

Distal Adductor Longus Avulsion: A Technique for Successful Repair



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Abstract: Strains of the adductor muscle are common among athletes, but avulsion at its insertion is rare. Likewise, the diagnosis and management of distal ruptures of the adductors are infrequently reported in the literature. Presented here are the common presenting clinical findings of chronic distal adductor longus tendon ruptures and a description of how these can be successfully treated with a previously undescribed surgical technique. Preoperative and postoperative magnetic resonance imaging can be compared for verification of successful surgical repair. Also reviewed are common sports and mechanisms that elicit this injury pattern, adductor longus muscle function, relevant surgical anatomy, and treatment strategies.

Groin injuries are frequently encountered in sports medicine and are estimated to represent 2% to 5% of all sports-related injuries.¹ The differential diagnosis is initially broad, ranging from adductor muscle sprains to osteitis pubis, sports hernia, iliopsoas bursitis, stress fractures, avulsion injuries, inguinal hernias, and other diagnoses. Of these potential diagnoses, strain of the adductor muscles is the most common,¹ with the adductor longus muscle having the highest incidence of involvement.² Contrary to this, actual rupture or avulsion of the adductor longus muscle is rare and distal ruptures are even more infrequent.³⁻¹²

The typical mechanism of trauma is an eccentric overload caused by forced abduction during contraction

of the adductor muscle group. As such, these injuries commonly occur in cutting, pivoting, and twisting sports such as soccer, football, and basketball.⁷⁻⁹

It is well established that the standard of treatment for adductor muscle strains consists of nonoperative rest and rehabilitation.^{1,13} However, given the rarity of adductor longus muscle rupture or avulsion and the resulting paucity of literature on this diagnosis, the optimal management for these injuries is currently unknown. The largest study of this diagnosis is a retrospective case series of 19 National Football League players who sustained proximal adductor longus ruptures verified by magnetic resonance imaging (MRI) from 1992 to 2004.⁸ Of the 19 adductor longus ruptures, 5 were treated surgically. Management of distal adductor longus tendon ruptures is even more lacking in the current literature.^{3,5,9,12,14}

To date, only a single technique for successful surgical repair of the distal adductor longus has been described in the literature, which occurred in the subacute setting.¹⁴ As such, the purpose of this article was to provide a description of a previously undescribed surgical technique for successful repair of distal adductor longus tendon ruptures.

Patient Evaluation and Preoperative Assessment

Patients often present with a remote history of a painful groin injury that occurred during participation in a team sport such as soccer, basketball, or football. They may or may not have been seen by a health care professional and treated conservatively at the time for

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The authors report the following potential conflicts of interest or sources of funding: J.G. is a consultant for Stryker, receives research support from DePuy Mitek, and receives fellowship funding from Arthrex. O.M.-D. receives grant support from and is a paid consultant for Stryker. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).

Received November 16, 2018; accepted February 16, 2019.

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2212-6287/181375

<https://doi.org/10.1016/j.eats.2019.02.005>

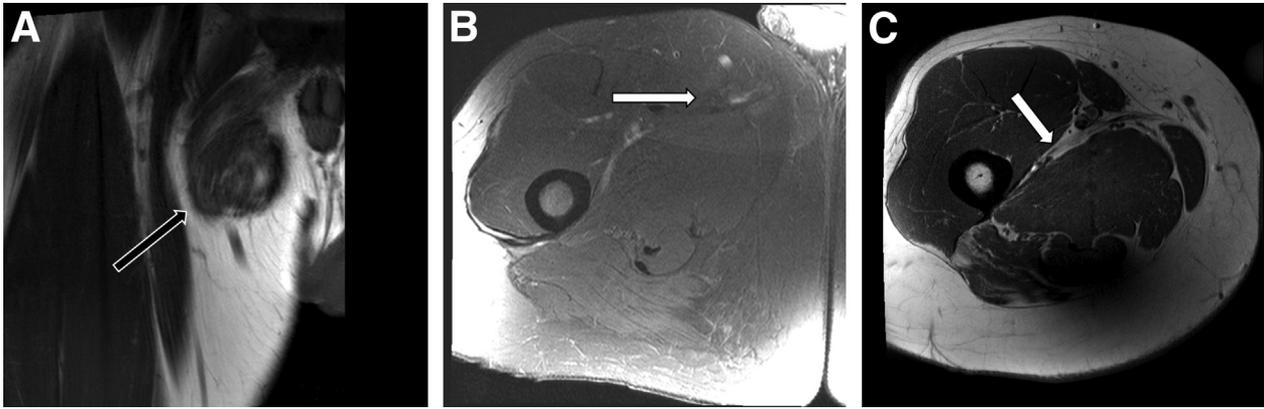


Fig 1. A T1 coronal magnetic resonance sequence (A) and axial short tau inversion recovery magnetic resonance sequence (B) show a chronically retracted adductor longus muscle belly (black arrow) at the proximal medial right thigh with abrupt termination evidenced by lack of continuation on the short tau inversion recovery image (white arrow). (C) A T1 axial magnetic resonance sequence shows only thin disorganized strands of T1 hypointense scar along the course of the adductor longus muscle to the femoral attachment (arrow).

“groin” or “adductor strain.” Patients will ultimately continue to complain of groin pain, weakness with adduction, and/or even an asymmetrical mass on the mid inner thigh. On examination, patients should have painless range of motion at the hip and knee. Pain should be reproduced with resisted thigh adduction, and a painless mass may be palpated and/or visualized at the mid inner thigh (Video 1). A strength deficit may be appreciated.

Standard radiographs should reveal no osseous abnormality in the region of the patients’ symptoms, and an MRI scan should be performed to confirm the diagnosis (Figs 1 and 2). Additional dynamic MRI sequences can be taken with patients actively adducting by holding a rubber ball between the legs. The muscle belly may be found to further retract proximally toward the adductor origin.

Surgical Technique

The surgical technique of distal adductor longus repair is described and shown in detail in Video 1. Pearls and pitfalls of the procedure are noted in Table 1.

Presurgical Imaging

On the day of surgery, a musculoskeletally trained radiologist or orthopaedic surgeon performs ultrasound to mark the following anatomic landmarks along the proximal half of the medial thigh: saphenous vein, sartorius muscle, gracilis muscle, and retracted adductor longus muscle (Fig 3).

Positioning

On completion of ultrasound, general anesthesia is induced and the patient remains in the supine position. The operative limb is placed in abduction and external



Fig 2. An axial short tau inversion recovery magnetic resonance sequence of the left thigh (A) and T1 coronal magnetic resonance sequence (B) show an edematous retracted adductor longus muscle belly (white arrow) at the proximal medial thigh with associated fatty atrophy (black arrow). (C) Absence of muscle or tendon to femoral attachment (arrows) on axial T1 magnetic resonance sequence.

Table 1. Surgical Pearls and Pitfalls for Repair of Distal Adductor Longus Avulsion

Pearls	Pitfalls
Preoperative ultrasound should be obtained on the day of surgery to mark important nearby anatomic structures to aid in dissection down to the retracted muscle belly and avoid iatrogenic injury.	Anatomic exposure is performed near several important anatomic neurovascular structures, placing them at risk of iatrogenic injury: great saphenous vein; femoral nerve, artery, and vein; and obturator nerve.
To regain the length of the adductor longus, the surgeon should make sure to meticulously separate the muscle from surrounding scar and anatomic structures.	Inadequate scar revision and freeing of the adductor longus from surrounding tissue can result in over-tensioning of the muscle, which can also place the nearby neurovascular structures at risk.
The middle third of the linea aspera should be located and cleaned prior to bone anchor insertion.	Reinserting the adductor longus outside of the range of its anatomic footprint may result in lack of restoration of normal function.
After fixation, the operative leg should be taken through gentle adduction, abduction, and knee extension to confirm correct tension.	Over-tensioning the repair could place the surrounding neurovascular structures at risk.
The repair should be protected in a hip brace in neutral position to avoid placing tension on the repair and to avoid active contraction of the repair with adduction for 4 to 6 wk.	Not protecting the repair can result in loss of fixation.

rotation, with flexion at the knee, to best expose the medial thigh (Fig 4).

Approach

A 5-cm incision is made along the medial thigh between the previously made ultrasound-guided markings of the triangle between the sartorius and gracilis muscles (Fig 4). After sharp dissection through subcutaneous tissue, with care taken to avoid the great saphenous vein, the sartorius and gracilis muscles are encountered and retracted laterally and medially, respectively. This exposes the adductor longus, which is initially tagged (Fig 5). The femoral nerve, artery, and vein, as well as their distal branches, and the obturator nerve and its branches may be identified and gently retracted away from the surgical field. Blunt finger dissection between the vastus medialis anterolaterally and the adductor brevis and magnus posteromedially is carried down to the femur.

Bone and Tendon Preparation

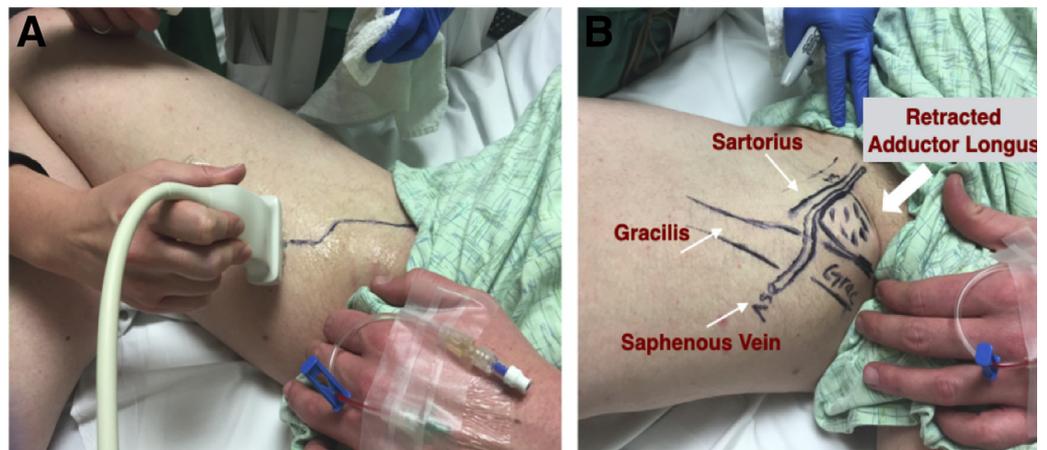
The linea aspera along the posterior femur is identified, and the middle third, where the adductor longus

originally inserts, is cleaned with a rongeur and rasp as necessary. The proximally retracted tendinous stump of the adductor longus is then exposed beneath its fascia. The muscle belly of the adductor longus is meticulously separated from surrounding scar tissue to regain its length (Fig 6). If the tendon cannot be placed in the middle of its insertion without excessive traction, it is placed slightly more proximally within the footprint.

Tendon Repair to Bone

Attention is then turned back to the bony insertion of the adductor longus. Two bone anchors double loaded with high-strength suture (2.8-mm Q-fix and Magnum wire; ArthroCare/Smith & Nephew) are placed into the middle third of the linea aspera. The sutures are stitched in Krackow fashion to the tendinous stump of the adductor longus, enabling a pulling force directed toward the insertional footprint, to achieve anatomic approximation and reinsertion (Fig 6). The leg is taken through gentle adduction, abduction, and knee extension to verify satisfactory adductor longus tension and to avoid over-tensioning, which can place the

Fig 3. (A) Ultrasound is performed to mark the important anatomic landmarks preoperatively on the day of surgery on the operative right leg. (B) Markings on the patient indicate the gracilis muscle (Grac), saphenous vein (SV), and sartorius muscle (Sart). The large arrow points to the retracted adductor longus muscle.



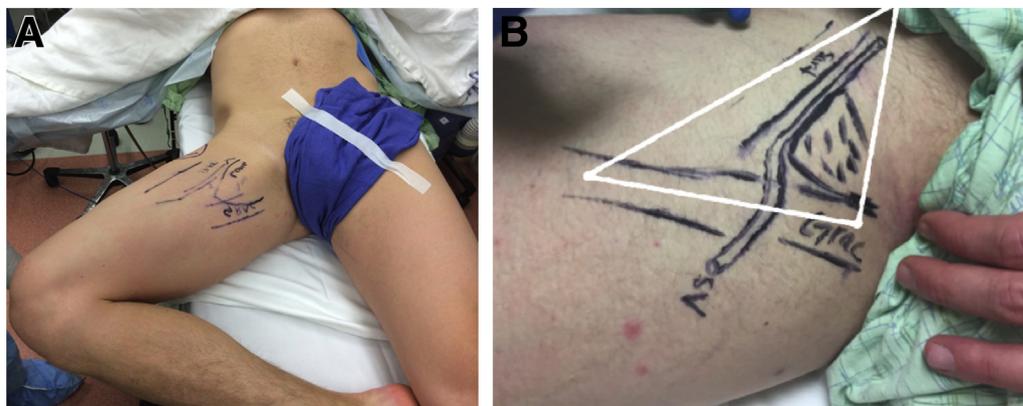


Fig 4. (A) The patient is placed in the supine position, and the operative limb (right side in this case) is placed in abduction and external rotation, with flexion at the knee, to best expose the medial thigh. (B) A 5-cm incision is made along the medial thigh between the previously made ultrasound-guided markings of the triangle between the sartorius muscle (Sart) and gracilis muscle (Grac). (SV, saphenous vein.)

surrounding neurovascular structures at risk. The incision is closed according to anatomic layers, a sterile dressing is applied, and the limb is placed into a hip brace in neutral position to avoid placing tension on the repair with abduction and active use of the repair with adduction.

Rehabilitation

Phase 1 of rehabilitation consists of the patient remaining non-weight bearing on the operative limb for 6 weeks and beginning guided physical therapy at 2 weeks from surgery. Use of the brace is discontinued at 4 weeks. Phase 2 goes from 6 to 12 weeks and focuses on return of full motion and closed-chain strengthening. During phase 3 (weeks 12-16), the aim is to increase strength and endurance. Phase 4 (weeks 16-24) involves a running progression, with a plan for returning to sport between 5 and 6 months postoperatively. At the

6-month follow-up appointment, the patient should be cleared to participate in full unrestricted activity. An MRI scan may be obtained to further verify tendon-to-bone healing prior to returning to play (Fig 7).

Discussion

In this article, we present an uncommon cause of medial thigh and groin pain, rupture of the distal adductor longus, and provide a description of our technique for surgical repair. The only other method of surgical repair was previously described in an elite soccer player in whom 4 months of conservative therapy had failed.¹⁴ Instead of the use of bone anchors as described in our article, 2 bicortical holes were drilled into the femoral diaphysis and the sutures attached to the distal adductor tendon stump were passed medially to laterally. This required a second lateral incision for knot tying and fixation of the sutures. The patient healed and was rehabilitated in a similar fashion to our described technique. However, larger and additional incisions were made, increasing the risk of iatrogenic injury to the nearby neurovascular structures and reducing cosmesis. Bicortical drilling of the femur also causes a greater stress riser than use of unicortical bone anchors, which could lead to iatrogenic femoral fracture if weight bearing is initiated too early. Larger-diameter drill holes (3.5 mm vs 3.0 mm in our technique) were made in the femur, also contributing to increased stress. Finally, the previously reported case was performed in the semi-acute setting, which is contrary to the standard of care per the limited literature on these injuries.

Other accounts of distal adductor longus tendon rupture described management predominantly with nonoperative therapy, and if this failed, surgical excision of the adductor longus muscle was most commonly the ensuing treatment.^{3,5,9,11,12} Peterson and Stener⁵ published the largest case series of distal adductor longus

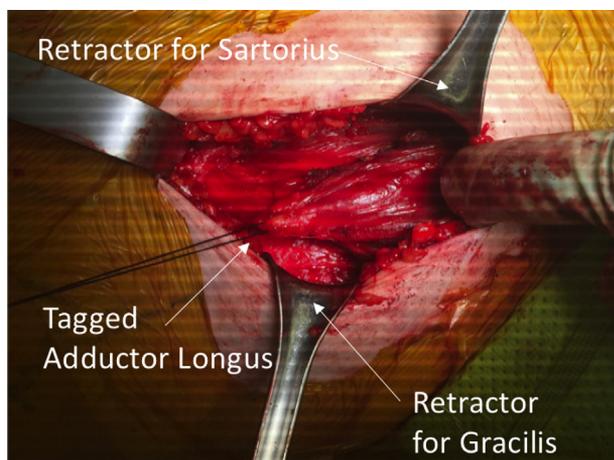


Fig 5. After retraction of the sartorius laterally and the gracilis medially, the adductor longus is visualized and tagged in a case of right distal adductor avulsion.

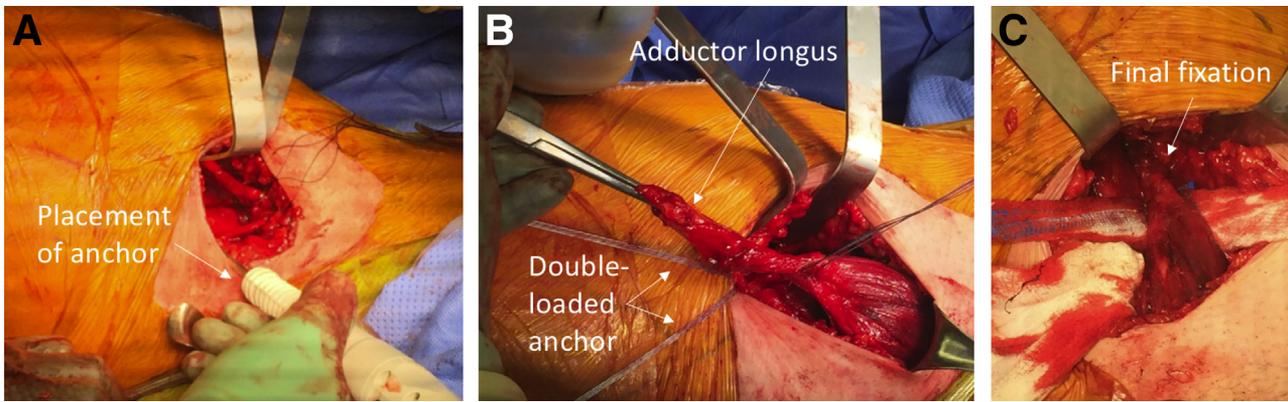


Fig 6. Images of a right thigh. (A) Placement of first bone anchor. (B) After meticulous separation from the surrounding scar tissue, the adductor longus is further exposed and more normal muscular length is regained, with close proximity to the double-loaded suture anchor obtained for suture repair. (C) After fixation with bone anchors of distal adductor longus stump to its insertion along linea aspera.

muscle ruptures. In 4 of 7 cases, the rupture occurred during soccer play. Of the 7 patients, 5 presented more than 3 months after the original date of injury, and only 1 patient continued to have pain in the proximal medial thigh. It was this patient who underwent excision of the adductor longus surgically; all others continued a nonoperative course of management. Symeonides⁹ also published a case series of distal adductor longus ruptures. Of the 6 patients, 4 presented less than 2 months after their injuries, all of which occurred while playing sports and remained symptomatic. These patients were treated with surgery: end-to-end suture repair that went on to fail versus excision of the ruptured muscle. The other 2 patients had a painless lump on the proximal medial thigh that had been present for many months with no known prior injury and were treated nonoperatively, given that they were pain free.

The risks and limitations of our technique are not unique. Meticulous dissection and preservation of the

nearby neurovascular structures are important; hence, we recommend preoperative ultrasound on the day of surgery to help prevent iatrogenic injury to these important nearby structures. The risk of this surgical procedure is inherent in the anatomic dissection of this area regardless of whether the surgeon is performing repair or excising the damaged adductor tissue. It is also why we recommend careful assessment of the repair to make sure it has not placed any undue tension on the nearby neurovascular structures. The other important risk of this surgical procedure is—as with any attempted repair of tendon to bone—repair failure. To address this, we recommend careful bone footprint preparation and dissection of the adductor longus muscle and tendon from surrounding scar such that anatomic restoration and healing can occur. It is also why we place our patients in a postoperative brace for 4 weeks and have them follow a structured and progressive rehabilitation plan.

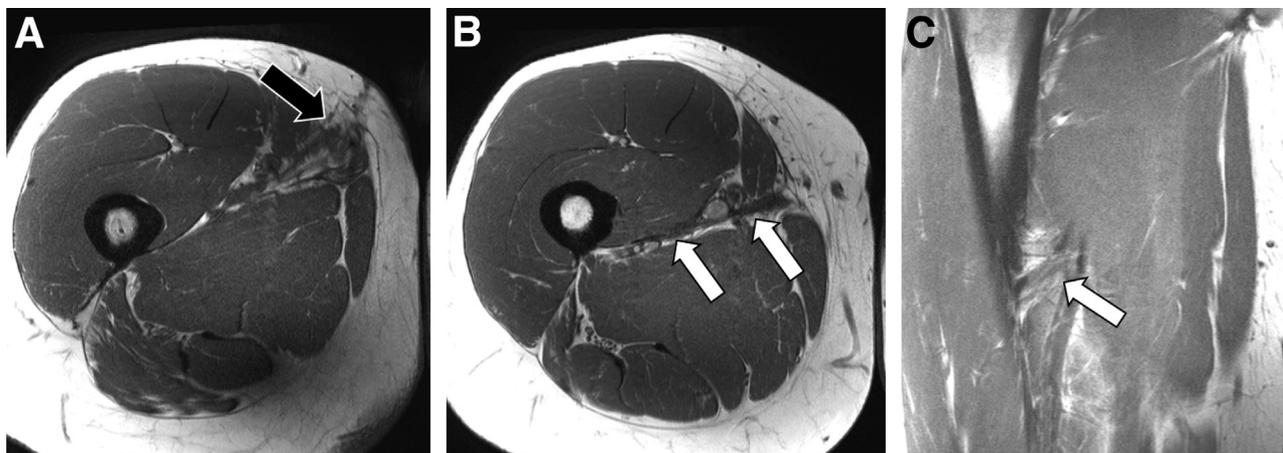


Fig 7. Axial T1 magnetic resonance sequences of the left thigh (A, B) and a coronal T1 magnetic resonance sequence (C) show the distal muscle belly (black arrow) with new thick postsurgical scarring along the course of the adductor to the femoral attachment (white arrows).

The vast majority of cases of distal adductor rupture in the literature occurred during soccer or football participation or as a result of other activity-related causes including the triple jump,⁹ skiing,³ kabaddi,¹² or motor-bike riding,⁵ as well as basketball, as was the case in our article. The relation in all of these activities to the ensuing rupture of the distal adductor is a mechanism of eccentric overload due to forced abduction during contraction of the adductor muscle group. The only documented non-activity-related and non-trauma-related cause of this injury was fluoroquinolone use in a 35-year-old patient with diabetes being treated for pneumonia.¹¹

The literature has established that the primary function of the adductor longus is as a stabilizer and not for producing power during cutting maneuvers.¹⁵ It is minimally active during in-line jogging and sprinting.¹⁶ In this sense, it is logical that the injury tends to occur predominantly in athletes participating in cutting, pivoting, and twisting sports and pain is often exacerbated by activity beyond the activities of daily living.

In this small case series, we describe our technique for surgical repair of painful, chronic distal adductor muscle rupture. On the basis of the literature currently available, a trial of 3 to 6 months of nonoperative management for pain subsidence appears appropriate before surgical intervention is offered.^{3,5,9,11,12,14} The goal of surgical repair is to restore the anatomic insertion of the adductor longus without placing too much strain on the muscle if significant retraction and scarring are present. Avoiding iatrogenic injury to the nearby neurovascular structures is paramount and is the reason for obtaining preoperative ultrasound on the day of surgery to mark these and nearby anatomic landmarks. Ultimately, the decision for surgical intervention should continue to be made on a case-by-case basis after careful discussion and consideration of patient-specific activities and goals.

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