Arthroscopic Pectoralis Minor Release

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Abstract: The scapula has long been recognized as a key component in shoulder motion and a crucial part of the kinetic chain connecting the body's core and upper extremity. The pectoralis minor (PM) has garnered increasing attention as we better understand scapular kinematics and its role in shoulder pain and dysfunction. This is particularly important in patients with scapular dyskinesis and especially in overhead throwing athletes. The most of these patients achieve their recovery goals through nonoperative management, stretching, and strengthening protocols; however, some patients do not respond to nonoperative modalities. Several studies have recently shown improvement in shoulder motion and outcome scores after open surgical release of the PM from its scapular attachment. Arthroscopic release of the PM can be accomplished in the lateral decubitus position with standard shoulder arthroscopic portals.

The pectoralis minor (PM) is increasingly recognized as a key contributor to scapular control, scapulohumeral, and scapulothoracic kinematics and overhead shoulder function. PM tightness has been attributed to many factors including muscular imbalances across the shoulder, chronic shoulder malposition or protraction, thoracic kyphosis, and repetitive overhead activity including throwing athletes, weight lifters, and volleyball players.[1-3] Patients with PM tightness often have pain localized over the coracoid process, scapular dyskinesis, and a protracted scapula.[4,5] The PM becomes contracted or shortened, and this has been associated with changes in scapular motion.[1,6-8] Often, these patients have positive subacromial impingement signs. This is believed to be associated with a malpositioned and protracted scapula decreasing the potential acromiohumeral space and limiting forward flexion and internal rotation. Overhead athletes, weight lifters, volleyball players, and other at-risk patients have a higher incidence of scapular dyskinesis and, consequently, a shortened PM.[1,4,6-9] A shortened, contracted PM induces a resultant lengthening and associated weakening of its antagonist, the lower trapezius.[6] These changes weaken the shoulder and place abnormal stress across the joint.[6,10,11] Scapular dyskinesis has been associated with multiple shoulder disorders including subacromial impingement, rotator cuff disease, labral, and acromioclavicular pathologies.[5,6] Addressing scapular dyskinesis and its dynamic position has become a point of emphasis when treating these patients.

Treating scapular dyskinesis can alleviate subacromial impingement by restoring the scapular spatial relation to the remainder of the shoulder.[8] Nonoperative treatment modalities have focused on mobilizing and stretching the shortened or contracted anterior shoulder musculature including the PM and conjoint tendon. Also, working to strengthen and stabilize scapulothoracic dynamics greatly improves shoulder kinematics.[5,6,10,12] Borstad and Ludewig[13] described 3 stretching mechanisms to increase the length of the PM and mobilize the anterior shoulder. This study and others have shown dynamic changes in the length of the PM tendon influenced by these stretching exercises, which in turn allows for mobility and a greater range of scapular control.[1,13] This is exaggerated in patients who compete in overhead throwing sports.

There are no reported cases in the literature on isolated arthroscopic PM releases for PM tightness and scapular dyskinesis unresponsive to conservative treatments. There are, however, numerous publications examining the indications and efficacy of an arthroscopic Latarjet, which includes a PM release during

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The authors report the following potential conflicts of interest or sources of funding: J.M.T. is a consultant for Arthrex and Johnson and Johnson. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received December 7, 2017; accepted February 7, 2018.

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2212-6287/171499

https://doi.org/10.1016/j.eats.2018.02.003

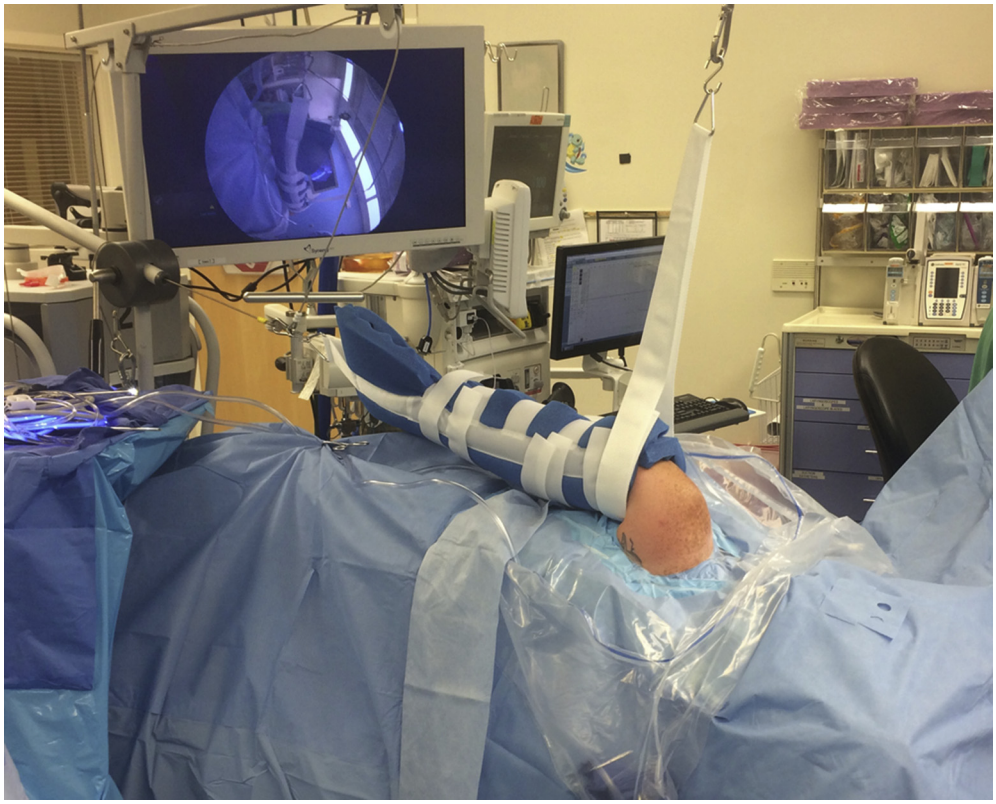

Fig 1. Surgical positioning and setup for a left shoulder in the lateral decubitus position. The STaR (Arthrex Shoulder Traction and Rotation) lateral suspension arm sleeve is used for assistance in arm positioning.

liberation of the coracoid. With improvements in technique and instrumentation, this procedure has become a viable option in the treatment of some shoulder instability. This is a universally recognized learning curve to performing this technically difficult procedure, and it often requires additional medial accessory portals in the beach chair position with absolute understanding of the anatomy of the brachial plexus and the anteromedial shoulder.[14-16] This arthroscopic technique is useful as a way to minimize accessory medial portals, remain in the lateral decubitus position, and adequately visualize the coracoid to safely releasing the PM from its superomedial aspect.

Technique

This technique for arthroscopic PM release was developed to show a safe, reproducible, and effective way to approach and release the PM from its attachment at the superomedial aspect of the coracoid process (Video 1). Indications for this operation include patients with a painful scapular dyskinesis who have failed a concerted effort at nonoperative management with physical therapy and PM stretching techniques.

Setup/Positioning

The patient is positioned in the standard lateral decubitus position (Fig 1), and the operative extremity is prepped and sterilely draped with a wide operative field medially to the sternoclavicular joint. The patient should be prepped and draped medial to the coracoid to ensure access for portal placement, but also in the event there is a need to convert to an open surgery.

Step 1: Portal Placement

A standard posterior viewing portal is made 1 cm medial and 3 cm distal to the posterolateral corner of

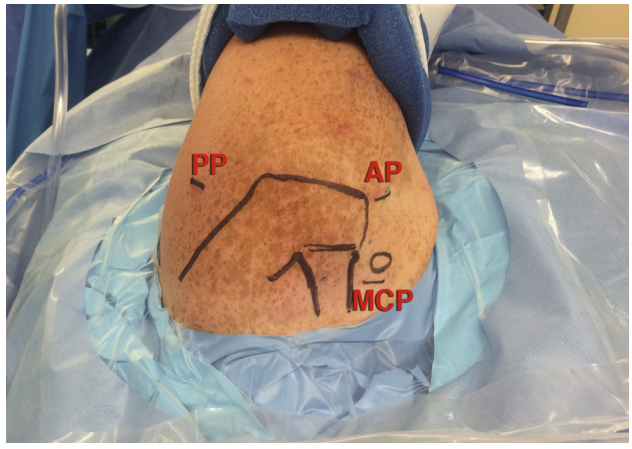

Fig 2. Left shoulder in the lateral decubitus position with the topical anatomy and proposed portal sites marked. (AP, anterior superior portal; MCP, mid coracoid portal; PP, posterior portal.)

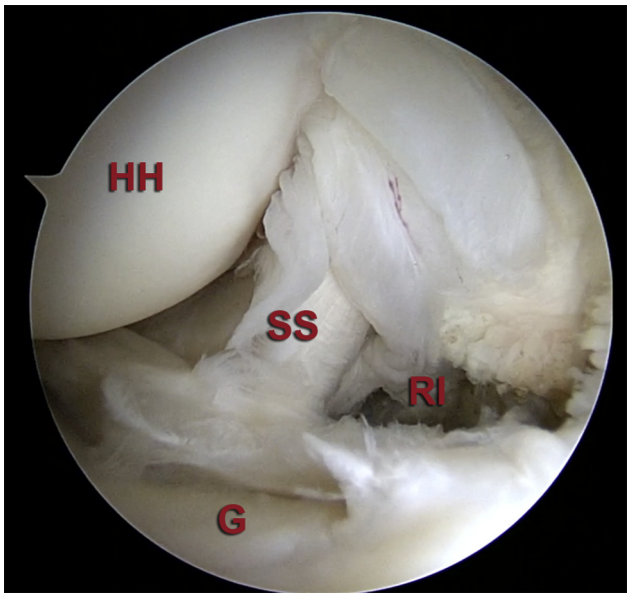

Fig 3. Left shoulder pictured in the lateral decubitus position and viewing from the posterior portal. Shown are the rotator interval (RI), subscapularis (SS), humeral head (HH), and glenoid (G). Also noted here is the long head of the bicep tendon that has previously been tenotomized. It is important to note that the RI is fully released and the SS should be debrided both superficially and deep to the tendon.

the acromion (Fig 2). On entering the glenohumeral joint, a complete diagnostic arthroscopy is performed. Next, the standard anterior portal is established using needle localization in the rotator interval and an outside-in technique. It is important that the anterior portal is placed so that adequate debridement along the superficial border of the subscapularis and the lateral aspect of the coracoid can be readily performed. The only additional accessory portal needed is the mid coracoid portal (MCP), as shown in Figure 2. This is established with needle localization from just superior and medial to the coracoid process. Again, care is taken to ensure proper trajectory and accessibility to the superomedial coracoid.

Step 2: Coracoid Exposure

After a complete diagnostic arthroscopy, the rotator interval is opened with either a motorized shaver (Arhtrex, Naples, FL) or a radiofrequency ablation (RFA) device (Smith & Nephew, Andover, MD) (Fig 3). It is important to locate and expose the superior border of the subscapularis and the base of the coracoid. The conjoint tendon, and coracoacromial and coracohumeral ligaments are identified (Fig 4). The coracohumeral ligament is released and the coracoid is meticulously exposed from the lateral flexure inferiorly. The most exposure of the coracoid is performed while viewing from the standard posterior portal and working anteriorly. If visibility is difficult, one could make an accessory anterior superior portal for viewing. In addition, a 70° arthroscope is useful for improved visualization. This allows for a complete 360° view of the subscapularis, the coracoid process, and the subcoracoid region.

Step 3: Identifying the PM

Once the subcoracoid space is readily visible and clear of debris, the arthroscopic camera is advanced across the joint anteriorly through the rotator interval (Fig 5). The PM tendon is seen coursing superolaterally and attaching to the superomedial aspect of the coracoid (Fig 6). The conjoint tendon is an excellent reference point for orientation when operating in this region of the shoulder.

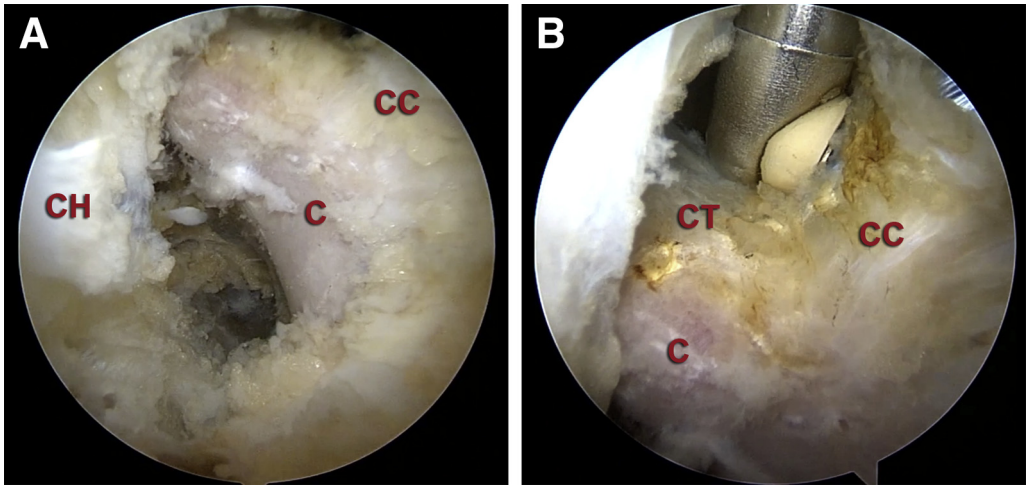

Fig 4. (A) A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. The conjoint tendon attachment to the tip of the coracoid is shown. (B) A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. Shown here is the well-exposed base of the coracoid, the conjoint tendon, and the coracoclavicular ligaments. (C, coracoid; CC, coracoclavicular; CH, coracohumeral ligament; CT, conjoint tendon.)

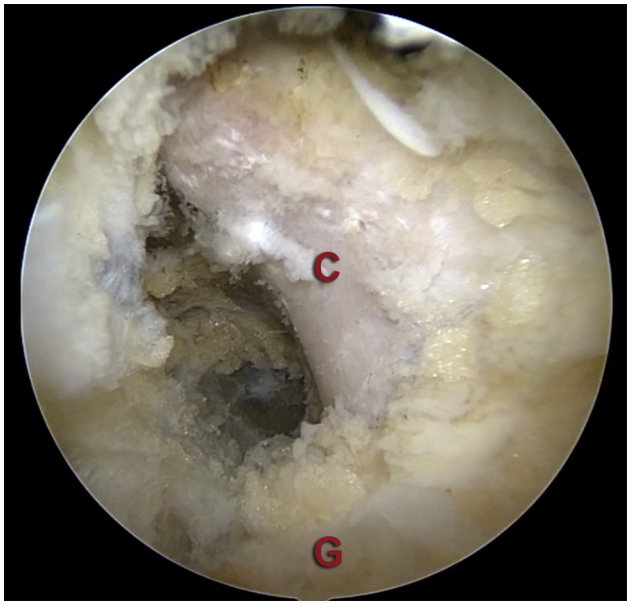

Fig 5. A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. View as the camera is advanced across into the rotator interval. (C, coracoid; G, glenoid.)

Step 4: Mid Coracoid Portal

Once the surrounding anatomy is well visualized, a needle is introduced through the mid coracoid region (Fig 7) ensuring a safe entry and proper trajectory to release the PM tendon from its insertion. The skin incision is typically 1 cm superior and just medial to the coracoid process (Fig 2). Once the MCP is established, a blunt instrument such as a nerve hook or a switching stick is used to bluntly and gently mechanically dissect the subcoracoid bursa free from the neurovascular structures and better define the superior and inferior border of the PM. It is important to readily identify the musculocutaneous nerve traversing just deep and medial to the border of the PM (Fig 8).

Step 5: PM Release

Once the borders of the PM are exposed an RFA can be introduced into the subcoracoid space. Depending on the surgeon's preference, a cannula can be used through this portal for instrument passage. The tendon insertion is palpated and scored with the RFA device and the tendon released adjacent to the superomedial aspect of the coracoid process. The release is performed with the RFA; however, it is important to direct the probe safely away from the musculocutaneous nerve. Another option for release is an arthroscopic meniscal biter or sharp dissection. On release some recoil of the musculotendinous complex is expected. A grasping instrument or switching stick is then used to confirm complete release of any residual adhesions or attachments to the PM (Fig 9). Care is taken throughout the case to locate and protect the relevant neurovascular structures.

Step 6: Post Op/Rehabilitation

The arthroscopic PM release is usually an adjunct procedure in patients with a painful static protracted scapula or throwing athletes with recalcitrant dyskinesis. The release of the PM should not alter the standard rehabilitation and return to throw postoperative protocol. Periscapular control and strengthening is vital to any dyskinesis rehabilitation. Of equal importance is attention to core strength, balance, and hip and lower extremity mobility and strength.

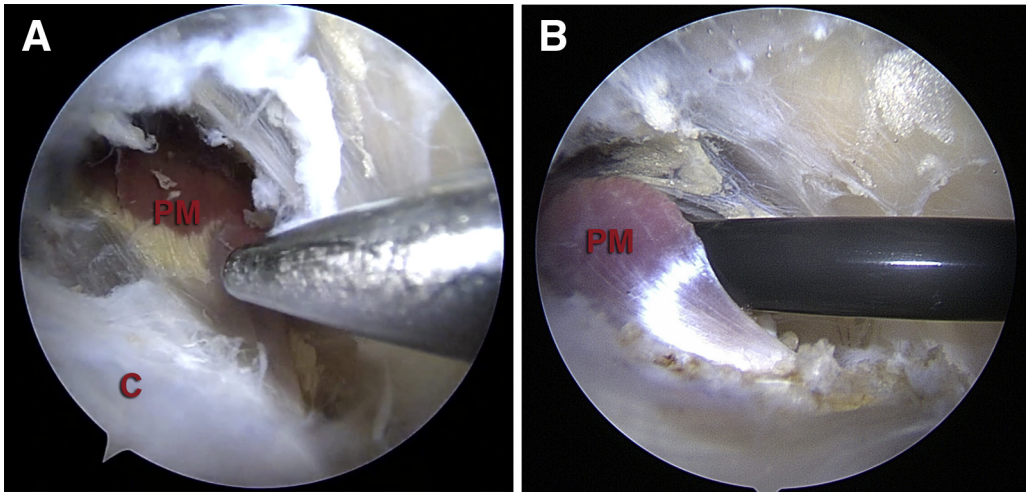

Fig 6. (A) A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. This is viewed using a 30° arthroscope. The switching stick has been introduced through the mid coracoid portal and is showing the path and trajectory to the pectoralis minor attachment on the coracoid. (B) A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. This is viewed using a 30° arthroscope. The surgical instrument is shown lifting the pectoralis minor muscle at the musculotendinous junction. (C, coracoid; PM, pectoralis minor.)

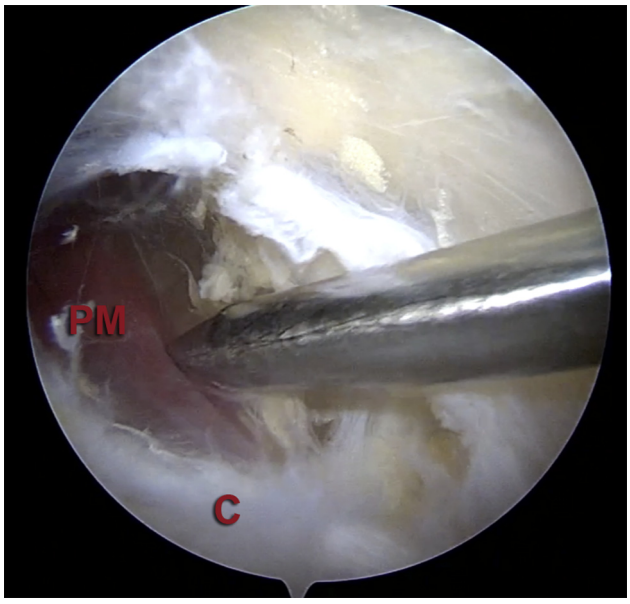

Fig 7. A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. This is viewed using a 30° arthroscope. (C, coracoid; PM, pectoralis minor.)

Discussion

Treatment for patients with scapular dyskinesis and a tight PM is initially nonoperative, including static and dynamic stretching, and periscapular muscular rehabilitation.[5,13,17,18] However, there is a subset of patients who do not adequately respond to stretching and other nonoperative modalities.[7] Isolated PM release has been reported as a viable option for recalcitrant PM tightness in the symptomatic patient who is unresponsive to nonoperative treatments.[7] The PM tendon is released as a part of the Latarjet bone block transfer performed for shoulder instability in the setting of bone loss. This can be performed arthroscopically and these patients show improved outcome scores with no definable deficit related to the PM release.[7] Provencher et al.[7] published a series patients with isolated PM tightness. This study included 46 patients with isolated PM tightness over 3 years. There were 6 patients who did not respond to the standardized nonoperative protocol and underwent open release. They noted significant improvement in patient-reported outcomes (Single Alpha Numeric Evaluation score), clinical outcomes (American Shoulder and Elbow Surgeons score), and pain scores (visual analog scale) with objective changes in scapular station in both groups with no reported complications. There were no differences in patient outcomes between the operative and nonoperative groups. All of these patients were able to return to full activities.[7] On the basis of these results in open PM release, this arthroscopic technique provides a minimally invasive option to avoid open medial dissection around the coracoid and provide a safe approach to the medial coracoid. In addition, this approach can be performed in the lateral decubitus position and can be performed in conjunction with other shoulder arthroscopic procedures.

Although an arthroscopic surgical release of the PM is a viable option in this patient population, it is not without limitations. The technique does introduce the MCP, which is often unfamiliar, and when placed improperly can risk damage to the musculocutaneous nerve, brachial plexus, and surrounding neurovascular structures. It is important to have sufficient visualization of the coracoid, PM, and surrounding anatomy and use needle localization to minimize this risk. Another key to visualization here is to completely expose the lateral flexure of the coracoid before advancing into the subcoracoid space. This allows for working space and visualization with either the 30° or the 70° arthroscope.

Scapular dyskinesis can be a difficult and debilitating problem that has been associated with shoulder pain and dysfunction. Although most patients with scapular dyskinesis and a shortened or tight PM respond well to nonoperative modalities, there is a defined subset of patients who do not respond to these modalities. This is a reproducible and safe technique to perform an isolated arthroscopic PM release in a patient with PM tightness who has not responded to nonoperative modalities including static and dynamic stretching and scapulothoracic training. The utility of this operation is still evolving, and further studies are needed for long-term follow-up and clinical outcomes of patients treated with arthroscopic release of the PM.

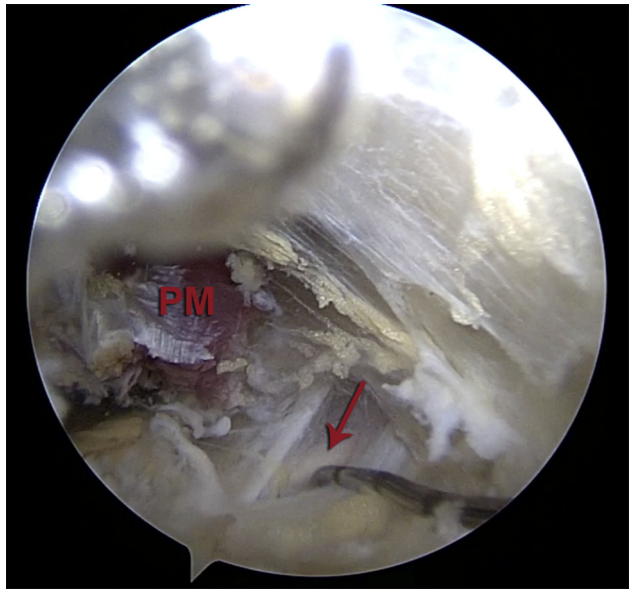

Fig 8. A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. This is viewed using a 30° arthroscope. After the release of the pectoralis minor tendon, the musculocutaneous nerve (red arrow) is readily visible. (PM, pectoralis minor.)

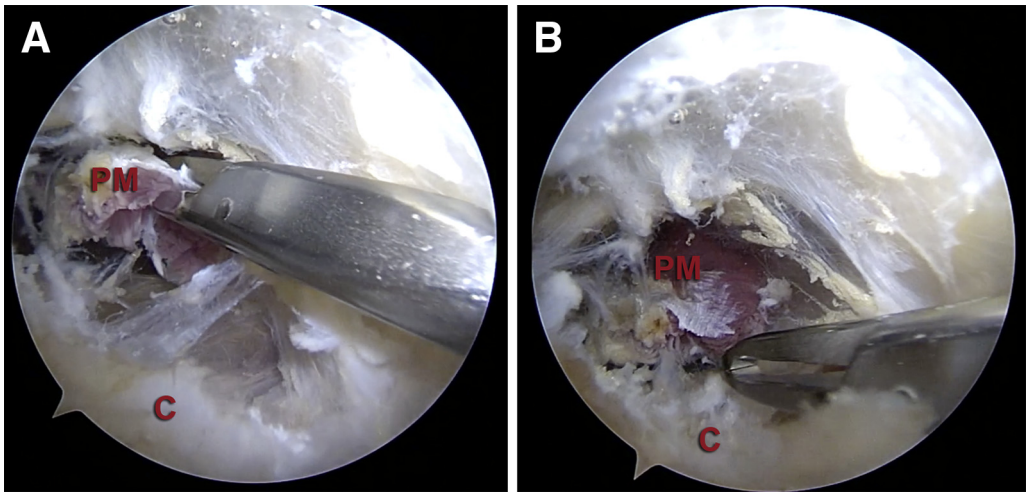

Fig 9. (A) A left shoulder in the lateral position, viewing from the posterior portal across anteriorly through the rotator interval. This is viewed using a 30° arthroscope. The grasping tool is introduced through the mid coracoid portal and is used to ensure the complete release and mobility of the tendon. (B) A left shoulder in the lateral position, viewing from the posterior portal the rotator interval. This is viewed using a 30° arthroscope. This again shows a fully released pectoralis minor. The grasping tool is introduced through the mid coracoid portal. Of note the musculotendinous junction will recoil along its axis after release. (C, coracoid; PM, pectoralis minor.)

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