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Case Report

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Intramuscular degloving injury of rectus femoris in a young elite athlete: A Case Report

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Abstract

Injuries to the rectus femoris muscle are common in sports. It is the second most common cause of lower limb muscle injuries in track and field events and third most common cause of injuries in football. It also hasprevalence among basketball, American football and rugby. Intramuscular degloving injury of rectus femoris is a very uncommon injury and has been reported in a few recent case reports. This injury is very specific for rectus femoris because of its peculiar anatomy. However uncommon the injury may be, its inclusion in muscle injury classification system is important in recognising it and treating it as per laid down guidelines. The various classification systems of muscle injury do not have a mention of intramuscular degloving injury. Hence, such injuries are most often missed in diagnosis and present a clinical dilemma to the clinician in terms of rehabilitation protocol and prognosis. The present report is about a rare case of intramuscular degloving injury of rectus femoris in a track and field athlete presenting two years after initial episode with multiple recurrences and loss of flexibility and strength.

Keywords: Intramuscular degloving injury, Rectus femoris, Athlete.

INTRODUCTION

In aggregate studies of all sports, quadriceps injuries appear to be the second most common type of lower extremity muscle injuries behind hamstrings [1,2]. The complex anatomy, high percentage of type 2 fibers, and its diarthrodial nature, all contribute to the fact that the rectus femoris is the most commonly injured quadriceps muscle [3].

Various classifications of muscle injuries exist which focus, respectively, on clinical signs, appearance on ultrasound imaging, or Magnetic Resonance Imaging (MRI) findings [4]. However, the peculiar anatomy of rectus femoris makes it vulnerable to unique injury patterns and injury types different from the existing classifications.

Rectus femoris muscle injuries can be classified based on the type and location into the following [5-7]: anterior - inferior iliac spine avulsion, injury to the origin (direct head, indirect head, conjoined tendon), proximal myotendinous junction strain of the indirect head, proximal myotendinous junction strain of the direct head, intramuscular degloving injury, muscle contusion, myofascial injury, and distal myotendinous junction strain.

Rectus femoris injuries occur most commonly at the distal muscle-tendon junction of the quadriceps tendon [6]. Intramuscular degloving injuries of Rectus femoris, the term as used by Kassarjian *et al* [8] for describing the injuries of the muscle belly where the inner bipennate muscle is separated and dissociated from the superficial unipennate muscle without involvement of myofascial junction, myotendinous junction, or the intratendinous region, is a relatively new pattern of muscle belly strain observed in athletes. This injury pattern accounts for only 9% of rectus femoris injuries [5]. The classification system of muscle injuries in sports has no mention of this pattern since it is seen exclusively in the rectus femoris because of its peculiar anatomy. The direct head of the rectus femoris originates from the anterior inferior iliac spine and the indirect head originates from the superior acetabular ridge and hip joint capsule. The two heads form a conjoint tendon 2 cm distal to their origin [9]. The myotendinous junction of the direct head covers one-third of the proximal rectus muscle and blends with the anterior fascia and is only typically visualized as a distinct entity at the level of the hip joint [3]. The indirect head contributes to a long and deep musculotendinous junction or 'central tendon' which can travel up to two-thirds of the

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muscle belly and gives rise to bipennate fibers. The more superficial direct head gives rise to unipennate fibers which surround the bipennate muscle. This muscle within a muscle architecture results in circumferential patterns of muscle tearing seen in degloving injuries that differ from what is typically encountered. Not much is known regarding the mechanism, management, prognosis and return to play (RTP) of these injuries in athletes as very few studies are available to date. Also, no case reports of such injuries were available in track and field athletes. We hence present one such rare case of a closed degloving injury to rectus femoris in an elite track and field athlete and its management which may be overlooked in sports medicine clinics.

CASE REPORT

A 22-year-old male elite track and field - middle distance runner (height-178 cm, weight-70kg, BMI-22.09 kg/m^2, training for the past eight years presented with pain and swelling in the right mid-thigh which occurred while sprinting 4 days before consulting the sports medicine center. The athlete could not complete the repetition and immediately stopped training. He reported a history of such episodes thrice in the past, all occurred while sprinting, within two years. He returned to play 20 days after the first episode and in 10 days in the next two subsequent episodes. No active rehabilitation was done during these episodes and the athlete managed pain at home with ice and rest. During the current episode, a dull, diffuse pain was felt over the mid-thigh region, non-radiating and aggravated by stretching, running, and sprinting. His personal history, dietary history were normal and his family history was unremarkable.

On examination, there was a diffuse tenderness and palpable swelling over the right mid-thigh about 12 cm in length. Thigh girth on the affected side was marginally increased by 1 cm and calf girth was equal bilaterally. The athlete was unable to perform active straight leg raise due to pain at the time of presentation. Resisted knee extension was painful and active prone knee flexion was restricted due to pain. Stretching of the quadriceps also provoked pain. Right hip flexion strength was also reduced and strength deficits were observed in the right quadriceps, hamstrings and calf as measured by a digital muscle dynamometer compared to another leg. Ely's test was positive whereas the fulcrum test for femoral stress fractures was negative. No neurological signs and symptoms were reported. X-ray of the right thigh displayed no signs of bone stress injury or myositis ossificans. MRI of the thigh was advised to identify the exact location and type of injury and it displayed the presence of fluid separating the outer and inner rectus fibers in the mid to distal thigh with proximal retraction of the inner fibers along with the central tendon. (Fig 1 & 2). The surrounding fluid extended over a length of 5 – 6 cm with edematous outer fibers and a streak of perifascial fluid along the anterior aspect. No chronic signs such as a scar or fibro-fatty tissue are observed in MRI.

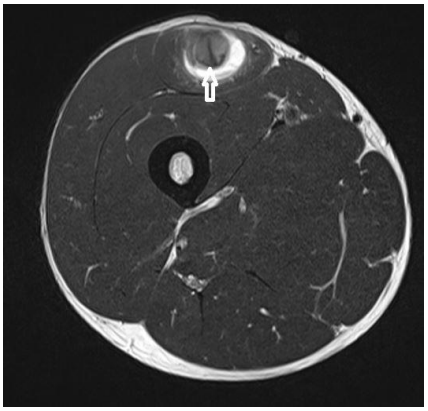

Figure 1: Axial T2 image showing dissociation between inner bipennate and outer unipennate fibers of rectus femoris (white arrow) and no involvement of central tendon.

Figure 2: Coronal T2 image showing central tendon is not ruptured along the entire length. Circumferential intermuscular dissociation of inner bipennate and outer unipennate fibers of rectus femoris (white arrow)

A diagnosis of intramuscular degloving injury of right rectus femoris was made and the athlete was advised activity modification. Meanwhile, the pain was managed by non steroidal anti inflammatory medicines and icing initially, followed by isometrics, active-assisted range of motion exercises, passive and PNF stretching of the quadriceps.

At 2 weeks post-injury, his symptoms were reduced and functional assessment was done. The athlete reported no pain on the squat, lunge and hop tests. However single-leg hop and tandem hop distance reduced with right leg. In absence of good quality studies on the management of these injuries, a rehabilitation protocol on the lines of rectus femoris strain grade 2 was initiated and gradually progressed. The functional outcomes and strength improvements were measured after every phase and progression to the next phase were determined. At 8 weeks, the activity was advanced to include neuromuscular coordination drills and high-velocity eccentric exercises including reverse nordic, squat jumps, box jumps and thrusts, and progressed towards a plyometrics regimen with cone and ladder drills along with sports specific drills and gradual running protocol. At 10 weeks, the athlete was advised gradual return to sport. He resumed his pre-injury training by 12 weeks. Repeat MRI could not be done as planned due to the shifting of his training base. However, the athlete was symptom-free on follow-up for 3 months over the telephone.

DISCUSSION

In sprinting, the risk for rectus femoris injuries may be highest during acceleration (eccentric muscle actions in the early swing phase) and deceleration phases [10]. In a case series of footballers [8], the most common mechanism of degloving injuries was kicking whereas in our athlete, the injury occurred while sprinting. Since the athlete is a middle-distance runner, contacting injury repeatedly while sprinting, poses a question related to training error (in the form of inadequate sprint training) as a risk factor for such injury. Athletes with a previous injury of the rectus are also at risk to get reinjured [6].

Though the incidence of muscle injuries increases with age, prospective studies on quadriceps injuries show no association with age. Since no reports on such cases are found among older athletes, and in footballers' study, the age of the athletes was between 15-21 years, injuries of such nature may be prevalent in the young adolescent age group.

The hypothesized mechanism of degloving injury could be due to a shearing phenomenon that develops as a result of the independent action of outer unipennate fibers and inner bipennate fibers in previously injured rectus muscle. Hughes et al. postulated a similar shearing phenomenon between direct and indirect heads of the

proximal tendon as a reason for longer rehabilitation associated with central tendon injuries [11]. Though the site of degloving injuries is in the muscle belly and peripheral, these injuries may also require longer rehabilitation times due to the shearing phenomenon.

The time to RTP varied between thirty one to fifty six days with an average of 38.7 days in the cohort of football players [8]. In a case report of a female lacrosse player [12], the RTP time was 56 days. The RTP time in our case report was 84 days. His slow recovery as evidenced by functional assessment could be due to the more conservative approach in rehabilitation as the current injury was his fourth recurrence. According to recently published studies, complete proximal rectus femoris avulsions and complete mid substance muscle rupture often need surgical management, especially when they occur in high-performance athletes [7]. But no studies on surgical indications of degloving injuries are available to date.

Many questions related to this injury in terms of sport-specific incidence rates, specific risk factors, its natural history of progression, time to return to play, indications for surgery and long-term prognosis need to be ascertained.

CONCLUSION

Intramuscular deglo**v**ing injury to the rectus femoris requires further evaluation with a large-scale study. Future research should aim at a better understanding of the injury risk and investigating appropriate treatment interventions for this particular group of injuries. Studies also need to be conducted to identify the protective mechanisms against the development of these shearing forces to prevent these injuries.

Conflicts of Interest

The authors declare no conflict of interest.

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