

TRAUMATIC QUADRICEPS MUSCLE TEARS AMONG ISRAELI SPECIAL FORCES SOLDIERS

T Marom¹, D Itskoviz¹, S Kutikov¹, JMD Naftal², I Ostfeld¹

¹Medical Branch, Ground Forces Command, Israel Defense Forces, Israel. ²Ultrasound Unit, Medical Corps, Israel Defense Forces, Israel

Abstract

Introduction: Quadriceps muscle tear, secondary to direct trauma, is an uncommon injury in a military setting. Signs and symptoms of this injury are usually non-specific and may resemble other, more common and benign overuse injuries.

Patients And Methods: Five Israeli Defense Forces Special Forces soldiers who were diagnosed with partial quadriceps muscle tears, following a “low-kick” exercise, aimed to the thigh, during “hand-to-hand combat” training. Diagnosis and follow-up were made using thigh sonography.

Results: Symptoms duration before diagnosis was 20.6±9.41 days (mean±SD, range: 7-35). Two of the soldiers were found to have myositis ossificans at the affected site, a known complication of muscle trauma. Treatment regime included a long rest and intensive physiotherapy, with a gradual return to active service. Downtime from diagnosis was 55.8±17.3 days (mean±SD, range: 24-73). All patients eventually fully recovered and returned to active service.

Conclusion: Quadriceps muscle tear is a rare injury with a delayed presentation and diagnosis in highly motivated soldiers. Sonography facilitates diagnosis and monitoring of healing. Early diagnosis may decrease morbidity and allow earlier return to work.

Keywords: traumatic tear, quadriceps muscle, hand-to-hand combat.

Introduction

Low-force trauma to the lower extremities, such as kicks and falls, is relatively common during “hand-to-hand combat” training, but usually has no substantial effect on a trainee’s health. When harmed, muscle contusion is the most common injury [1]. Partial or complete traumatic tear of the muscle belly is infrequently encountered. A spontaneous quadriceps tendon rupture in young people can also rarely occur [2].

Severe direct trauma may eventually lead to a more serious muscle belly tear. In some cases, the tear presents with a severe, sharp pain following the trauma, which does not alleviate with time. In subacute cases, pain is not the major complaint, and the presentation may mimic a soft tissue tumor, due to an underlying organizing growing haematoma [3].

Diagnosis is usually made using sonography. Although Magnetic Resonance Imaging’s (MRI) role is not yet fully determined, it may contribute to the diagnosis of other resembling injuries, such as anterior cruciate ligament tears; it could also add to muscle tear follow-up [4].

This report describes a case series of five Israeli Defense Forces (IDF) Special Forces (SF) soldiers from different units who presented with partial quadriceps muscle tears following a direct trauma during “hand-to-hand combat” trainings. All of the injuries occurred following a “low-kick” exercise, a combat maneuver which specifically targets opponent’s thigh.

Case Series

Within a time frame of several weeks, five IDF SF soldiers, from different units, were diagnosed with traumatic quadriceps muscle

tears, following a “low-kick” exercise, during “hand-to-hand combat” training lessons (Figure 1). They initially consulted their primary military physicians, mainly due to persistent thigh pain and were then referred for sonography, which was performed by a single experienced technician. One soldier reported an earlier tear at the same muscle site four years prior to the current injury which resolved spontaneously without any functional consequences.



Figure 1. Low-kick demonstration. IDF SF soldiers during “hand-to-hand combat” training.

Corresponding Author: Major Tal Marom, MD, c/o 4, Kalman Bialer Street, 76661 Rehovot, Israel.

Tel: (+) 972-57-8175075 Fax: (+) 972-8-8619483

Email: maromtal@013.net.il

The soldiers did not report any other overuse injuries, during their military service, prior to the current injury. None of them used thigh protection gear during the training. The sonographic studies consisted both axial and transverse scans, using a high definition Philips© HD11 ultrasound system (Philips Electronics N.V., Eindhoven, the Netherlands), with a 12-5 MHz broadband linear array transducer and a musculoskeletal-knee analysis preset. Patients returned to their original units once symptoms were alleviated and when they thought they were able to gradually return to activity, as consulted and recommended by the treating physicians.

Results

All five soldiers were diagnosed with partial quadriceps belly tears of varying lengths between 6 to 10 centimetres. Tears were located in the distal parts of the vastus medialis or vastus lateralis. In two soldiers, who did not have previous quadriceps tears, sonography demonstrated foci of myositis ossificans, a known complication of muscle trauma (Figure 2).



Figure 2. Panoramic view, vastus lateralis tear, with myositis ossificans. A 6 cm longitudinal tear with foci of myositis ossificans (circles), under an intact muscle.

The duration of symptoms until diagnosis (“Time from injury”) was 20.6±9.41 days (mean±SD, range: 7-35). The treatment regime included rest, intensive physiotherapy and analgesics and follow-up included periodical clinical assessments and further imaging studies, if needed. The time from diagnosis to recovery (“Downtime”) was 55.8±17.3 days (mean±SD, range: 24-73). Eventually, all the soldiers gradually returned to serve in their units. Patient data is summarized in Table 1. From our data, it appears that earlier diagnosis was associated with shorter rehabilitation period.

Discussion

Quadriceps tendon tears are usually diagnosed in adults, often due to decreased tendon vascularity in systemic illnesses such as diabetes mellitus, secondary hyperparathyroidism, rheumatoid arthritis, systemic lupus erythematosus, gout and chronic renal failure [5-8]. A tear of the muscle belly in younger patients is usually encountered following a severe substantial trauma.

Since “hand-to-hand combat” skills are essential to SF soldiers, injuries while trainings cannot be avoided. Previously in the IDF, only shin protectors are applied to the offending practicing soldier, but no protection is provided to the defender.

“Hand-to-hand combat” training is usually associated with low-force trauma. Israeli SF soldiers are trained in very aggressive “full-contact” techniques, which emphasize rapid threat neutralization. Thus, in the “low-kick” exercise, they are trained to aggressively strike the opponent’s thigh, using their shin. Therefore, trainees are obliged to use protective gear. Until recently, this consisted of shin protector but not thigh protective gear. As shin protectors are not designed to protect the opponent’s thigh, the IDF safety measures and gears were found unsatisfactory, resulting in traumatic quadriceps tears. It is expected that future use of appropriate protection thigh gears will minimize the risk from “low-kicks” injuries.

Patient	Age (years)	Past medical history	Affected muscle	Presenting symptoms	Primary sonography	Time from injury (days)	Treatment	Downtime (days)	Later imaging study and follow up
1	19	-	Rt. Vastus lateralis	Persisting thigh pain	Partial tear (9cm), with myositis ossificans	35	Extensive physiotherapy	73	Returned to service
2	19	-	Lt. vastus lateralis	Persisting pain, claudication, knee effusion	Distal tear (6cm), reactive effusion	25	Extensive physiotherapy, knee effusion aspiration	70	Post 2 months MRI- normal, Returned to service
3	20	-	Rt. Vastus lateralis	Persisting pain	Partial tear (10 cm)	7	Extensive physiotherapy	24	Post 3 months sonography- smaller tear, hematoma absorbed. Returned to service
4	19	s/p isipilateral quadriceps tear (4 years ago)	Rt. Vastus medialis	Persisting pain, local hematoma	Partial tear (6 cm)	15	Extensive physiotherapy, high-energy sound waves	56	Returned to service
5	21	-	Lt. vastus medialis	Persisting pain	Partial tear (6 cm), with myositis ossificans	21	Extensive physiotherapy	56	Post 6 months sonography- intact muscle, with myositis ossificans. Returned to service

Table 1. Data for the five patients presenting with quadriceps tears

Time from injury - the time from the injury in training to the time of treatment beginning.

Downtime - the time from treatment beginning to the time of return to service.

Quadriceps muscle belly tears may not be suspected initially. Persistent local pain and other related symptoms, such as local hematoma or prolonged claudication, should raise the possibility of a torn muscle. Moreover, it is notable that once highly motivated SF soldiers are injured, they tend to underreport their symptoms, for fear of being disqualified from the unit, thus making the diagnosis even more difficult. This pattern, together with low medical awareness to the injury, was probably the cause for the average delay of three weeks in diagnosis, as we report. We think that military primary care physicians should be familiar with this uncommon injury, in the relevant setting, to facilitate early diagnosis and treatment.

MRI, with its exquisite soft-tissue contrast resolution, is an excellent imaging modality for evaluation of acute traumatic musculotendinous abnormalities, since it allows optimal assessment of damage to all components of the musculotendinous unit including the muscle belly, myotendinous junction, and tendon insertion site [4]. It may also contribute to the diagnosis of other similarly-presenting knee-related injuries, such as anterior cruciate ligament tears, helping in establishing the differential diagnosis [9]. However, due to MRI costs and relative limited accessibility, sonography may be the preferred diagnostic imaging modality, with a high sensitivity and specificity rates [10]. In our series, the use of sonography was found to be an excellent diagnostic tool, which helped to identify the common cause of these injuries. Therefore, we recommend prioritizing a thigh sonography, searching for muscle tears, in any case of unresolved pain following direct thigh trauma.

Treatment of quadriceps tears requires a temporary cessation of physical activity, intensive physiotherapy and rehabilitation. This, and other complications, as myositis ossificans, may require a longer period of recovery. Consequently, we assume that early diagnosis was a positive predictor for an early recovery and a shorter downtime. Because in the setting of SF units it is especially important to have soldiers back to duty rapidly, that finding emphasizes the importance of early diagnosis of quadriceps tears.

Conclusions

Quadriceps muscle tear is a rare injury with a delayed presentation and diagnosis in highly motivated soldiers. Sonography facilitates diagnosis and monitoring of healing. Early diagnosis may decrease morbidity and allow earlier return to work. Because of the notable similarity between SF soldiers and elite athletes, we assume that these conclusions are also valid for non-military professional athletes.

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