

Arthroscopic Repair of a Circumferential 360° Labral Tear



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Abstract: Injuries to the glenoid labrum can result in shoulder instability and pain. These lesions may occur anywhere around the glenoid labrum, and thus, the arthroscopist must be prepared to approach all aspects of the glenoid from multiple angles. The pan-labral or circumferential (360°) tear of the glenoid labrum presents a unique challenge to even the experienced arthroscopist. The extent of the lesion requires the use of accessory portals and percutaneous techniques to establish adequate visualization and to facilitate the proper trajectory for anchor placement. The pan-labral tear also demands intraoperative planning throughout the repair to ensure proper tensioning and alignment of the labrum and capsular tissue. The purposes of this article are to report a technique for repairing a pan-labral lesion and to emphasize the use of accessory portals and percutaneous techniques for complete access to the glenoid.

Arthroscopic repair of the circumferential 360° labral tear has been shown to successfully re-establish stability and decrease shoulder pain, allowing a return to preinjury activity in most patients.¹ This lesion is typically associated with a traumatic insult, resulting in subsequent instability and pain. It is hypothesized that the lesion of the glenoid labrum may not initially be circumferential but actually progresses to a complete circumferential lesion after additional instability events.¹ Because imaging may not accurately depict the extent of the lesion, the history and physical examination, along with heightened suspicion, are paramount to the diagnosis.²

Arthroscopic repair of the circumferential type IX SLAP tear (Table 1)—although less commonly encountered than SLAP tears, Bankart lesions (tears of the anterior-inferior labrum), and reverse Bankart lesions (tears of the posterior-inferior labrum)—synthesizes

techniques from each of these more common repairs.³ A similar surgical approach is taken, combining the techniques of individual labral repair techniques. The primary principles are still followed, including thorough identification of the extent of the tear, exploration for any concomitant pathology, preparation of the surface to promote healing and a bleeding base, and secure circumferential fixation with restoration of an appropriately tensioned labral bumper. A unique problem of the pan-labral tear is obtaining access to the entire labrum, as well as establishing appropriate tension for anatomic repair.⁴ The purpose of this article is to present a technique for arthroscopic repair of a circumferential labral tear emphasizing portal use, glenoid rim preparation, and the sequence of anchor placement to simplify the treatment of this extensive lesion (Video 1).

Technique

The indication for this procedure is a pan-labral tear diagnosed by imaging or arthroscopy. In addition, the steps of this technique can be indicated when labral tears extend posteriorly and inferiorly. Standard magnetic resonance imaging can be used to diagnose a pan-labral tear, although the extent of the tear can be underestimated, therefore necessitating arthroscopic confirmation.

The procedure is performed with the patient under general anesthesia after an interscalene block has been administered. The patient is placed in the beach-chair position, and a complete examination under

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Table 1. SLAP Tear Classification³

	Description
Type I	Fraying and degeneration of superior labrum
Type II	Detached superior labrum from supraglenoid tubercle
Type III	Superior bucket-handle tear displaced into joint; biceps tendon remaining stable
Type IV	Superior bucket-handle tear including biceps tendon
Type V	Anterior-inferior (Bankart) lesion that propagates superiorly to biceps tendon
Type VI	Unstable flap tear of labrum with separation of biceps anchor
Type VII	Superior biceps labral detachment extending anteriorly beneath MGHL
Type VIII	Extension posteriorly to 6-o'clock position
Type IX	Pan-labral lesion
Type X	Superior labral tear associated with posterior-inferior (reverse Bankart) lesion

MGHL, middle glenohumeral ligament.

anesthesia including passive range of motion, the anterior and posterior load-and-shift test, and the sulcus sign is performed. The head is secured, and an arm holder (Spider 2 Limb Positioner; Smith & Nephew, Andover, MA) is used, ensuring all bony prominences are well padded. The shoulder is subsequently prepared and draped in the usual manner.

Diagnostic Arthroscopy

A standard posterior viewing portal is established followed by an anterior rotator interval portal through an outside-in spinal needle technique (Fig 1).

Diagnostic arthroscopy is performed, examining the biceps tendon and anchor, rotator interval, middle glenohumeral ligament, subscapularis and subscapularis recess, superior glenohumeral ligament, humeral head, glenoid surface, rotator cuff, inferior glenohumeral ligament, and capsule. The glenohumeral head is also inspected for chondral damage, and the subscapular recess or axillary pouch is checked for loose bodies. The extent of the labral tear is examined. A type IX lesion is defined by complete separation of the superior biceps anchor–labral complex and the anterior, inferior, and posterior labra (Fig 2, Table 1).

Biceps Anchor–Labral Complex

To address the superior-anterior labrum and biceps anchor tear, an accessory anterior-superior lateral portal is established at a position 1 cm anterolateral to the anterolateral acromion border. This portal is localized by an outside-in spinal needle technique. Care is taken not to violate the supraspinatus tendon by ensuring passage through the superolateral aspect of the rotator interval. Once the portal is established, a barrel burr is used to freshen the supraglenoid tubercle, extending this exposure of bone to the 10-o'clock position relative to the 12-o'clock position (Fig 3). A Neviaser portal can be used for suture shuttling in the interval between the posterior acromioclavicular joint and the spine of the scapula, but in this case, labral tape (Arthrex, Naples, FL) is passed with arthroscopic instruments through the anterior superolateral portal

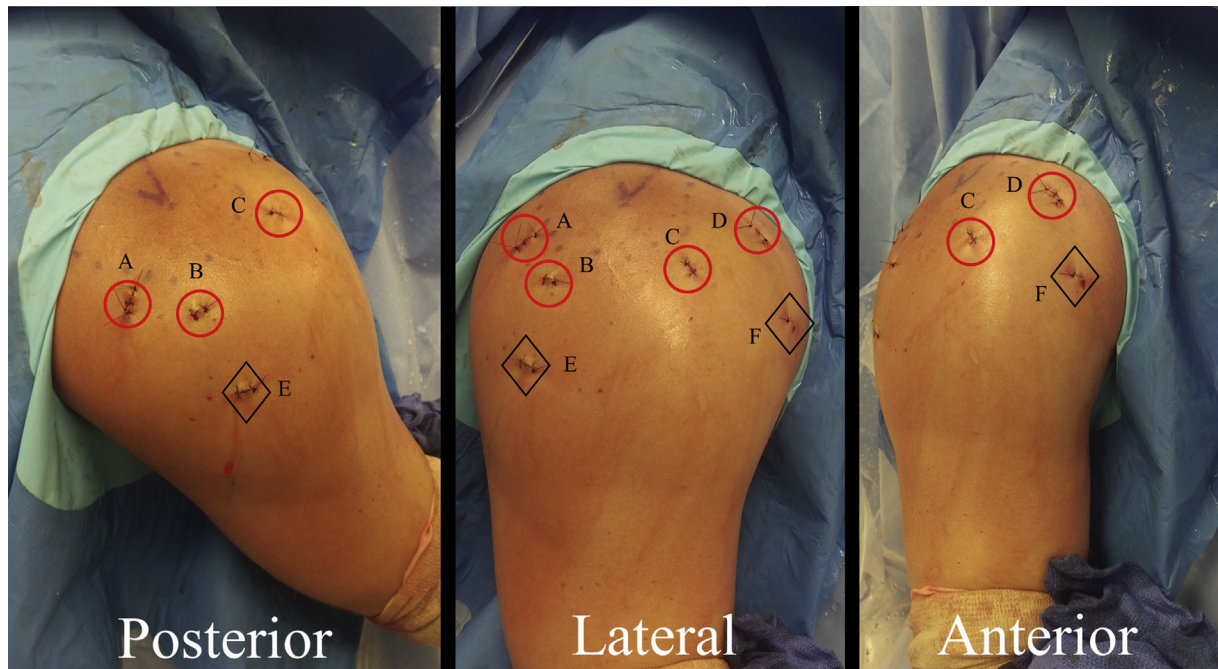


Fig 1. Beach-chair positioning with posterior, lateral, and anterior views of the right shoulder to show portals used. Percutaneous access is outlined by the diamonds. Portal A is posterior; B, posterior superolateral; C, anterior superolateral; D, anterior; E, 7-o'clock percutaneous; and F, 5-o'clock percutaneous.

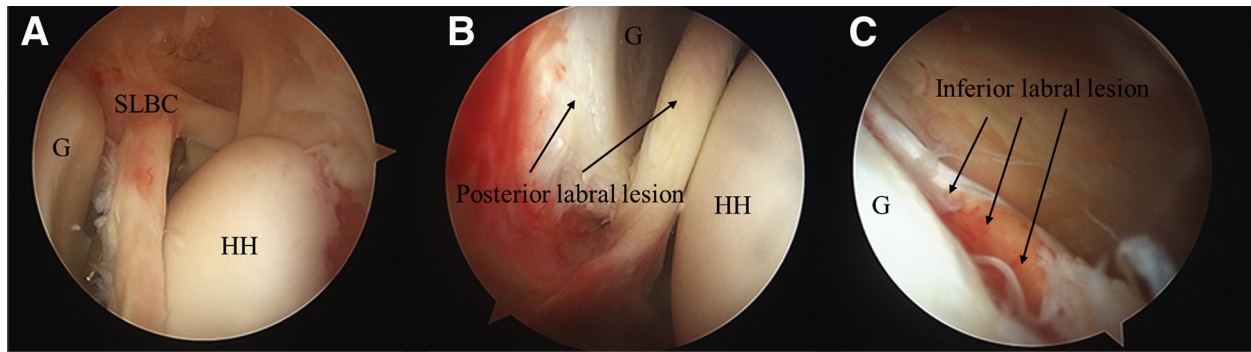


Fig 2. Right shoulder, with patient in beach-chair position, viewed from posterior portal. Diagnostic arthroscopy shows a type IX SLAP lesion. (A) Complete separation of the superior labrum—biceps anchor complex (SLBC) is seen with anterior and posterior extension. The tear is shown extending posteriorly and inferiorly (B) and anteriorly and inferiorly (C), constituting a pan-labral tear with circumferential detachment of labral tissue. (G, glenoid; HH, humeral head.)

given the extent of labral separation. In addition, an accessory posterolateral portal is established 2 cm posterolateral to the posterolateral corner of the acromion.

For suture shuttling, 8-mm cannulas are placed in the anterior and posterior portals, with a 5-mm cannula placed in the accessory superolateral portal. After shuttling of the labral tape, the 12- and 10-o'clock positions are predrilled. The labral tissue is reattached with 2.9-mm PEEK (polyether ether ketone) PushLock devices (Arthrex) (Fig 4). The 12-o'clock PushLock is placed through the anterior superolateral portal, whereas the 10-o'clock PushLock is placed through the

accessory posterolateral portal, reattaching the biceps anchor—labral complex.

Posterior-Inferior Labrum

Attention is then turned to the posterior-inferior labral tear. While the surgeon is viewing through the anterior superolateral portal, the glenoid rim is freshened from the 9- to 6-o'clock position with an arthroscopic rasp. Eight-millimeter cannulas are positioned in the standard anterior and posterior portals for instrumentation and suture shuttling. The labral tissue at the 8-o'clock position is then captured with a SutureLasso (Arthrex). The labral tape is shuttled, and the area is predrilled in preparation for a 2.9-mm PushLock. The

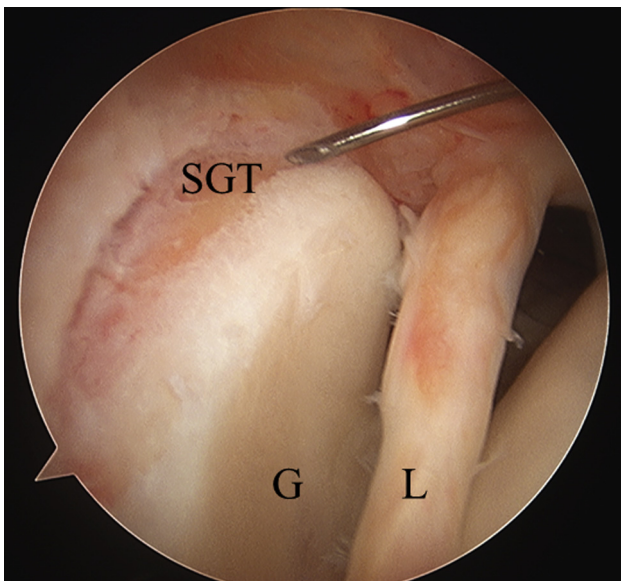


Fig 3. Right shoulder, with patient in beach-chair position, viewed from posterior portal. The accessory anterior superolateral portal is localized with a spinal needle through the superolateral aspect of the rotator interval. The supraglenoid tubercle (SGT) has been freshened with a burr. The superior labrum (L) can be seen detached from the glenoid (G).

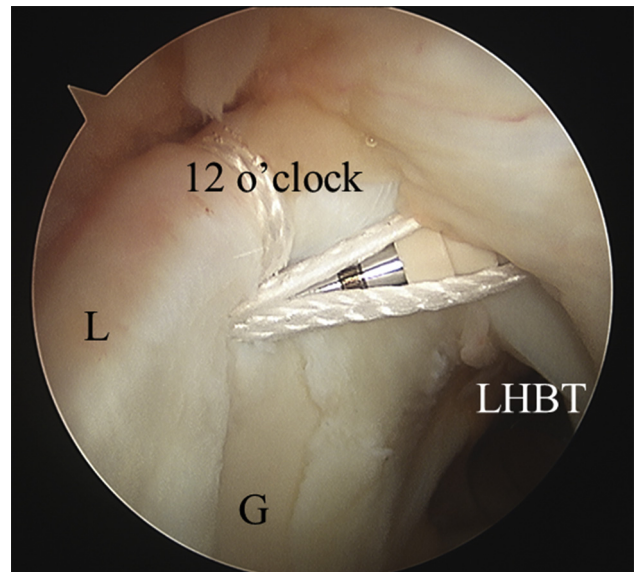


Fig 4. View from posterior portal in a right shoulder. Labral reattachment is performed at the 12-o'clock position with a 2.9-mm PEEK PushLock placed through the anterior superolateral portal. The long head of the biceps tendon (LHBT) can be seen anterior to the 12-o'clock anchor. (G, glenoid; L, labrum.)

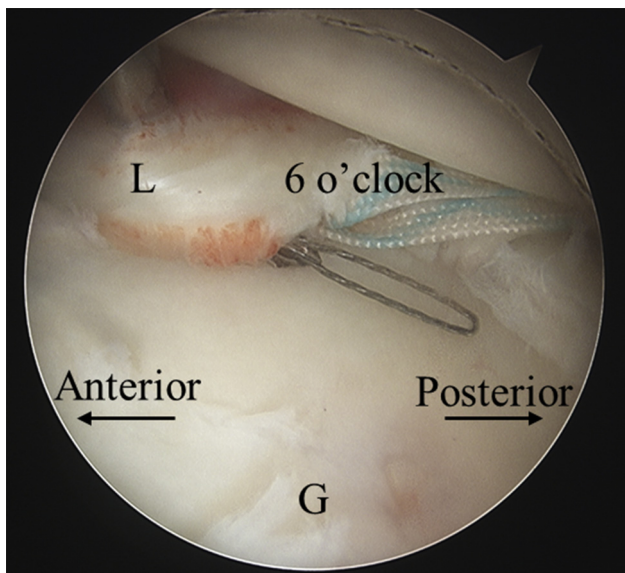


Fig 5. View from anterior superolateral portal in a right shoulder. Working through the 5-o'clock percutaneous portal, the surgeon captures the labral tissue (L) at the 6-o'clock position with a SutureLasso. Fiber tape from the double-loaded 3.0-mm SutureTak is subsequently shuttled. (G, glenoid.)

labral tape capturing the posterior-inferior capsulolabral tissues is then anchored in the 8-o'clock position. Through a 7-o'clock percutaneous approach, a 3.0-mm double-loaded SutureTak with FiberTape (Arthrex) is placed at the 6-o'clock position (Fig 5). Again, a SutureLasso shuttle is used to shuttle both FiberTape sutures. By use of a sliding arthroscopic Weston knot, followed by 3 alternating half-hitches, the second fixation point for the posterior-inferior repair and capsulorrhaphy is established, ensuring adequate tension of the posterior-inferior bumper and capsule.

Anterior-Inferior Labrum

The anterior-inferior labral tear, or the Bankart lesion, is the last step of the repair. A 5-o'clock (trans-subscapularis) percutaneous approach is used for anchor placement, localized by an inside-out technique at the 5-o'clock position on the glenoid, lateral to the conjoint tendon, through the lower aspect of the subscapularis. The anterior superolateral portal is used for visualization, and the standard anterior and posterior portals (with cannulas) are used for instrumentation and suture shuttling. The cortical rim is again freshened between the 2- and 6-o'clock positions on the glenoid. Three anchors are placed sequentially, beginning inferiorly and progressing superiorly at the 5, 4, and 3-o'clock positions (Fig 6). With the 25° SutureLasso, the No. 2 FiberWire (Arthrex) is shuttled and tied by 3 sliding arthroscopic Weston knots, followed by 3 alternating half-hitches, to establish 3 fixation points.

Inferiorly, several millimeters of capsular tissue are imbricated, incorporating the anterior band of the inferior glenohumeral ligament. At this point, the anterior-inferior bumper is completely restored with adequate tension throughout the inferior glenohumeral ligament complex and fasciculus obliquus. This completes the arthroscopic anterior-inferior labral repair and capsulorrhaphy. A summary of portal use can be found in Table 2.

Postoperative Rehabilitation

Postoperatively, the patient is placed in an abduction pillow and sling, which is worn full time for 5 weeks, except during physical therapy. The sling is removed for gentle passive range of motion in shoulder abduction, as well as elbow and wrist range of motion. Active range of motion is allowed with the elbow flexed at the side in the planes of shoulder internal and external rotation. No active flexion or abduction is allowed. Physical therapy is initiated 3 weeks after surgery. From 4 to 12 weeks, physical therapy focuses on increasing range of motion, gentle resistance exercises, active range of motion, and periscapular isometric exercises. Internal and external rotation resistance exercises are initiated at 6 weeks. Internal and external rotation with the arm abducted is permitted at 8 weeks. From 3 to 4 months, physical therapy focuses on aggressive strengthening of the shoulder and scapular muscles. Return to contact sports is allowed after 6 months.

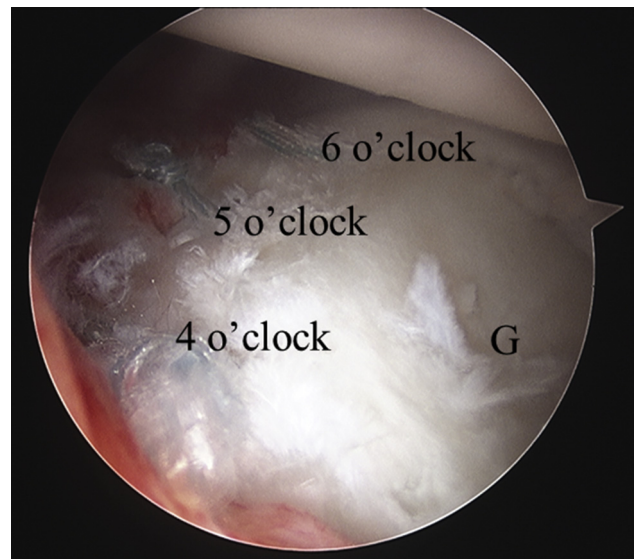


Fig 6. Right shoulder, with patient in beach-chair position, viewed from anterior superolateral portal. Prior to repair of the anterior-inferior labral tear, the glenoid rim is prepared with a rasp between the 2- and 6-o'clock positions. Three anchors are seen beginning inferiorly on the glenoid (G) and progressing superiorly at the 6-, 5-, and 4-o'clock positions. A 3-o'clock anchor is not shown.

Table 2. Portal Use

Glenoid Labrum Location	Viewing Portals	Working Portals	Anchor Insertion
Diagnostic arthroscopy	Posterior, anterior		
Biceps anchor—superior labral complex	Posterior	Anterior, anterior superolateral	Anterior superolateral
Posterior-inferior labrum	Anterior superolateral, posterior	Anterior, posterior	7-o'clock percutaneous
Anterior-inferior labrum	Anterior superolateral	Posterior, anterior	5-o'clock percutaneous

Discussion

Successful arthroscopic circumferential labral repair is dependent on glenoid visualization and access.^{5,6} A sequential and systematic approach is also necessary for ensuring appropriate alignment of the repaired labrum on the glenoid. The described approach begins by securing the labrum to the superior aspect of the glenoid, with the biceps tendon used as a landmark. Once initial fixation is achieved, progression to accomplish inferior labral repair should follow. Ultimately, the fixation of the anterior, posterior, and inferior labrum is accomplished by a combination of percutaneous techniques and accessory portals. A successful repair also requires containment and alignment of the detached labrum (Table 3). Furthermore, meticulous preparation of the glenoid rim is necessary to promote healing (Table 4).⁵

Although access to the anterior-inferior labrum has been well described for repair of Bankart lesions, posterior and inferior labral tears have been described less.⁷ Access to the inferior glenoid has been described with an accessory posterolateral portal at the 7-o'clock position.⁸ For more posterior extension, an additional accessory portal at the 5-o'clock position has been described.⁹ Described in this technique was the use of a percutaneous approach at both the 5- and 7-o'clock positions to access the inferior glenoid.¹⁰

The 5-o'clock trans-subscapularis portal can be used for access to the anterior and anteroinferior glenoid and labrum.⁷ Although the 5-o'clock portal has been questioned because of its proximity to the axillary nerve, musculocutaneous nerve, cephalic vein, and humeral articular cartilage, a percutaneous technique without use of a cannula may make this an

advantageous portal. It can be used to place anchors from the 3-o'clock to 5:30 clock-face position, with minimal damage to the subscapularis tendon.¹¹

The 7-o'clock portal can be used for posteroinferior injuries, for access to the 5- to 6-o'clock position on the glenoid face, and for suture shuttling in anteroinferior injuries.^{7,10} Although this is an intratendinous portal, a cannula can be used or anchors may be placed percutaneously. A percutaneous technique decreases the risk of injury to the suprascapular nerve and artery, axillary nerve, and posterior circumflex humeral artery associated with this portal.⁷ These portals provide a trajectory into the glenoid bone to facilitate secure anchor fixation and prevent shallow trajectories that otherwise risk violating the glenoid cartilage. Furthermore, the proper trajectory will reduce the risk of tunnel confluence.

Other investigators have suggested alternative portals for access to the posterior and inferior labrum. Ciccone¹² reported on his use of a lateralized posterior portal without use of accessory portals for fixation of posterior labral tears, and the posterolateral accessory portal, as well as a low posterolateral portal, has been described—all used with the purpose of gaining a proper angle for anchor placement.⁶ Any of these described portals can be used at the surgeon's discretion, as long as the entire labrum is visualized, with the correct trajectory achieved for anchor placement circumferentially. Additional portals may also be

Table 3. Advantages and Disadvantages

Advantages
Step-wise progression of this technique helps control the labra throughout the procedure.
By use of accessory portals, the proper anchor trajectory can be attained around the glenoid.
Visualization can be difficult because of soft-tissue swelling toward the end of the procedure, so initial fixation of the posterior and inferior labra can have its advantages.
Disadvantages
Accessory portals may place the neurovascular structures at risk.
Initial malpositioning of the superior labrum—biceps anchor complex will prevent adequate restoration of tension and positioning of the final repair.

Table 4. Pearls and Pitfalls of Circumferential Labral Repairs

Pearls	Pitfalls
Meticulously debride the glenoid rim before securing the labrum.	Avoid overtensioning of the capsular tissues.
Initially, control and reduce the labrum with a superior anchor to stabilize the biceps anchor—labral complex.	Be aware of the axillary nerve when placating inferior capsular tissues.
Work posteriorly and inferiorly after superior labral fixation.	Be aware of humeral avulsion of the glenohumeral ligament lesions.
Finish with anteroinferior stabilization.	Bear in mind that a malpositioned labrum early in the repair may result in difficulty with reducing and tensioning the labrum.
Avoid placement of anchors anterosuperiorly to avoid tensioning the normal sublabral foramen, which will result in loss of external rotation.	Note that an improper trajectory may violate the glenoid cartilage if too shallow or result in tunnel confluence if misdirected.

necessary and may provide ease of access for instruments to thoroughly debride and rasp the glenoid rim. We believe that robust preparation of the glenoid rim prior to labral fixation is a necessary step for all aspects of the lesion. In summary, the circumferential labral lesion can successfully be repaired arthroscopically by use of accessory portals at the 5- and 7-o'clock positions with additional attention to initial labral positioning and glenoid rim preparation.

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