open Latarjet procedures, immediate self28 rehabilitation, range of motion

Study design: Retrospective case series; Level of evidence, IV.

INTRODUCTION

Anterior shoulder instability is surgically managed by two standard techniques: Bankart (labral) repairs, and Latarjet (bone block) procedures [21]. Bankart repairs require long rehabilitation periods and are associated with recurrence of instability, reported in 9% to 60% [14,25]. By contrast, Latarjet procedures enable faster return to sport [1] and are more effective at preventing recurrence of instability, reported to be 0% to 6% [7,16,19,20], despite some risks of malunion or fracture and concerns of stiffness due to splitting of the subscapularis [10-12].

In the literature, standard rehabilitation after Latarjet procedures involves full postoperative immobilization using a sling for 3 to 6 weeks, passive rehabilitation with a physiotherapist for another 3 to 6 weeks, followed by strengthening exercises as necessary [5,9,13,15,28]. Current research underlines the negative effects of delayed mobilization after shoulder surgery [22,23,27]. So far, most studies on open Latarjet procedures (OLP) focused on complication rates [1,5,15,17], while only few evaluated the benefits and drawbacks of different rehabilitation programs [6,26,28].

There are no published studies of clinical outcomes following OLP after self-rehabilitation. The purpose of this study was therefore to evaluate short-term clinical outcomes of patients treated for anterior shoulder instability by OLP followed by immediate self-rehabilitation. The hypothesis was that patients would recover pre-operative range of motion at 3 months with no adverse events related to self-rehabilitation.

MATERIAL AND METHODS

The authors retrospectively reviewed the clinical and radiographic records of 307 consecutive shoulders (300 patients) treated for anterior shoulder instability by OLP, between January 2012 and December 2017, by the same experienced surgeon (AG). The indication for OLP was 2 or more episodes of dislocation and/or subluxation, a positive apprehension, an Instability Severity Index Score ≥3, and dislocation confirmed on radiographs. The inclusion criteria were closed epiphyseal cartilage plates, anterior shoulder instability confirmed on Bernageau and true anteroposterior radiographs (Figure 1), no prior surgery on the ipsilateral shoulder, and open bone block fixation with 2 screws. The exclusion criteria were neurological lesions and preoperative fractures of the coracoid. A total of 303 shoulders (296 patients) met the eligibility criteria, but 38 shoulders (34 patients) could not be evaluated at 3 months (6 patients living abroad), among which 18 were assessed by telephone and reported no complications or recurrence of instability (Figure 2). This left a study cohort of 265 shoulders (262 patients), of which 237 shoulders (234 patients) also had routine radiographs at 3 months.

Figure 1. Preoperative radiographs of a shoulder with glenoid bone loss in the (a) true anteroposterior and (b) Bernageau view.

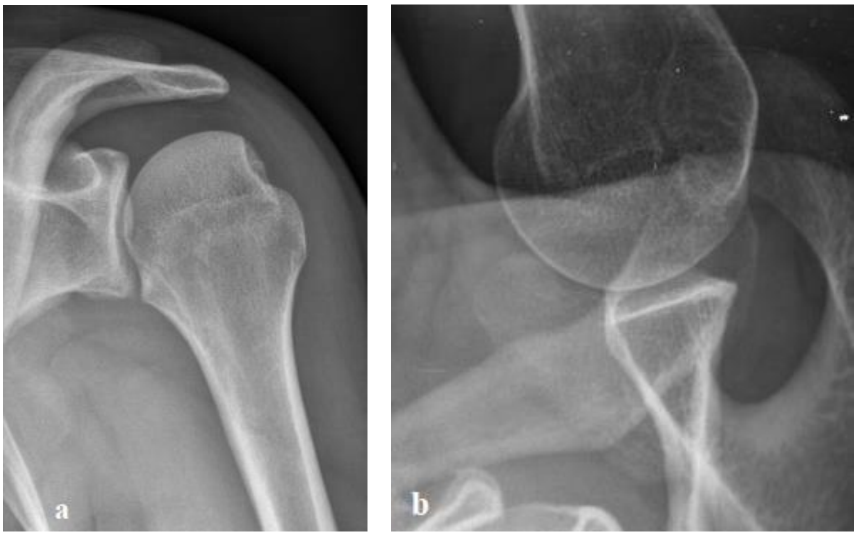
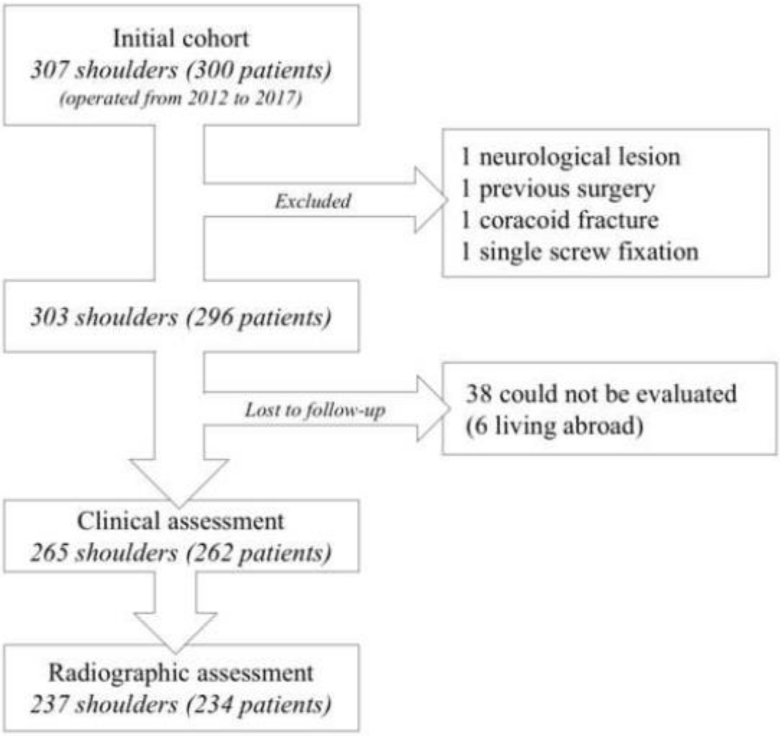


Figure 2. Flow chart detailing inclusion and exclusion of patients from the original cohort.



The study cohort comprised shoulders of 222 (84%) men and 43 (14%) women, aged 25.1±7.9 (range, 18–65; median, 24) at surgery, involving the dominant arm in 133 (50%) (Table 1). The majority of shoulders were of sedentary workers and students (83%), with only few manual workers (17%). Glenoid lesions included isolated Bankart lesions in 39 shoulders (15%), bony-Bankart lesions in 123 (46%) and glenoid erosion in 103 (38%). Humeral Hill Sachs lesions were present in 258 (97%) shoulders. The preoperative Instability Severity Index Score (ISIS) [3] was 6 ± 2 (range, 3–10; median, 6). The difference of mobility between healthy and instable shoulders was 4° (range, -20°–90°) for active forward elevation (AFE), 2° (range, -20°–40°) for passive forward elevation (PFE), 10° (range, -30°–60°) for external rotation (ER), and 1 spine segment (range, -3–12) for internal rotation (IR).

With the patient standing, the experienced surgeon (AG) used a goniometer to measure AFE, ER and IRs relative to spinal segments [8]. Shoulder hyperlaxity was defined as ER with arm at side ≥85° and/or an asymmetrical hyperabduction >20°. With the patient lying down, the surgeon measured passive forward elevation (PFE).

Table 1: Patient demographics

	Study cohort (n= 265 shoulders)	
	N (%) Mean ±SD	Range
Age	25.1 ± 7.9	(14 – 65)
Male sex	222 (84%)	
Type of work		
Sedentary or student	220 (83%)	
Manual	45 (17%)	
Dominant shoulder	133 (50%)	
Preoperative ISIS	6.1 ± 1.9	(3 – 10)
Age ≤20 years	94 (35%)	
Contact sports or forced overhead	177 (67%)	
Competition sport	112 (42%)	
Shoulder hyperlaxity	64 (24%)	
Hill-Sachs lesion on AP X-ray	258 (97%)	
Glenoid loss of contour on AP X-ray	227 (86%)	
Glenoid lesions		
Isolated Bankart lesions	39 (15%)	
Bony Bankart lesions	123 (46%)	
Glenoid erosion	103 (39%)	
Screw type		
Malleolar (Synthes)	190 (72%)	
Cannulated (Arthrex)	75 (28%)	
Intraoperative complications	0 (0%)	

Abbreviations: AP, AnteroPosterior; ISIS, Instability Severity Index Score

The operative technique was consistent throughout the 6-year period: the same approach and equipment were used, except for the screws, which were malleolar in the period 2012-2016 and cannulated in the period 2016-2017. Patients were operated in the beach chair position under ultrasound-guided interscalene brachial plexus block and general anesthesia. OLP was performed according to the Latarjet-Patte technique following a standard deltopectoral approach [24]. The skin incision was made vertically from the tip of the coracoid 3-4 cm toward the axillary fold. The coracoacromial ligament was exposed and incised 1 cm from the coracoid attachment. The coracohumeral ligament and the pectoralis minor were released. Coracoid osteotomy was performed at the junction of the horizontal and vertical components. Wax was applied to prevent bleeding at the resected bone surface.

A capsulotomy was performed by splitting the inferior two-thirds of the subscapularis in 201 (76%) shoulders and the inferior half in 64 (24%) shoulders with hyperlaxity. The labrum was resected if damaged. The anterior aspect of the glenoid was decorticated by an osteotome. Two 4.5mm screws were placed through the graft: partially threaded malleolar stainless steal screws (Synthes, Solotum, Switzerland) in 190 (72%), and partially threaded cannulated titanium screws (Arthrex Inc, Naples, FL, USA) in 75 (28%). The capsule was then repaired to the stump of the coracoacromial ligament with the arm at 45° ER. A hemostatic resorbable sponge was positioned on the anterior surface of the scapula under the subscapularis to prevent bleeding. A subcutaneous drain was placed before closing the skin incision and removed within 24 hours.

The operated arm was immobilized using a sling for the first 2-3 weeks, but patients resumed activities progressively, provided that they did not trigger pain. Patients were instructed to perform self-rehabilitation exercises at home, as of the first postoperative day, following a protocol designed by an experienced sports physician (JPL). Neither passive physiotherapist-assisted rehabilitation nor instrument-assisted strengthening (pulley, sticks, strings, weight) were allowed during the first 3 months. Return to sports and strengthening exercises were permitted under the supervision of a physiotherapist after 3 months.

The self-rehabilitation protocol comprised 3 phases, which were illustrated on a brochure, and explained to each patient prior to hospital discharge. All patients were instructed to perform each exercise in 5 consecutive cycles, and to repeat them 5 times per day. Patients were permitted to sustain low to moderate pain while performing the self-rehabilitation exercises.

Phase I: days 1-7 after surgery

Exercise I (Video 1): The patient lies in a comfortable position, with the elbows half-flexed along the trunk, the fingers interlocked, and palms on the abdomen. The hands are moved over the head for 5 seconds (Figure 3a). Then, the arms are stretched for 5 seconds (Figure 3b). The hands are brought back to their starting position on the abdomen for 5 seconds. Once the patient performs this exercise with ease, he/she moves to Phase II.

Video 1. Self-rehabilitation exercises of phase I

http://164.132.41.249/roulet_2019/

Phase II: days 7-30 after surgery

Exercise IIa (Video 2): The patient sits with the back leaning on a chair, fingers interlocked, but palms open on the lap. The hands are moved over the head for 5 seconds (Figure 3c), then lifted further while bringing the palms together for 5 seconds (Figure 3d).

Exercise IIb: The patient sits with the back leaning on a chair, with palms in contact with one-another, in front of the abdomen (Figure 3e). The arms are rotated externally, moving the hands away from the abdomen, with the elbows free to abduct slightly with rotation. This position is maintained for 5 seconds (Figure 3f).

Video 2. Self-rehabilitation exercises of phase II

http://164.132.41.249/roulet_2019/

Phase III: days 30-90 after surgery

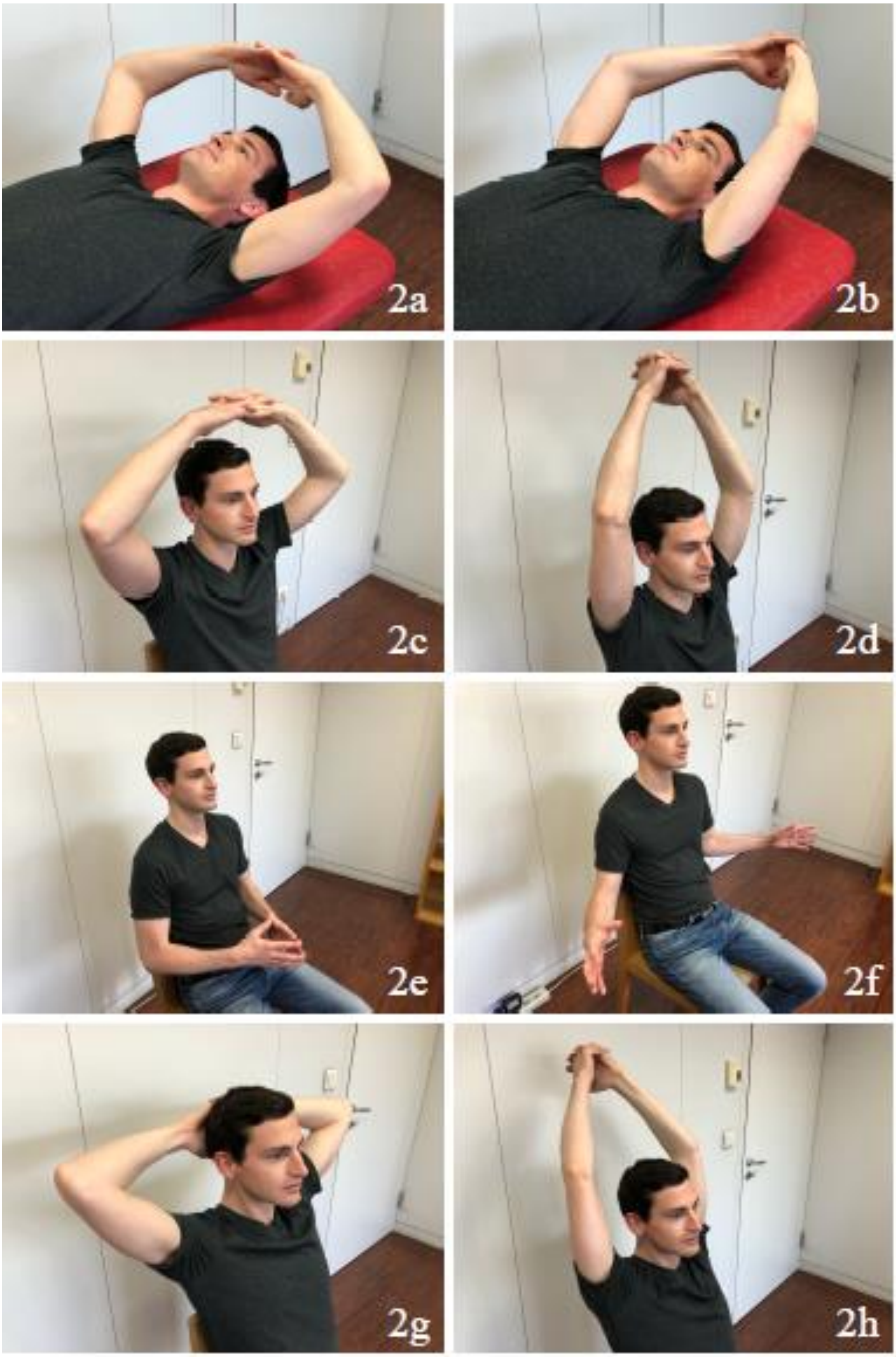
Exercise IIIa (Video 3): The patient sits with the back leaning on a chair, fingers interlocked, but palms open on the lap. The hands are moved behind the head, well above the neck, and the elbows move further apart by rotating the shoulders externally. This position is maintained for 5 seconds (Figure 3g). The hands are then pulled upward and backward, but not forward, by extending the elbows fully. This position is also maintained for 5 seconds (Figure 3h).

Exercise IIb: (see phase II).

Video 3. Self-rehabilitation exercises of phase III

http://164.132.41.249/roulet_2019/

Figure 3. Photographs of self-rehabilitation exercises.



Operative notes were retrieved to report screw types and any perioperative complications (coracoidal fracture, screw failure, others).

Follow-up assessments at 1 and 3 months were performed by three sport physicians specialized in the upper limb (JPL, FB, GF) who were not involved in the treatments. They evaluated: (i) recurrence of anterior dislocation or subluxation, (ii) any postoperative complications (hematoma, sepsis, neurological lesions, complex regional pain syndrom, others), (iii) shoulder pain on a 0-10 Likert scale, and (iv) range of motion comprising AFE, ER and IR in the standing position and PFE while lying down. Patients were asked to perform the phase-2 or phase-3 exercises of the self-rehabilitation protocol in front of the sports physician, who recorded whether they had exercised regularly. Patients who did not follow the self-rehabilitation protocol for the first month were instructed to start performing the prescribed exercises. Patients were permitted to perform resistive exercises under the supervision of a physiotherapist and to progressively resume sport after 3 months.

Bernageau and true anteroposterior radiographs were acquired at 3 months to evaluate graft fusion, secondary displacement or fracture (Figure 4). All patients provided written informed consent for their participation in this study, which was approved by the institutional review board of Ramsay Générale de Santé in advance (COS-RGDS-2018-12-003).

Statistical analyses

Shapiro–Wilk tests were used to assess the normality of distributions. For non-Gaussian quantitative data, differences between groups were evaluated using Wilcoxon ranksum tests (Mann–Whitney U test). For non-Gaussian categorical data, differences between groups were evaluated using Fisher exact tests. Uni-and multi-variable linear regressions were performed to determine associations between four outcomes (PFE, AFE, ER, IR) and fifteen independent variables (sex, age, sport contact, sport competition, shoulder hyperlaxity, professional activities, stretching, dominant side, Hill-Sachs lesion radiograph, glenoid lesionradiograph, Bankart lesion, bony Bankart lesion, glenoid erosion, screws, ISIS score). Considering recommendations of Austin and Steyerberg of 2 subjects per variable [2], 30 subjects were deemed sufficient to include 15 variables in our multivariable linear regressions. Our analyses based on 245 subjects was therefore deemed sufficiently powered. Statistical analyses were performed using R version 3.3.3 (R Foundation for Statistical Computing, Vienna, Austria). p values < 0.05 were considered statistically significant.

RESULTS

From the study cohort of 265 shoulders, none had intraoperative coracoid fractures, screw failures, infections, nor complex regional pain syndrome. Early complications were observed in 10 (4%) shoulders, including 2 (1%) thromboembolic events (1 deep vein thrombosis and 1 pulmonary embolism, both treated by anticoagulants), 3 (1%) musculocutaneous neurological lesions (2 neuropraxia and biceps atonies that resolved within 2 months, and 1 deficit of the musculo-cutaneous nerve lasting >3 months), and 5 (2%) hematomas (resolved by open lavage) (Table 2). Late complications included sensations of subluxation in 2 (1%) shoulders, but there were no dislocations or adverse events related to self-rehabilitation. The difference between mobility before surgery and at 3 months was 0° (range, -60°–90°) for AFE, 0° (range, -60°–30°) for PFE, 10° (range, -50°–60°) for ER, and 0 spine segments (range, -11–10) for IR (Figure 5).

Only 13 (5%) shoulders had not followed the self-rehabilitation protocol during the first postoperative month due to lack of motivation, but adhered to it for the next two months. At 1 month, these patients had significantly more pain ($p<0.001$) and less improvements in range of motion ($p<0.001$). At 3 months, they continued to have significantly more pain ($p=0.033$), and less improvement in AFE ($p=0.023$) and IR ($p<0.001$) (Table 3).

Of the 237 shoulders assessed radiographically at 3 months, 229 (97%) shoulders had complete radiographic bone block fusion (Figure 4), 5 (2%) had signs of lyses at the superior portion of the bone block, but none had displacements or screws failures (Table 2).

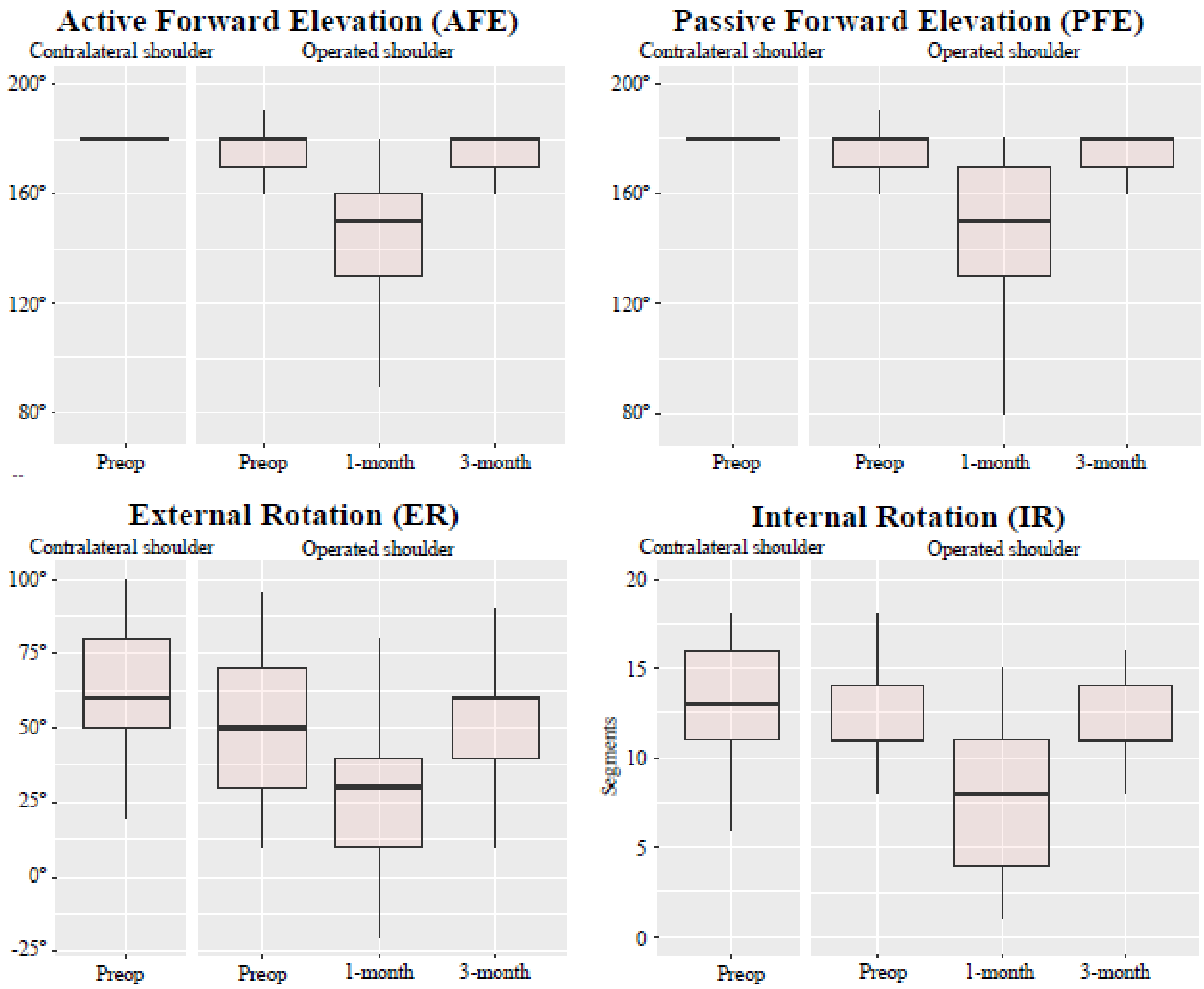
Multivariable analyses (Table 4) revealed that patients who adhered to self-rehabilitation in the first postoperative month had greater improvements of AFE ($p=0.001$), PFE ($p=0.004$), and IR ($p=0.012$).

Table 2: Complications, range of motions and radiographic outcomes

	Study cohort (n=265 shoulders)		
	Mean ±SD	Median	Range
Postoperative (operated shoulder)			
Early complications	10 (4%)		
Subluxation	2 (1%)		
Luxation	0 (0%)		
Clinical outcomes			
AFE (°)			
Preoperative	174 ± 12	180	(90 – 190)
At 1 month	145 ± 28	150	(30 – 180)
At 3 months	172 ± 13	180	(110 – 180)
PFE (°)			
Preoperative	176 ± 8	180	(130 – 190)
At 1 month	149 ± 24	150	(80 – 180)
At 3 months	172 ± 13	180	(110 – 180)
ER (°)			
Preoperative	51 ± 22	50	(10 – 95)
At 1 month	26 ± 18	30	(-20 – 80)
At 3 months	56 ± 16	60	(0 – 90)
IR (segments)			
Preoperative	11.9 ± 2.8	11	(3 – 18)
At 1 month	6.9 ± 3.5	8	(1 – 15)
At 3 months	11.4 ± 2.4	11	(2 – 16)
	Radiographic cohort (n=237 shoulders)		
Radiographic outcomes at 3 months			
Bone block fused	229 (97%)		
Screw failure	1 (0%)		
Signs of osteolyses	5 (2%)		

Abbreviations: ISIS, Instability Severity Index Score; AP, AnteroPosterior; Δ, net improvement; AFE, Active Forward Elevation; PFE, Passive Forward Elevation; ER, External Rotation; IR, Internal Rotation.

Figure 5. Boxplots showing pre- and postoperative ranges of motion.



All differences in range of motion between controlateral (preoperative) and operated shoulder (preoperative, at 1-month, and at 3-month) were statistically significant.

Table 3: Demographics and improvements for patients who did or did not adhere to self-rehabilitation in the first postoperative month

	Immediate self-rehabilitation (n=252 shoulders)				Self-rehabilitation at 1 month (n=13 shoulders)				*p-value*
	N	(%)			N	(%)			
	Mean	±SD	Median	Range	Mean	±SD	Median	Range	
Demographics									
Age (years)	25	± 8	23	(14 – 65)	28	± 7	28	(17 – 40)	n.s
Male sex	212	(84%)			10	(77%)			n.s
Operation on dominant side	130	(52%)			3	(23%)			n.s
Preoperative ISIS (0–10)	6.1	± 1.9	6	(3 – 10)	5.7	± 1.9	5	(3 – 10)	n.s
Age ≤20 years	92	(37%)			2	(15%)			n.s
Contact sports or forced overhead	168	(67%)			9	(69%)			n.s
Competition sport	108	(43%)			4	(31%)			n.s
Shoulder hyperlaxity	59	(23%)			5	(38%)			n.s
Hill-Sachs lesion on AP X-ray	245	(97%)			13	(100%)			n.s
Glenoid loss of contour on AP X-ray	216	(86%)			11	(85%)			n.s
Type of work									n.s
Sedentary or student	42	(17%)			3	(23%)			
Manual	210	(83%)			10	(77%)			
Glenoid lesions									n.s
Isolated Bankart lesions	37	(15%)			2	(15%)			
Bony Bankart lesions	118	(47%)			5	(38%)			
Glenoid erosion	97	(38%)			6	(46%)			
Outcomes									
At 1 month									
Pain (0–10)	0.5	± 1.0	0	(0 – 4)	2.3	± 1.4	3	(0 – 4)	<0.001
Δ AFE (°)	-27	± 26	-25	(-140 – 90)	-72	± 27	-80	(-100 – -20)	<0.001
Δ PFE (°)	-12	± 51	-20	(-90 – 180)	-72	± 22	-80	(-100 – -20)	<0.001
Δ ER (°)	-18	± 30	-20	(-90 – 60)	-48	± 27	-40	(-90 – 0)	0.001
Δ IR (segment)	-4.8	± 4.1	-5	(-15 – 5)	-10.1	± 2.1	-10	(-12 – -6)	<0.001
At 3 months									
Pain (0–10)	0.3	± 0.7	0	(0 – 3)	0.8	± 1.1	0	(0 – 3)	0.033
Δ AFE (°)	-1	± 15	0	(-55 – 90)	-19	± 26	0	(-60 – 10)	0.023
Δ PFE (°)	-3	± 12	0	(-55 – 30)	-15	± 24	0	(-60 – 10)	n.s
Δ ER (°)	6	± 21	10	(-50 – 60)	-3	± 28	-5	(-50 – 40)	n.s
Δ IR (segment)	-0.4	± 3.2	0	(-11 – 10)	-3.5	± 2.1	-3	(-7 – 0)	<0.001

Abbreviations: ISIS, Instability Severity Index Score; AP, AnteroPosterior; Δ, net improvement; AFE, Active Forward Elevation; PFE, Passive Forward Elevation; ER, External Rotation; IR, Internal Rotation.

Figure 4. Radiographs at 3 postoperative months of a shoulder with complete bone block fusion in the (a) true anteroposterior and (b) Bernageau view.

Table 4: Multivariable regression analysis of improvements in ranges of motion at 3-month follow-up

Variable		AFE (n=265 shoulders)				PFA (n=265 shoulders)				ER (n=265 shoulders)				IR (n=245 shoulders)			
		β (deg)	95% C.I.		*p-value*	β (deg)	95% C.I.		*p-value*	β (deg)	95% C.I.		*p-value*	β (segments)	95% C.I.		*p-value*
Age	n=265	-0.3	(-0.6	0.034	0.028	-0.252	0.470	0.035	0.023	-0.090	0.448	0.268	n.s	0.000	0.056	0.055	n.s
Sex																	
Female	n=43	REF				REF				REF				REF			
Male	n=222	-2.7	(-8.1	2.678	n.s	-2.148	6.454	2.158	n.s	9.785	2.704	16.866	0.007	0.793	0.293	1.879	n.s
Professional activity																	
Sedentary or student	n=220	REF				REF				REF				REF			
Manual	n=45	-1.2	(-6.4	4.030	n.s	1.127	3.033	5.286	n.s	2.292	4.549	9.132	n.s	1.230	0.193	2.266	0.020
Preoperative ISIS*	n=265																
Age ≤20 years**																	
Contact sports or forced overhead		-1.9	(-7.1	3.303	n.s	-0.886	5.055	3.284	n.s	-3.266	10.123	3.591	n.s	0.400	0.640	1.439	n.s
Competition sport		0.1	(-5.1	5.235	n.s	1.508	2.613	5.630	n.s	4.871	1.906	11.649	n.s	0.228	0.808	1.265	n.s
Shoulder hyperlaxity		-1.9	(-6.5	2.754	n.s	0.546	3.155	4.247	n.s	-10.282	16.368	4.196	0.001	-1.472	2.394	0.550	0.002
Hill-Sachs lesion on AP X-ray		-0.9	(-13.3	11.374	n.s	-3.822	13.659	6.016	n.s	1.036	15.141	17.213	n.s	-0.748	3.317	1.821	n.s
Glenoid loss of contour on AP X-ray		-1.2	(-20.3	17.871	n.s	0.764	14.480	16.008	n.s	-4.868	29.937	20.200	n.s	-0.344	4.036	3.348	n.s
Operated side																	
Non dominant	n=132	REF				REF				REF				REF			
Dominant	n=133	1.2	(-2.7	5.086	n.s	2.469	0.658	5.597	0.121	1.815	3.328	6.958	n.s	1.239	0.454	2.024	0.002
Lesion																	
Bony Bankart lesions	n=123	REF				REF				REF				REF			
Glenoid erosion	n=103	-1.9	(-6.1	2.255	n.s	-1.272	4.616	2.073	n.s	0.552	4.948	6.052	n.s	-0.159	0.998	0.680	n.s
Isolated Bankart lesions	n=39	-4.6	(-23.4	14.110	n.s	-1.292	16.262	13.678	n.s	-4.542	29.159	20.076	n.s	-0.865	4.493	2.763	n.s
Screw type																	
Cannulated (Arthrex)	n=75	REF				REF				REF				REF			
Malleolar (Synthes)	n=190	4.1	(-0.2	8.516	n.s	2.661	0.838	6.160	n.s	8.151	2.397	13.905	0.006	0.655	0.282	1.591	n.s
Self-rehabilitation																	
Started at 1 month	n=13	REF				REF				REF				REF			
Immediate postoperative	n=252	15.7	(6.8	24.604	0.001	10.481	3.366	17.597	0.004	3.302	8.400	15.004	0.579	2.290	0.501	4.080	0.012

Abbreviations: β, Regression Coefficient; AFE, Active Forward Elevation; PFE, Passive Forward Elevation; ER, External Rotation; IR, Internal Rotation; AP, AnteroPosterior; ISIS, Instability Severity Index Score.

* ISIS subcomponents were considered as separate variables in the regression model without the total preoperative ISIS to avoid colinearity.

** ISIS includes age as a binary variable; the regression model considered age as a continous variable instead.

DISCUSSION

The most important finding of the study was that recovery of preoperative function at 3 months was enabled by immediate self-rehabilitation after OLP. Our hypothesis that patients would recover pre-operative function at 3 months with no adverse events related to self-rehabilitation was confirmed. Furthermore, immediate self-rehabilitation was found to be independently associated with better recovery than delayed self-rehabilitation, and did not cause any adverse events.

To the authors' knowledge, no published studies reported short-term clinical outcomes after OLP, and the few studies that reported mobility at mid- or long-terms (10 to 59 months) [6,26,28] observed that patients recovered preoperative FE, ER and IR, including those with inverted pear-shape glenoids or engaged Hill-Sachs lesions [6]. In our study, we found that patients had recovered their preoperative AFE, PFE, IR, and even gained 5° of ER. This gain likely represents recovery of normal mobility prior to instability symptoms, considering the preoperative deficit of ER in unstable shoulders compared to their contralateral sides. As a general comment from our practice, we recommend that PFE be evaluated with patients lying, as any other position renders PFE measurement unreliable.

Rehabilitation protocols aim to promote healing by balancing protection of repair against prevention of stiffness. Immobilization using slings, together with delayed rehabilitation are intended to shield repairs from disruptive forces, but have the potential drawbacks of joint adhesions, muscle atrophy, and tendon deterioration. While current research underlines the negative effects of delayed mobilization after shoulder surgery [22,23,27], sling immobilization for 3-6 weeks and rehabilitation assisted by physiotherapists for 16 weeks after OLP remains common practice [5,9,13,15,28]. In our series, patients who did not follow the self-rehabilitation protocol for the first month experienced significantly more stiffness and more pain than patients who immediately followed the protocol. Multivariable analysis confirmed that immediate self-rehabilitation can independently improve AFE by 16°, PFE by 11°, and IR by 2 spinal segments at 3 months.

The <5% early complication, 0% dislocation and 2% subluxation rates compare favorably with the 30% complication, 3% dislocation and 6% subluxation rates reported in a comprehensive systematic review on complications after Latarjet procedures [18], and outperform rates reported after Bankart procedures [25]. In our series, most early complications were due to hematomas despite application of wax on the coracoid to prevent bleeding, while there were no complications associated with self-rehabilitation.

Self-rehabilitation did not trigger bone block malunion and only few minor signs of lyses were observed at 3 months, but none of these patients had revision or follow-up consultation for pain or disfunction. Rate of osteointegration was high for both malleolar and cannulated screws (98% and 92%, respectively), although the latter performed significantly worse ($p=0.038$). This corroborates Barth et al.’s [4] finding that the use of malleolar screws results in better contact angle, than cannulated screws.

The limitations of this study are typical of retrospective design, with 12% of patients lost to follow-up (12%), as well as the use of 2 different types of screws (malleolar and cannulated), the absence of control group (of patients undergoing physiotherapist-assisted rehabilitation), as well as the lack of long-term outcomes or scores. Although evaluation of ROM is somewhat subjective, patients were evaluated using a goniometer by the same experimented clinician pre- and postoperatively. To the authors’ knowledge, this study, which comprises a sizeable cohort of consecutive patients operated by a single surgeon, is the first to assess immediate self-rehabilitation and to report short term clinical outcomes after OLP. Our findings suggest that immediate self-rehabilitation after Latarjet procedures is safe and effective in motivated patients, and could improve patient postoperative quality of life as well as reduce healthcare costs.

CONCLUSION

Immediate self-rehabilitation after open Latarjet procedures enabled recovery of preoperative shoulder mobility at 3 months. Patients who did not adhere to immediate self-rehabilitation had more pain and less improvement in mobility. Furthermore, immediate self-rehabilitation was found to be independently associated with better recovery and did not cause any adverse events.

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