

Arthroscopic Acute Bony Bankart Repair in Lateral Decubitus



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Abstract: The optimal management of anterior shoulder instability continues to be a challenge. The presence of an anterior glenoid rim fracture in the context of a glenohumeral dislocation, also called “bony Bankart lesion,” can alter therapeutic behavior. Reduction and fixation of the bone fragment has been shown to greatly reduce the risk of recurrence once bone consolidation is achieved. However, there is no gold standard surgical technique. Stability of fixation and the healing of the bony fragment are still a concern, and there are no clinical studies comparing the different techniques to date. The aim of this report is to describe an arthroscopic double-point fragment fixation technique in lateral decubitus for the treatment of an acute traumatic shoulder dislocation with a bony Bankart lesion.

The presence of an anterior glenoid bone defect, also called “bony Bankart lesion,” is a critical prognostic factor for therapeutic decision-making in the context of glenohumeral instability.¹ A special group of patients consists of those who suffer a fracture of the anterior glenoid rim caused by the traction of the capsulolabral complex at the time of dislocation. The initial diagnosis and evaluation may be difficult in the acute episode, as conventional radiographs have low sensitivity. Reduction and fixation of the bone fragment have been shown to greatly reduce the risk of recurrence when bone consolidation is achieved.²⁻⁶ Conversely, not treating the lesion properly can lead to malunion or nonunion and progressive reabsorption of the fragment, generating a major bone defect and thereby favoring recurrences.^{7,8}

The treatment of these lesions has evolved since the first reports of reduction and fixation with screws through open surgery. While different techniques have been described within the scope of open and

arthroscopic approach, the stability of fixation and the healing of the bony fragment are still a concern and there is currently no gold standard.^{3,9-13}

The aim of this report is to describe a double-point fragment fixation technique with an arthroscopic approach, in lateral decubitus, for the treatment of an acute traumatic shoulder dislocation with a bony Bankart lesion. We believe that positioning the patient in lateral decubitus can improve joint visualization and facilitate the procedure. On the other hand, making 2 pulleys with 2 fixing points could allow a more stable construction and greater interfragmentary compression.

Preoperative Evaluation

The preoperative clinical assessment begins with a standard history surrounding the mechanism of injury, previous episodes of instability, and documentation of any previous surgical interventions. Patient sport level and work intensity are registered. This is followed by a physical examination, including tests of instability (e.g., apprehension, relocation, load-and-shift, and sulcus tests). Active and passive shoulder motion, including forward flexion, external rotation at the side, and internal rotation to the back, are measured.

Imaging

All patients are studied with standard anteroposterior and lateral radiographs of the shoulder (Figs 1A and 1B), magnetic resonance imaging, and computed tomography scan with 3-dimensional reconstructions of the glenoid with subtraction of the humeral head (Figs 1C and 1D).

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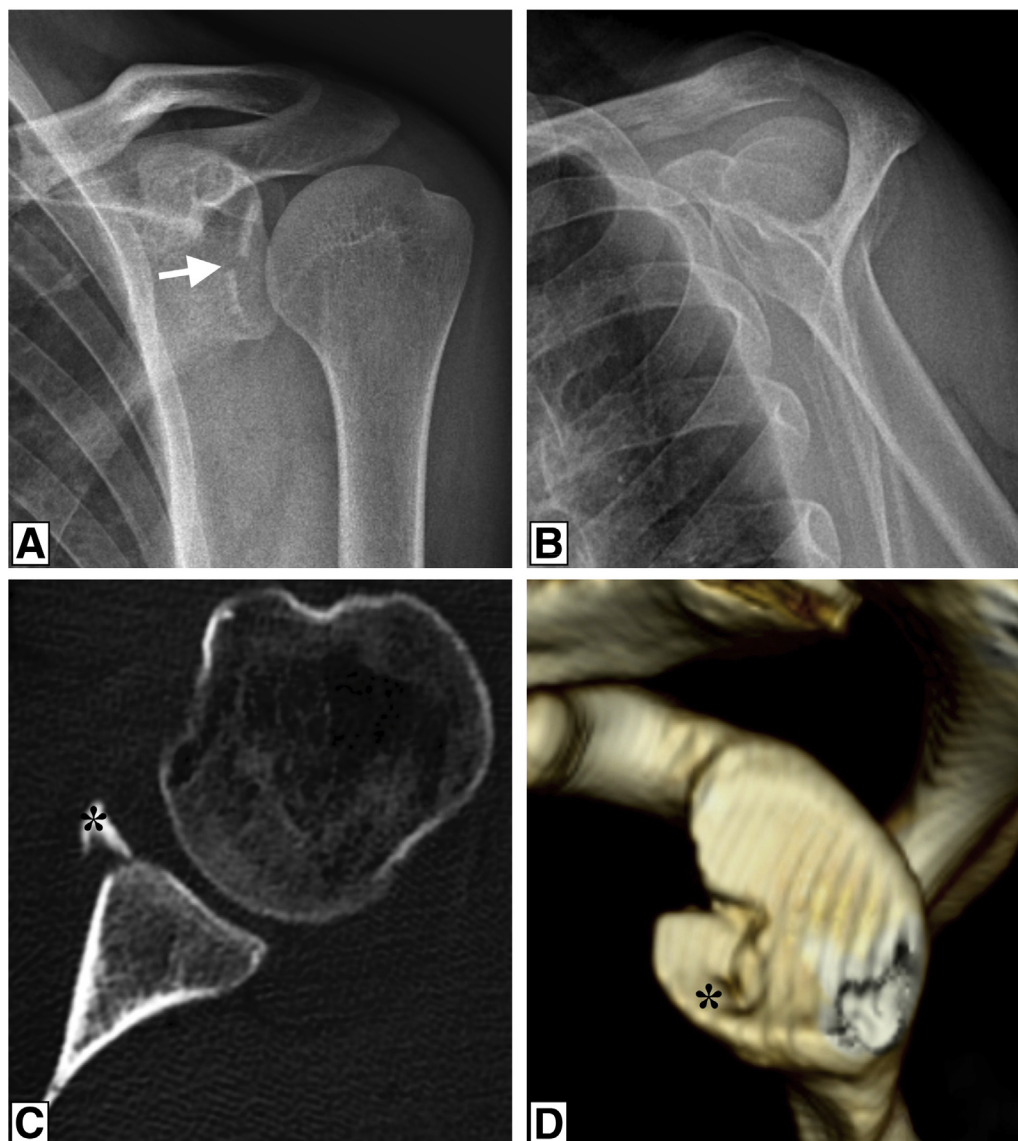


Fig 1. Preoperative anteroposterior (A) and lateral (B) radiographic views of the right shoulder showing an anterior glenoid rim fracture (white arrow) and 3-dimensional computed tomography scan on the axial plane (C) and an oblique 3-dimensional sagittal plane with humeral subtraction (D) showing a bony Bankart lesion of the anteroinferior glenoid rim with a displaced bulky fragment (*). 24% of the joint surface is affected.

These images assist in the decision-making process regarding attempted fixation of a bone fragment versus bone reconstruction. Bone loss, fragment comminution, and displacement are evaluated and recorded.

Indications

The presented technique is suggested for active patients suffering from an acute displaced anterior glenoid rim fracture-avulsion with a reducible bone fragment. It is not recommended in cases of a comminuted fracture or in those cases in which the bone fragment is partially or totally reabsorbed.

Surgical Technique (With Video Illustration)

A detailed technique of the procedure is shown in [Video 1](#).

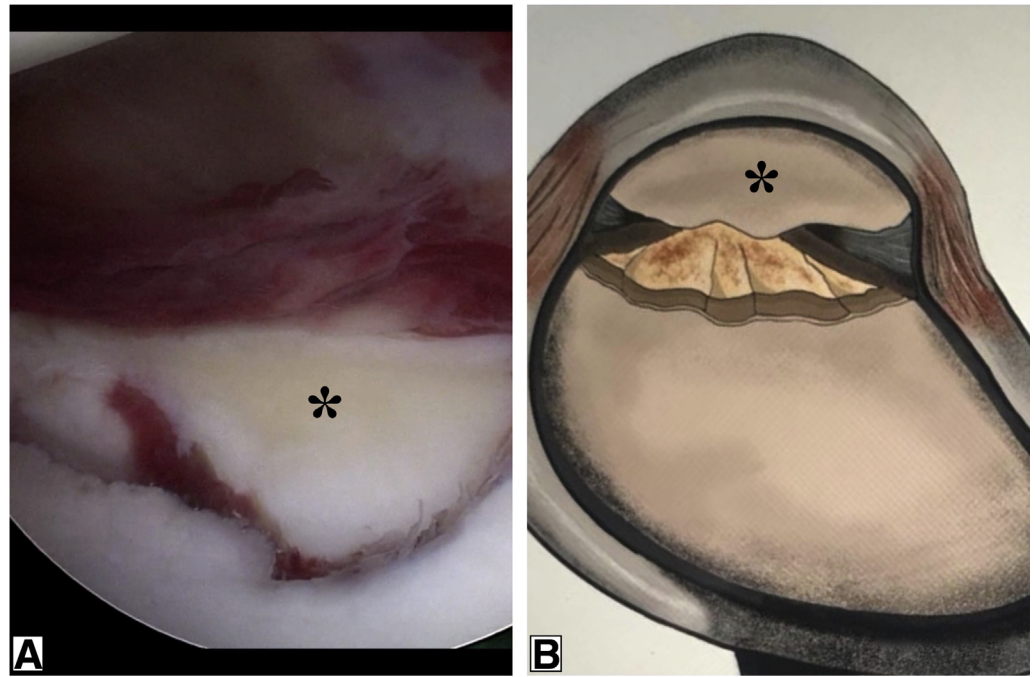
Anesthesia and Patient Positioning

The surgery is performed with an ultrasound-guided interscalene block and general anesthesia. The patient is secured in lateral decubitus with the arm under traction of 5 kg and the head in proper position to avoid traction at the level of the brachial plexus. Careful attention is paid to pad all bony prominences, including the peroneal nerve at the knee. The shoulder is prepared and draped in the usual sterile fashion.

Surgical Approach

A posterior portal is created 2 cm distal and medial to the posterolateral corner of the acromion. The glenohumeral joint is examined, looking for secondary lesions, and the presence of bony Bankart injury is confirmed ([Fig 2](#)). In the acute setting, the amount of glenoid articular bone loss typically correlates with

Fig 2. Arthroscopic photograph (A) and illustration (B) of the left shoulder from the posterior portal in lateral decubitus showing a bony Bankart lesion (*).



fragment size. The anterosuperior portal is then placed with an “outside-in” technique with a spinal needle in the rotator interval, just below the insertion of the biceps. A cannula could be placed in this portal as retrieving and handling anchor sutures could be difficult. We prefer not to use cannulas, as they limit mobility and add a higher economic cost. Through the anterosuperior portal, an angled elevator is introduced to mobilize the fragment (Fig 3A). This working portal allows a more parallel access to the fracture and the glenoid neck than the anterior portal. The fracture hematoma is then evacuated with a shaver and scar tissue is released to obtain a bleeding cancellous bed. Care should be taken during this release to preserve the

attachment of the inferior glenohumeral ligament complex to the fragment and to avoid further comminution of the bony fragment. Anatomical reduction of the fragment is then tested with a grasper. The antero-inferior portal is then established just above the subscapular tendon and 1 cm medial to its humeral insertion (Fig 3B). It is important to maintain the distance between the 2 anterior portals. With the help of a switching stick, the arthroscope is passed to the anterosuperior portal, where a global view of the glenoid and the fracture could be obtained (Fig 4). Two double-loaded anchors (3-mm PEEK SutureTak anchor containing two No. 2 FiberWire sutures [FiberWire; Arthrex, Naples, FL]) are placed on the medial edge in

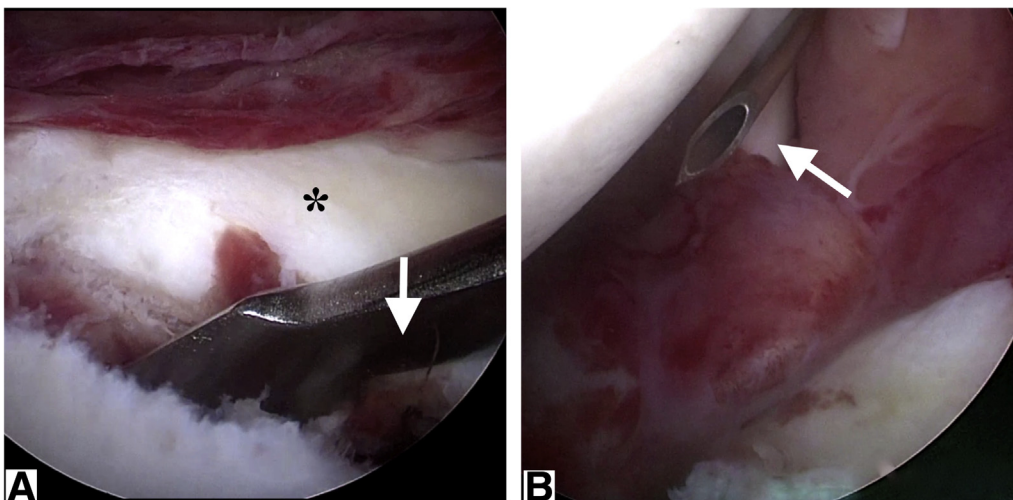


Fig 3. Arthroscopic photographs of the left shoulder from the posterior portal in lateral decubitus. (A) An angled elevator (white arrow in A) is introduced through the anterosuperior portal to mobilize the fragment (*). (B) An antero-inferior portal is established just above the subscapular tendon (white arrow in B) and 1 cm medial to its humeral insertion using an outside-in technique with a spinal needle.

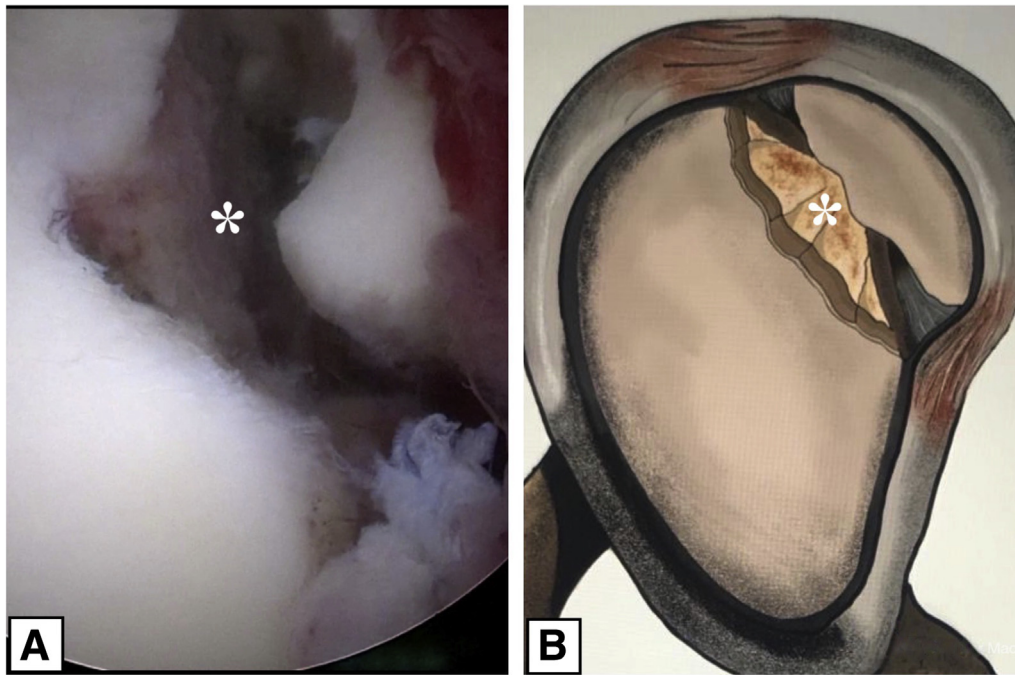


Fig 4. Arthroscopic photograph (A) and illustration (B) of the left shoulder from the anterosuperior portal in lateral decubitus showing a global view of the glenoid and the fracture (*).

the glenoid neck along the rim fracture through the anteroinferior portal (Fig 5). For the sutures passage, the vision portal is changed back to the posterior one and the sutures are rescued with a grasper through the anterosuperior portal. Through the anteroinferior portal, a 45° angled suture-passing device (SutureLasso; Arthrex) loaded with a nitinol loop is introduced and

passed around the bone fragment through the capsulolabral complex (Fig 6A). Two different-colored suture limbs of the lower anchor are retrieved and passed through the tissue (Fig 6B). This step is repeated for the remaining 2 suture limbs of the inferior anchor with a separation of 5 mm and then with both pairs of free suture limbs from the upper anchor (Fig 7). Sutures are

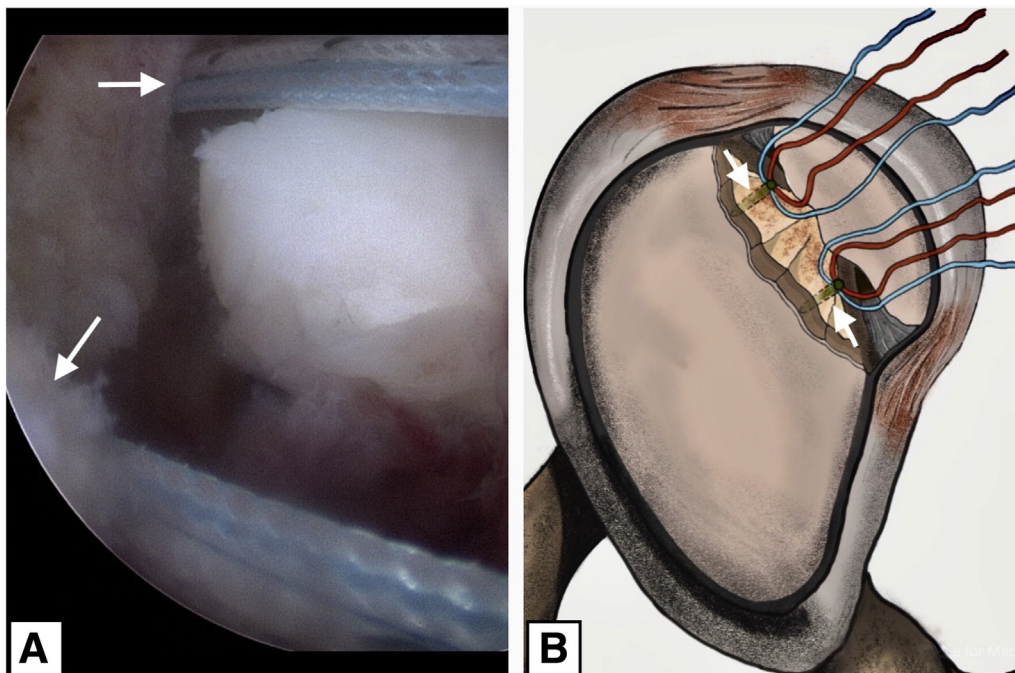


Fig 5. Arthroscopic photograph (A) and illustration (B) of the left shoulder from the anterosuperior portal in lateral decubitus. Two double-loaded anchors (white arrows) are placed on the medial edge in the glenoid neck along the rim fracture through the anteroinferior portal.

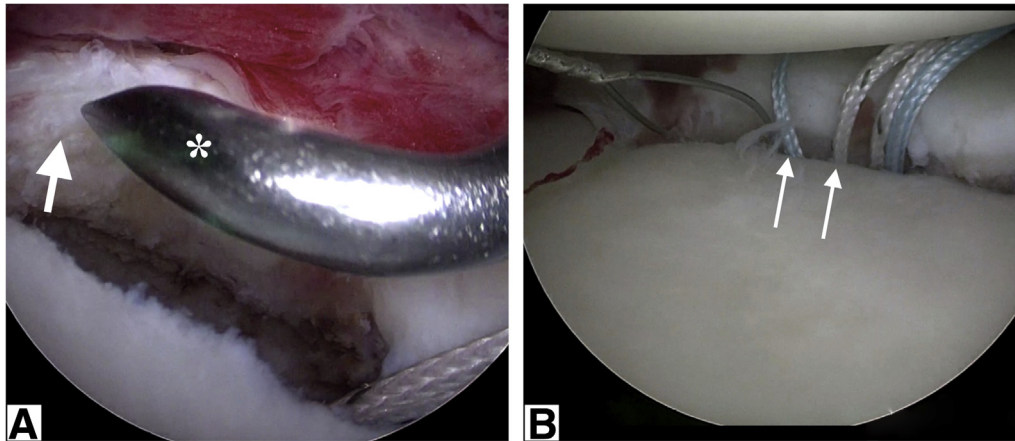


Fig 6. Arthroscopic photographs of the left shoulder from the posterior portal in lateral decubitus. (A) A 45° angled suture-passing device (left curve) loaded with a nitinol loop (*) is introduced through the anteroinferior portal and passed around the bone fragment (white arrow in A) through the capsulolabral complex. (B) Two different-colored suture limbs (white arrows in B) of the lower anchor are retrieved and passed through the tissue.

then retrieved through the anterosuperior portal to maintain suture organization. Two same color suture limbs of the inferior–medial anchor are recovered using the anterior portal and preloaded through the eyelet of a 2.9-mm PEEK PushLock anchor (Arthrex). The drill hole is placed on the glenoid face at the cartilage–fracture margin (Fig 8). The anchor is inserted until its body contacted bone, maintaining tension of the sutures. If additional tension is needed to reduce the bone fragment, suture tails should be pulled on, while keeping a firm grasp of the driver. The final tension is attained when the anchor is in contact with the bone. The limbs of the suture threads are then cut flush using a suture cutter (Fig 9). This step is repeated with the same color pair of sutures of the upper medial anchor. Anatomic fragment reduction and adequate interfragmentary compression are finally verified with a probe (Fig 10A). If the fixation obtained is satisfactory, the remaining sutures can be removed and the surgery is finished. If not, the remaining 2 threads from the inferior anchor should be retrieved through the same portal and a sliding knot should be made to finish the reduction of the fragment by compressing it against the neck of the glenoid (Fig 10B). This step is repeated with the 2 remaining sutures of the upper anchor.

Technical pearls of our technique are summarized in Table 1. Advantages and disadvantages are summarized in Table 2.

Surgical Risks

Regarding the positioning, the most commonly reported complication in the lateral decubitus position is neurologic injury, which can be due to excessive strain on the brachial plexus, as a result of intraoperative traction, or due to external nerve compression.¹⁴ Care should be taken to ensure that the minimum traction necessary to visualize the joint is applied and to

guarantee that the patient's head and neck are maintained in a neutral position before the procedure starts. Another disadvantage of the lateral decubitus position is that intraoperative conversion to an open approach could be more challenging compared with the beach chair position and may require patient repositioning.¹⁴

Regarding the surgical procedure, iatrogenic comminution of the bone fragment is one possible complication. It can be cracked during manipulation or if too much tension is applied during the impaction of the medial anchors. Lastly, if an appropriate reduction is not obtained or there is not sufficient bone to bone

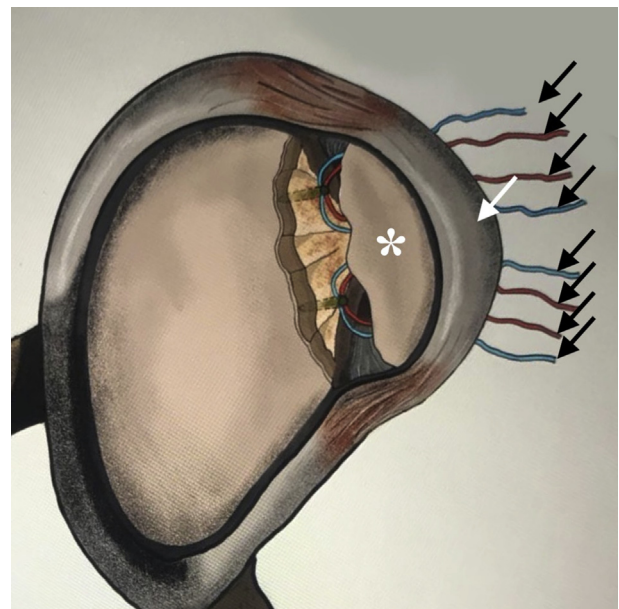


Fig 7. Illustration of the left shoulder. All the sutures (black arrows) are retrieved and passed through the capsulolabral complex (white arrow) around the bone fragment (*).

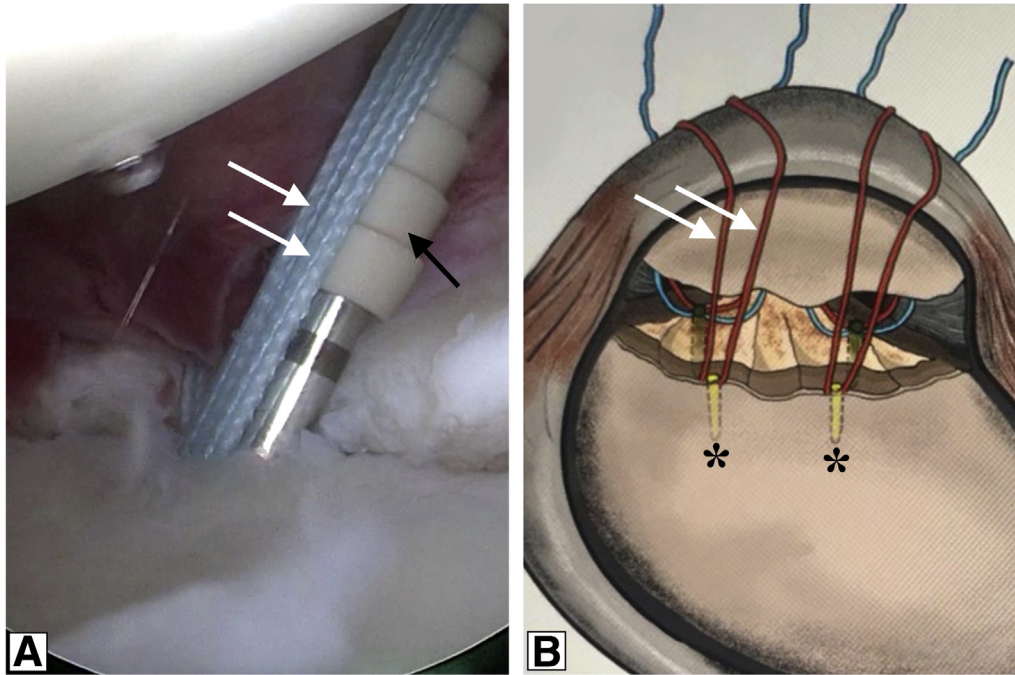


Fig 8. (A) Arthroscopic photograph of the left shoulder from the posterior portal in lateral decubitus. Two same-color suture limbs (white arrows) of the inferior-medial anchor are recovered using the anterior portal and preload them through the eyelet of a knotless anchor (black arrows in A). The anchor is placed on the glenoid face at the cartilage-fracture margin. (B) Illustration of the left shoulder representing the two lateral anchors placement before achieving fragment reduction (* in B).

contact, the potential risk of pseudoarthrosis and bone fragment absorption could increase.

Postoperative Follow-up and Rehabilitation

The patient's shoulder is immobilized with a sling for 4 weeks. After the fourth week, rehabilitation begins, consisting of passive and progressive active mobility

exercises. From the eighth week on, strengthening exercises are initiated. Rehabilitation continues for 3 months. On the third month, a computed axial tomography with 3-dimensional reconstruction is performed to confirm proper alignment and bone healing (Fig 11). Heavy manual tasks and return to sport activities are allowed after confirming these imaging

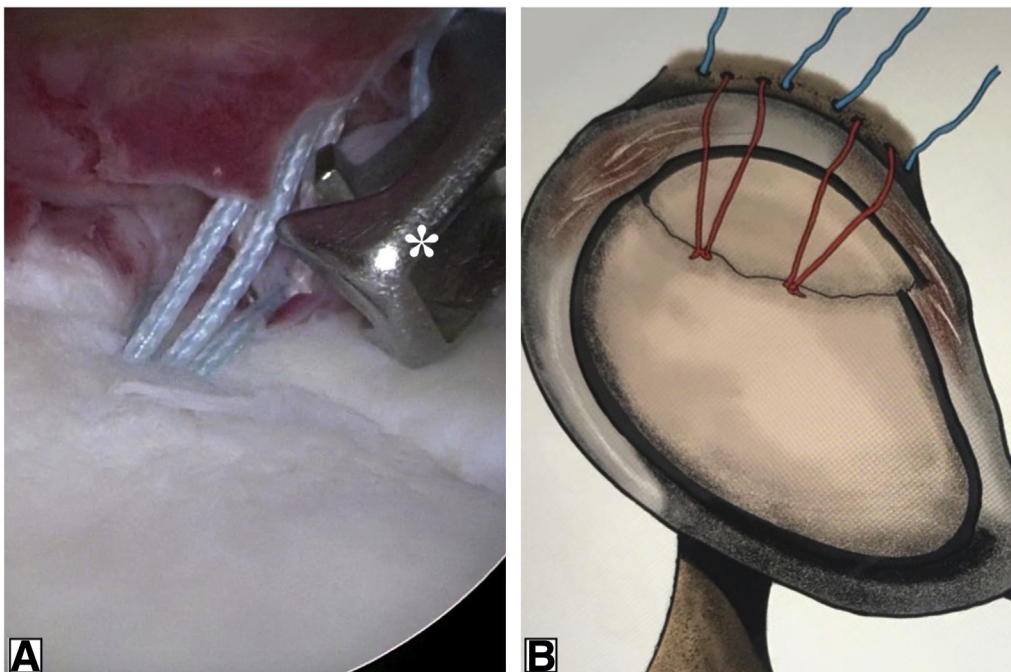
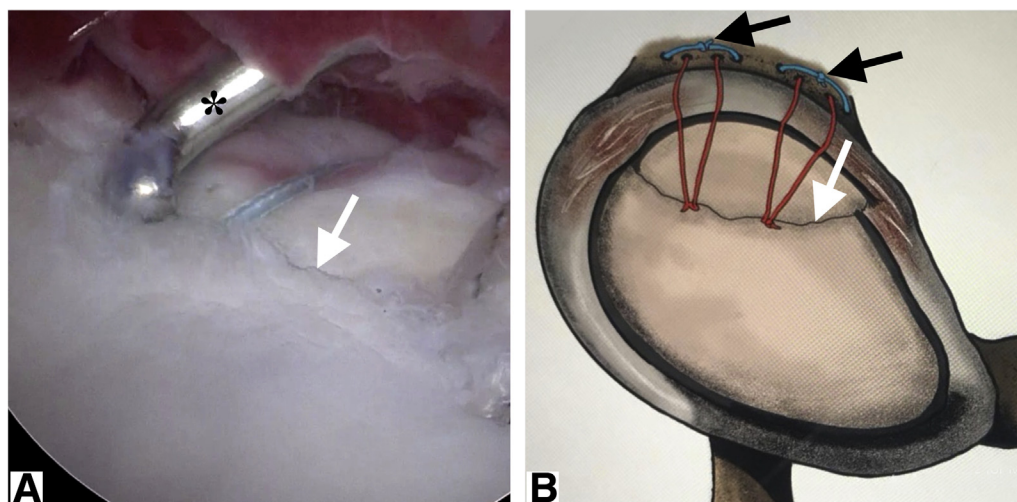


Fig 9. (A) Arthroscopic photograph of the left shoulder from the posterior portal in lateral decubitus. The limbs of the suture threads are cut flush using a suture cutter (*). (B) Illustration of the left shoulder representing the reduction obtained after bone fragment compression.

Fig 10. (A) Arthroscopic photograph of the left shoulder from the posterior portal in lateral decubitus. Anatomic fragment reduction (white arrows) and adequate interfragmentary compression are finally verified with a probe (*). (B) Illustration of the left shoulder. Two sliding knots could be made with the remaining sutures (black arrows) through the anterior portal to augment the interfragmentary compression.



results. At the fourth month, the patients resume their physical activity completely as long as they have no pain and obtain full range passive and active shoulder mobility (Fig 12).

Discussion

Glenoid bone loss generated in a traumatic glenohumeral dislocation has become a key factor when defining therapeutic behavior.¹ Bigliani et al.¹⁵ classified these injuries according to evolution time. An acute displaced fracture-avulsion with presence of the bone fragment is considered as type I; a malunited fracture-avulsion as type II; and a chronic erosion of the glenoid edge without the presence of a residual fragment as type III. In most type 3 lesions, the glenoid deficit requires a bone graft procedure to recover the joint surface. However, types I and II could be treated by

reducing and fixing the fragment. Multiple techniques have been described over time. Initially, the treatment consisted in open surgery with screw fixation, but advances in arthroscopy have broadened surgical options. In 2002, Porcellini et al.³ reported the first case series using an arthroscopic approach in acute lesions. The author used anchors placed on the medial edge of the glenoid to surround the fragment with sutures, performing a single-point fixation technique. The 25 treated patients had no recurrences, and all returned to their previous sporting activities, although 2 of them (8%) showed no signs of radiographic bone healing. Subsequently, Sugaya et al.⁹ presented a case series with a similar technique adding the use of sutures through the fragment for a more solid fixation. The author reported 5% redislocation in patients with injuries of more than 3 months of evolution.

Despite these good results, a number of concerns and shortcomings have been identified. First, the use of single points of fixation along the fracture predisposes the fragment to tilting in the direction of the anchor, reducing the contact area between the fragment and the glenoid, thus potentially affecting healing. Second,

Table 1. Technical Pearls

1. Place the patient's head in a suitable position to avoid traction of the brachial plexus.
2. Insert an elevator through the anterosuperior portal to mobilize the bony Bankart fragment until it is easily reducible to the intact glenoid.
3. Use a shaver to create bleeding surfaces to enhance bone-to-bone healing.
4. Switch the arthroscope to the anterosuperior portal to place the medial anchors.
5. For the suture passage, change back the vision portal to the posterior one.
6. Use an angled suture-passing device loaded with a loop to pass the sutures around the bone fragment through the capsulolabral complex.
7. Handle sutures carefully to avoid tangles.
8. Place the 2 lateral anchors on the glenoid face at the cartilage–fracture margin to obtain an anatomical reduction.
9. Pull on the sutures, while keeping a firm grasp of the driver, to create tension on them before the final lateral anchor insertion.
10. When performing the sliding knots, use a knot pusher to compress the fragment base.

Table 2. Advantages and Disadvantages of This Technique

Advantages	Disadvantages
<ul style="list-style-type: none"> • The 2-point fixation creates a larger contact area and provides better compression and rotational control. • Sutures do not cross between the 2 bone surfaces, improving bone-to-bone contact. • Lateral decubitus may allow better joint visualization and decreases risk of intra-operative cerebral desaturation events. 	<ul style="list-style-type: none"> • Suture limbs over the glenoid surface may cause complications affecting the humeral head. • At least 4 anchors are needed, thus increasing surgical costs. • Anchor placement could be technically more challenging using this technique.



Fig 11. The 3-dimensional computed tomography scan of a left shoulder at third month post-operatively showing proper alignment and union of the bony Bankart fragment (white arrow). (A) Axial 2-dimensional plane and (B) an oblique 3-dimensional sagittal plane with humeral subtraction.

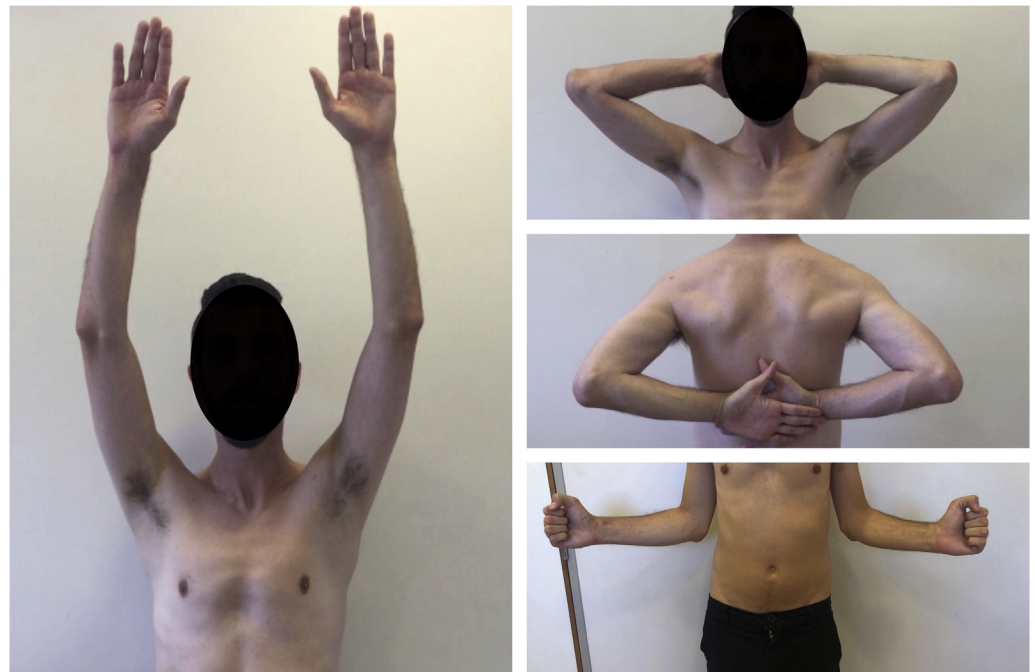
the sutures loop around the fragment and return to a single anchor, thereby making it not possible to effectively compress the fragment into the glenoid fracture surface. Third, the sutures around the fragment sit between the 2 bone surfaces and may further inhibit bone-to-bone contact and healing.

To correct these issues, Millet and Braun¹⁰ described, in 2009, a double-point fixation technique named as

“bony Bankart bridge.” However, the author reports 23% of subjective instability at 5 years of follow-up.¹⁶ Biomechanical studies comparing these techniques demonstrated that double-row fixation allows improved fracture reduction and stability and enhanced interfracture compression.^{17,18}

To date, there are no clinical studies comparing these techniques. However, some authors report high rates of

Fig 12. Photographs of physical examination at fourth month post-operatively showing full range passive and active shoulder mobility. Patient’s informed consent for publication was obtained.



unsatisfactory reduction when using a single-point fixation technique.^{5,19} Kim et al.⁵ evaluated 32 patients clinically and tomographically. They observed residual joint incongruity in the obtained reduction, with a step-off greater than 2 mm in 22% of the cases treated with a single-point fixation technique. In this group of patients, the clinical results 1 year after surgery were worse than in the group with a residual articular step-off of less than 2 mm. The risk of recurrence was also greater in those with a non-united fracture. Nakagawa et al.² reported that redislocation rates range from 50% to 62.5% in cases in which the fracture does not consolidate, and from 6.1% to 8.4% in patients where it does. All authors agreed that the key to success lies in achieving an adequate reduction and a stable fixation that promotes bone healing. The biggest conflict with the double-point fixation technique lies in its technical difficulty, since the placement of anchors in the glenoid neck can be difficult.

We believe that positioning the patient in lateral decubitus can improve joint visualization and facilitate the procedure. Some authors consider that the traction on the arm allows increased intra-articular space, thus providing better access to the anterior and posterior labrum, subacromial space and inferior capsule, and thereby increasing the working space for instrumentation.¹⁴ Moreover, there is strong evidence that patients who undergo shoulder arthroscopy in lateral decubitus have a decreased risk of intraoperative cerebral desaturation events.²⁰ Clinical studies comparing the described techniques are required to confirm these claims.

Conclusions

We consider that treating acute bony Bankart lesions with an arthroscopic approach, in lateral decubitus and using a double-row technique, is a viable option to achieve anatomical reduction and a stable fixation.

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