



# A Technique for Hamstring Donor-Site Injection With Anesthetic Cocktail in Remnant-Preserving Anterior Cruciate Ligament Reconstruction

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**Abstract:** Arthroscopic anterior cruciate ligament reconstruction is a common procedure that requires effective postoperative pain management for successful rehabilitation. Opioids are traditionally used for pain relief, but their side effects decrease their widespread use. Local anesthesia techniques have gained interest as an alternative to opioids. This Technical Note discusses the use of an anesthetic cocktail for pain relief at the hamstring's donor site in anterior cruciate ligament reconstruction. This approach may enhance early rehabilitation and patient satisfaction.

Arthroscopic anterior cruciate ligament (ACL) reconstruction is a common orthopaedic procedure. The success of this procedure relies on early mobilization and accelerated rehabilitation.<sup>1,2</sup> Effective management of postoperative pain is a crucial aspect to consider in achieving favorable results.<sup>3,4</sup> Effective postoperative pain control is a subject of considerable interest in the medical field. Opioids have long been recognized for their ability to provide substantial pain relief, particularly in cases of severe pain.<sup>5</sup> However, their widespread use is restricted due to the potential for adverse effects and associated concerns.<sup>5</sup> Local anesthesia techniques are gaining interest as a potential strategy to minimize the reliance on opioids due to their

inherent side effects, such as nausea, vomiting, dizziness, and vertigo.<sup>6</sup>

Hamstring donor-site pain is a common complaint among patients following arthroscopic ACL reconstruction.<sup>7,8</sup> The studies have demonstrated that administering a local anesthetic injection at the hamstring donor site is more effective than a placebo in relieving postoperative pain and reducing opioid consumption.<sup>9-11</sup> Several studies have reported the use of the anesthetic cocktail in periarticular injections during total knee-replacement surgery.<sup>12-14</sup> The findings consistently demonstrate a reduction in postoperative pain and opioid consumption. This Technical Note describes the effective and easy way to administer an anesthetic cocktail to alleviate postoperative pain and enhance early rehabilitation.

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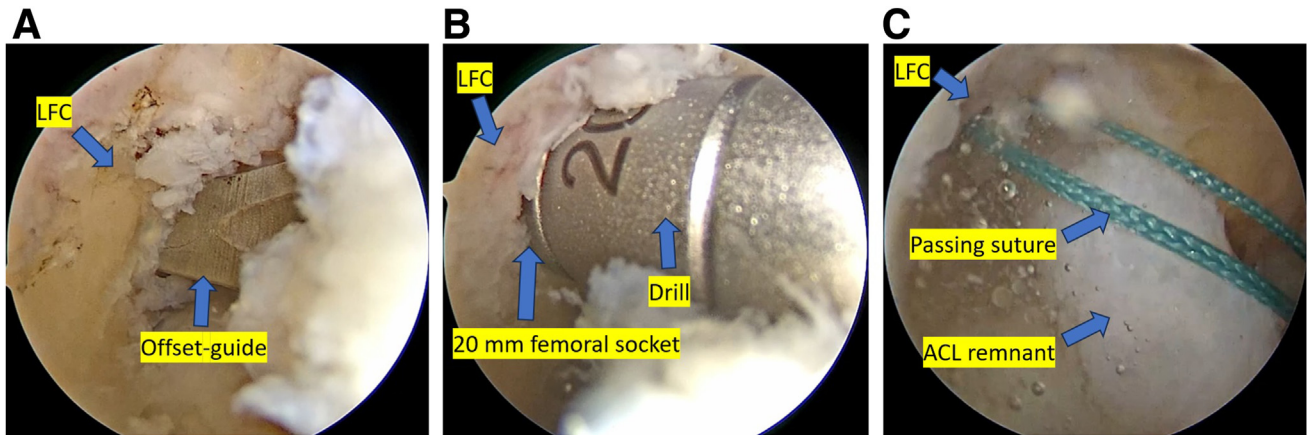
## Surgical Technique (With Video Illustration)

### Patient Positioning

The patient is positioned supine on the operating table with lateral support for the thigh and distal foot support, allowing for a knee flexion of 90°. The affected leg is then prepared and draped in a sterile manner.

### Step 1: Hamstring Harvest

A small longitudinal incision, approximately 3 cm in length, is made over the anteromedial aspect of the tibia, about 3 fingerbreadths below the knee joint line. The incision is extended through the subcutaneous tissue and fascia until the underlying sartorial fascia is reached. Careful dissection is performed to expose the



**Fig 1.** Right knee, supine position, viewing from anterolateral portal. (A) The anatomical femoral tunnel is targeted using the Infinity anteromedial offset-guide. (B) A matched-size graft drill is employed to create a femoral socket with a length of 20 mm. (C) A passing suture is passed through the femoral tunnel. (ACL, anterior cruciate ligament; LFC, lateral femoral condyle.)

anteromedial surface of the tibia. The surgeon identifies the semitendinosus tendon and proceeds to carefully dissect it from the surrounding tissues, ensuring the preservation of its integrity and length. The semitendinosus tendon is detached from its insertion on the pes anserinus by cutting it close to the tibia. Subsequently, the tendon is whipstitched and harvested using an 8-mm closed-end tendon stripper (Conmed, Utica, NY). The harvested semitendinosus tendon is usually prepared by triple-folding it over itself to create a graft that is stronger and thicker. The tendon graft is then loaded onto the Infinity button (Conmed).

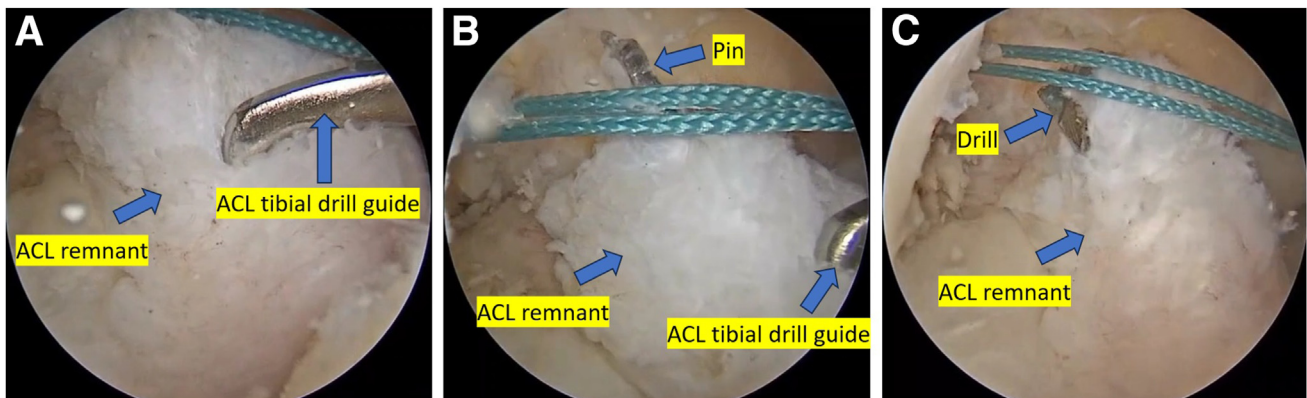
### Step 2: Arthroscopic Remnant-Preserving ACL Reconstruction

The fibrous tissue proximal to the ruptured anterior cruciate ligament was resected posteriorly to achieve complete exposure of the posterior lateral femoral edge. The anatomical femoral tunnel is targeted using the Infinity anteromedial offset-guide (Conmed) (Fig 1A, Video 1), and a pin is introduced through the lateral

femoral condyle. To establish the tunnel, drilling with a diameter of 5 mm is then carried out through the anteromedial portal with the knee flexed at 110°. Subsequently, a matched-size graft drill is employed to create a femoral socket with a length of 20 mm, ensuring an appropriate graft fit within the socket. (Fig 1B, Video 1) Throughout the process of reaming the femoral tunnel and socket, the knee is maintained in a flexed position. Furthermore, a passing suture is passed through the femoral tunnel (Fig 1C, Video 1).

The drilling of the tibial tunnel is carried out using the ACL tibial drill guide (Conmed) (Fig 2A, Video 1). The exit of the tunnel is precisely positioned within the native ACL remnant (Fig 2B, Video 1), followed by the use of a drill of appropriate size to create the tibial tunnel (Fig 2C, Video 1). With the aid of an arthroscopic probe, the passing suture is meticulously guided through the tibial tunnel.

The graft, which is prepared and secured to the Infinity button (Conmed), is carefully passed into the tibial tunnel through the previously created femoral



**Fig 2.** Right knee, supine position, viewing from anterolateral portal. (A) The drilling of the tibial tunnel is carried out using the ACL tibial drill guide. (B) The exit of the tunnel is precisely positioned within the native ACL remnant. (C) A drill of appropriate size is used to create the tibial tunnel. (ACL, anterior cruciate ligament.)

tunnel. Subsequently, the Infinity button (Conmed) is carefully flipped over the lateral femoral condyle under visualization through the anteromedial viewing portal. The adjustable loop suture tail is carefully tensioned, allowing for the gradual advancement of the graft into the tunnel (Fig 3, Video 1).

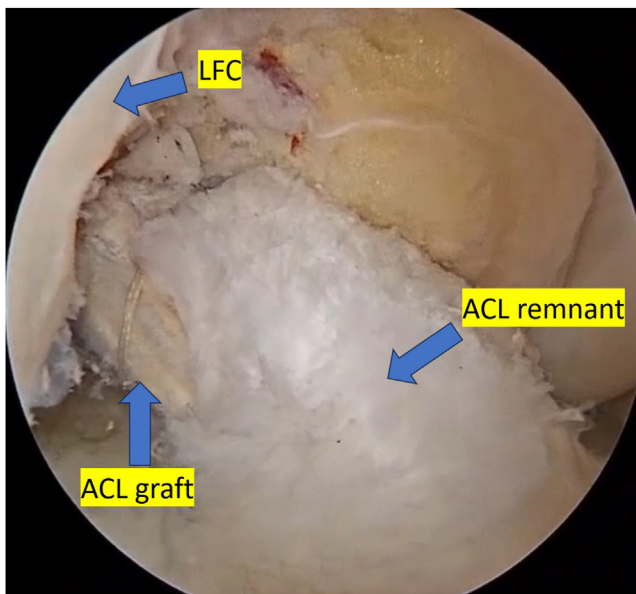
The tibial fixation is performed using an interference screw (Conmed). Finally, the construct is reinforced by suturing it to the post with a 4.5-mm cortical screw and washer (Fig 4, Video 1).

### Step 3: Local Anesthetic Cocktail Preparation

The local anesthetic cocktail consists of 100 mg of 0.5% bupivacaine, 30 mg of ketorolac, and 0.2 mg of adrenaline, which is then diluted with 0.9% saline solution to a total volume of 60 mL. Subsequently, 20 mL of the local anesthetic cocktail is injected into the hamstring harvest site.

### Step 4: Hamstring Harvest-Site Injection

The arthroscopic sheath (Karl Storz, Tuttlingen, Germany) is carefully inserted using the obturator to ensure proper coverage of the tip. Subsequently, the encased arthroscopic sheath is introduced into the incision site where the hamstrings are harvested, allowing it to pass through the harvested tract (Fig 5, Video 1). To administer the local anesthetic cocktail, a syringe prepared with the appropriate mixture is inserted into the inflow valve of the arthroscopic sheath. It is important to ensure that the opposite side of the valve is closed and that the obturator securely locks to the arthroscopic sheath, maintaining the

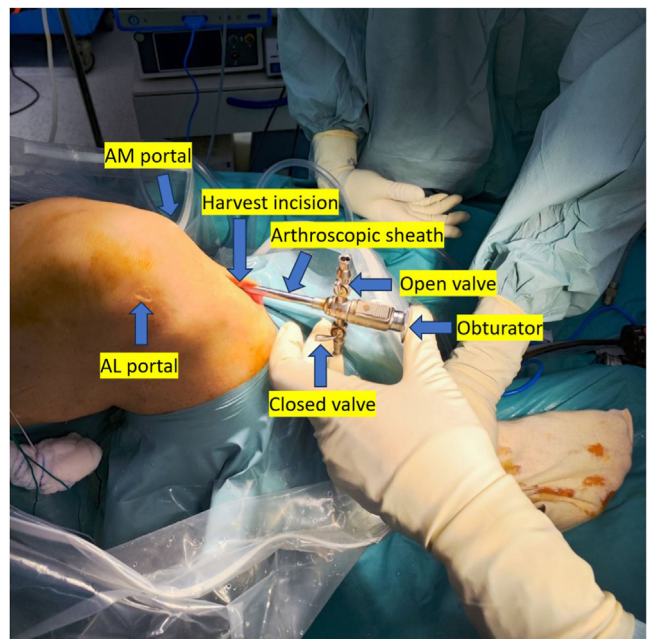


**Fig 3.** Right knee, supine position, viewing from anterolateral portal. The remnant-preserving anterior cruciate ligament reconstruction has been successful. (ACL, anterior cruciate ligament; LFC, lateral femoral condyle.)



**Fig 4.** The plain radiograph of right knee demonstrates the construct of anterior cruciate ligament reconstruction, with tibial fixation using an interference screw and suture to post, and femoral fixation with a cortical button.

integrity of the procedure (Fig 6, Video 1). The next step involves gently injecting the local anesthetic cocktail into the hamstring harvest tract (Fig 7A, Video 1). Notably, upon careful observation, it is observed that no fluid is leaked from the incision, indicating successful infiltration (Fig 7B, Video 1).



**Fig 5.** Right knee, supine position. The arthroscopic sheath is carefully inserted using the obturator to ensure proper coverage of the tip. Subsequently, the encased arthroscopic sheath is introduced into the incision site where the hamstrings were harvested, allowing it to pass through the harvested tract. (AL, anterolateral; AM, anteromedial.)





**Fig 6.** Right knee, supine position. To administer the local anesthetic cocktail, a syringe prepared with the appropriate mixture is inserted into the inflow valve of the arthroscopic sheath. It is important to ensure that the opposite side of the valve is closed and that the obturator securely locks to the arthroscopic sheath, maintaining the integrity of the procedure.

### Postoperative Rehabilitation

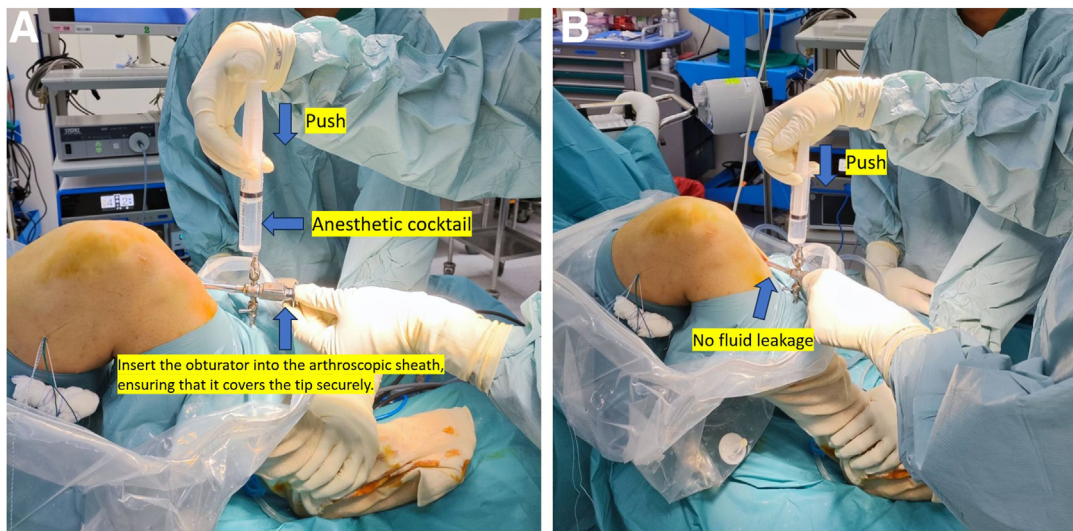
For the first 4 weeks following ACL reconstruction, a knee brace is used with a locked flexion angle of 90°. During the initial 2 weeks, weight-bearing is restricted to toe-touch. From weeks 2 to 6, weight-bearing gradually increases as tolerated. The rehabilitation

program involves passive range of motion exercises in the first 2 weeks, transitioning to active range of motion exercises from weeks 4 to 6. Quadriceps isometric exercises are initiated on the first day postoperatively, whereas closed-chain strengthening exercises are introduced from weeks 8 to 12. Return to sports typically takes place at 9-10 months, once symmetrical knee extension isometric strength is achieved and successful completion of single leg hop tests for distance is demonstrated.

### Discussion

This Technical Note describes the technique of enhancing patient comfort and reducing postoperative pain in remnant-preserving ACL reconstruction through the use of hamstrings donor-site injection with anesthetic cocktail. Ensuring effective management of postoperative pain is essential for achieving positive outcomes. This technique is designed to alleviate postoperative pain and decrease the need for morphine. Previous research has demonstrated the efficacy of local anesthesia.<sup>9-11</sup> However, the use of anesthetic cocktails containing a combination of drugs for local injection during arthroplasty procedures has shown promising results in further reducing postoperative pain.<sup>12-14</sup>

Arthroscopic ACL reconstruction using an ipsilateral hamstring autograft is an effective management option for ACL injuries. Following surgery, patients may experience moderate-to-severe pain in the knee, wounds, and hamstring harvest site.<sup>15</sup> Adequate pain control plays a crucial role in patients' recovery, rehabilitation, ambulation, and overall satisfaction.<sup>16</sup> The use of multimodal analgesia, combining spinal anesthesia with a local anesthetic cocktail, may decrease postoperative pain and enhance patient satisfaction.



**Fig 7.** Right knee, supine position. (A) The local anesthetic cocktail is gently injected into the hamstrings harvest tract. (B) Upon careful observation, it is observed that no fluid is leaked from the incision, indicating successful infiltration.

**Table 1.** Pearls, Advantages, and Disadvantages of the Procedure

Pearls	<ul style="list-style-type: none"> <li>- Preservation of the anterior cruciate ligament (ACL) remnant, avoiding complete removal of the remaining ligament.</li> <li>- Using the femoral offset-guide for femoral footprint preparation to overcome visual obstruction caused by the remaining tissue during the creation of the femoral tunnel.</li> <li>- Aiming the pin through the ligament during tibial tunnel creation to ensure proper coverage of the graft by the ligament.</li> <li>- Using the obturator to securely cover the tip and prevent leakage of the anesthetic cocktail through the track.</li> <li>- Carefully inserting the arthroscopic sheath into the hamstring harvest track to avoid creating a false track.</li> </ul>
Advantages	<p>Remnant-preserving ACL reconstruction:</p> <ul style="list-style-type: none"> <li>- Potential improvement in clinical outcomes and proprioception.</li> <li>- No significant difference in complications compared with conventional reconstruction.</li> </ul> <p>Injection of local anesthetic cocktails into the hamstrings harvest tract:</p> <ul style="list-style-type: none"> <li>- Reduction in postoperative pain.</li> <li>- Alleviation of posterior thigh discomfort.</li> </ul>
Disadvantages	<ul style="list-style-type: none"> <li>- Requirement for skilled surgeons to perform remnant-preserving ACL reconstruction.</li> <li>- Increased operative time.</li> <li>- Potential for allergic reactions to the local anesthetic cocktail.</li> </ul>

The technique described in this procedure encompasses several key points and pearls. First, the preservation of the ACL remnant is emphasized, as it is essential to retain a portion of the ligament rather than completely removing it. Second, the femoral off-set guide is employed for preparing the femoral footprint. This is crucial to ensure optimal visibility during the creation of the femoral tunnel, as any remaining tissue can obstruct the view. During the tibial tunnel creation, the aim is to guide the pin through the ligament, ensuring that the ligament covers the graft effectively. To prevent any leakage of the anesthetic cocktail through the track, the obturator is used to securely cover the tip, thus ensuring proper coverage. Lastly, great care is taken when inserting the arthroscopic sheath into the hamstrings harvest track to avoid creating any false tracks. These key points and pearls are important guidelines for achieving successful outcomes and are further described in [Table 1](#).

This technique offers several advantages. First, remnant-preserving ACL reconstruction has the potential to improve clinical outcomes and proprioception without any significant difference in complications compared to conventional ACL reconstruction.<sup>17-20</sup> In addition, injecting local anesthetic cocktails into the hamstrings harvest tract may effectively reduce

postoperative pain and alleviate posterior thigh discomfort.<sup>9-14</sup> However, this technique does have some disadvantages, including the requirement for skilled surgeons to perform remnant-preserving ACL reconstruction, an increase in operative time, and the potential for some patients to experience allergies to the local anesthetic cocktail. Advantages and disadvantages of the procedure are further described in [Table 1](#).

In conclusion, the technique described in this article represents a reliable and reproducible surgical approach for reducing postoperative pain in patients undergoing remnant-preserving ACL reconstruction.

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