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ORIGINAL ARTICLE

Is the subscapularis normal after the open Latarjet procedure? An isokinetic and magnetic resonance imaging evaluation

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Background: The Latarjet procedure is considered to be a violation of the subscapularis muscle. This study evaluated the postoperative status of the subscapularis through isokinetic and magnetic resonance imaging analysis after splitting. We hypothesized that compared with a healthy contralateral shoulder, there would be satisfactory recovery of subscapularis strength at the cost of some fatigability and some mild fatty infiltration.
Materials and methods: This was a case-control retrospective study of patients who underwent a Latarjet procedure between January 2013 and January 2015. A total of 20 patients were reviewed at 1 year postoperatively. With the patient seated, strength testing of both shoulders was done (concentric, eccentric, and fatigability) with a dynamometer. Trophicity and fatty infiltration were analyzed by magnetic resonance imaging.
Results: Strength of the internal rotators (IRs) and external rotators (ERs) of the injured shoulder was significantly lower compared with the healthy shoulder in concentric testing at 180°/s and 60°/s (13% for IR and 20% for E, $P < .05$) and in eccentric testing at 60°/s (19% for IR and 16% for ER, $P < .05$). A peak torque ratio (ER/IR) of the operated-on shoulder was maintained. The difference in muscular endurance was significant ($P < .001$). There was no muscle atrophy and minimal or no fatty infiltration of the subscapularis in any patient.
Conclusion: At 1 year after the open Latarjet procedure, isokinetic testing showed a combined strength deficit in both internal and external rotation with a conserved muscle balance. Although no significant subscapularis fatty infiltration or atrophy was noted, there was a significant deficit in endurance compared with the healthy shoulder.
Level of evidence: Basic Science Study; Kinesiology and Imaging

Keywords: Latarjet procedure; subscapularis muscle; splitting; strength; isokinetic; MRI

Institutional Review Board approval was not required because this was a retrospective study of patients whose surgery followed validated techniques and no unnecessary invasive examinations were performed.

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The Latarjet procedure consists of transferring a coracoid bone block to the anteroinferior neck of the glenoid after its passage through the subscapularis muscle. The procedure is indicated in young patients with anterior recurrent shoulder instability and who plays contact and overhead

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sports.[1,8] The transfer through the subscapularis muscle represents a violation of the most important active stabilizer of the glenohumeral joint. This surgical aggression can lead to muscle atrophy and imbalanced shoulder musculature.[1,6,8,14,22] However, whether the subscapularis muscle returns to normal after a Latarjet procedure is still unknown.

Our purpose was to evaluate the postoperative status of the subscapularis muscle through isokinetic and magnetic resonance imaging (MRI) analysis and assess the effect on shoulder function. We hypothesized that compared with a healthy contralateral shoulder, recovery of subscapularis strength after the Latarjet procedure would be satisfactory, at the cost of some mild fatty infiltration.

Materials and methods

Patients

This was a retrospective case-control study that included all patients who underwent an open Latarjet procedure by a single surgeon between January 2013 and January 2015.

The exclusion criteria were (1) patients with pathology of the contralateral shoulder or who had a bilateral procedure, or both; (2) patients with previous failed instability surgery, and (3) patients with insufficient follow-up of less than 12 months. Patients were informed by mail of the objectives of the analysis and were contacted by the examiner to obtain their consent.

During this period, 35 open Latarjet procedures were performed. Of these patients, 15 were excluded from the series: 7 had bilateral instability of the shoulder (19%), 3 were lost to follow-up, 3 refused to participate in the study, and 2 were in jail and unable to participate. At a follow-up of 12 months, 20 patients (all men) were reviewed with clinical, isokinetic, and MRI evaluation. The demographics of the series are presented in Table I. The patients were a mean age of 25.3 years (range, 17-41 years). The dominant side was involved in 12 patients (60%). Most patients practiced a high-risk sport (type 4 according to the Walch and Duplay score[26]) at a competition level (boxing, swimming, and tennis). Three or more dislocations had occurred in 81% of the patients before surgery, and they had waited an average of 11 months (range, 2-48 months) between the last dislocation and the intervention. It took an average of 4 months of therapy, 50 sessions at a rate of 3 sessions per week, for the patients to resume their professional and sports activities.

Table I Population characteristics

Variable	Patients (n = 20)
Age (years)	
Average	25.3
Minimum	17
Maximum	41
Gender, No. (%)	
Male	20 (100)
Female	0 (0)
Body mass index, kg/m^2	
Average	24.3
Minimum	18.5
Maximum	30.4
Profession at shoulder risk, No. (%)	10 (50)
Dominant side, No. (%)	12 (60)
Sport, No. (%)	
0 (no sport)	0 (0)
1 (no risk)	3 (15)
2 (light risk)	4 (20)
3 (medium risk)	6 (30)
4 (high risk)	7 (35)
Dislocation, No.	
Average	3

Surgical technique and postoperative management

The patient was selected according to the Instability Severity Index Score described by Balg and Boileau.[2] The operation was performed with the patient under general anesthesia in the beach chair position. A deltopectoral approach was used. After splitting of the subscapularis muscle (at the lower third), the coracoid bone block was prepared and fixed with 2 compressive screws. At the end of the procedure, we systematically sutured the coracoacromial ligament to establish the "triple" blocking effect described by Patte et al.[23]

The patient was immobilized with a sling in internal rotation for 15 days and only permitted to perform pendulum exercises during this period. The functional rehabilitation protocol was the same for all patients:

- Postoperative day 8 to 21: physiotherapy, soft relaxing massages. Mobilization of elbow and hand. Working in passive, with external rotation limitation up to 20° and anterior elevation up to 100°. No muscle-building work.
- Postoperative day 21 to 45: began progressively active motion.
- From postoperative day 45: recovery of all amplitudes without limitation in anterior elevation, external rotation, and internal rotation. No musculation of the anterior chamber of the arm
- After postoperative day 90: muscular strengthening.
- No-risk sporting activities were permitted at 3 months, depending on the follow-up radiographs, and higher-risk activities were allowed at 4.5 months.

Clinical evaluation

A questionnaire was used to record the type of sport, level of competition, and patient satisfaction (very satisfied, satisfied, dissatisfied, or disappointed). Objective function of the shoulder was assessed by the scores of Rowe,[24] of Walch and Duplay[26] and the Western Ontario Shoulder Instability Index (WOSI).[18]

Isokinetic evaluation

Isokinetic evaluation was performed with the Con-Trex MJ dynamometer (CMV AG, Dübendorf, Switzerland). This assessment involved both shoulders, beginning with the nonoperated-on, healthy shoulder. After a warm-up period of 10 minutes, the patient was seated with the shoulder in 45° of abduction in the plane of the scapula