Scapular position after the open Latarjet procedure: results of a computed tomography scan study

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Background: The aim of this study was to investigate, through a computed tomography (CT) scan analysis, the effects of the Latarjet procedure on scapular position in an axial plane.

Materials and methods: Twenty healthy young male subjects (mean age, 22 years; range, 18-27 years) were enrolled as a control group. Twenty young male patients (mean age, 23 years; range, 17-30 years) with recurrent anterior shoulder dislocation were enrolled as the study group. CT cuts at a proper level allowed the identification of an $\alpha$ angle, which defined the tilt of the scapula relative to the anterior-posterior axis.

Results: In the control population, the $\alpha$ angles on the right and left shoulders were 48° (44°-52°) and 48° (44°-54°), respectively. In the study group, the preoperative $\alpha$ angles at the affected and healthy shoulders were 49° (46°-52°) and 49° (44°-52°), respectively. At day 45, the corresponding angles were 45° (40°-50°) and 49° (46°-52°). At 6 months, the average $\alpha$ angle of the shoulder operated on was 52° (46°-58°). The $\alpha$ angle value was restored in 5 cases, increased in 9 cases (mean, 8°), and decreased in 6 cases (mean, 3°).

Conclusion: A general symmetry of scapular position was observed during CT scan analysis. This balance was lost initially after the Latarjet procedure, with a decrease of the $\alpha$ angle and scapular protraction. Six months after surgery, a small trend toward scapular retraction was conversely observed; however, the data were not statistically significant.

Level of evidence: Level III, Case-Control Design, Treatment Study.

Keywords: Latarjet procedure; scapular position; glenohumeral instability; CT scan

The Latarjet procedure has emerged in the last few decades as an effective treatment of recurrent anterior glenohumeral instability. The principles of the operation have been explained by Patte, who described its effects as “triple blocking.”\textsuperscript{10} The first mechanism of the Latarjet procedure to treat instability is the increase in glenoid diameter.
created by the bone block. The second stabilizing mechanism is attributed to the fibers of the inferior third of the subscapularis, which resist anterior translation of the humeral head with the arm in abduction and external rotation. The third stabilizing mechanism is the restoration of the integrity of the anteroinferior capsule by suturing of the lateral capsular flap to the medial centimeter of the coracoacromial ligament, which remains attached to the coracoid process. The Latarjet procedure successfully restores glenohumeral stability (recurrence rate <2%), does not limit external rotation, and can address bone lesions of the glenoid rim in patients with recurrent anterior shoulder instability.1,11 The satisfactory results have led several surgeons to propose this operation in high-demand individuals.3,6 In addition, some surgeons advocate performance of the Latarjet procedure by arthroscopic techniques.2,8 However, some concerns still exist about possible intraoperative complications,6 postoperative complications,2,12 arthritic changes in the glenohumeral joint,13 and potential negative effects induced by distorting the normal anatomy (pectoralis minor detachment, coracoid transfer, and subscapularis split).5 The aim of this study was to investigate the effects of the Latarjet procedure on scapular position in the axial plane.

Materials and methods

Twenty consecutive healthy subjects, the control group, underwent bilateral shoulder and upper chest computed tomography (CT) scans to elucidate the position of both scapulae relative to the chest and to the median anterior-posterior axis. All the control group were male with an average age of 22 years (range, 18-27 years). All were prone during evaluation (Fig. 1). An accurate analysis of bone landmarks was necessary to identify reliable references. Proximal cuts where the acromion had a hockey-stick shape (Fig. 2) and distal cuts at the level of the supraspinatus fossa (Fig. 3) did not yield reliable landmarks. However, an intermediate cut, just below the spine of the scapula at the uppermost part of the supraspinatus fossa, yielded consistent reference points (Fig. 4). At this level, a tangent to the posterior profile of the scapular spine was drawn, and the angle between this line and the anterior-posterior axis was calculated (Fig. 5). The angle was called $\alpha$.

Twenty consecutive patients undergoing an open Latarjet procedure for recurrent anterior instability and 20 control subjects were enrolled in this study. All patients were male with an average age of 23 years (range, 17-30 years). The right side was affected in 11 patients. Exclusion criteria were previous surgery on the affected side and diagnosis of hyperlaxity. CT scans were performed on both shoulders preoperatively and at 45 days postoperatively. All the operations were performed according to the original technique modified by Walch2,3,11 by one senior surgeon (G.C.). All patients underwent routine radiographic evaluation consisting of a true anterior-posterior view in neutral rotation and an outlet view the day after the operation to confirm the length and good orientation of the screws and the position of the bone graft. The operative extremity was placed in a sling for the first 15 days after surgery. Passive mobility exercises were allowed starting the first postoperative day. No passive stretching exercises were allowed before the third week postoperatively. One month postoperatively, after healing of the graft was radiographically confirmed, progressive active mobility exercises were initiated. Unrestricted return to activity was allowed at 3 months postoperatively. A final CT scan was performed 6 months after surgery.

All the methods described in this article were approved by the local ethics committee (Health Director of the Villa Betania Hospital in Rome), and all patients gave informed consent to be included in the study.

Statistical analysis

Statistical analysis of the preoperative and postoperative values was performed with the Wilcoxon signed ranks test: XLSTAT 2009 (v. 3.01; Addinsoft, New York, NY, USA) setting the $\alpha$ value at .05.

Results

In the control group, the average $\alpha$ angle was $48^\circ \pm 2^\circ$ for the right shoulder and $48^\circ \pm 3^\circ$ ($P = .867$) for the left shoulder.
In the study group, 11 patients had surgery on the right shoulder and 9 had surgery on the left shoulder. The preoperative $\alpha$ angle was 49° ± 2° for the right shoulder and 49° ± 2° for the left shoulder ($P = .701$). The preoperative $\alpha$ angle for the affected shoulder (right in 11 cases and left in 9 cases) was 49° ± 2°, and the preoperative $\alpha$ angle was 49° ± 2° for the healthy side ($P = .6069$).

At postoperative day 45, the $\alpha$ angle for the unaffected side was 49° ± 2° ($P = .8431$). At the same time, the value of the shoulder operated on was 45° ± 2° ($P = .000$), which corresponded to a decrease of the calculated $\alpha$ angle of 5° ± 3°. At the 6-month CT scan, the $\alpha$ angle was 52° ± 5° ($P = .132$) with an average increase of 3° ± 5°. However, the $\alpha$ angle was restored in only 5 cases, whereas it increased in 9 cases (average increase of 8°) and decreased in 6 cases (average decrease of 3°) compared with preoperative values.

**Discussion**

The Latarjet procedure is a “nonanatomic” reconstruction. Despite the good results reported in long-term follow-up studies, some concerns still exist about the long-term consequences of such a procedure. Until now, no study has evaluated the effects of pectoralis minor detachment, coracohumeral ligament resection, and coracobrachialis muscle transposition. Theoretically, coracohumeral ligament resection should increase humeral external rotation because it is the primary restraint to external rotation with the arm at the side. Nevertheless, a recent meta-analysis demonstrated a loss of external rotation of the arm of 11.7° and 16° after open and arthroscopic Latarjet procedures, respectively. These data are in accordance with those of our series, in which a limitation of external rotation with the arm at the side of 10° was observed.

We hypothesized that transection of the pectoralis minor, which is a protractor and downward rotator of the scapula, may be compensated by the transposition of the coracobrachialis muscle, which now acts in a similar way (downward rotation and protraction of the scapula) and with an increased lever arm (lateral transposition). These variations in the local anatomy may alter the balance between antagonist muscle groups. We expected a prevalence of posterior axial humeral-scapular muscles with a posterior tilt of the scapula (retraction) and increase of the $\alpha$ angle. However, a precise CT scan protocol was necessary to investigate the position of the scapula relative to the chest in the axial plane. To achieve this goal, a CT scan was performed on 20 healthy male subjects. Data from this control group demonstrated symmetry in scapular position between right and left shoulders. Once the method was demonstrated to be easily reproducible, a group of 20 young male patients with recurrent anterior dislocation was enrolled in the study. Symmetry between right and left sides emerged in the study group as well as symmetry between affected and unaffected shoulders. Conversely, a statistically significant trend toward protraction of the scapula was observed on CT scan 45 days after the Latarjet procedure. This protraction may have been the consequence of an antalgic contracture of the pectoralis major in the early postoperative period. Alternatively, it is well established that the rest position of the arm is in adduction and internal rotation. This rest position of the arm, with
prevalence of the internal rotators, may force the scapula into a more protracted position. At the last CT scan, 6 months after surgery, the original scapular position was restored in 5 cases. A small trend toward scapular retraction and an increase of α angle were reported. A wide distribution of values, however, was observed. These data were not statistically significant. Thus, the hypothesis could be confirmed: in the first postoperative period, the pectoralis minor detachment and variation of the vector of the coracobrachialis muscle may contribute to the loss of balance between groups of antagonist muscles. This may result in increased scapular motion in the axial plane. These data may suggest a postoperative physical therapy program aiming at strengthening of the periscapular muscles to improve scapular motion control.

At longer follow-up, once physical activities are resumed, the effect of the Latarjet procedure on the scapular position was not statistically significant. To our knowledge, this was the first study focusing on the effects of the Latarjet procedure on the scapular axial position. However, the study has some limitations. First, the study population is quite small. The present data should be confirmed in larger series to raise definitive conclusions. Second, the present study was focused only on the scapular position in an axial plane. Additional information on the effects on upward and downward inclination of the scapula would be of great interest.

Conclusion

This study demonstrated symmetry in scapular position between right and left shoulders as well as symmetry between affected and unaffected shoulders. This balance was lost in the first weeks after the Latarjet procedure with a decrease of the α angle and consequent scapular protraction. At the latest follow-up, 6 months postoperatively, a small trend toward scapular retraction was conversely observed; however, the data were not significant. We therefore say that the Latarjet procedure has no significant effects on scapular position once normal physical activities are resumed.

Disclaimer

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Dr Simone Cerciello is the son of Dr Giuliano Cerciello.

References