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Lower limb acute onset muscle pain: what do we have to look for? A case of isolated rupture of the rectus femoris

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Abstract

Acute muscle pain is muscle soreness that occurs during or within 24 hours of strenuous activity. Possible causes of acute muscle pain include localized muscle trauma, muscle tear, contusion with acute hemorrhage, or acute compartment syndrome. Isolated ruptures of the rectus femoris muscle are rare clinical conditions that result from excessive muscle strain following an abrupt contraction, incorrect movement, or sudden snap that exceeds the physiological limit of strain that the muscle can withstand. To date, there are few published reports evaluating the results of non-invasive treatment of such injuries. Herein, we report an unusual case of isolated distal rectus femoris tear in a 46-year-old female patient with no risk factors, who initially presented with extensor muscle weakness and pain and was treated conservatively with functional rest, physiotherapy, and cryotherapy.

Key Words: cryocompression, muscle tear, acute pain, rectus femoris, rehabilitation.

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An acute muscle injury can be defined as any injury resulting from the sudden application of excessive intrinsic or extrinsic force to muscle tissue, resulting in disruption of the muscle fibres and surrounding tissue.[1] Possible causes of acute muscle pain include localised muscle trauma, muscle tear, contusion with acute haemorrhage or acute compartment syndrome.[2] A rupture is an injury that causes some muscle fibres to tear[3] and can be caused by eccentric contractions resulting from direct mechanical damage to myofibrils.[4] Typically, tears are caused by over-exertion of an untrained muscle, inadequate warming up before exercise, sudden changes in the intensity or type of exercise, muscle imbalances, previous injury, lack of flexibility, dehydration, poor diet.[5] In these cases, the muscle fibres become overstretched and, in the worst case, can break.[4]

Symptoms generally include sudden onset of localised sharp pain, bruising, swelling, loss of muscle strength and function and, in severe cases, a palpable gap may be felt in the muscle and there may be a visible deformity.[1] In addition, functional impairment and limited range of motion were present with a worsening of symptoms with physical activity.[6] Diagnosis involves a combination of history to assess the mechanism of injury and acute symptoms, clinical examination to assess pain, range of motion, muscle gap and strength, and imaging studies (ultrasound or magnetic resonance imaging).[7] Correct grading of the tear will help in developing the appropriate treatment and rehabilitation strategies.[8]

Initial treatment often includes the R.I.C.E. (Rest, Ice, Compression, Elevation) protocol to manage pain and swelling, which is typically recommended within the first 48-72 hours.[9] Cryotherapy is a widely used intervention in the management of muscle tears due to its anti-inflammatory and analgesic effects.[10] By reducing tissue temperature, cryotherapy induces vasoconstriction, which helps to limit blood flow to the injured area, thereby reducing swelling and haematoma formation.[11] This reduction in inflammation helps to relieve pain, making it an effective first treatment for acute muscle injury. In addition, cryotherapy slows the metabolic rate of the affected tissue, minimising secondary tissue damage.[12] Athletes and people with muscle tears often use methods such as ice packs, cold water immersion or cryotherapy chambers to manage pain and swelling in the early stages of injury.[13] Physiotherapy is crucial to recovery and focuses on the gradual restoration of muscle strength, flexibility, and Range Of Motion (ROM), including gradual

stretching, progressive resistance exercises and functional training to return to normal activities.[14] In severe cases, where there is a complete tear or significant loss of function, surgery may be required to repair the damaged fibres.[15] Prevention strategies include regular strength training to build muscle resistance, proper warm-up, and cool-down routines to prepare muscles for activity and facilitate recovery and ensuring adequate hydration and nutrition to maintain muscle health.[16] It is also important to avoid overtraining and to allow sufficient recovery time between intense exercise sessions to prevent fatigue-related injuries.[17]
The aim of this paper is to present a case of isolated rupture of the rectus femoris muscle in a healthy woman, its conservative management and follow-up.

Case presentation

A 46-year-old woman presented with localised sharp pain in the quadriceps. One week prior to the onset of symptoms, the patient had been travelling and had been walking steadily, although she did not report any specific symptoms apart from a mild pain in the right thigh which disappeared spontaneously. A few days later, she complained of gradual pain aggravated by walking, but she attributed these symptoms to delayed-onset myalgia. As the myalgia worsened over the days, she came under our observation. Her medical history included antiplatelet therapy for patent foramen ovale. Physical examination of the right leg revealed no localised oedema; minimal pain to acupressure in the middle third of the proximal right thigh; moderate pain to active and passive flexion of the right knee beyond 90°. Following clinical assessment, she underwent ultrasound of the right thigh, which was suggestive of compartment syndrome. She then underwent MRI of the right thigh muscle at time T0 (acute event), which showed a proximal tear of the right rectus femoris muscle and an intramuscular haematoma (Figure 1). The diagnosis was a third-degree rupture of the right rectus femoris muscle. Four weeks of functional rest and cryotherapy for one month were recommended, together with interruption of antiplatelet therapy. After the first month of rest, a second T2 MRI was performed (Figure 1), which already showed an improvement in the radiological picture. The patient then began 4 weeks of rehabilitation for 45 minutes, 3 times a week. Conventional rehabilitation included mobilisation, stretching and active exercises, followed by 20-minute cryo-compression therapy sessions using a special device (CryoTool®). Muscle MRI after one month of treatment (at T3) was within normal limits, with no further evidence of rectus femoris tear (Figure 1). The initial (T1) and final (T2) functional assessments included the use of the following scales and functional tests Visual Analogue Scale (VAS), a visual analogue pain scale used as a tool to measure the subjective characteristics of pain experienced by the patient;[6] Modified Barthel Index (MBI), a measurement tool based on an ordinal scale used to assess activities of daily living; TUG (timed up and go test), a test to measure a person's level of mobility requiring static and dynamic balance skills; Six-Minute Walk Test (6MWT), which allows measurement of a patient's functional ability (Table 1).
In our case, the beneficial effect occurred in 2 months with complete resolution of the clinical and radiological picture. Discontinuation of antiplatelet therapy, paracetamol, bromelain, rest, and cryotherapy were adjuvant factors in the initial improvement of the clinical picture. Periodic physiatric assessments using functional scales (VAS, MBI, TUG, 6MWT) and radiological follow-up documented the clinical improvement achieved during rehabilitation.
The rehabilitation protocol used to treat the isolated rupture of the rectus femoris muscle in our patient allowed a rapid resolution of the muscle injury, reduced the sensitivity of the pain receptors, promoted the resumption of activities of daily living and socio-occupational reintegra-

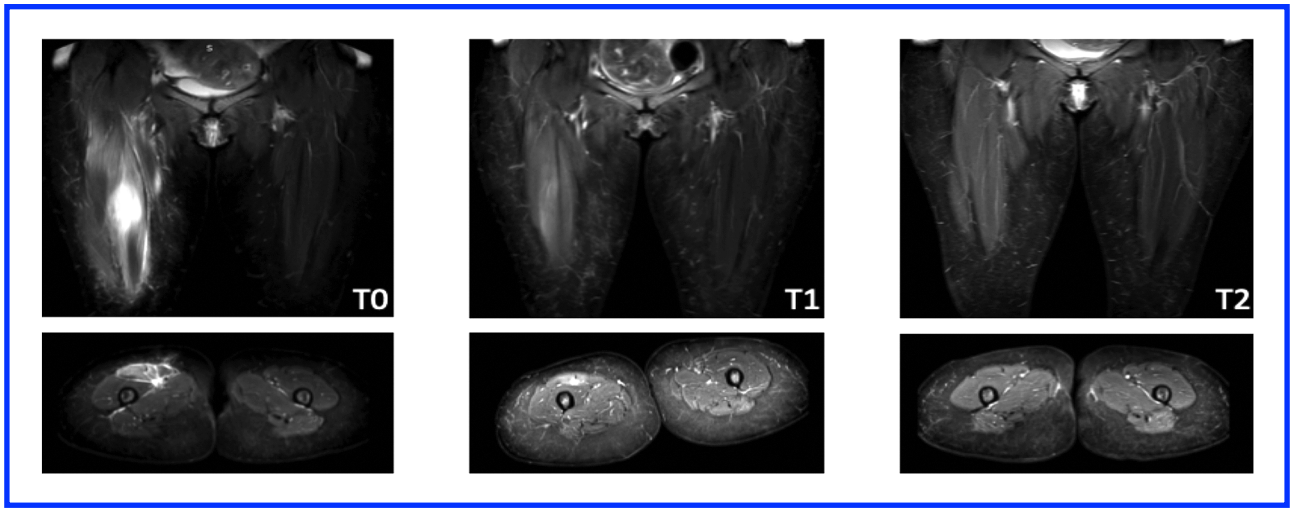

Figure 1. *Muscle MRI (STIR_longTE sequences) at T0 (acute phase), T1 (at 4 weeks after T0) and T2 (at 8 weeks after T0).*

Table 1. *Comprehensive assessments at the start and end of treatment: A global view of functional evaluation.*

	Start of treatment (T1)	End of treatment (T2)
VAS	8	0
MBI	95	100
TUG	12.73 s	10.70 s
6MWT	269 m (At 160 m discomfort, at 240 m burning, never stopping)	367 m

6MWT, Six-minute walking test; MBI, Modified Barthel Index; TUG, Timed Up and Go; VAS, Visual Analogue Scale.

tion in a short period of time. To date, the average recovery time for a third-degree muscle rupture without the need for surgery is 4-6 months, whereas in our case the recovery time was reduced to two months.

Discussion

Muscle tears are clinical conditions resulting from overstressing the muscle beyond the physiological limit of tension that the muscle can tolerate, usually caused by abrupt contraction, improper movement, or sudden jerking.[18] Muscle tears are one of the possible causes of acute muscle pain.[1] Acute muscle pain is generally classified as nociceptive pain, which results from the activation of pain receptors (nociceptors) in response to actual or potential tissue damage, such as trauma, inflammation, or muscle injury.[19] Nociceptive pain is typically described as sharp, stabbing, throbbing, or aching and tends to improve as the damaged tissue heals.[20] The initial injury triggers an inflammatory response, causing inflammatory cells (*i.e.*, neutrophils and macrophages) to migrate to the site of injury, releasing cytokines and other pro-inflammatory mediators (*i.e.*, prostaglandins, bradykinin, and substance P) that sensitise the nociceptors, causing pain and damaging muscle fibres and blood vessels.[21] As a result, bleeding and accumulation of interstitial fluid leads to swelling and the formation of a haematoma, so the increased pressure within the muscle can further irritate the nociceptors, which can further contribute to the pain.[22]

Isolated rectus femoris muscle tears are rarely reported in the literature.[23,24] However, it has been associated with inadequate training, excessive fatigue, inadequate warm-up before training and running on uneven terrain.[25] Most cases present with sharp, sudden pain proportional to the extent of the injury, total motor disability of the affected muscle, stiff and contracted muscles, oedema and swelling, appearance of a superficial haematoma or ecchymosis, often distal to the site of injury.[1] Even in isolated rectus femoris tears, acute muscle pain results from a complex interplay of direct muscle damage, inflammation, oedema, and nerve irritation.[24] Understanding these underlying mechanisms allows a targeted approach to treatment using both pharmacological and non-pharmacological therapies.[14] Non-steroidal anti-inflammatory drugs and paracetamol can provide effective pain relief and reduce inflammation, while physiotherapy and cryotherapy can aid the healing process and restore function optimising patient outcomes and facilitating a faster return to normal activities.[26]

Physiotherapy also plays a key role in the recovery from a third-degree muscle tear, using a structured and progressive approach to restore full function and prevent future injury.[27] The rehabilitation protocol consists of early mobilisation to prevent stiffness and maintain flexibility of the affected joints, followed by incremental isometric exercises to maintain muscle strength without further stressing the injured muscle.[28] The plan then involves a gradual return to daily activities and eventually sport to prevent relapse and ensure complete recovery.[18]

The role of cryotherapy in accelerating functional recovery is well established: the beneficial effect of cryotherapy is mediated by the reduction of ROS formation (and associated damage), the reduction of metabolic demands (associated with vasoconstriction), the anti-inflammatory effect induced by the increase in IL-6 and IL-10, and the reduction of nerve conduction velocity.[12,29] These are all effects that limit secondary damage and thus accelerate recovery time.

This study has several limitations that should be acknowledged. The findings are based on a single patient with a specific type of lesion, and individual patient factors limit the generalisability of the conclusions. The case report does not include long-term follow-up, which is crucial for understanding the full recovery process, potential complications, and recurrence rates. In addition, the therapeutic interventions and rehabilitation strategies used were tailored to this patient, and variations in treatment protocols could affect outcomes differently. Finally, the report lacks a comparative analysis with other cases or a review of similar cases from the existing literature, which could have provided a more comprehensive understanding of the injury and its management. These limitations highlight the need for further research and larger studies to better elucidate the characteristics, optimal diagnostic methods, and effective management strategies for isolated rectus femoris ruptures.

Conclusions

Identifying muscle tears requires attention to acute symptoms and loss of muscle function. Early medical assessment is essential for accurate diagnosis and appropriate treatment planning. Rest, physiotherapy, and cryotherapy play complementary roles in the management of third-degree rupture. While rest, pharmacological therapy and cryotherapy are essential in the early stages to manage acute symptoms, physiotherapy combined with cryotherapy becomes critical for long-term recovery of muscle function.

List of abbreviations

6MWT, Six-Minute Walk Test
MBI, Modified Barthel Index
MRI, magnetic resonance imaging
ROM, range of motion
ROS, reactive oxygen species
TUG, timed up and go test
VAS, Visual Analogue Scale

Contributions

SP, CF, and AT, conceptualization; DB, AA, DL, and GL, methodology, data curation; AA, SP, CF, SE and GL, writing—original draft; DM, DL, DB, and AT, writing—review and editing; DM, AA, and AT, supervision. All authors have read and agreed to the published version of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

Ethics approval and consent to participate

No ethical committee approval was required for this case report by the Department, because this article does not contain any studies with human participants or animals. Informed consent was obtained from the patient included in this study.

Informed consent

Written informed consent has been obtained from the patient to publish this paper.

Availability of data and materials

All data analyzed in this study are included in this published article.

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