

# Adductor Lengthening and Rectus Abdominis Repair via a 2-Incision Approach for Treatment of Core Muscle Injuries: A Technique Guide



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**Abstract:** Core muscle injuries are a common source of groin pain in athletes. An understanding of the pathoanatomy and clinical workup for this condition will assist in correctly identifying core muscle injuries from other causes of groin pain. In cases refractory to nonoperative management, surgical intervention may be indicated. In this Technical Note, we describe a comprehensive approach for the clinical evaluation of core muscle injuries, indications for operative intervention, and a surgical technique for adductor lengthening and rectus abdominis repair via a 2-incision approach.

When evaluating an athlete with refractory groin pain, physicians should consider core muscle injury, often called “sports hernia” or “athletic pubalgia.” Historically, this injury was thought to result from inguinal canal insufficiency, but more recent evaluations have focused on the rectus abdominis and adductor longus. Omar et al.<sup>1</sup> proposed that core muscle injury may occur as a result of an initial injury to either the rectus abdominis or adductor longus muscles, leading to unequal contraction forces and shearing at the aponeurotic plate. This is the proposed source of pain and the basis for core muscle repair surgery. Nonoperative treatment, such as rest, nonsteroidal anti-inflammatory drugs, corticosteroid injections, and physical therapy, may relieve groin pain caused by core muscle injury. Rehabilitation programs aim to strengthen core muscles and increase flexibility

before reintroducing sports activities.<sup>2</sup> If symptoms persist beyond 2 to 3 months, surgical repair may be considered (Video 1).

## Patient Evaluation, Imaging, and Indications

**History and Physical Examination.** Core muscle injuries most commonly occur in young male athletes involved in sports requiring cutting, pivoting, and rapid acceleration.<sup>3</sup> Symptoms often appear with activity or increased intra-abdominal pressure radiating from the groin to the proximal thigh or scrotum. Pain in this distribution may be elicited with resisted hip adduction or sit-ups.<sup>4</sup>

It is important to rule out other causes of groin pain such as femoroacetabular impingement (FAI), osteitis pubis, labral tear, avascular necrosis of the femoral head, neoplasm, hernia, or testicular pathology.<sup>3</sup> Given a high prevalence of symptomatic FAI with core muscle injuries, we assess for this during the examination. If there is concern for pubic symphysis instability, we evaluate for pain centered over the pubic area with a single-leg stance.

**Imaging.** Screening radiographs should be obtained to evaluate for concomitant pathologies such as FAI or osteitis pubis. Single-leg “flamingo” x-rays can assess for pubic symphysis instability. Magnetic resonance imaging (MRI) remains the preferred imaging modality for diagnosing core muscle injuries. MRI should be reviewed for tears or fluid undermining the aponeurotic plate and abnormalities in the adductor

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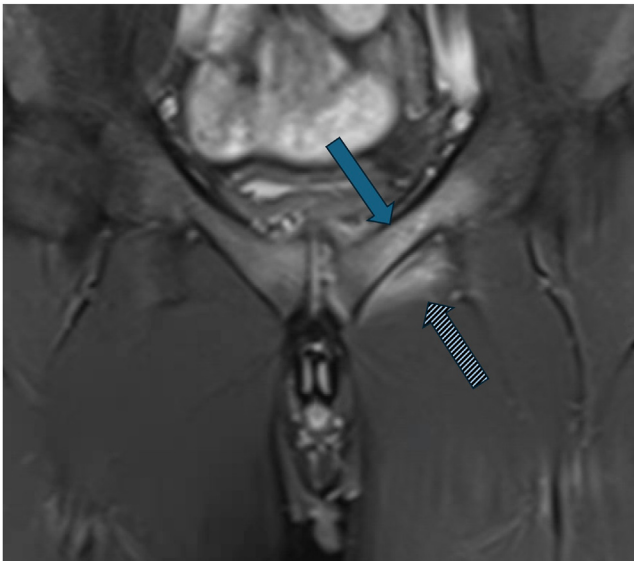
musculature distally. These are best visualized on coronal oblique and axial oblique images. Abnormal marrow signal at the anterior-inferior pubic body is a sign of potential injury (Figs 1-3).<sup>1</sup> The secondary cleft sign, a linear hyperintensity along the inferior pubic ramus, signals adductor microtearing.<sup>5</sup> The superior cleft sign, characterized by hyperintensity at the inferior margin of the superior pubic ramus, indicates partial avulsion or microtearing of the aponeurotic plate.<sup>6</sup>

**Indications.** There are no absolute surgical indications for core muscle injuries. However, relative indications include persistent pain despite conservative treatments. Relief from image-guided injections targeting the adductor origin or rectus abdominis insertion can confirm the diagnosis and help predict potential relief from surgery. Relative contraindications include the presence of a concomitant inguinal hernia and prior pelvic surgery with a low Pfannenstiel approach, as scar tissue from previous surgeries can complicate outcomes (Table 1). Inguinal hernias should be treated first, as they can cause groin pain, even when MRI findings suggest core muscle injury.

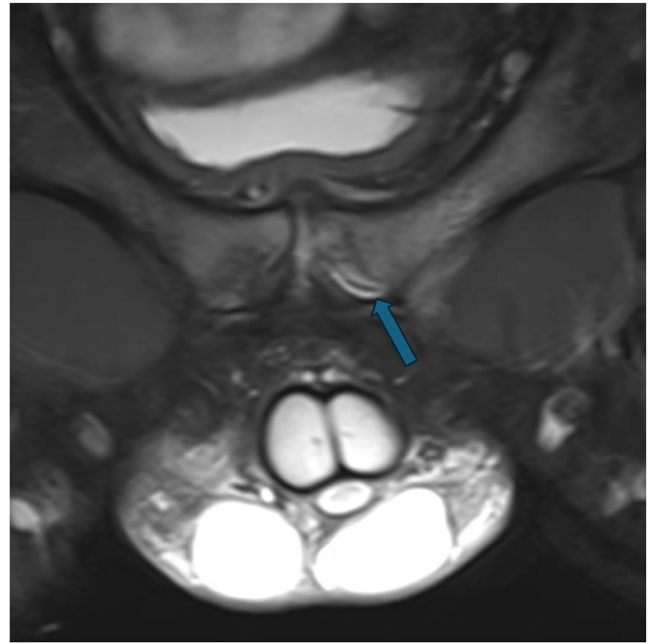
## Surgical Technique

### Positioning

The patient is placed supine on the operating table. The lower extremity is placed in a frog-leg position to provide easy exposure of both surgical sites and to place the adductor under tension. The abdomen and



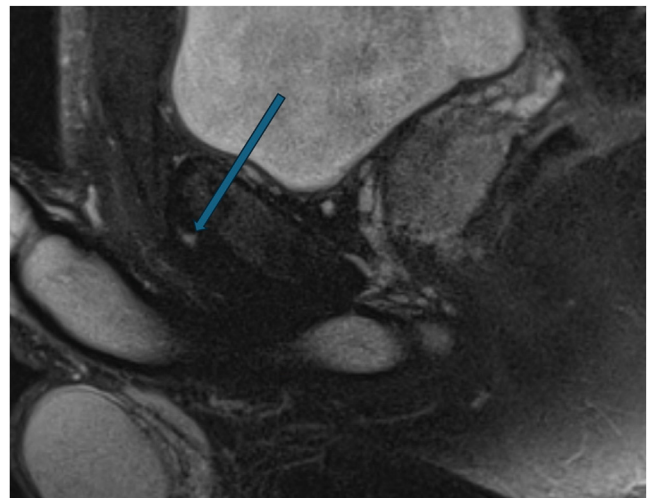
**Fig 1.** Coronal short tau inversion recovery magnetic resonance imaging of a 19-year-old man. View of left core muscle injury with pubic edema (solid arrow) and adductor strain (striped arrow).



**Fig 2.** Oblique T2-weighted fat-saturated magnetic resonance imaging in a 19-year-old man displaying the rectus abdominis (solid arrow) peeling off of the pubis.

proximal thigh are prepped in the standard fashion, making sure to allow visualization of the umbilicus to provide a midline landmark (Fig 4).

**Adductor Longus Tenotomy.** A transverse incision is made over the adductor longus tendon approximately 3 cm distal to the adductor origin on the pubic tubercle. Dissection is taken down through the subcutaneous



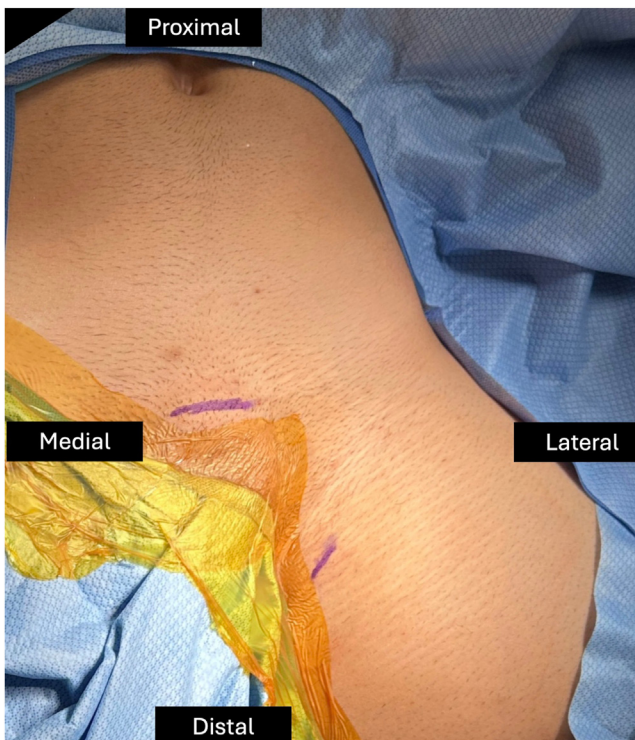
**Fig 3.** Sagittal T2-weighted fat-saturated magnetic resonance imaging in an 18-year-old male football kicker displaying the rectus abdominis insertion (solid arrow) peeling off of the pubis.

**Table 1.** Indications and Contraindications

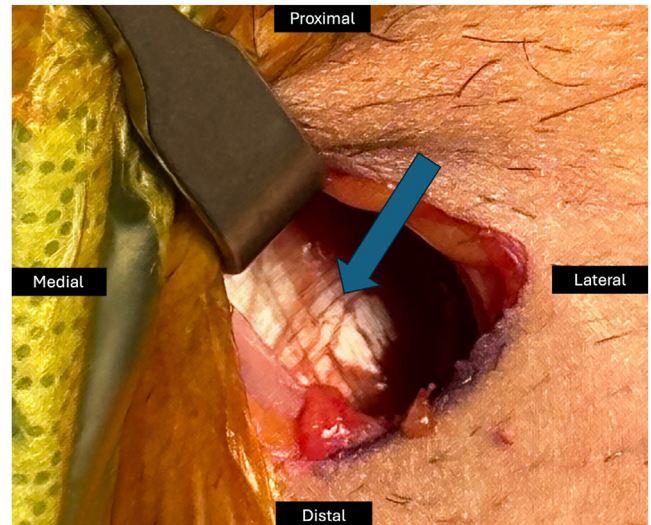
Relative indications
Failed rehabilitation
Desire to continue physical activities that provoke pain
Pain with activities of daily living
Pain relief with adductor origin or rectus abdominis insertion corticosteroid injection
Rupture of rectus abdominis insertion
Relative contraindications
Concomitant inguinal hernia
Prior pelvic surgery with low Pfannenstiel approach
There are no absolute indications for core muscle repair. This table describes the relative indications and contraindications for surgical intervention of core muscle injuries.

tissue to the adductor fascia. A longitudinal split is made in the adductor fascia to expose the adductor longus tendon (Fig 5). Electrocautery is then used to divide the adductor longus tendon approximately 2 cm distal to the adductor origin (Fig 6). There are often palpable tendinous bands within the adductor longus musculature that should be divided to produce a greater lengthening. Care is taken to minimize division of the adductor muscle fibers deep to the adductor longus tendon.

**Repair of Rectus Abdominis Insertion.** A small transverse skin incision is made 2 cm proximal to the pubic symphysis. Dissection is taken down through subcutaneous tissue to the abdominal fascia. Care is taken to

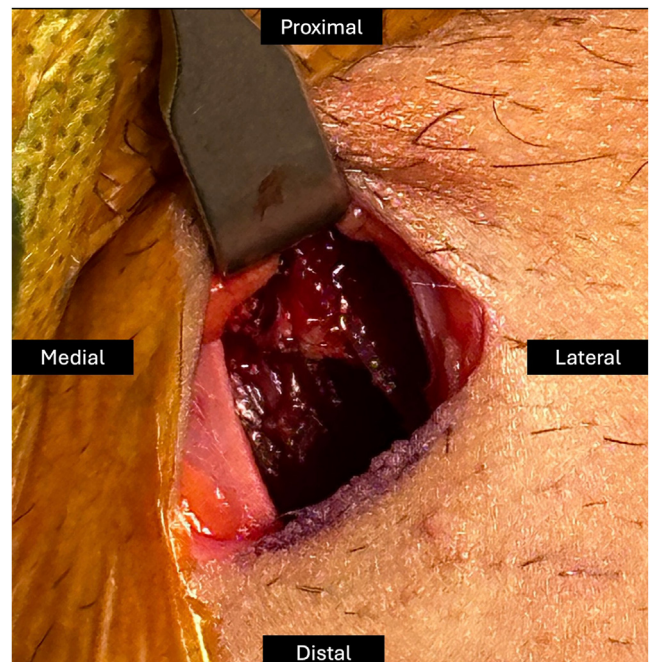


**Fig 4.** Image of patient positioning. Patient is in the frog-leg position, and both incisions are marked with purple marker. The umbilicus is included in the surgical field.

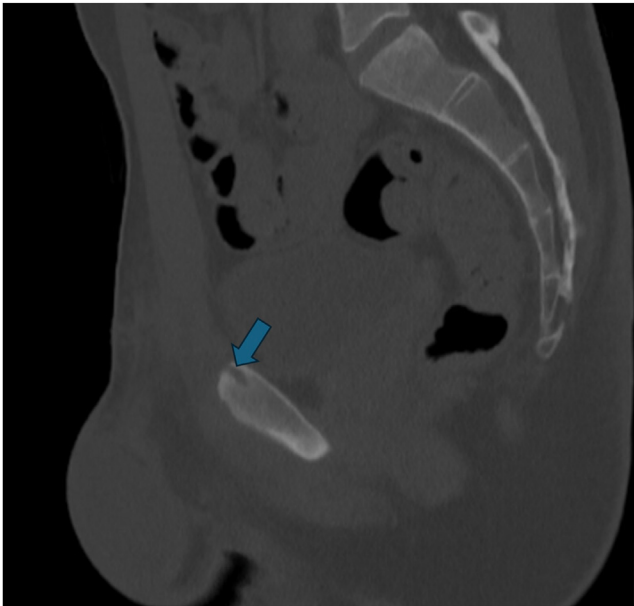


**Fig 5.** Left hip. Frog-leg position. Initial dissection is taken down to the adductor longus tendon (solid arrow).

protect the spermatic cord, which is kept on the lateral side of the incision. When the rectus abdominis insertion on the anterior pubis is clearly exposed, a small longitudinal incision in the rectus abdominis tendon is made to expose the pubic bone lateral to the pubic symphysis. The rectus abdominis muscle anterior to the pubic bone can be divided and retracted to obtain direct access to the pubic bone. Our preference is to use a 4.75-mm Stryker Alphavent PEEK (polyether ether ketone) double-loaded suture anchor, although any suture anchor can be utilized (Figs 7, 8). A free

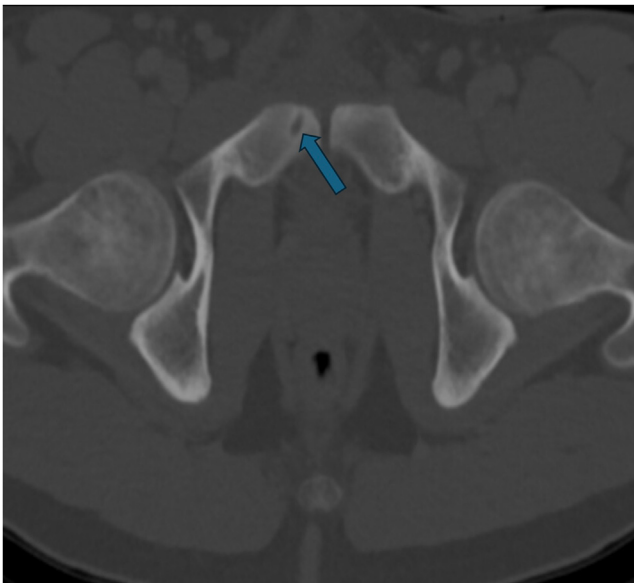


**Fig 6.** Left hip. Frog-leg position. The adductor longus tendon is being retracted after lengthening.

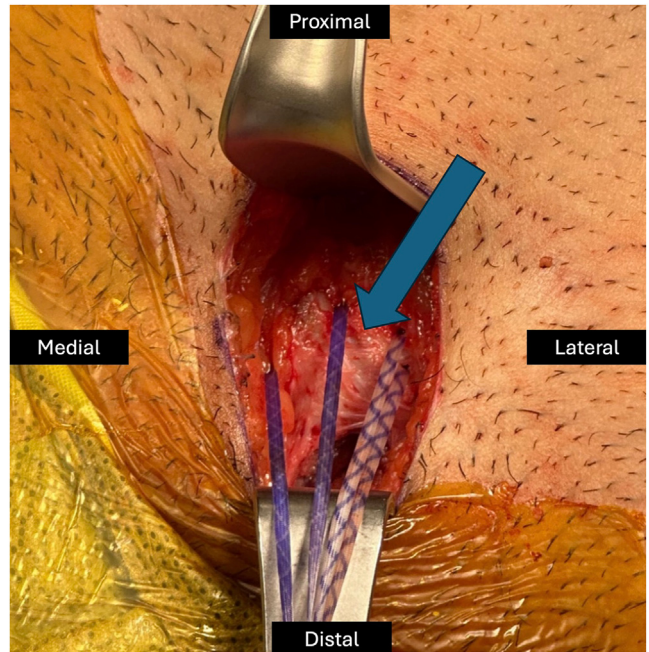


**Fig 7.** Sagittal computed tomography image showing the appropriate trajectory of the suture anchor (solid arrow) angled 45° caudad to account for the oblique nature of the pubic bone while supine.

needle is used to pass each suture pair into the rectus abdominis fascia in a horizontal mattress configuration. The depth of the needle pass should be limited to minimize risk of breaching the peritoneum. The repair includes primarily the anterior rectus abdominis fascia. Each suture pair is tied independently (Figs 9, 10). The defect in the anterior rectus abdominis fascia created for anchor placement



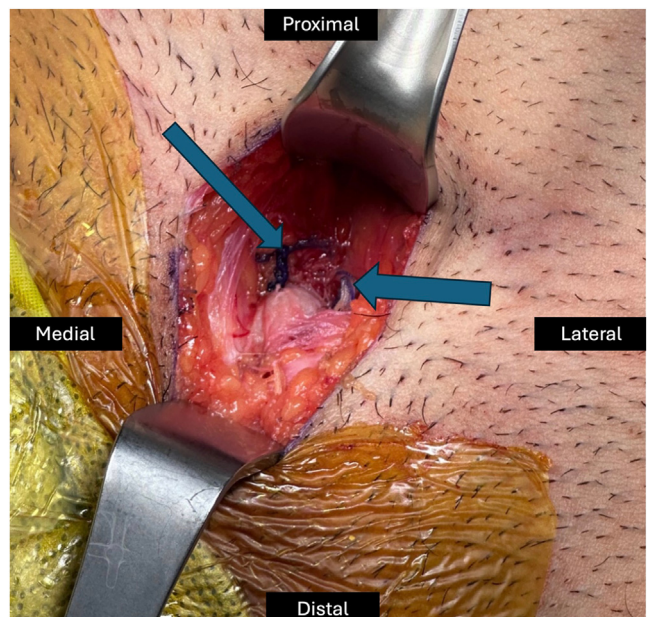
**Fig 8.** Axial computed tomography image demonstrating the appropriate trajectory of the suture anchor (solid arrow) angled 45° caudad to account for the oblique nature of the pubic bone while supine.



**Fig 9.** Left hip. Frog-leg position. Suture anchor is placed in pairs passing through the anterior rectus abdominis fascia (solid arrow) in a horizontal mattress configuration.

is closed with interrupted suture. A layered closure is performed. Additional surgical considerations are described in Table 2.

**Postoperative Care/Recovery.** During the early postoperative period, patients are instructed to avoid activities requiring core activation. Muscle spasms are common in the early postoperative period. The use of a



**Fig 10.** Left hip. Frog-leg position. Each suture anchor pair is tied independently and depicted at the solid arrows.

**Table 2.** Considerations

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Placement of patient supine with lower extremity in the frog-leg position
Easy exposure of both surgical sites and places the adductor under tension.
Facilitates adductor lengthening and intraoperative assessment of adductor tension.
Use of a 2-incision approach
Allows access to adductor origin and rectus origins with minimized exposure to the inguinal canal or spermatic cord.
Minimizes risk of spermatic cord injury or injury to contents of the inguinal canal.
Extend the prepped field proximally to include the umbilicus.
Provides a visual landmark for midline.
Angle of approach to pubis should be 45° caudad.
The pubic bone is oblique when laying supine.
Minimize risk of perforation of posterior cortex of pubic bone into space of Retzius and the bladder.
Use of fluoroscopy or direct exposure of the pubic bone with longitudinal split through the rectus fascia
Prevents entry into the pubic symphysis when placing the suture anchor.
Avoid excessive depth of needle passes through the rectus abdominis tendon
Minimize risk of perforating the abdominal cavity.
The goal of the repair is to secure the anterior rectus abdominis tendon and fascia.
Tendinous bands should be palpated and individually released within the adductor longus muscle after first releasing the broad, sheet-like adductor longus tendon

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skeletal muscle relaxant is highly encouraged as part of the postoperative analgesic plan. Return-to-sport timelines are highly individualized, although typical return to cutting-pivoting sports at a competitive level is 3 to 5 months.

### Discussion

While several surgical techniques for core muscle injuries have been described, the technique outlined here offers a standardized approach to improve pain by reducing tensile force on the rectus-adductor aponeurosis. It addresses the forces created by both the adductor longus and rectus abdominis in a single surgical setting with a minimally invasive approach. Like many orthopaedic interventions, this surgery is reserved for patients in whom nonoperative treatments, such as rest, physical therapy, and injections,

**Table 3.** Risks and Limitations of Core Muscle Repair via a 2-Incision Approach

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- Technique is not appropriate for treatment of inguinal hernia
- Potential injury to the bladder if instruments are misdirected when placing anchors into the pubic bone
- Potential injury to abdominopelvic contents if suture passes deep to the posterior abdominal fascia
- Does not address other causes of medial thigh pain in athletes such as obturator nerve entrapment
- Potential injury to spermatic cord if soft tissue dissection is taken too far lateral

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have failed. For those individuals, this approach can provide an effective and reliable option for an earlier return to sport.

Multiple studies support surgical intervention for core muscle injuries in terms of faster return to sport compared to nonoperative treatment.<sup>7,8</sup> Paaajanen et al.<sup>7</sup> reported a 90% return to sport at 3 months for patients who underwent surgery, compared to only 27% in the nonoperative group. In National Football League athletes, Jack et al.<sup>9</sup> reported a similar return-to-sport rate of 94%, with no significant differences in pre- and postoperative performance metrics.

This surgical technique also incorporates the use of a suture anchor to reinforce the rectus abdominis insertion, which minimizes strain on the rectus insertion. This method addresses the source of core muscle injury pain, offering a successful return to activity. While we have had success performing this technique, it is not without some risks and limitations. These include potential injury to the bladder when placing anchors into the pubic bone, spermatic cord injury during soft tissue dissection, and abdominopelvic content injury if suture is passed too deep (Table 3).

### Disclosures

All authors (A.R.R., N.J.L., J.T.F., A.R.G., J.S.E.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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