Knee Surg Sports Traumatol Arthrosc (2008) 16:872–875
DOI 10.1007/s00167-008-0541-y

SHOULDER

An arthroscopic bone graft procedure for treating anterior–inferior glenohumeral instability

E. Taverna · P. Golanò · V. Pascale · F. Battistella

Received: 1 February 2008 / Accepted: 1 April 2008 / Published online: 7 June 2008

Abstract The purpose of this study is twofold: to present an arthroscopic method for treating anterior–inferior glenohumeral instability, and to evaluate its feasibility in a cadaveric model. This arthroscopic technique was performed in ten fresh frozen cadaver shoulder specimens. Quality of the results following the procedure were evaluated subjectively by assessing how the bone block graft was placed respect glenoid rim. We also evaluated adjacent axillary nerve and the neuro-vascular structures medial to the coracoid. We had six 'good' results, two 'fair' results, and two 'poor' results. The present study indicates that an anterior bone graft procedure for treating anterior bone defects of the glenoid in anterior inferior shoulder instability can be successfully performed. The worst results occurred during our first five procedures, suggesting a learning curve. However, the learning curve doesn't appear to be steep, as the good results gained in the last five procedures confirm.

Keywords Glenohumeral instability · Bone block · Anterior inferior instability

E. Taverna (✉) · V. Pascale · F. Battistella
Department of Shoulder Surgery,
IRCCS Istituto Ortopedico Galeazzi,
Via R. Galeazzi 4, 20161 Milan, Italy
e-mail: taverna@shoulder.it

V. Pascale
e-mail: valerio.pascale@fastwebnet.it

P. Golanò
Department of Anatomy, University of Barcelona,
Barcelona, Spain

Introduction

The etiology of anterior–inferior glenohumeral instability is multifactorial. Successful treatment of this condition requires that any surgical approach be sufficiently flexible to allow the surgeon to identify and repair the relevant lesions which may be causing shoulder instability. At present, anterior–inferior shoulder instability associated with lesions in soft tissue can be successfully treated arthroscopically and clinical outcomes are generally similar to those found after an open procedure. The major risk of recurrent instability after an arthroscopic procedure compared with an open procedure is related to the presence of additional bony defects of the glenoid. However, when the source of shoulder instability is thought to be a bony defect of the anterior–inferior glenoid, an open procedure such as that those described by Bristow, Latarjet, and Gerber [1–3], is commonly employed. To our knowledge, no arthroscopic method has been reported describing how to address glenohumeral instability associated with a bony defect. The purpose of this technical note is twofold: to present an arthroscopic method for treating anterior–inferior glenohumeral instability, and to evaluate its feasibility in a cadaveric model.

Surgical technique

The cadaveric shoulder joint is entered posteriorly in standard arthroscopic fashion. Using an out-in technique, a 10-mm cannula is placed anterior–inferior ly and a 5.5-mm cannula is placed anterior-superiorly. The anterior capsuloligamentous complex is detached from the glenoid at the 2–6 o'clock position until it is possible to see the subscapularis muscle from the posterior portal and the entire glenoid neck from the anterior-superior portal. Using a motorized bur, the anterior glenoid is shaved to make its top half wider than its lower half (inverted pear shape). At this point, a bone block measuring 1 cm by 2 cm is harvested from a fresh frozen cadaver knee specimen. It is collected from the anterior tibial apophysis, immediately inferior to the patellar tendon insertion. However, for a patient procedure we consider the tricortical iliac crest graft the best choice. The harvested bone block is pierced with a 1 mm Kirschner wire approximately 0.5 cm from the edge to create two holes exactly in the middle of the graft (Fig. 1). The arthroscope is shifted into the anterior-superior portal and two suture anchors are placed 1 cm apart, 0.5 cm medial to the glenoid rim and centered over the previously created bone defect (Fig. 2a, b). For both anchors, one limb of the suture is retrieved from the posterior cannula, and the other from the 10 mm anterior–inferior cannula. The two suture limbs threaded through the anterior–inferior cannula are passed through each of the two holes of the bone block graft. The bone block is then rotated to 90 degrees, with respect to the sutures coming out of the cannula, and sutures are passed through the cannulated trocar of the cannula. Under direct arthroscopic visualization, the bone block graft is inserted through the cannula with the cannulated trocar and introduced into the joint (Fig. 3). By keeping the two anterior sutures under gentle tension, the bone block graft is approximated exactly into the anterior–inferior section of the glenoid (Fig. 4a, b). At this point, the four limbs of the suture anchors are retrieved from the posterior portal while maintaining gentle tension to keep the bone block adherent and parallel to the anterior glenoid neck and aligned with the glenoid rim.

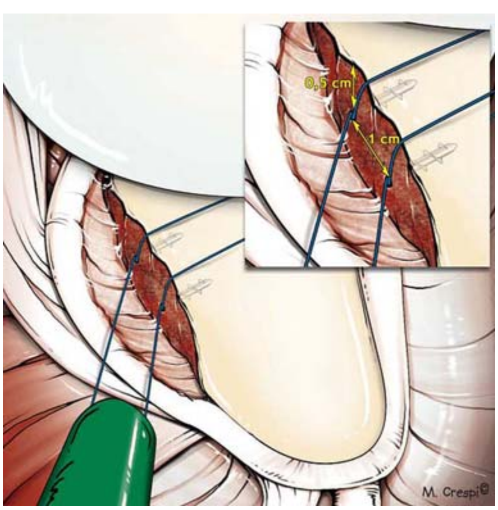

Fig. 1 Two suture anchors are placed along the bone defect, 1 cm apart and 0.5 cm medial to the glenoid rim

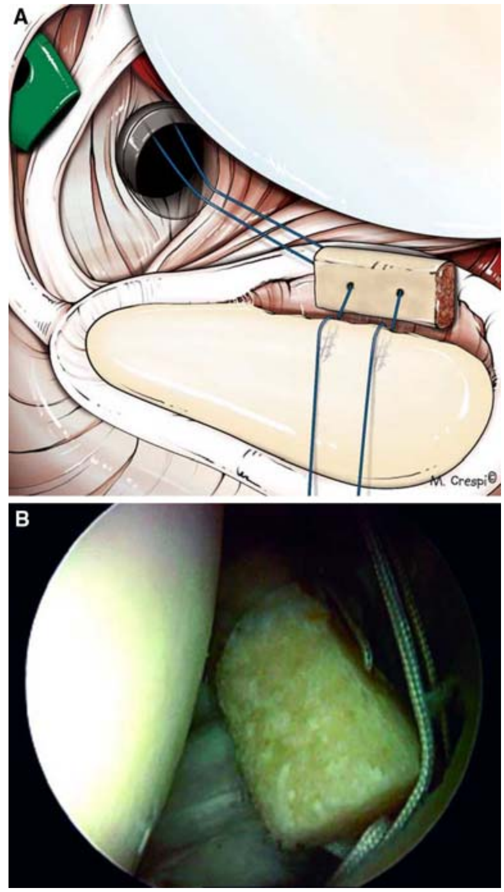

Fig. 2 By keeping the two anterior sutures under gentle tension, the bone block graft is pushed along the sutures and approximated exactly into the anterior–inferior section of the glenoid

After completing retrieval of the suture limbs, a 2 mm Kirschner wire is introduced percutaneously through the subscapularis muscle, as if it were going through a 5 o'clock port, to completely pierce the bone block at its mid-point and into underlying the glenoid neck. To prevent the bone block from rotating while introducing the Kirschner wire, the sutures are gently tensed and a probe, introduced through the anterior–inferior cannula, is used to stabilize the structure. At this point two additional 1 mm diameter Kirschner wires are introduced in similar fashion through the bone block, immediately inferior to the superior sutures, and immediately superior to the inferior sutures (Fig. 5a–c). Placement of the graft is evaluated as the perfect alignment between the plane of the bone graft and the plane of the glenoid with no medial or lateral displacement. Referring to the 1 mm Kirschner wires for guidance, a hole is created through the bone block and underlying glenoid using a 2.5 mm cannulated drill. In the same manner, two 3.5 mm diameter half-threaded cannulated screws, measuring 35 mm in length, are also introduced. The solidity of the graft is assessed using an arthroscopic probe. The three Kirschner wires and the

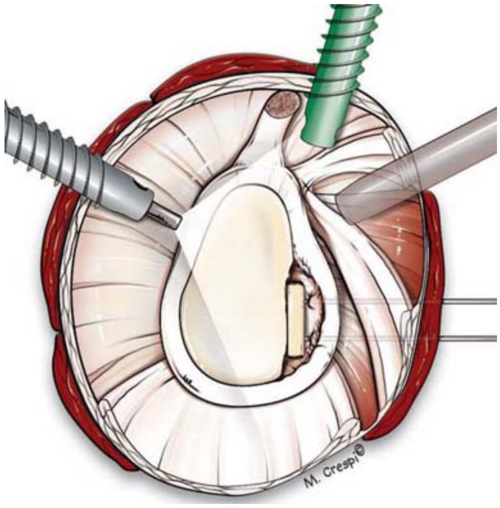

Fig. 3 Two 1 mm Kirschner guide wires are drilled percutaneously through the subscapularis muscle and then through the bone block and glenoid

anchor sutures that had been placed on the glenoid neck are removed. Three suture anchors are then placed along the glenoid rim at the 3, 4, and 5 o'clock positions, allowing an anterior–inferior capsuloligamentous plication.

Methods

Ten fresh frozen cadaver shoulder specimens were obtained for performing an anterior arthroscopic bone graft. The same surgical technique was conducted in all ten cases. Results were assessed by anatomically dissecting treated specimens. Quality of the results following the procedure were evaluated subjectively by assessing placement of the bone block graft and condition of the adjacent axillary nerve and the neuro-vascular structures medial to the coracoid. The result was considered 'good' when the graft was found perfectly attached to the glenoid rim, with no medial or lateral displacement of the graft upon the plane of the glenoid rim. The result was considered 'fair' when the graft was found to be medially malaligned by 1 mm or less and 'poor' when the graft was medially misaligned by more than 1 mm, laterally misaligned, broken, or rotated. Whenever nerve or vascular damage was observed, the results were considered 'poor', regardless of the graft position.

Results

In this series of ten procedures, we had six 'good' results, two 'fair' results, and two 'poor' results. In the cases with 'poor' results, one graft was broken and one was rotated. We found that results improved over time; the four cases with 'poor' and 'fair' results were among the first five consecutive procedures, while the last five consecutive cases were considered good.

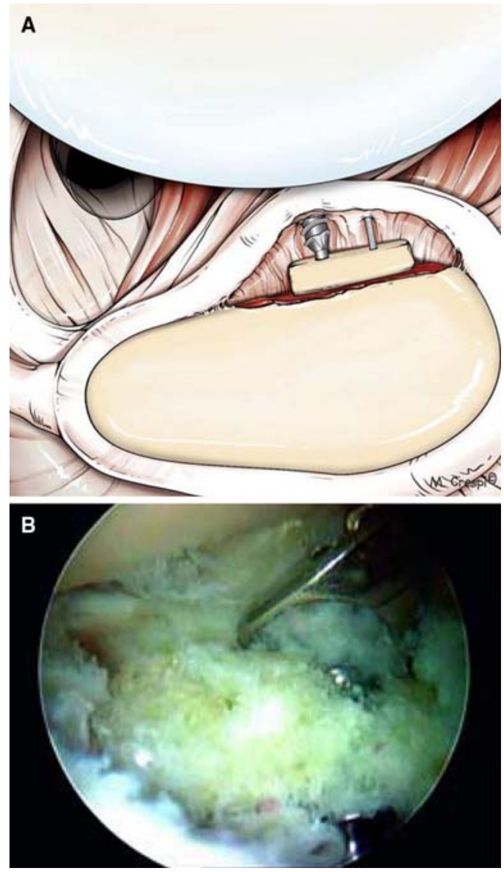

Fig. 4 Two 3.5 mm diameter half-threaded cannulated cortical screws, measuring 35 mm in length, are advanced down each guide pin to secure the bone block to the glenoid

Discussion

Literature shows very good results in treating anterior glenohumeral instability by open procedures [1–3].

Operative techniques have recently advanced sufficiently so that the shoulder surgeon can successfully repair anterior–inferior glenohumeral instability arthroscopically [4–6]. Optimally however, the arthroscopic surgeon should be able to address all clinically relevant lesions, including bony defects by incorporating techniques that allow restoration of both the anatomy and biomechanical function of damaged structures [7].

The proposed advantages of using arthroscopic means for surgically stabilizing the damaged joint include smaller incisions with less soft tissue dissection,

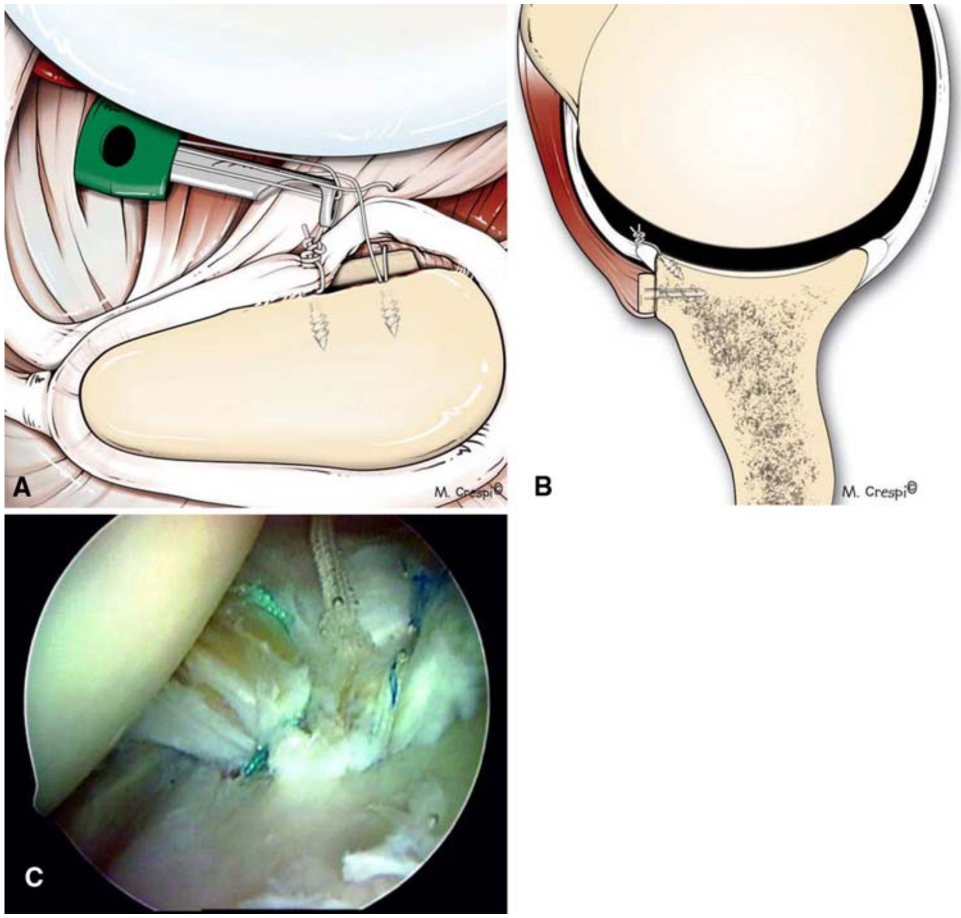

Fig. 5 **a** Suture anchors are placed along the glenoid rim allowing an anterior–inferior capsuloligamentous plication. **b** Labral tissue is attached to the glenoid and not to the bone block. **c** Final repair

improved ability to completely inspect the glenohumeral joint and access all areas of the joint for repair, and potentially, maximum preservation of external rotation. The greatest disadvantage of the arthroscopic procedure is the inability to successfully treat significant structural bone defects.

The present technical note indicates that an anterior bone graft procedure can be successfully performed on cadaveric shoulders using an arthroscopic technique in the laboratory setting using standard techniques and instrumentation. The four non-optimal results occurred during our first five procedures suggest a learning curve. However, it does not appear to be lengthy or steep, as confirmed by the consecutive good results we achieved in the latter five cases.

Limitations of this study include a small sample size and the possibility to assess the quality of the results only after anatomical dissection of the specimen. However, we were successful in describing an arthroscopic technique for treating glenohumeral instability corresponding to a significant bone deficit, and provided a cadaveric series that supports its feasibility. Further studies need to be conducted to quantify the results, using validated outcome measures, in the clinical setting.

References

1. Latarjet M (1965) Techniques chirurgicales dans le traitement de la luxation anterointerne 1 recidivante de l'épaule. Lyon Chir 61:313–318
2. Helfet AJ (1958) Coracoid transplantation for recurring dislocation off the shoulder. J Bone Joint Surg Br 40:198–202
3. Gerber C (1997) Symposium on shoulder instability. American Academy of Orthopaedic Surgeons Annual Meeting. San Francisco
4. Bacilla P, Field LD, Savoie FH (1997) Arthroscopic Bankart repair in a high demand athletic population. Arthroscopy 13:51–60
5. Rowe CR, Patel D, Souyhmayd WW (1978) The Bankart procedure. A long-term end-result study. J Bone Joint Surg Am 60:1–16
6. Gartsman GM, Roddey TS, Hammerman SM (2000) Arthroscopic treatment of anterior–inferior glenohumeral instability. J Bone Joint Surg Am 7:991–1003
7. Burkhart SS, De Beer JF (2000) Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: significance of the inverted-pear glenoid and the humeral engaging Hill–Sachs lesion. Arthroscopy 16:677–694