

Diagnosis of Biceps Incarceration: Observations on the Biceps Incarceration Maneuver



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Abstract: Instability of the long head of the biceps brachii tendon is a recognized source of shoulder pain. However, this diagnosis is usually associated with concomitant pathology including subscapularis tendon tears. The appropriate diagnosis of biceps incarceration or instability remains challenging, with failure to address instability being likely to result in persistent pain and disability despite arthroscopic management of concomitant shoulder pathology. The objective of this article is to (1) describe a dynamic test performed both preoperatively and intraoperatively, termed the “biceps incarceration maneuver,” to help identify biceps instability; (2) reinforce the concept that biceps instability must be ruled out in young patients presenting with anterior shoulder pain; and (3) report that with proper diagnosis and treatment, patients with biceps instability will experience rapid symptomatic resolution after management.

Advancements in arthroscopic techniques and instrumentation have led to marked improvement in our knowledge of shoulder pathology. Involvement of the long head of the biceps brachii tendon (LHBT) has emerged as a recognized pain generator, contributing to both anterior shoulder pain and flexion loss.¹ Coexistent pathology within the shoulder, including SLAP tears, tears to the upper border of the subscapularis, and increased posterior translation of the shoulder, is associated with biceps instability.² In the experience of the senior author (B.R.B.), variable origins of the biceps tendon, as well as the presence of the Buford complex, can also contribute to the presence of biceps instability. In the painful shoulder, the LHBT can be inflamed, with a notable “lipstick” sign when probed arthroscopically,

partially torn, or frayed, or the LHBT can be subluxated or dislocated, particularly in the presence of subscapularis tears.³ However, an accurate clinical diagnosis specific for LHBT instability can be difficult because of the high frequency of concomitant pathologies in the shoulder.²

We have noted an increasing number of younger patients, aged 15 to 35 years, presenting with variable durations of anterior shoulder pain localized to the biceps groove, most notably those with a traction-type mechanism of injury. Patients may report pain in the biceps muscle that is referred from the bicipital groove (Fig 1A); deep posterior shoulder pain; and clicking, popping, and shifting of the shoulder. Generally, no limitations in active or passive shoulder range of motion are appreciated and no evidence of scapular dyskinesia or anterior shoulder instability is detected; however, a history of perceived “shoulder instability” may be reported. The findings of magnetic resonance imaging of the shoulder may be interpreted as normal specific to the biceps tendon because patients may not possess fluid in the bicipital groove or evidence of biceps tendon fraying. Furthermore, ultrasound-guided biceps sheath injections have not proved predictably beneficial. We have observed that with forward elevation (Fig 1B) and internal rotation (Fig 1C) at the shoulder level, termed the “biceps incarceration maneuver,” pain is generated anteriorly. Although potentially interpreted as a positive impingement sign, this test is different as it is performed in forward flexion and not in the plane of the scapula. In contrast to the O’Brien maneuver, recognized as sensitive for SLAP pathology, minimal

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Fig 1. (A) In the office setting, a patient with biceps instability reports left anterior shoulder pain with tenderness on palpation of the bicipital groove. The biceps incarceration maneuver is performed on the left arm by placing the arm into 90° of forward elevation with the elbow flexed to 90° (B), followed by internal rotation of the arm (C), with patients generally reporting the reproduction of pain in the anterior shoulder.

adduction is involved and the elbow is flexed 90° . Moreover, we have noted that most patients with a diagnosis of biceps incarceration do not have a positive O'Brien or Speed test finding.

In patients with shoulder pain with a positive result of the preoperative biceps incarceration maneuver, performing this maneuver intraoperatively shows various degrees of incarceration or pinching of the tendon into the glenohumeral joint. We have even noted the tendon to formally dislocate within the glenohumeral joint. Failure to properly perform and assess for instability using the maneuver, especially with the patient in the lateral decubitus position, may result in an incorrect diagnosis and continued symptoms owing to persistent

instability of the LHBT. This article describes the dynamic biceps incarceration maneuver for the diagnosis of biceps instability during shoulder arthroscopy.

Biceps Incarceration Maneuver

The biceps incarceration maneuver is initially performed in the office setting and during standard shoulder arthroscopy with the patient in the beach-chair or lateral decubitus position (Video 1). While maintaining the arthroscope in the glenohumeral joint and focusing at the course of the LHBT within the joint, the surgeon releases the operative arm from traction. The shoulder is raised to 90° of flexion with the elbow flexed 90° . The arm is internally rotated with the arthroscope centered

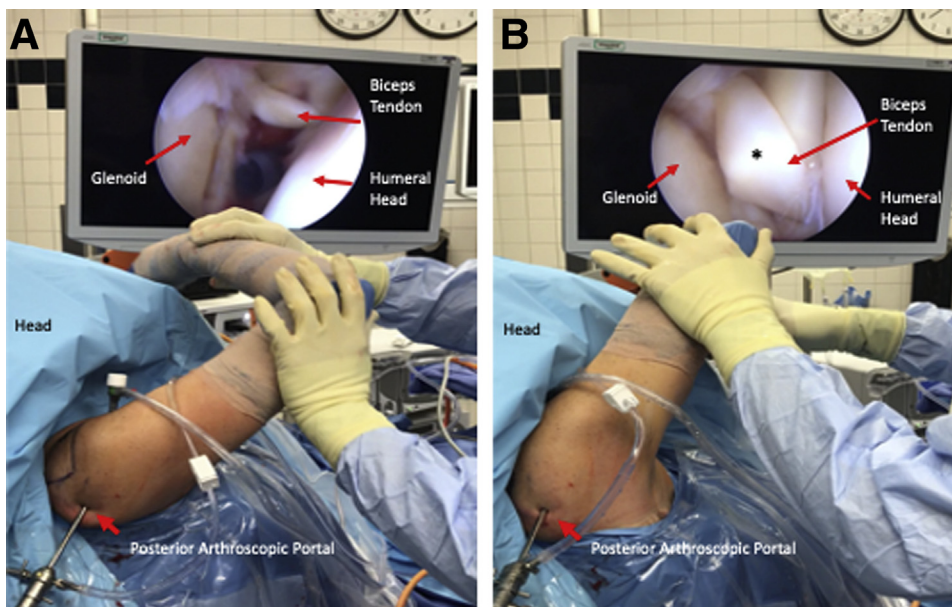


Fig 2. (A) In the operating room, with the arthroscope in the standard posterior viewing portal centered on the biceps tendon of the right shoulder, the biceps incarceration maneuver is performed by releasing the arm with forward elevation of the arm to 90° and the elbow in 90° of flexion. (B) While the arthroscope is maintained centered on the biceps tendon, the arm is internally rotated, and in patients with biceps instability, the biceps tendon can be seen becoming pinched between the humeral head and glenoid during internal rotation, occasionally resulting in dislocation of the tendon (asterisk) into the glenohumeral joint.

Table 1. Advantages and Disadvantages of Biceps Incarceration Maneuver

<p>Advantages</p> <ul style="list-style-type: none"> Noninvasive maneuver, easily performed in office and operating room Allows for preoperative identification of biceps instability in patients presenting with anterior shoulder pain Represents dynamic maneuver allowing for intraoperative confirmation of biceps instability Decreases risk of continued pain and instability in patients with minimal symptoms and in those with concurrent shoulder pathology (rotator cuff tearing or inflammation, subacromial impingement, or AC joint pain) without overt biceps instability symptoms Can be performed with patient in beach-chair or lateral decubitus position during shoulder arthroscopy <p>Disadvantages</p> <ul style="list-style-type: none"> Generation of pain with maneuver due to biceps instability when performed in clinic setting

AC, acromioclavicular.

on the LHBT (Fig 2A), which—in the setting of biceps incarceration or instability—will show evidence of incarceration or pinching of the tendon by the humeral head against the glenoid and occasionally will show true dislocation into the glenohumeral joint (Fig 2B). In patients with long-standing biceps instability, there may be evidence of articular cartilage wear to the anterosuperior aspect of the humeral head, also known as a “chondral print lesion.”² Concomitant findings in patients with biceps instability include SLAP lesions, partial-thickness tearing of the subscapularis, increased posterior translation, anomalous anterior origins of the biceps tendon, and the Buford complex.

If both preoperative and arthroscopic diagnoses are consistent with biceps incarceration or instability, a biceps tenotomy is indicated. After all concomitant pathology in the shoulder has been addressed arthroscopically, an open subpectoral biceps tenodesis using an all-suture device (1.9-mm SutureFix anchor; Smith & Nephew, London, England) is performed using a small drill hole in the humerus with onlay fixation of the tendon in younger patients. We attempt to minimize the size of the drill hole in the younger patient

population to reduce the potential for a torsionally induced fracture because many of these patients are involved in overhead throwing activities. Frequently, within 1 week postoperatively, the preoperative symptoms are resolved. We have noted that patients reporting chronic pain varying from 1 to 8 years consistently report rapid resolution of symptoms.

Discussion

In young patients presenting with shoulder pain, performance of the biceps incarceration maneuver may help surgeons better isolate, visualize, and successfully treat patients with subtle biceps instability. Previous studies have found that in patients with LHBT instability, signs such as the palm-up test and O’Brien test are sensitive but not specific for biceps instability.⁴ Moreover, during arthroscopy, although the diagnosis of an LHBT dislocation may easily be identified, subluxation with minimal displacement can easily be missed. In their case series examining 150 shoulders with LHBT instability in the absence of large rotator cuff tears, Castagna et al.² reported the presence of a chondral print lesion at the level of the humeral head, indicative of instability, in 84% of patients (49 of 58) with LHBT subluxation. The biceps incarceration maneuver represents a simply performed, noninvasive maneuver, offering both a preoperative confirmation and dynamic intraoperative confirmation of biceps instability. Moreover, use of this maneuver offers minimal risk to patients outside of pain and discomfort when performed in the office setting (Table 1).

In patients with SLAP lesions, clinicians must maintain a high degree of suspicion for LHBT instability. Although such lesions are traditionally repaired, especially in younger patients, recent data have shown a decrease in the performance of SLAP repairs with a concurrent increase in the performance of biceps tenodeses owing to the potential for failed SLAP repair requiring revision surgery.^{5,6} When comparing outcomes of biceps tenodesis versus SLAP repair versus sham surgery in patients (mean age, 40 years) with isolated type II SLAP tears, Schröder et al.⁷ reported no

Table 2. Pearls and Pitfalls During Biceps Incarceration Maneuver

Pearls	Pitfalls
<ul style="list-style-type: none"> • When the maneuver is performed, the arm is flexed to 90° and the elbow is flexed to 90° in front of the body prior to internal rotation. • Intraoperatively, the arthroscope should be maintained centered on the biceps tendon to allow for visualization of pinching and instability, as well as possible articular cartilage wear (chondral print lesion). • The surgeon should assess for concurrent SLAP tearing, subscapularis tearing, and increased posterior translation during arthroscopic evaluation to allow for identification and treatment of all symptomatic pathology. • Arthroscopic tenotomy is recommended in the setting of biceps instability, with tenodesis performed in younger and active patients. 	<ul style="list-style-type: none"> • Performing the maneuver with the arm in the plane of the scapula should be avoided. • Adduction of the arm should be avoided during the maneuver. • Palpation on the biceps tendon should be avoided during the maneuver because this may produce a false-positive test result in the setting of biceps tendinitis. • Performing the maneuver intraoperatively with the forearm in an arm holder should not be attempted.

significant differences in outcomes between groups at 2-year follow-up. Moreover, when evaluating outcomes of open subpectoral biceps tenodesis in 20 patients aged 45 years and younger (mean age, 38.5 years) with type II SLAP tears and minimum 2-year follow-up, Pogorzelski et al.⁸ reported significant improvement in American Shoulder and Elbow Surgeons, QuickDASH (the shortened version of Disabilities of the Arm, Shoulder and Hand questionnaire), Single Assessment Numeric Evaluation, and Short Form 12 Physical Composite scores. As such, owing to concern for SLAP repair failure, especially in younger patients, primary treatment of SLAP lesions using biceps tenodesis yields successful outcomes while also effectively addressing LHBT instability.

Determination of biceps instability is challenging; however, performance of the dynamic biceps incarceration maneuver may aid in the diagnosis of instability, offering both preoperative and intraoperative opportunities for assessment (Table 2). Failure to identify and correct biceps instability, especially in patients in the lateral decubitus position with the arm in traction, may lead to continued pain and symptoms despite treatment of concurrent pathology within the shoulder. Further clinical investigations examining outcomes in patients with biceps instability with a positive result of the biceps incarceration maneuver undergoing biceps tenodesis are underway.

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