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Original article

Modified Bristow-Latarjet procedure for treatment of recurrent traumatic anterior glenohumeral dislocation☆

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ABSTRACT

Objective: Retrospective case–control study of authors experience in the modified Bristow-Latarjet procedure for treatment of recurrent traumatic anterior glenohumeral dislocation with glenoid bone injury.

Methods: Sample with 102 recurrent glenohumeral dislocation cases submitted to modified Bristow-Latarjet procedure. Indications included situations of recurrent traumatic anterior glenohumeral instability with more than two dislocation episodes and with glenoid bone attritional or fragmentary injuries, without possibility of reconstruction. Mean follow-up time was 5.33 ± 2.74 years (minimum 1; range 1–13).

Results: The mean Walch-Duplay Score at the last evaluation was 91.23 ± 11.46 (range 15–100). The functional score of patients with glenoid bone loss greater than 20% did not show a significant difference in comparison with patients with glenoid bone loss lower than 20% (90 *vs.* 92, respectively). The functional score also did not show a significant difference between sports practice categories and between recreational and competitive practice, being excellent (greater than 90) in every category. There were no dislocation recurrences and the only complications were a case of persistent instability and a screw revision. Mild glenohumeral osteoarthrosis imaging signs were identified in 7.84% of the patients; however, their functional scores were not significantly different in comparison to other patients.

Conclusion: The modified Bristow-Latarjet procedure is a very effective procedure with few complications in the medium-term, showing very satisfactory functional outcomes in the treatment of recurrent traumatic anterior glenohumeral dislocation associated with glenoid bone injury.

☆ Study conducted at Centro Hospitalar e Universitário de Coimbra, Departamento de Ortopedia, Setor do Ombro, Coimbra, Portugal.

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Operação de Bristow-Latarjet modificada no tratamento na luxação glenoumeral anterior traumática recidivante

Palavras-chave:
Articulação glenoumeral
Luxação articular
Luxação do ombro
Procedimentos ortopédicos/métodos

RESUMO

Objetivo: Estudo retrospectivo sobre a experiência dos autores na operação de Bristow-Latarjet modificada como tratamento da luxação glenoumeral anterior traumática recidivante com lesão óssea glenoidea.

Métodos: Amostra com 102 casos de luxações glenoumerais submetidos à cirurgia de Bristow-Latarjet modificada. As indicações foram situações de instabilidade glenoumeral anterior traumática recidivante com número de episódios de luxações superior a dois e com lesão óssea da glenoide erosiva ou fragmentária, sem possibilidade de reconstrução. O tempo de seguimento médio foi de 5,33 ± 2,74 anos (mínimo 1; intervalo 1-13).

Resultados: O escore de Walch-Duplay médio na última avaliação foi de 91,23 ± 11,46 (intervalo 15-100). O escore funcional dos pacientes com lesão óssea da glenoide superior a 20% não demonstrou diferença significativa em comparação com aqueles com lesão óssea da glenoide inferior a 20% (90 *vs.* 92, respetivamente). O escore funcional também não demonstrou diferença significativa entre as categorias de prática desportiva e entre a prática recreativa ou de competição, foi excelente (superior a 90) em todas as categorias. Não se verificou qualquer recidiva das luxações e as únicas complicações observadas foram um caso de instabilidade persistente e uma revisão de um parafuso. Foram identificados sinais imagiológicos de osteoartrose glenoumeral ligeira em 7,84% dos pacientes; no entanto, o escore funcional desses pacientes não demonstrou diferença significativa em comparação com o dos demais.

Conclusão: A cirurgia de Bristow-Latarjet modificada descrita é uma intervenção muito eficaz e com reduzidas complicações em médio prazo, apresenta resultados funcionais muito satisfatórios no tratamento da instabilidade glenoumeral anterior recidivante associada a lesões ósseas da glenoide.

Introduction

The glenohumeral joint is the main joint complex of the shoulder; it is the joint with the highest mobility in the human body, and therefore has a high susceptibility of dislocation and instability. Glenohumeral dislocations are classified according to the position of the humeral head in relation to the glenoid cavity; the anteroinferior direction accounts for 95% of the dislocations.[1,2]

Recurrent glenohumeral dislocations occur when one or more of the active or passive stabilizers of the glenohumeral joint are affected, either by changes in coordination and muscle power of the rotator cuff or deltoid; by lesions of the labrum, ligaments, or joint capsule; or by single or repeated trauma, involving direct or indirect forces.[3] Recurrent glenohumeral instability often causes traumatic bone defects of the glenoid and humeral head, and are responsible for increasing the risk of further dislocations. In a series of 100 recurrent anterior glenohumeral dislocations, Sugaya et al.[4] demonstrated that Bankart capsulolabral lesions were present in 97% of cases and glenoid bone lesions were present in 90% of cases, divided into fragmentary lesions or bony Bankart (50%) and erosion of the glenoid edge (40%). In other series of recurrent anterior glenohumeral dislocations, glenoid bone lesions were observed in 80–90% of the patients.[5–8] The treatment of recurrent glenohumeral dislocation is surgical; the type of procedure depends on the characteristics of the instability, type of underlying lesion, number of dislocations until surgery, age, and level of physical activity practiced and expected.[3,6,7] In order to respond to the broad spectrum of pathological alterations that affect the unstable glenohumeral joint, four groups of procedures have emerged: osteotomies, capsulorrhaphy, labrum repairs, and bone transfers. Within the latter group, the transfer of the coracoid apophysis to the glenoid is the best-known technique, applied worldwide.[9]

In this article, the authors present their experience with a modified Bristow-Latarjet procedure for the treatment of recurrent anterior glenohumeral instabilities and their results.

Material and methods

This is a retrospective series of 102 cases of recurrent glenohumeral dislocations in 102 patients who underwent the modified Bristow-Latarjet surgery performed by the same orthopedic team using the same surgical technique. Indications for this procedure are cases of recurrent traumatic anterior glenohumeral instability with more than two episodes of glenohumeral dislocation and presence of glenoid erosive or fragmentary bone injury, without possibility of reconstruction due to high comminution, reduced size, or

resorption of the bone fragment. All patients previously underwent conservative treatment with immobilization followed by rehabilitation, which was unsuccessful, and the instability persisted. Patients with glenohumeral instabilities with engaging Hill-Sachs lesions, ligament hyperlaxity, instabilities in directions other than the anterior, other pathologies, or previous surgeries of the shoulder in question were excluded. The mean follow-up time was 5.33 ± 2.74 years (minimum: 1; range: 1–13 years). Patients were retrospectively clinically and radiologically evaluated at the final follow-up consultation, and the following information was collected: gender; cause of and age at the first glenohumeral dislocation; activity level and type of sport practiced; dominance and side of the affected shoulder; number of recurrent dislocations; type of dislocation; presence of glenoid or humeral head bone injury (evaluated through simple radiography on anteroposterior, axillary, and scapular Y views, as well as computed tomography and magnetic resonance imaging done in the preoperative period; the percentage of glenoid bone defect was evaluated using the circle method[4]); and the presence or absence of ligament hyperlaxity. The Walch-Duplay functional score was used; it has been validated for the evaluation of situations of glenohumeral instability.[10,11] The sport practiced was classified into five categories according to the risk of glenohumeral dislocation: non-practitioner, without risk (track and field, swimming – breaststroke, diving, leisure gymnastics, rowing, sailing, and shooting), contact sports (judo, karate, cycling, motorcycling, soccer, skiing, water skiing, paragliding, equestrian sports, and surfing), arm-locking sports (swimming – butterfly or freestyle strokes, hockey, golf, tennis, and mountaineering), and high-risk sports (basketball, handball, volleyball, canoeing, and windsurfing). Patients were also evaluated for perioperative complications and level of satisfaction (range: 0–5). In the last follow-up consultation, simple radiography and computed tomography were used to check the presence of non-consolidation signs (persistence of the radiolucent line between the graft and the glenoid), osteolysis or bone block migration, screw loosening failure, and signs of glenohumeral arthrosis (glenohumeral arthropathy classified using the Samilson and Prieto criteria).[12] The variables were statistically analyzed using SPSS, version 23. The Mann–Whitney test was used to compare quantitative variables in two groups; in several groups, the Kruskal–Wallis test was used, as the normality of the sample was not confirmed in the Kolmogorov–Smirnov test. The significance level was set at 0.05. All patients signed the Informed Consent Form and the present study was approved by this institution.

Description of the modified Bristow-Latarjet surgery

The osteotomy of the coracoid apophysis and its transfer along with the insertion of the conjoint tendon to the glenoid neck was first described by Latarjet[13] and later by Helfet.[14] The surgical technique used in this study is a modification of the original techniques and has been used by the Shoulder Department of the University of Coimbra Hospital for 20 years (Fig. 1). The main modifications introduced in the original techniques are described below.

The patient is positioned in a beach chair position. Through a deltopectoral approach (Fig. 1A), the coracoid apophysis and the conjoint tendon inserted in it are identified. The coracoacromial ligament is sectioned at approximately 5 mm from its insertion in the coracoid apophysis; the pectoralis minor is identified, referenced, and sectioned. After adequate exposure of the coracoid apophysis, an osteotomy is performed at its base using a saw, in a position immediately anterior to the insertion of the coracoclavicular ligaments and in a medial to lateral direction (Fig. 1B). Subsequently, the conjoint tendon is isolated and the coracoid apophysis is centrally drilled with a 3.2 mm diameter drill (Fig. 1C). After the long portion of the brachial biceps is identified, a U-shaped incision is made in the subscapularis and the joint capsule (with a medial opening), with the shoulder in lateral rotation. This incision begins at the rotator interval and spares the lower third of the subscapularis, so as to avoid the axillary nerve (Fig. 1D). At this time, the glenohumeral joint is explored; capsulolabral repairs of any lesions identified at this level can be performed. Subsequently, the anterior face of the glenoid neck is exposed and opened, with the creation of micro-holes using a drill. The coracoid apophysis is also opened on its concave face with the use of a drill or saw. The concave surface of the coracoid bone block (concave surface corresponding to the inferior or posterior aspect of the coracoid apophysis at its anatomical site) is then adapted to the convex surface of the anterior aspect of the glenoid neck in the inferior third of the latter and in the extension of its articular face (without passing it laterally). The adaptation of the coracoid-glenoid block should be as congruent as possible; its stability should always be tested intraoperatively after fixation. For fixation, a self-tapping malleolar screw (cancellous bone screw, usually 35-mm long) is used; it is placed in the pre-drilled hole in the center of the coracoid bone block and manually screwed, perpendicular to the glenoid neck and parallel to the glenoid articular surface (Figs. 1E and F). The articular capsule is then closed, reinforced with suture to the coracoacromial ligament, which was previously divided and inserted into the coracoid bone block. The rotator interval is closed and the subscapularis is sutured in neutral rotation, with eventual retention (tensioning) of that muscle if necessary (Fig. 1G). The pectoralis minor is reinserted into the excision zone of the coracoid apophysis, and the deltoid is repaired with separate single sutures after a vacuum drain is placed. After the surgical procedure, the shoulder is immobilized with brachial suspension and thoracic band for three weeks, in order to avoid lateral rotation and allow adequate subscapularis healing. Subsequently, pendular movements of the limb are initiated, and the rehabilitation protocol progresses after radiographic control.

Results

The sample consisted of 102 patients, with a mean age of 26 ± 6.9 years (range 16–47) at the time of the modified Bristow-Latarjet surgery. Most patients (87.3%; $n = 89$) were males and the dominant shoulder was affected in 68.6% ($n = 70$) of the cases. The mean age of the first traumatic anterior glenohumeral dislocation was 24 ± 5.4 years; in 46.08% of the sample, the trauma occurred in a sporting context, and the remainder was divided between car accidents and injuries in activities of daily living. The mean number of episodes of

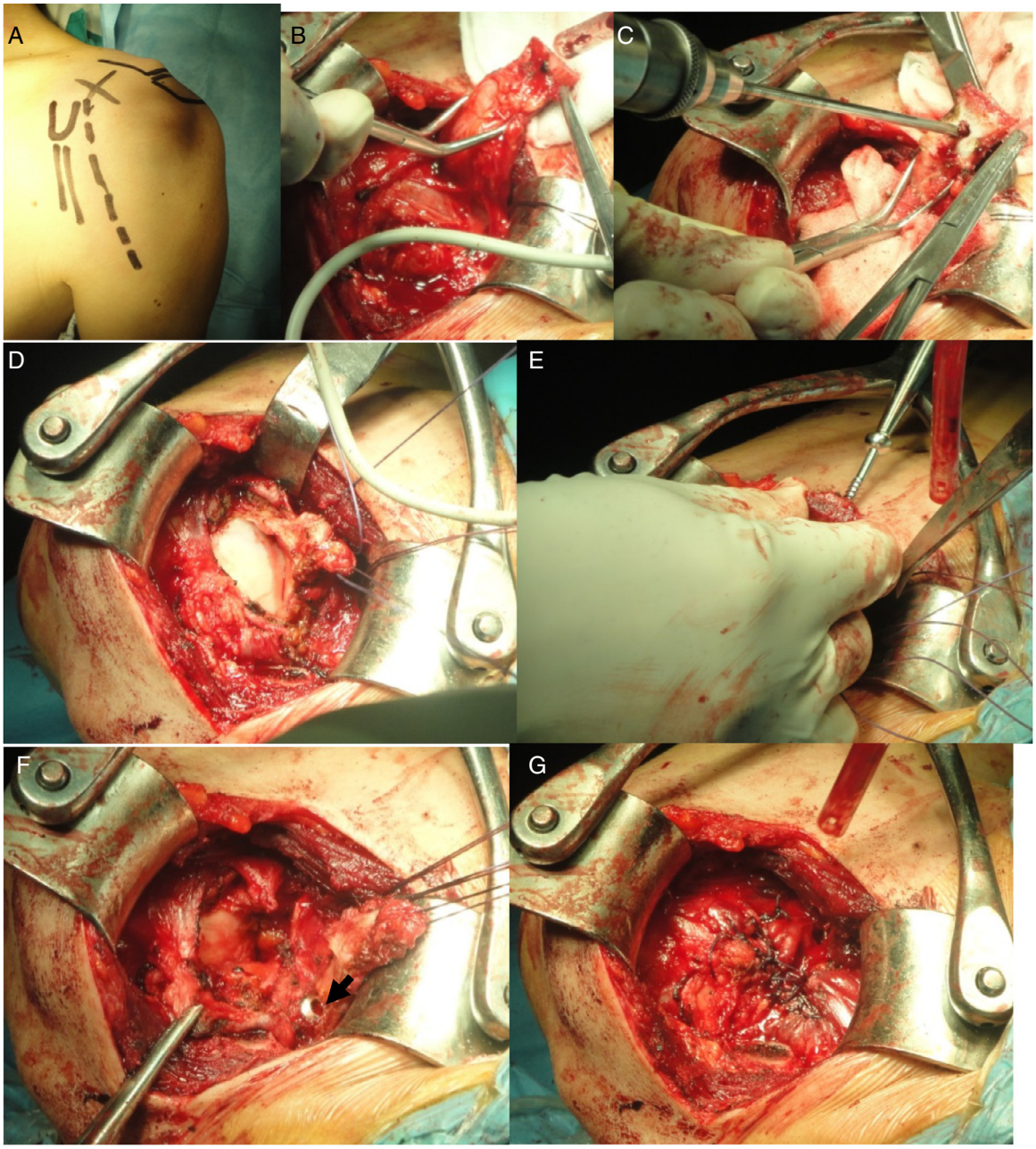

Fig. 1 – Surgical technique. (A) Skin reference markings for the deltopectoral approach; (B) Osteotomy of the coracoid apophysis and isolation of the conjoint tendon; (C) Central drilling of the coracoid apophysis with a 3.2 mm drill bit for the passage of the malleolar screw for fixation to the glenoid; (D) Subscapularis and the joint capsule U-incision; (E) Application of the self-tapping malleolar screw initially at the site of the previous drilling, in the center of the coracoid bone block; (F) Application of the coracoid bone block in the lower third of the glenoid neck, in the extension of its articular face, and fixation with a malleolar screw (arrow); (G) Repair of the subscapularis and of the capsule's previous U-incision.

glenohumeral dislocations until the modified Bristow-Latarjet surgical procedure was 6.07 ± 2.16.

After surgery, no cases of glenohumeral dislocation recurrences were observed. The mean Walch-Duplay score at the last assessment (which corresponded to the follow-up time) was 91.23 ± 11.46 (range 15–100). The score was considered excellent (91–100 points) in 39.22% ($n = 40$) of the patients good (76–90 points) in 52.94% ($n = 54$), fair (51–75 points) in 6.86% ($n = 7$), and poor (less than 50 points) in only one patient. The only patient with a poor result (Walch-Duplay score = 15) after the modified Bristow-Latarjet surgery persisted with a sensation of glenohumeral instability and presented a significant mobility limitation. Due to this poor result, this patient underwent adhesion release, as well as retensioning and resection of the subscapularis and of the capsule, with improved mobility and pain; nonetheless, the glenohumeral apprehension persisted, without any episode of dislocation recurrence. In this sample, all patients presented glenoid bone lesion; however,

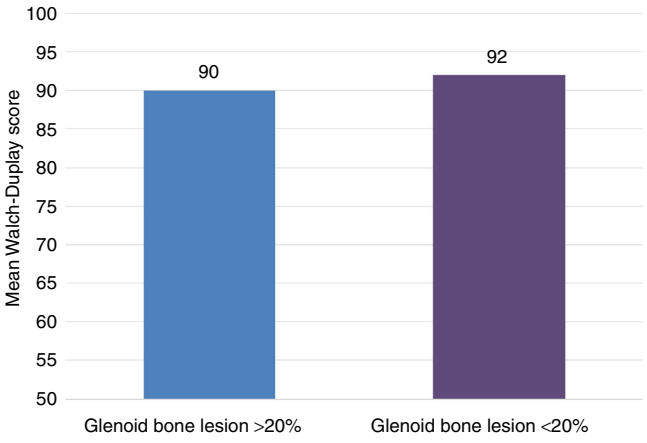

Fig. 2 – Mean Walch-Duplay score according to degree of glenoid bone lesion.

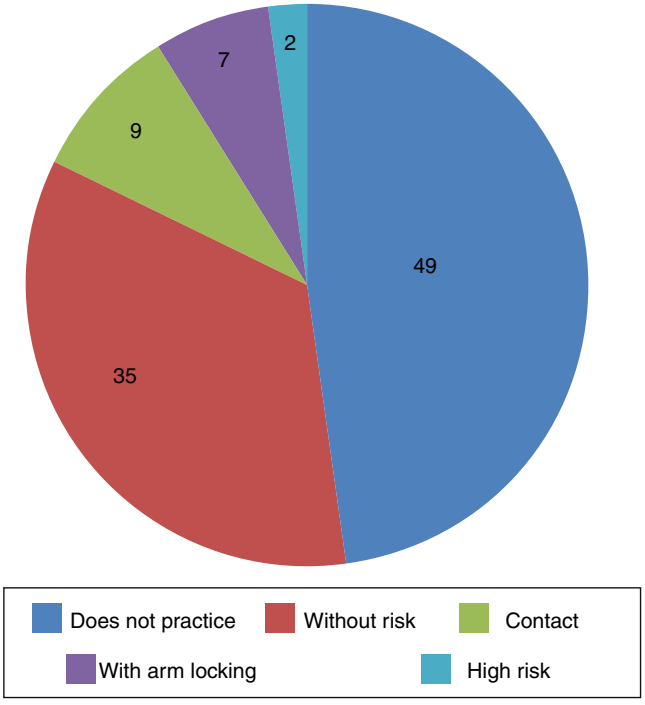

Fig. 3 – Graphical distribution of sports activity level of the sample. The numbers refer to the frequency; *n* = number of individuals.

the glenoid defect exceeded 20% in only 38.24% of the sample ($n = 39$). Hill-Sachs lesions of varying degrees were observed in 72.55% ($n = 74$) of the patients. The functional score in the group of patients with glenoid bone lesions greater than 20% (mean Walch-Duplay score: 90) was not significantly different ($p = 0.38$) than that of the group of patients with glenoid bone lesion smaller than 20% (mean Walch-Duplay score: 92; Fig. 2). The level of sport practiced was stratified into five categories, and the respective frequencies are shown in Fig. 3. Approximately half of the sample (51.96%, $n = 53$) practiced a sport activity, and 37 did so at competitive levels. In all the analyzed categories, the mean of the Walch-Duplay score was always higher than 90 points, which corresponds

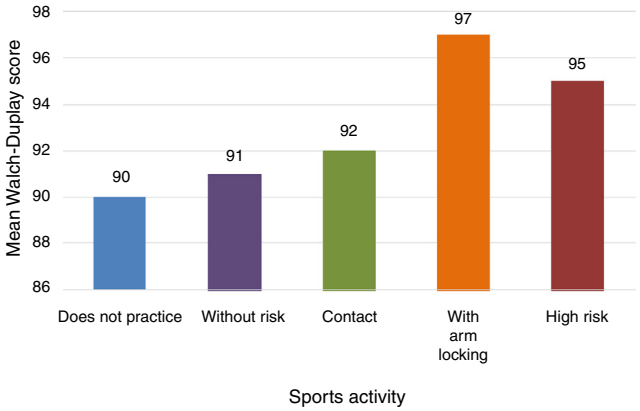

Fig. 4 – Mean Walch-Duplay score according to the sports activity category.

to an excellent result (Fig. 4). Regarding the functional score, no significant differences were observed between the various categories of sports practice and between recreational or competitive practice. The only complications observed were the previously described case of persistent instability and another case in which the graft fixation screw was too long, and had to be replaced with a shorter screw. No other perioperative complications were observed, including lesions of the musculocutaneus or axillary nerves; fixation, consolidation, or osteolysis failure; or necrosis or resorption of the bone block. Imaging signs of mild glenohumeral osteoarthrosis, particularly small inferior glenoid osteophytes, were observed in 7.84% ($n = 8$) of the patients. No significant differences were observed in the functional score when comparing the group of patients with signs of glenohumeral osteoarthrosis (mean Walch-Duplay score: 96) with those without signs of osteoarthrosis (mean Walch-Duplay score: 91). All patients stated that they would undergo a new surgical procedure (mean satisfaction level of 4.61 ± 0.49 with a range of 4–5 on a scale of 0–5), including the patient with a functional score of 15, especially due to the absence of new episodes of glenohumeral dislocation and the functional improvement of the shoulder, which allowed an improvement in the quality of life.

Discussion

Procedures for coracoid apophysis transfer, such as the surgeries described by Latarjet and Bristow, are often indicated in cases of recurrent anterior glenohumeral instability associated with glenoid bone lesion.[13,14] In these procedures, the osteotomy and the transfer of a fragment of the coracoid apophysis are performed together with the insertion of the conjoint tendon into the anterior aspect of the glenoid neck. This has a triple effect that makes it superior to the isolated transfer of other bone blocks: bone stop effect, which increases the diameter of the glenoid cavity; stretching effect on the conjoint tendon in the inferior portion of the subscapularis; and tensioning effect of the joint capsule, preventing excessive anterior humeral translation.[15–17] Before a surgical procedure to treat glenohumeral instability, it is important to identify who are the individuals with higher risk of

instability and recurrent dislocation and what type of surgery to perform, whether a capsulolabral repair or a bone transfer procedure. The three most important factors for selecting a treatment for glenohumeral instability are the degree of glenoid bone lesion, the expected functional level, and the patient's expectations.[6,7,18]

Isolated capsulolabral repair in glenohumeral instability has proven results in cases with minimal glenoid bone loss. However, no randomized prospective studies with a high level of evidence on this subject are available in the literature.[19] Many authors advocate the efficacy of isolated capsulolabral arthroscopic repair in the treatment of glenohumeral instability for situations with glenoid bone loss of less than 15–20%; bone transfer surgeries are preferred only in cases in which the glenoid bone loss exceeds 20–25%.[6,7] Nonetheless, the lower bone defect threshold value for which isolated capsulolabral repair is indicated remains controversial; it has been increasingly considered that this value should not be exhaustive and universal, but rather only one of the parameters of each individual's instability risk profile.[5,7,20,21]

Any glenoid bone lesion is an important risk factor for recurrence of glenohumeral dislocations, and isolated capsulolabral repair has higher recurrence rates than bone transfer surgeries in these patients; the larger the glenoid bone defect, the higher the risk.[5–8,19,22–29]

Boileau et al.[22] demonstrated that a glenoid bone loss greater than 25% predicted 75% of cases of recurrence after isolated arthroscopic capsulolabral stabilization. In turn, Bessière et al.[27] compared 93 patients who underwent arthroscopic Bankart operations with 93 patients who underwent open Latarjet (the groups were comparable, except for the fact that patients undergoing the Latarjet surgery presented more glenoid bone lesions and a higher number of dislocations in the preoperative period) for treatment of post-traumatic anterior glenohumeral instability. Those authors observed that the recurrence rate was twice as high for Bankart operations (22%) when compared with the bone procedure (11%). In addition, they found that recurrences in Latarjet operations occurred predominantly in the first two postoperative years and then decreased, being associated with technical surgical errors, while recurrences in Bankart repairs continued to be observed throughout follow-up.

Several studies have demonstrated an unacceptable glenohumeral dislocation recurrence rate after arthroscopic isolated capsulolabral repair as a treatment of traumatic anterior glenohumeral instability in patients under 20 years of age who practiced competitive or contact sports, or sports with gestures above the level of the head, who presented capsular hyperlaxity and marked bony glenoid or humeral head defects. Those authors concluded that isolated capsulolabral repair is contraindicated in this group of at-risk patients and recommend that, in these cases, the instability should be treated through a bone transfer procedure.[3,6,20–22,24,27] In their series of patients who underwent arthroscopic capsulolabral repair, Mologne et al.[29] demonstrated that recurrences occurred exclusively in patients with erosive glenoid injury, *i.e.*, in those in which it was not possible to incorporate the bone fragment into the glenoid. That study demonstrated the importance of assessing the degree of glenoid bone loss and whether there is a possibility of glenoid bone reconstruction. Those authors concluded that erosive glenoid losses indicate a higher risk of glenohumeral dislocation recurrence and that these cases should be treated with bone transfer surgery, rather than simply isolated capsulolabral stabilization.

The present authors advocate the principle of anatomical reconstruction: the orthopedist, in the presence of a fragmentary glenoid lesion (bony Bankart) with bone fragment that can be incorporated into the capsulolabral repair, should seek an anatomical arthroscopic glenoid reconstruction.[6] Nonetheless, and according to the authors' experience, most of the recurrent traumatic anterior glenohumeral dislocations patients present in the subacute or chronic phase; these cases are most frequently associated with erosive lesions, rarely presenting a bone fragment suitable for glenoid reconstruction. As such, given the importance of glenoid bone loss in glenohumeral biomechanical stability and the impossibility of glenoid reconstruction in most cases of recurrent traumatic anterior glenohumeral instability, the authors advocate that the Bristow-Latarjet surgery is the most indicated procedure in most patients with this pathology, particularly in those who present other risk factors for concomitant instability. Although it is a non-anatomical technique whose primary objective is to avoid more episodes of glenohumeral dislocations, and despite the fact that it has been associated in some studies with the early development of glenohumeral osteoarthrosis and limitations of shoulder mobility, it is an effective and safe procedure, with low rates of complications and recurrences that often allows very satisfactory functional results in the medium and long terms. Several studies have shown that their functional results are superimposable to those of the anatomical techniques of capsulolabral repair and that they are more effective than the latter in reducing recurrences.[1,3,6,7,13–16,20–28,30] Bessière et al.[27] observed significantly higher functional levels in patients undergoing Latarjet surgeries (mean Rowe score: 78) when compared with those undergoing Bankart arthroscopic repair (mean Rowe score: 68; $p = 0.018$). The authors acknowledge the role of isolated capsulolabral repairs in the treatment of glenohumeral instability; however, they recommend caution in its application and the imperative need of a detailed study of the patient's risk profile before proceeding with this procedure, particularly in cases of glenoid bone loss without possibility of reconstruction. Several studies have reported that the Bristow-Latarjet surgery is indicated and should be performed only in cases of glenoid bone lesion greater than 20–25%; however this procedure has proven efficacy and is a valid functional option for the surgical treatment of recurrent traumatic anterior glenohumeral dislocation with varying degrees of glenoid bone defect.[1,6,7,13,14,16,20,28,30] The present study confirmed this last statement, insofar as no significant differences were observed in the functional score between patients with bone lesion of the inferior glenoid greater than or lower than 20%; furthermore, no functional or recurrence differences were observed among the various groups of participants stratified by levels of activity.

In light of the recurrence rates observed in isolated arthroscopic capsulolabral repair in instabilities associated with

glenoid bone lesions, and considering the efficacy, functional results, and the absence of recurrences in this study with 102 patients who underwent the modified Bristow-Latarjet operation, the authors recommend its application to situations of recurrent traumatic anterior glenohumeral instability with erosive glenoid bone lesions of any degree. Given the very satisfactory functional results (and even superior to several series with isolated capsulolabral repairs in instabilities without bone defects); the absence of recurrences; and the reduced rate of complications and development of glenohumeral osteoarthrosis, regardless of the degree of sports practice, the authors believe that this surgical procedure to be an excellent option for the treatment of these patients. Thus, patients in the second and third decades of life, involved in risky sports and with erosive glenoid bone lesions or without adequate bone fragments for glenoid reconstruction, are the ideal candidates for bone transfer surgery; an isolated capsulolabral repair would not be sufficient for the resolution of instability. Nonetheless, the increase in the follow-up time of the present study may lead to the identification of more cases that are typically observed in the long term with signs of glenohumeral osteoarthritis and other complications.[15,23,30]

The authors consider that the very satisfactory results and the reduced rate of complications observed in the present study may be related to the long experience of this surgical team and the modifications introduced in the original surgical technique, particularly in terms of bone block fixation, subscapularis approach, and the glenohumeral stability obtained. The U-opening of the subscapularis, preserving its lower third, allows an excellent visualization of the glenoid and minimizes the risk of injury to the axillary nerve. Moreover, the lower aggressiveness of this incision in the subscapularis when compared with its deinsertion in the original technique may also be responsible for the very satisfactory functional results and mobility of the operated shoulders.[13] If necessary, in cases of a lax articular capsule that still allows some abnormal mobilization of the humeral head after closure, this muscular incision also allows a subscapularis shortening or retention, a very important factor that ensures glenohumeral stability and reduces the risk of dislocation recurrence. The adaptation of the concave surface of the coracoid bone block, corresponding to the inferior or posterior aspect of the coracoid apophysis at its anatomical site, allows a more congruent adaptation to the convex surface of the lower third of the glenoid. The fixation is usually performed using a self-tapping malleolar screw after adequate roughing up of the glenoid coracoid bone block surfaces, in order to stimulate the consolidation of the bone transfer. The authors consider this fixation method to be simple, inexpensive, stable, and efficient, as observed in the present study, in which no cases of fixation failure were observed.

The main limitations of the present study were its retrospective nature, which did not allow a rigorous preoperative functional evaluation, a short follow-up period, and a non-normal data distribution, which required the use of non-parametric tests. In turn, the fact that the surgeries were all performed by the same team of orthopedists using the same surgical technique reduced some biases arising from these factors.

Conclusion

The present study demonstrated that, in the medium-term, the modified Bristow-Latarjet surgery is a very effective and safe procedure with reduced complications, presenting very satisfactory functional results in the treatment of recurrent anterior glenohumeral instability associated with glenoid bone lesions.

Conflicts of interest

The authors declare no conflicts of interest.

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