Arthroscopic Transtendinous Modified Double-Row Suture Bridge Repair of a Bony PASTA Lesion

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Abstract: Surgical and conservative management of partial tears of the rotator cuff has long been a controversial topic for many generations of shoulder surgeons. These tears frequently occur on both the articular and bursal surfaces and within the intrasubstance of the rotator cuff. The term "PASTA lesion" describes the partial articular supraspinatus tendon avulsion–type injury. A less common variant of this injury is the bony PASTA lesion or partial articular bony avulsion of the supraspinatus tendon (PABAST).

Surgical and conservative management of partial tears of the rotator cuff has long been a controversial topic for many generations of shoulder surgeons. In 1934 Codman[1] described partial tears of the rotator cuff as "rim rents" and recognized that these rim rents frequently occurred on the articular and bursal surfaces, as well as within the intrasubstance of the rotator cuff. Ellman[2] subsequently developed a classification scheme based on the location and depth of these tears. It is well established that articular-sided tears are 2 to 3 times more common than bursal-sided tears and that they occur most commonly on the undersurface of the supraspinatus tendon.[3-5] Millstein and Snyder[6] later coined the term "PASTA lesion" to describe the partial articular supraspinatus tendon avulsion–type injury. An even less common variant of this injury is the bony PASTA lesion or partial articular bony avulsion of the supraspinatus tendon (PABAST) described by Bhatia et al.[7,8] There have been numerous arthroscopic techniques described to address this lesion,[9] and we present a case of a bony PASTA lesion along with our arthroscopic repair technique.

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Patient

A 60-year-old right hand–dominant female nurse sustained a traction-type injury to her right shoulder. The injury occurred while she was walking her dog and the dog suddenly pulled against the leash to chase a squirrel. The patient reported immediate pain, along with limited range of motion and function. Initial radiographs at another institution showed an avulsion fracture of the greater tuberosity, and she was treated in a conservative fashion by another orthopaedic surgeon with 4 weeks of sling immobilization, followed by 4 months of physical therapy. She subsequently presented to us with continued pain and significant weakness of the right upper extremity despite conservative treatment. Repeat radiographs showed a delayed union of the avulsion fracture of the greater tuberosity, and subsequent magnetic resonance imaging confirmed a bony PASTA lesion of the right shoulder. After we discussed operative versus nonoperative treatment options with the patient, the decision was made to proceed with an arthroscopic inspection and possible repair.

Surgical Technique

The arthroscopic technique is performed with the patient in the lateral decubitus position but is certainly amenable to the beach-chair position as well. A standard posterior portal is created, and a diagnostic arthroscopy is performed. Additional intra-articular pathology may be addressed in the same setting. Once the partial undersurface tear of the supraspinatus is identified (Fig 1 and Video 1), an anterior portal is created by an outside-in technique within the superior aspect of the rotator interval to facilitate inspection and treatment of the rotator cuff. If the bony avulsion

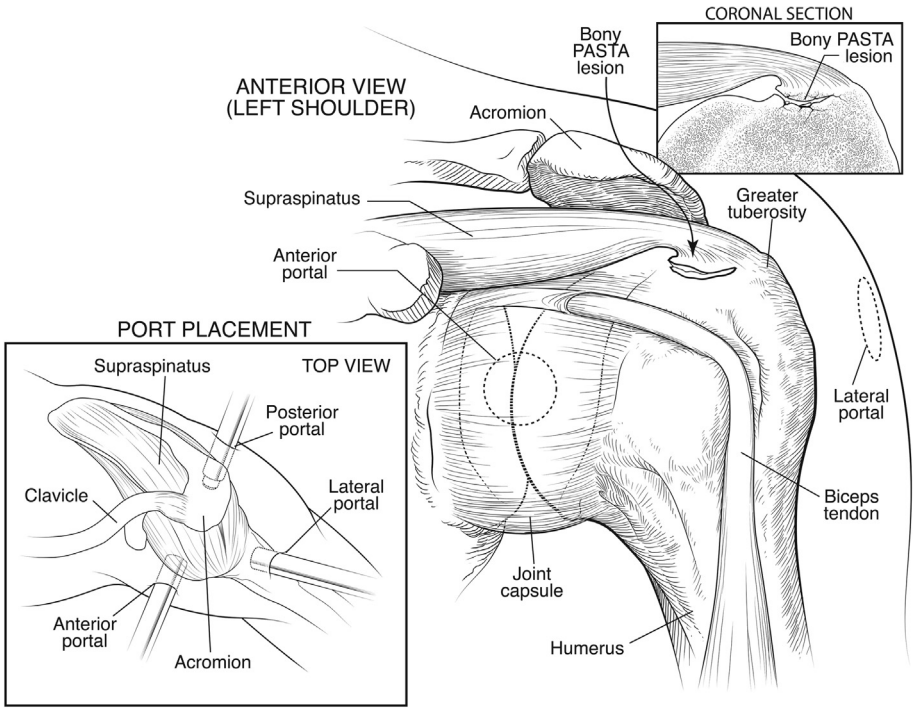

Fig 1. Anterior view of shoulder joint showing arthroscopic setup along with partially avulsed supraspinatus tendon and bony fragment from greater tuberosity.

propagates into the bicipital groove, a biceps tenotomy or tenodesis may be indicated. The supraspinatus undersurface is evaluated to establish the depth of the tear, as well as the size and comminution of the greater tuberosity fragment(s). The bone-tendon interface is also meticulously assessed to ensure that a bony repair is feasible. After debridement of the frayed undersurface of the rotator cuff and removal of unstable bony fragments, a more accurate assessment of the extent of the tear is possible. This information is imperative to determine whether a transtendinous (all-inside) repair may be attempted or completion of the tear should be performed. In our patient the lateral footprint of the rotator cuff and tuberosity fragment were deemed to be intact and amenable to an arthroscopic transtendinous repair.

After lightly decorticating the bony surfaces, we used an 18-gauge spinal needle to localize the insertion point of the anchor. A percutaneous skin incision is made following the course of the spinal needle and is carried down through the rotator cuff, parallel to the supraspinatus fibers. An anchor (5.5-mm Bio-Corkscrew suture anchor; Arthrex, Naples, FL) is inserted in the standard percutaneous fashion in preparation for repair. The spinal needle is again inserted from a lateral entry through the rotator cuff, just medial to the tear. A monofilament suture is passed through the spinal needle and retrieved out the anterior portal along with 1 of the free limbs of suture from the anchor. The spinal needle is removed, and the monofilament suture and the free limb of suture from the anchor are then tied together and shuttled out the lateral skin in the standard fashion. This shuttle sequence is repeated, progressing from the anterior aspect of the tear to the posterior aspect of the tear. The sutures are retrieved and shuttled in a horizontal mattress configuration. Additional anchors are placed and sutures are passed to accommodate the size of the tear (Fig 2).

Once the sutures have all been shuttled, attention is turned to the subacromial space. The same posterior portal is used, and the arthroscope is redirected into the subacromial space. A standard lateral portal is established by an outside-in technique, and a shaver is used to remove the subacromial bursa in an effort to localize the previously passed sutures. It is recommended to begin the subacromial bursectomy well medial to the sutures in an effort to avoid inadvertent suction of the sutures into the shaver device. Alternatively, the bursa may be removed before passing the sutures to make visualization less precarious.

Once localized, the sutures are retrieved within a cannula from the posterior portal and subsequently tied from posterior to anterior by use of a standard sliding locking knot with 3 reversed half-hitches (Fig 3). The free ends of the sutures may be left long and incorporated into a lateral push-in anchor (3.5-mm PushLock anchor; Arthrex) to complete a modified double-row suture bridge repair (Fig 4). This provides compression to the rotator cuff and bony fragment and facilitates a low-profile repair. The repair may then be viewed from the articular side of the rotator cuff to ensure a satisfactory repair.

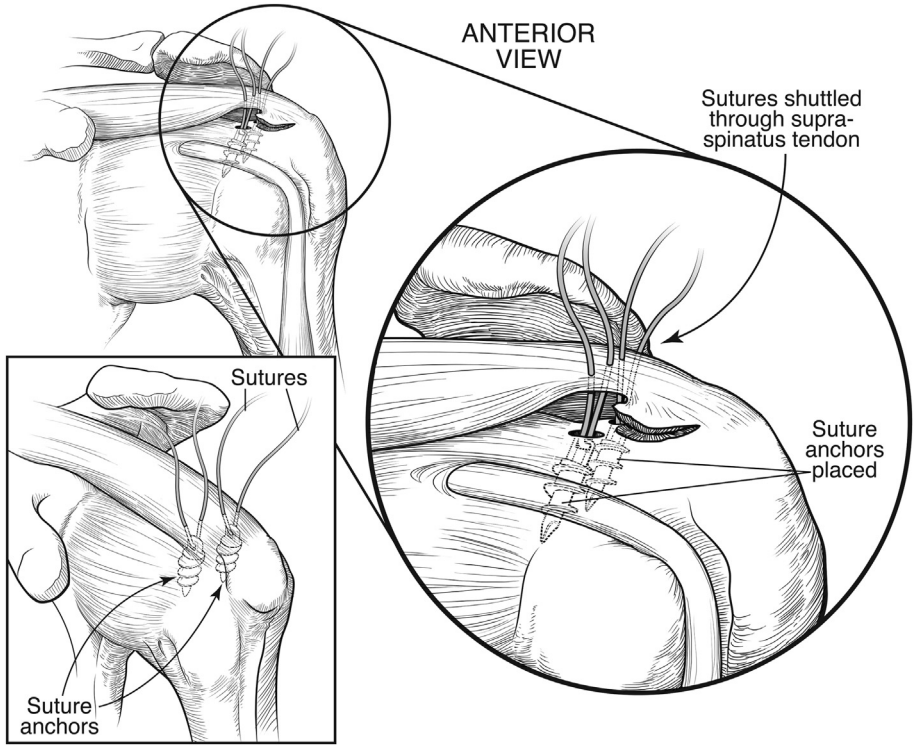

Fig 2. Anterior and superior oblique views of shoulder joint showing 2 suture anchors placed percutaneously through supraspinatus within greater tuberosity.

Discussion

Rotator cuff pathology is 1 of the most common conditions evaluated and treated by the practicing shoulder surgeon. Multiple studies have shown an increase in prevalence of rotator cuff tears with age, and examination of asymptomatic patients with magnetic resonance imaging and ultrasound has documented significant findings of full-thickness and partial rotator cuff tears.[10,11] Partial articular-sided tears have been recognized to occur 2 to 3 times more frequently than bursal or intrasubstance tears.[3-5] Although the bony PASTA lesion was first described in the literature in 2007,[7] its incidence is unknown, and this lesion is significantly less common.

Unlike the natural progression of attritional rotator cuff tears,[12,13] bony PASTA lesions are often associated with a traumatic event and present acutely to be evaluated.[6,13] Nonoperative management of this injury may be challenging because of the forces applied to the bony fragment by the attached rotator cuff tendon and the

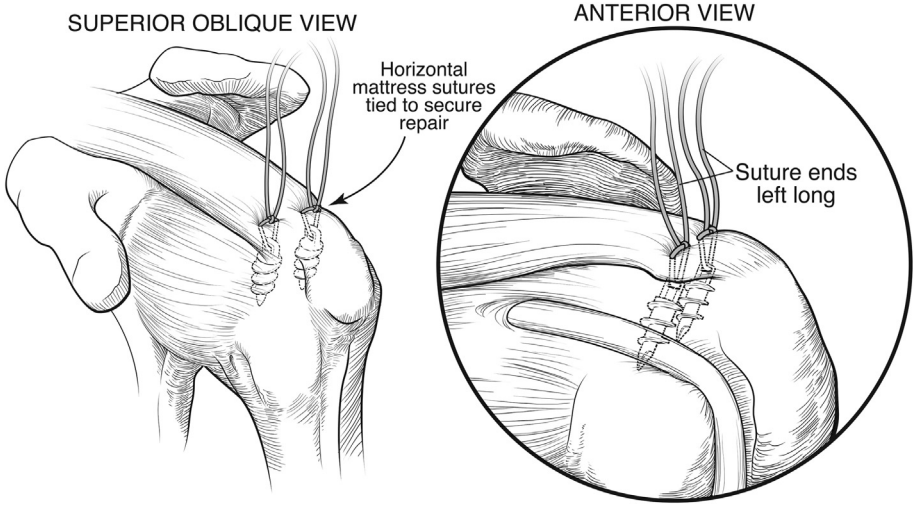

Fig 3. Anterior and superior oblique views of shoulder joint showing 2 sutures tied in horizontal mattress configuration with free suture ends left long.

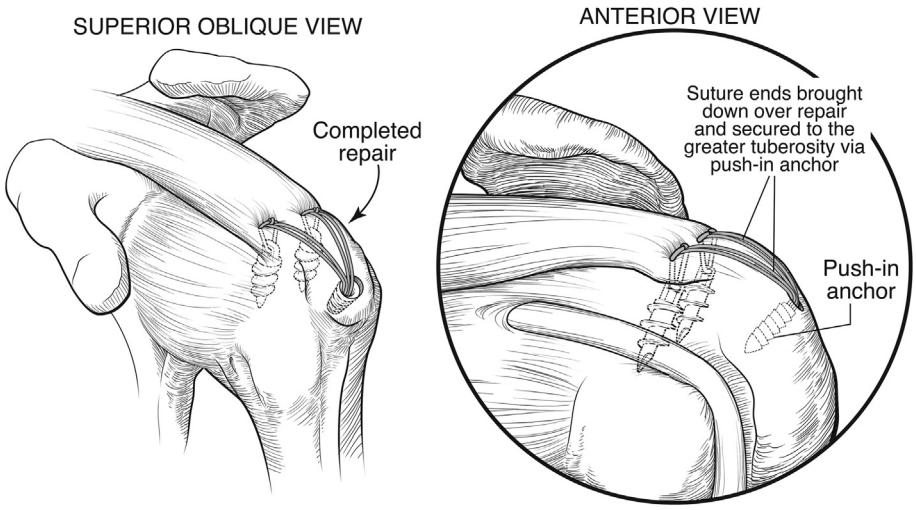

Fig 4. Anterior and superior oblique views of shoulder joint showing 2 suture anchors with free ends of sutures being incorporated into push-in anchor inserted into lateral cortex of greater tuberosity.

immobilization necessary for bony healing. As with customary fracture healing, motion at the site of injury often leads to delayed union, persistent pain, and loss of function.

Surgical techniques for addressing partial rotator cuff tears have progressed from early arthroscopic debridement to tear completion and repair, and more recently, a transtendinous arthroscopic repair has been described.[13] Snyder[14] was the first author to describe this approach of repairing the articular-sided partial tear while retaining the intact lateral cuff insertion. Ide et al.[15] went on to report good to excellent results using this technique for repairing grade 3 articular-sided partial tears. Biomechanical data also have shown less gapping at the repair site and increased ultimate load to failure with the transtendinous repair compared with a technique in which the tear is completed and then repaired.[16]

Both Bhatia et al.[7] and Murena et al.[9] have described techniques for transtendinous repair of a bony PASTA lesion. Bhatia et al. described a technique using a single suture anchor and mattress sutures placed through a transtendinous approach. Murena et al. more recently described a double-pulley technique. We report a technique using a modified transtendinous double-row suture bridge repair. We believe that the advantages of this repair technique include compression to the bony fragment and rotator cuff, allowing restoration of the supraspinatus footprint (Table 1). This suture configuration also offers secure fixation and a low-profile repair with the potential for immediate rehabilitation.

Table 1. Advantages of Arthroscopic Transtendinous Modified Double-Row Suture Bridge Repair of Bony PASTA Lesion

Standard arthroscopic setup and portals
No special instrumentation
Preservation of lateral footprint
Minimal risk of over-tensioning of repair
Compression of bony fragment
Low-profile repair

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