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Case Report

Surgical Reconstruction of an Isolated Complete Rectus Femoris Rupture at the Myotendinous Junction Using Achilles Tendon Allograft: A Case Report

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Abstract

Background: Isolated complete ruptures of the rectus femoris at the myotendinous junction are rare injuries in athletes and may lead to persistent functional deficits when managed nonoperatively. Surgical reconstruction may be indicated in selected high-demand patients.

Case Presentation: A 24-year-old semi-professional soccer player sustained an acute complete rectus femoris myotendinous rupture during a maximal-power kick. Magnetic resonance imaging confirmed a grade III rupture with proximal muscle retraction.

Surgical Technique and Outcome: An anatomical reconstruction was performed using an Achilles tendon allograft, restoring physiological muscle length with final tensioning at 45° of knee flexion. Postoperative management included a structured rehabilitation program with progressive mobilization and strengthening. Functional reassessment using isokinetic testing and gait analysis demonstrated satisfactory recovery and progression toward return to sport at short-term follow-up.

Conclusion: Achilles tendon allograft reconstruction represents a viable option for complete rectus femoris myotendinous ruptures when primary repair is not feasible, potentially facilitating functional recovery in young, physically active patients.

Keywords: Rectus Femoris; Complete Rupture; Reconstruction; Achilles Allograft; Rehabilitation

Introduction

The rectus femoris muscle is particularly prone to injury due to its unique biarticular anatomy, crossing both the hip and knee joints, and its high proportion of type II muscle fibers. These anatomical and functional characteristics expose the muscle to high tensile forces during eccentric contraction, especially during explosive activities such as sprinting and kicking, which are common in soccer players and other high-velocity sports [1-3]. Consequently, rectus femoris injuries represent a frequent cause of time loss in athletes.

Most rectus femoris injuries correspond to strains or partial tears and are successfully managed with conservative treatment, including rest, physiotherapy, and progressive return to sport [4]. However, isolated complete ruptures, particularly at the myotendinous junction, are uncommon and represent a significant therapeutic challenge [1,5]. A recent systematic review of isolated full-thickness rectus femoris injuries in competitive athletes reported that most lesions occur during kicking maneuvers, with eccentric overload identified as the primary injury mechanism, and suggested operative treatment in high-demand athletes [1].

The rectus femoris differs from the remaining quadriceps muscles due to its complex central tendon anatomy and biarticular function, which subject the muscle to extreme tensile stress during explosive hip flexion and knee extension [2,6]. These features help explain its increased vulnerability to injury under high-load conditions and the propensity for myotendinous junction disruption.

Although nonoperative management is effective for most muscle injuries, complete ruptures associated with significant retraction may result in persistent pain, strength deficits, cosmetic deformity, and delayed or incomplete return to sport, particularly in elite or semi-professional athletes [5-7]. Several case reports and small series have suggested that, despite their rarity, isolated rectus femoris ruptures are clinically relevant injuries that may justify surgical intervention when conservative treatment fails or when athletic demands are substantial [5,7-9].

Magnetic resonance imaging (MRI) remains the diagnostic modality of choice for rectus femoris injuries, allowing precise assessment of injury location, extent, tissue quality, and degree of musculotendinous retraction. MRI is also essential for differentiating proximal avulsions, myotendinous junction ruptures, and intramuscular tendon injuries, which differ in prognosis and therapeutic approach [10-12].

The literature addressing surgical reconstruction of isolated rectus femoris ruptures at the myotendinous junction remains limited, and no consensus exists regarding the optimal surgical technique. In cases of extensive tissue damage, fibrosis, or marked retraction, direct primary repair may not be feasible. Under these circumstances, reconstruction using tendon grafts—either autograft or allograft—has been proposed as a viable alternative to restore muscle continuity and function [8,9,13]. Achilles tendon allograft reconstruction offers several advantages, including sufficient length, high tensile strength, and avoidance of donor-site morbidity, and has been successfully applied in complex quadriceps and rectus femoris reconstructions [9,13-15].

Given the rarity of isolated complete rectus femoris ruptures at the myotendinous junction and the limited evidence guiding reconstructive strategies, this case report describes the anatomical reconstruction of such an injury using an Achilles tendon allograft in a semi-professional soccer player, with emphasis on diagnostic evaluation, surgical technique, and postoperative rehabilitation.

Case Presentation

A 24-year-old male semi-professional soccer player with no relevant medical history sustained an acute injury during a competitive match. The injury occurred while attempting a maximal-power shot with his dominant right leg, at which point he experienced sudden, severe pain localized to the anterior aspect of the right thigh, immediately preventing continuation of play.

On physical examination, the patient ambulated with an antalgic gait and maintained the right knee in a semiflexed position. Palpation revealed marked tenderness over the anterior middle third of the thigh, associated with a palpable defect at the rectus femoris myotendinous junction. Localized swelling and ecchymosis were present, without evidence of neurovascular compromise.

Magnetic resonance imaging (MRI) confirmed a complete (grade III) rupture of the right rectus femoris at the myotendinous junction, with disruption of muscle fibers, surrounding edema, and proximal retraction of the muscle belly (Figure 1). Given the extent of the injury and the patient's high functional demands, surgical reconstruction was recommended to restore muscle continuity and facilitate return to sport.

Surgical technique

The patient was positioned supine with the right lower limb extended. After standard antisepsis and sterile draping, a longitudinal anterior incision of approximately 9 cm was made over the middle third of the thigh. Layer-by-layer dissection was performed until the quadriceps fascia was identified and incised, with careful preservation of adjacent neurovascular structures.

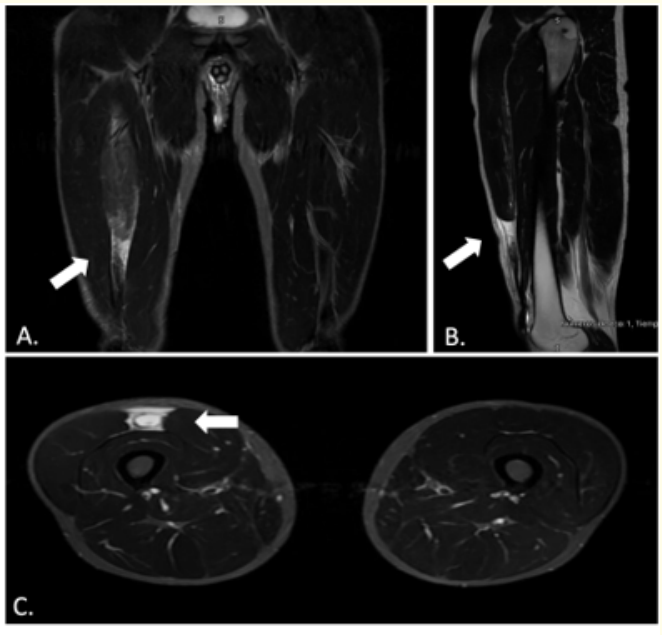


Fig 1. Magnetic resonance imaging (MRI) of the affected thigh demonstrated a complete injury of the rectus femoris muscle at the myotendinous junction. Sagittal (A.) and coronal (B.) sequences revealed discontinuity of muscle fibers with associated hyperintense signal compatible with intramuscular edema and hematoma formation. Axial (C) images showed asymmetry of the rectus femoris compared with the contralateral side, with evidence of muscle retraction and loss of normal architecture, while the vastus muscles remained preserved. These findings were consistent with a grade III rectus femoris myotendinous rupture.

Intraoperative exploration revealed a complete myotendinous rupture of the rectus femoris with proximal retraction of the muscle belly and interposed fibrotic tissue (Figure 2). Both proximal and distal stumps were identified, debrided, mobilized, and prepared for reconstruction.

Figure 2. Identification of the myotendinous rupture. Intraoperative findings revealed complete disruption of the rectus femoris at the myotendinous junction with muscle retraction and interposed fibrotic tissue.

An Achilles tendon allograft was prepared on the back table (Figure 3). The graft was passed through the distal portion of the proximal stump from medial to lateral and subsequently through the proximal portion of the distal stump from lateral to medial. Temporary tensioning allowed adequate approximation of the muscle-tendon unit. The graft limbs were overlapped and secured using high-strength nonabsorbable sutures, with final tensioning performed with the knee positioned at 45° of flexion to restore physiological muscle length (Figure 4).

Figure 3. Achilles tendon allograft prepared for surgical use. The graft corresponds to a freeze-dried Achilles tendon allograft (FlexiGRAFT®, LifeNet Health), size TL-250 mm.

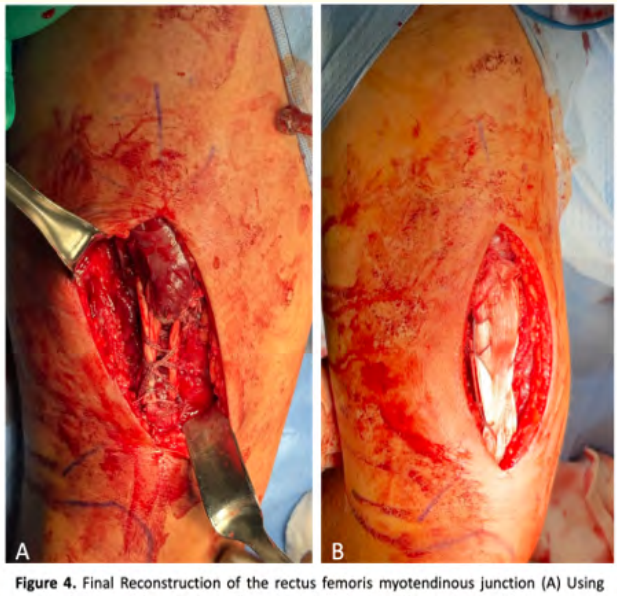


Figure 4. Final Reconstruction of the rectus femoris myotendinous junction (A) Using apart of the Achiles tendon allograft and high-strength sutures, achieving secure approximation of the muscle–tendon interface. (B) Reinforcement of the repair with an Rest of the Achilles tendon allograft, augmenting reconstruction.

Circumferential reinforcement sutures were placed to enhance construct stability, and the remaining portion of the allograft was fanned out over the reconstruction to reinforce the repair

and secured proximally and distally with sutures. Gentle passive flexion and extension of the knee confirmed satisfactory stability. The wound was closed in layers, and a hinged knee brace locked between 0° and 30° of flexion was applied.

Postoperative management and outcome

Postoperatively, the patient was immobilized in a hinged knee brace allowing 0-30° of motion for the first four weeks. Partial weight-bearing was permitted with the brace locked in extension during ambulation. Progressive range of motion and strengthening exercises were initiated between weeks 4 and 6 under supervised physiotherapy. As part of the return-to-sport protocol, once the initial immobilization phase had been completed and ambulation was resumed at 6 weeks, the mechanical knee brace was discontinued and a supervised rehabilitation program was initiated. The program was based on passive mobilization strategies aimed at restoring knee range of motion, with particular emphasis on knee flexion, until symmetry was achieved relative to the contralateral limb. Subsequently, isometric strengthening exercises for the quadriceps, hamstrings, and hip abductors were introduced, with a weekly progression to concentric exercises using elastic bands and body weight in closed kinetic chain, emphasizing quadriceps activation to facilitate functional recovery. In addition, lumbopelvic control and lower-limb proprioceptive training were incorporated (Figure 5).

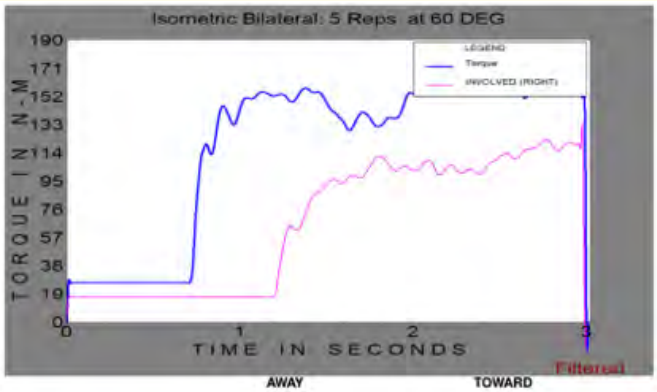
Figure 5. Clinical and functional assessment of quadriceps muscle recovery during the postoperative rehabilitation process following rectus femoris reconstruction. (A) Anterior view of the affected thigh showing the surgical scar and restoration of quadriceps muscle tone during follow-up. (B) Gait analysis performed on a treadmill as part of functional rehabilitation, allowing objective monitoring of lower limb biomechanics and muscle performance. (C) Progressive strengthening exercises targeting the quadriceps muscle, illustrating advanced-stage rehabilitation with controlled load and neuromuscular engagement. Muscle recovery and functional progression were systematically quantified throughout the rehabilitation protocol.

Upon completion of this phase (10-12 weeks), the patient underwent a comprehensive reassessment including range-of-motion measurements, isometric knee extensor strength testing at 60° of knee flexion using an isokinetic dynamometer (Cybex®) (Figure 6), biomechanical gait analysis, assessment of basic movement patterns, and evaluation during light jogging [18-22]. Further reassessment was planned after completion of the subsequent phase of the return-to-sport protocol [23-25]. Long-term functional follow-up is ongoing.

Discussion

Isolated complete ruptures of the rectus femoris at the myotendinous junction are rare injuries, and current evidence guiding optimal management is largely limited to case reports and technical descriptions [7,9,16]. The low incidence of this injury pattern has hindered the development of standardized treatment protocols, particularly in high-demand athletes with significant functional expectations.

The typical mechanism of injury involves sudden eccentric overload during explosive activities such as kicking, sprinting, or



		AWAY 60 DEG			TOWARD 60 DEG		
# OF REPS (60 DEG): R 5 - L 5		UNINV	INV	DEFICIT	UNINV	INV	DEFICIT
		Left	Right		Left	Right	
PEAK TORQUE	N-M	168.9	121.7	28.0	0.0	0.0	0.0
AVG PEAK TQ	N-M	161.6	112.1		0.0	0.0	
AVE PKTQ/BW	%	249.0	172.7		0.0	0.0	
RELAXATION TIME	SEC	5	5		5	5	
CONTRACTION TIME	SEC	3	3		3	3	
COEFF. OF VAR.	%	3.1	6.0		0.0	0.0	
IMPULSE	N-M	53.9	37.4	30.6	0.0	0.0	0.0
AGON/ANTAG RATIO	%	0.0			0.0		

Figure 6. Isokinetic dynamometry graph using an isometric contraction protocol at 60° of knee flexion for the assessment of peak torque of the knee extensor muscles. This evaluation method demonstrates a 28% asymmetry relative to the maximum

rapid changes of direction, consistent with the mechanism observed in the present case [1,7]. MRI plays a critical role in diagnosis and surgical planning by accurately defining injury location, degree of retraction, and tissue quality, all of which influence treatment strategy [10-12].

While conservative treatment may be effective for low-grade or partial injuries, complete grade III ruptures at the myotendinous junction have been associated with persistent weakness, pain, and delayed return to sport when managed nonoperatively [5,7]. Surgical intervention in selected cases aims to restore anatomical continuity, optimize muscle tension, and prevent chronic functional deficits.

Primary direct repair may be feasible in acute settings when tissue quality allows adequate approximation [7]. However, retraction, fibrosis, or compromised tissue may necessitate reconstructive strategies. Tendon graft reconstruction has been successfully applied in chronic quadriceps tendon ruptures and rectus femoris injuries, demonstrating favorable functional outcomes and return to sport [9,13,15].

The Achilles tendon allograft offers several advantages, including high tensile strength, sufficient length to bridge large defects, and avoidance of donor-site morbidity [13-15]. In the present case, allograft reconstruction allowed anatomical restoration of the rectus femoris musculotendinous unit with satisfactory intraoperative stability.

Despite encouraging outcomes reported in isolated cases, evidence supporting surgical reconstruction of rectus femoris myotendinous ruptures remains limited. Larger case series, comparative studies, and long-term follow-up are required to better define indications, rehabilitation protocols, and functional outcomes.

Conclusion

Anatomical reconstruction using an Achilles tendon allograft represents a valid surgical option for complete rectus femoris myotendinous ruptures in young and physically active patients when primary repair is not feasible. Combined with a structured rehabilitation program, this approach may optimize functional recovery and facilitate return to sport. Further studies are required to establish evidence-based guidelines for the management of this uncommon injury.

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The content is solely the responsibility of the author.

Conflicts of Interest

The research team is not in a conflicts of interest situation regarding the conduct of this research project since there is no direct commercial or economic relationship with any sponsor, no direct professional relationship with any sponsor, and furthermore, there is no cause or reason that could affect the objectivity or independence in the performance of the functions of the researchers involved in this project.

Ethical Considerations

Protection of People and Animals

The authors declare that no experiments involving humans or animals were conducted for this research. Confidentiality, Informed Consent, and Ethical Approval.

Confidentiality, Informed Consent, and Ethical Approval

The authors have adhered to their institution's confidentiality protocols, obtained informed consent from patients, and received approval from the Ethics Committee. The recommendations of the SAGER guidelines have been followed according to the nature of the study.

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