



Case Report

Isolated Vastus Intermedius Avulsion Injury: A Case Report with Imaging Spectrum of this Rare Incidence

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ABSTRACT

Isolated mid-tendon vastus intermedius avulsion injuries are rare, painful, and overuse-related changes with a wide spectrum of epidemiology often demonstrating an exceptional spectrum of imaging features, especially on conventional radiographs. Although they can be easily diagnosed on magnetic resonance imaging, it is pertinent to identify the features of conventional imaging as that forms the first line of investigation. Our case report emphasizes the significance of identifying early signs of vastus intermedius avulsions on plain radiographs which can avoid neglect and functional disability. Timely identification of conventional imaging can avoid months of excruciating pain and streamline the further course of the treatment.

Keywords: Musculoskeletal bone, Musculoskeletal system, Magnetic resonance, Trauma, Inflammation

INTRODUCTION

Isolated vastus intermedius avulsion injuries are rare, painful, and overuse-related changes, most commonly involving the femoral shaft insertions.^[1] This condition occurs more frequently in females or marathon runners, manifesting as traction periostitis, periosteal new bone formation, or cortical elevation mimicking malignancy.^[2] If training persists, these individuals are at risk for proceeding to stress fracture; thus, vastus intermedius injury can be thought of as a herald event for the latter.

CASE REPORT

In 2015, a 56-year-old female with a few week's history of severe, acute onset of progressive pain of her left thigh was referred to radiology for further musculoskeletal imaging. The symptomatic patient informed that she was frequently climbing steep stairs.

The first radiograph demonstrated very subtle periosteal reaction and cortical elevation in the anterior, mid to upper portion of a left femoral shaft [Figure 1a and b].

Subsequent MRI revealed intra-cortical linear hyperintense signal abnormality in association with periosteal elevation, periosteal fluid, and associated muscle edema at the femoral insertion of vastus intermedius [Figure 2a-f]. The imaging pattern was almost identical to the previously reported cases of adductor magnus avulsion insertion syndrome.^[2,3] The only minimal difference was the anterior location as per vastus intermedius muscle insertion site.

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Given, the clinical scenario and acute symptoms following frequent climbing of stairs and clinical examination, a vastus intermedius avulsion insertion injury was suspected. However, due to the rarity of such isolated injuries and limited literature review, a possibility of osteoid osteoma, osteomyelitis, or even neoplastic process was also included in the spectrum differential diagnoses. In addition, a follow-up radiograph and microscopic verification were advised to eliminate the differential diagnoses.

The symptomatic patient requested conservative management with analgesics and did not agree for any interventional

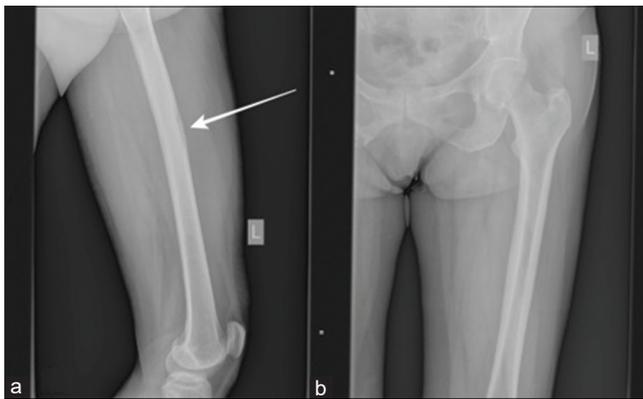


Figure 1: (a and b) A 56-year-old female with a history of acute and increasing pain in the mid to upper left thigh. The patient informed that she was frequently climbing steep stairs. Initial radiographs demonstrated a subtle periosteal reaction only seen on a lateral view (arrow) figure a. No abnormality visualized on a-p view.

procedures such as biopsy at that time. The associated pain resolved in few months.

After a year, the patient was completely asymptomatic, however, decided to represent for a follow-up plain film of the left thigh. This was performed, and the radiograph revealed cortical thickening involving the femoral shaft in the setting of reactive changes and associated healing process [Figures 3a and b and 4a]. The visualized extensive bone thickening was similar to the typical reactive focal cortical changes seen in osteoid osteoma.

A complementary biopsy to rule out osteoid osteoma or osteomyelitis and establish a definite diagnosis was again advised and requested as the site of avulsion was unusually higher than the common insertion site involving the mid-tendon area rather than tendon-bone junction. Following discussions and review of the images, the patient agreed to undergo the procedure. The histological examination finally confirmed the suspected benign reactive periosteal reaction [Figure 4b].

Identical imaging features with associated cortical thickening on follow-up radiographs in the setting of “thigh splints” were previously reported. However, the cortical thickening observed in the current literature was less conspicuous, likely as per much shorter follow-up period.^[2]

In subsequent clinical reviews over the 3 years, the same patient reassured that the previously noted symptoms never came back and she was comfortable during her average, daily physical activities without any disability.

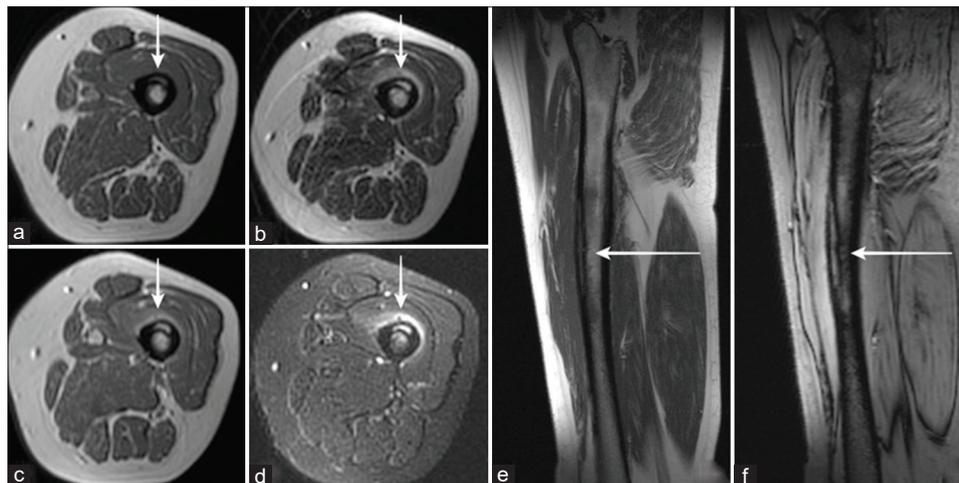


Figure 2: (a-d) A 56-year-old female with a history of acute pain after frequently climbing steep stairs. Four axial magnetic resonance images: T1-weighted sequence pre-contrast – on figure and subsequent post-contrast T1 image – figure c on the image below. T2-weighted sequences – figure b and subsequent T2 sequence with fat saturation on the image below – figure d. MRI showed linear, enhancing intracortical hyperintensity on both T2-weighted sequences figure b, d, and, additionally, on T1 post-contrast image figure c (arrows). Reactive edema of the adjacent soft tissues on T2-weighted images – figures b and d (arrows). There was associated post-contrast enhancement of the surrounding tissues – figure c (arrow). (e and f) A 56-year-old female with a history of acute pain after frequently climbing steep stairs. T1-TSE sagittal – figure e and T2-weighted sagittal images. Magnetic resonance imaging demonstrated linear signal abnormality at the anterior aspect of the left thigh (arrows).



Figure 3: (a and b) Please note the initial radiograph (3-a) for comparison, as this revealed only a subtle periosteal change in symptomatic acute phase. One year later, the same 57-year-old female with a history of acute pain after frequently climbing steep stairs. Follow-up plain radiograph was done approximately 14-month later – figure b. The female was completely asymptomatic at the time of follow-up imaging. Radiograph showed dramatic cortical thickening as a sequela of a healing process – figure b.



Figure 4: (a and b) One year later, the same 57-year-old female with a history of acute pain after frequently climbing steep stairs. Fourteen-month follow-up radiograph, A-P view – figure a and b. Both X-rays show extensive cortical thickening at the site of injury. Please note the post-bone biopsy image – figure b. Microscopic examination did not reveal any evidence of malignancy and confirmed benign reactive osseous changes.

DISCUSSION

The vastus intermedius is a component of the quadriceps tendon including vastus lateralis, vastus medialis, and rectus femoris. This muscle gets its blood supply from the lateral femoral circumflex artery. It acts to stabilize the patella in midline and contraction of this muscle helps in extension of the lower leg. As the isolated mid-tendon avulsion injury of

vastus intermedius is rare, not much of demographic data is available on the subject.

Acute symptoms of pain and swelling with regard to related extensor injury usually occur secondary to repetitive weight-bearing activities and forceful sudden contractions and are often related to chronic inflammatory changes in the setting of long-standing trauma.

Sudden eccentric load bearing of the extensor tendons, when the knee is flexed with plantar extension, simultaneously can lead to such kind of injury. In addition, usage of anabolic steroids and corticosteroids can increase the risk regarding this type of injury.^[1,4]

Clinical examination usually shows bruising and swelling with diffuse tenderness in the distal thigh and may extend up to the suprapatellar region. Mild suprapatellar fullness can be seen. Functional evaluation usually reveals weak extension as compared to the normal contralateral limb.

As the condition progresses, the patient may experience pain throughout and following the activity.

The vastus intermedius muscle of the upper leg exerts traction forces on the femoral tendinous insertions resulting in periosteal elevation which can be identified early on plain radiographs.

The radiographs performed in the initial acute phase may reveal periosteal reaction involving the distal femoral shaft following chronic stress injury [Figure 1a].^[5,6]

Long-term follow-up shows reactive cortical thickening at the site of injury, which may challenge diagnosis and misleads radiologists regardless of experience [Figures 3a and b and 4a and b].^[2]

In acute settings, ultrasound may help in identifying the torn fibers of the mid-tendon with echogenic frayed ends. Dynamic ultrasound can not only identify the site of tear but also the gap between the torn edges which can be helpful information for the operating surgeon. Associated hematoma can also be identified on ultrasound.

CT can only play a significant role in ruling out other differential diagnoses for periosteal thickening. Imaging related to these uncommon injuries may mimic osteoid osteoma or osteomyelitis.^[7,8]

MRI is the modality of choice and may reveal cortical hyperintensities on T2W and STIR images involving the proximal or midshaft of femur at the site of tendinous insertion of vastus intermedius [Figure 2a-f].^[2,3,6]

The common differentials to be kept in mind when radiographs and CT show periosteal thickening or elevation include osteomyelitis and osteoid osteoma. Osteomyelitis may have a gradual onset with associated fever and pain. Other ancillary findings such as soft tissue edema and fat pad elevation can be seen on imaging.

Early periosteal changes of vastus intermedius avulsion may mimic osteoid osteoma; however, contrast-enhanced CT can help to identify the nidus of osteoid osteoma in the setting of normal soft tissues, whereas vastus intermedius avulsion may show soft tissue enhancement along with periosteal thickening.

In our case, as the site of injury was very proximal to the otherwise involved distal shaft of femur at the tendon-bone junction; hence, a core biopsy had to be performed.

Bone biopsy should be ideally avoided; however, as the line of the treatment for possible differentials varies drastically, so the need for biopsies in such exceptional cases can crucially guide the treatment protocol.

Medical history in combination with normal laboratory tests, lack of bony destruction, and follow-up radiographs can help exclude and differentiate with other hazardous conditions such as osteomyelitis or osteoid osteoma where the treatment plan completely differs.^[7,8]

Physical therapy focusing on appropriate body alignment and balance and the design of a graded training program with realistic goals will reduce the occurrence of chronic stress injuries. Despite this, some will still invariably occur, as these individuals typically train through pain and initially disregard advice. Patients should be treated conservatively through modification of training activities directed at limiting the biomechanical stress and tension.

CONCLUSION

The knowledge of the patient's medical history and activities, understanding the mechanism of injury, acquaintance with the possible imaging spectrum, and awareness of the diagnosis increase our ability to diagnose vastus intermedius injury patterns at the initial investigations including plain radiographs and distinguish them from more serious differential diagnoses.

Identifying subtle conventional signs on radiograph can save the patient from neglect and excruciating pain, providing for emergency MRI and timely treatment.

It is essential to highlight the importance of plain film radiographs in the setting of follow-up imaging also which supports our diagnosis and guides us toward recovery.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Azzopardi C, Vidoni A, Goswami V, Botchu R. Isolated vastus intermedius rupture case report and review of literature. *SM J Clin Med Imaging* 2018;4:1022.
2. Nishio J, Hara M, Naito M. Adductor insertion avulsion syndrome mimicking neoplastic processes in a 14-year-old long-distance runner. *Orthopedics* 2012;35:e1442-5.
3. Anderson MW, Kaplan PA, Dussault RG. Adductor insertion avulsion syndrome (thigh splints): Spectrum of MR imaging features. *AJR Am J Roentgenol* 2001;177:673-5.
4. Cetinkaya E, Aydin CG, Akman YE, Gul M, Arikan Y, Aycan OE, *et al.* A rare knee extensor mechanism injury: Vastus intermedius tendon rupture. *Int J Surg Case Rep* 2015;14:186-8.
5. Ozburn MS, Nichols JW. Pubic ramus and adductor insertion stress fractures in female basic trainees. *Mil Med* 1981;146:332-4.
6. Weaver JS, Jacobson JA, Jamadar DA, Hayes CW. Sonographic findings of adductor insertion avulsion syndrome with magnetic resonance imaging correlation. *J Ultrasound Med* 2003;22:403-7.
7. Anderson SE, Johnston JO, O'Donnell R, Steinbach LS. MR Imaging of sports-related pseudotumor in children: Mid femoral diaphyseal periostitis at insertion site of adductor musculature. *AJR Am J Roentgenol* 2001;176:1227-31.
8. Tshering-Vogel D, Waldherr C, Schindera ST, Steinbach LS, Stauffer E, Anderson SE. Adductor insertion avulsion syndrome, "thigh splints": Relevance of radiological follow-up. *Skeletal Radiol* 2005;34:355-8.

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