

Compression type stress fracture of femoral neck with equivocal X-ray features diagnosed on ^{99m}Tc -MDP SPECT/CT in a case of trivial hip pain

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ABSTRACT

Stress insufficiency fracture is usually diagnosed clinically and on the basis of routine X-ray imaging findings. However, the absence of any known predisposing factors and negative or occult radiographic findings pose diagnostic challenges. We report the case of an elderly male patient who presented with a chief complaint of trivial left hip pain and with equivocal radiographic findings. Triphasic ^{99m}Tc -methylene diphosphonate bone scan and single-photon emission computed tomography/computed tomography helped in arriving at the diagnosis of stress insufficiency fracture involving femoral neck.

Keywords: Bone scan, ^{99m}Tc -methylene diphosphonate, single photon emission computed tomography/computed tomography, stress insufficiency fracture

INTRODUCTION

Conventional X-ray imaging remains first line investigation in cases of trivial hip pain in almost all cases; however, stress fractures, especially in hip joint region, often remain undiagnosed on the radiograph. Triphasic bone scan with ^{99m}Tc -methylene diphosphonate (MDP) and single-photon emission computed tomography/computed tomography (SPECT/CT) as in our case aided in clinching the diagnosis of stress insufficiency fracture involving the left femoral neck.

CASE REPORT

A 71-year-old overweight man with no known comorbidities presented to an orthopedic outpatient unit of our institution with

complaints of trivial left hip pain and difficulty in walking for 1 month. He used to walk regularly and was able to perform his routine activities to begin with. However, the pain progressively increased in intensity with slight worsening for 5 days relieved to an extent after consumption of oral analgesics. There was no history of trauma or any precipitating event. Laboratory investigations showed low serum Vitamin D₃ level at 20 ng/ml (normal >30 ng/ml). Serum calcium and phosphate levels were within normal limits. On clinical examination, there were no local signs of inflammation except for slight tenderness over Scarpa's triangle. Femoral nerve stretch test was negative ruling out possibility of lumbar radiculopathy. In view of his complaints and clinical suspicion of a possible fracture, the patient underwent anteroposterior radiograph of pelvis [Figure 1], which showed no obvious fracture or displacement with maintained contours of visualized bones. Shenton's line was preserved with no clear disruption. The patient was then referred to Nuclear Medicine Department for ^{99m}Tc -MDP bone

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scintigraphy. Triphasic bone scan was performed. 20 mCi of ^{99m}Tc -MDP was injected intravenously with pelvis positioned in the field of view of gamma camera. No abnormal perfusion was noticed to the symptomatic region on arterial phase. Mildly increased pooling of radiotracer in the left hip region on 2 min initial static image was observed. Delayed skeletal phase image acquired at 3 h showed crescent shaped area of intense tracer uptake in femoral neck region [Figure 2]. Rest of the skeletal



Figure 1: Anteroposterior radiograph showing no obvious fracture seen involving the left hip joint with maintained contour of visualized bones

system was unremarkable. On subsequent fused SPECT/CT performed for further characterization, abnormal tracer uptake localized to subcapital left femoral neck with diffuse sclerosis on corresponding CT image [Figure 3]. No obvious fracture or displacement was noted. Considering patient's age, timing of injury, unexplained left hip pain, and factors such as obesity, osteoporosis, and radiologically equivocal findings, the imaging characteristics on bone scan pointed toward stress fracture. The patient underwent open reduction and internal fixation with dynamic hip screw plate and cancellous screws. Postsurgery, the patient, was referred for a rehabilitation program. The patient was clinically better at the time of the last follow-up.

DISCUSSION

Stress insufficiency fractures involving femoral neck can occur without any high impact trauma or event and usually appear when normal activity stresses a bone that is deficient in resistance.^[1] These are commonly observed in runners and comprise 5–10% of all stress fractures.^[2] These fractures are usually diagnosed clinically and on X-ray imaging, which is a first-line imaging investigation. However, in the majority of cases, there may not be obvious abnormality on plain radiograph.^[3,4] On histology, in a stress insufficiency fracture, repeated stress leads to the early reparative osteoblastic response which outpaces

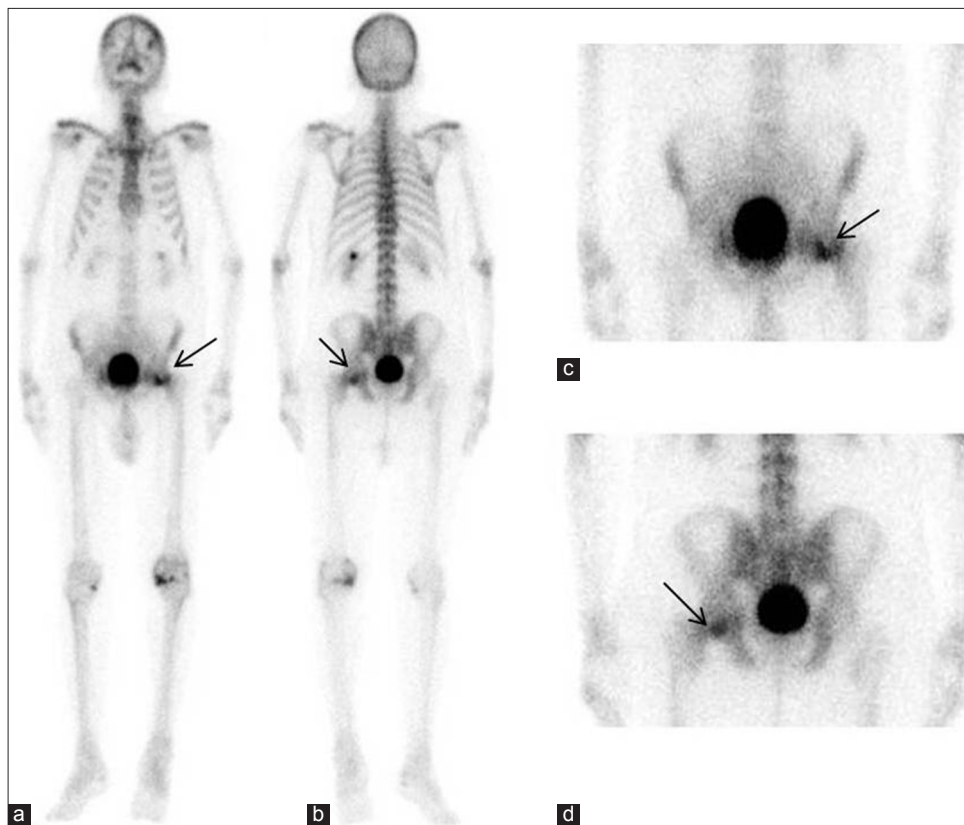


Figure 2: ^{99m}Tc -methylene diphosphonate bone scintigraphy – anterior (a and c) and posterior (b and d) images showing marginated area of increased tracer uptake in the left femoral neck appreciated better on high count images of pelvis (arrows)

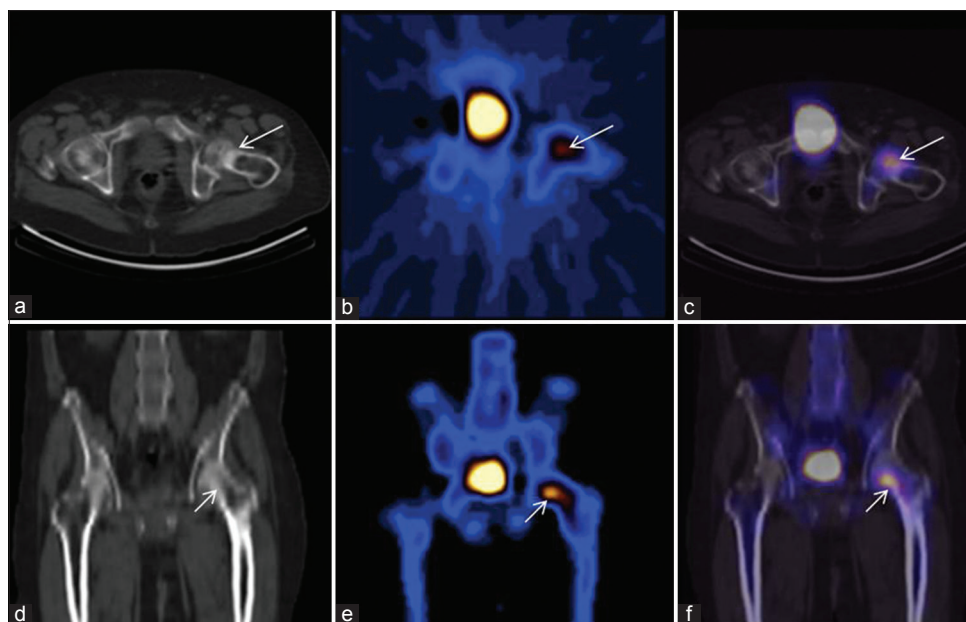


Figure 3: Computed tomography, single photon emission computed tomography, and fused single photon emission computed tomography/computed tomography images in axial (a-c) and coronal (d-f) views accurately localize the abnormal tracer uptake to the left femoral inferior neck (arrows), with sclerosis seen on corresponding computed tomography image

osteoclastic activity. With continued physical activity, trabecular microfractures occur. Compensatory bone strengthening is then achieved by periosteal bone formation.^[5,6] These early changes are unlikely to be picked on plain radiographs unless increased osteoclastic activity exceeds osteoblastic activity which results in cortical break.^[6] In the initial stage of the fracture, thus, radiology does not permit diagnosis because the findings are completely normal.^[7] Magnetic resonance imaging helps in early detection with its ability to pick up marrow edema; however, since patients present when they are symptomatic, bone scan in this scenario is equally sensitive.^[8] Bone scintigraphy is highly sensitive radionuclide imaging procedure in which ^{99m}Tc-MDP is adsorbed by the mineral phase of the bone with radiotracer uptake proportional to the rate of new bone formation.^[9] Bone scintigraphy thus remains an early method for detection of this injury.^[10] In our case, a bone scan showed mild tracer pooling and characteristic bone scan appearance of a sharply marginated area of increased uptake^[11] in the left femoral neck region. Classical scan features of hyperperfusion and hyperemia along with delayed osseous uptake are typically present in the setting of an acute stress fracture.^[12] Planar bone scintigraphy carries a modest sensitivity and specificity for demonstrating a fracture, especially at femoral neck.^[11] SPECT/CT in our patient not only accurately localized the abnormal activity to the left femoral inferior neck region but also demonstrated cortical changes in the form of diffuse sclerosis. Devas has given classification system of femoral neck stress fractures in 1965 as tensile and compression type. The compression type of stress fracture is typically known to demonstrate internal callus formation on the inferior femoral neck without any apparent cortical disruption.^[13] This correlated well with the pattern of tracer uptake on SPECT/CT in this case. On the basis of clinical history, laboratory investigations, bone scintigraphy, and SPECT/CT findings;

other causes such as infection, acute trauma and malignancy were ruled out, and diagnosis of stress insufficiency fracture was confirmed. To conclude, in an elderly individual with trivial hip pain, a stress insufficiency fracture of femoral neck should be suspected until proven otherwise, especially in the presence of predisposing factors such as osteoporosis. Early diagnosis and prompt intervention are important as stress insufficiency fractures carry a risk of displacement and severe complications.^[14] Our case emphasizes on the role of bone scan and SPECT/CT in diagnosing radiologically negative or equivocal stress fracture involving femoral neck. It also highlights the significance of clinical history and correlation with a pathologic basis in clinching the diagnosis.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Peris P. Stress fractures. *Best Pract Res Clin Rheumatol* 2003;17:1043-61.
2. Wen DY, Propeck T, Singh A. Femoral neck stress injury with negative bone scan. *J Am Board Fam Pract* 2003;16:170-4.
3. Avrahami D, Pajczkowski JA. Femoral neck stress fracture in a female athlete: A case report. *J Chiropr Med* 2012;11:273-9.
4. Kiuru MJ, Pihlajamaki HK, Ahovuo JA. Fatigue stress injuries of the pelvic bones and proximal femur: Evaluation with MR imaging. *Eur Radiol* 2003;13:605-11.
5. Li GP, Zhang SD, Chen G, Chen H, Wang AM. Radiographic and histologic analyses of stress fracture in rabbit tibias. *Am J Sports Med* 1985;13:285-94.
6. Ben Chihaoui M, Elleuch M, Sahli H, Cheour I, Romdhane RH, Sellami S. Stress fracture: Epidemiology, physiopathology and risk factors. *Tunis Med* 2008;86:1031-5.

7. Garcés GL, González-Montoro I, Rasines JL, Santonja F. Early diagnosis of stress fracture of the lumbar spine in athletes. *Int Orthop* 1999;23:213-5.
8. Ishibashi Y, Okamura Y, Otsuka H, Nishizawa K, Sasaki T, Toh S. Comparison of scintigraphy and magnetic resonance imaging for stress injuries of bone. *Clin J Sport Med* 2002;12:79-84.
9. Galasko CS. The pathological basis for skeletal scintigraphy. *J Bone Joint Surg Br* 1975;57:353-9.
10. Simon RR, Sherman SC, Koenigsnecht SJ. *Emergency Orthopedics of the Extremities*. 5th ed. Chicago, IL: The McGraw-Hill Companies; 2007. p. 285-7.
11. Fredericson M, Jennings F, Beaulieu C, Matheson GO. Stress fractures in athletes. *Top Magn Reson Imaging* 2006;17:309-25.
12. Rupani HD, Holder LE, Espinola DA, Engin SI. Three-phase radionuclide bone imaging in sports medicine. *Radiology* 1985;156:187-96.
13. Devas MB. Stress fractures of the femoral neck. *J Bone Joint Surg Br* 1965;47:728-38.
14. Román M, Recio R, Moreno JC, Fuentes S, Collantes F. Stress fracture of the femoral neck in a child. Case report and review of the literature. *Acta Orthop Belg* 2001;67:286-9.