

Avascular Necrosis of Femoral Head Diagnosed by ^{99m}Tc MDP Bone Scan Incorporated with SPECT- A Case Report

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ABSTRACT

Avascular necrosis (AVN) may be defined as cellular death of bone components due to the lack of blood supply resulting in joint damage and loss of joint function. This condition may arise from a number of causes i.e. both traumatic and non-traumatic. Diagnosis of the disease at an early stage and deliberate management can prevent the unwanted complications like femoral head collapse and severe arthritis and may save the bone. Although diagnosis of AVN is primarily dependent on radiological investigations, the incremental value and vital role of ^{99m}Tc -methylene diphosphonate (^{99m}Tc -MDP) single-photon emission computed tomography (SPECT) over planar bone scintigraphy permits more accurate localization of lesions and provide pertinent information to recognize the disease at initial stage for better management. We present a case of unexplained low back pain in a young woman who was diagnosed as having avascular necrosis of both femoral heads by ^{99m}Tc -MDP bone scan incorporated with SPECT

Key words: Avascular necrosis, bone scintigraphy, SPECT-CT.

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INTRODUCTION

Avascular necrosis of bone or osteonecrosis is the result of interference in blood supply of bone leading to its death, which causes collapse of bony architecture. The interruption of blood supply may be due to local trauma or non-traumatic systemic conditions such as use of steroid, sickle cell disease, Gaucher's disease, smoking, gout and orthopedic disorders (1). Common sites involved are-head of the femur, humerus, knee, femoral and tibial metadiaphysis, scaphoid, lunate and talus (2). However, femoral head is the commonest site (1). Patients usually present with pain, swelling, redness, reduced joint mobility. Initially, pain is due to increase in intramedullary pressure resulting from bone marrow

edema. However, clinical diagnosis is often difficult due to lack of specific symptoms during initial period. Though MRI (magnetic resonance imaging) is the gold standard for its diagnosis, bone scan is useful in detecting AVN during early phase of the disease. Radionucleotide bone scan plays a vital role to evaluate the benign and malignant conditions of bones, degenerative / arthritic changes in joints and to determine the causes of bone pain and inflammation. Here, we present a case where the diagnosis of AVN was aided by ^{99m}Tc -MDP bone scan incorporated with SPECT.

CASE REPORT

A 21-year old woman presented with severe low back pain with difficulty in walking for six months which radiated to both lower limbs. She stated that her symptoms were aggravated by stair climbing and long walks. Initially her pain was relieved by sitting and resting. The patient did not report numbness or paresthesias in her back or extremities. She had no history of trauma, fall, fever or bowel and bladder dysfunction. X-ray of lumbo-sacral spine and hip joint was normal. She was treated conservatively with analgesics and was referred to NINMAS for a whole body bone scan. Scanning was done in the anterior and posterior views 03 hours after administration of 12 mCi of ^{99m}Tc -MDP. Delayed coronal and sagittal SPECT images of pelvic region were taken.

Delayed static images demonstrated photon deficient areas with increased rim of activity in both femoral heads (right > left) (Figure 1).

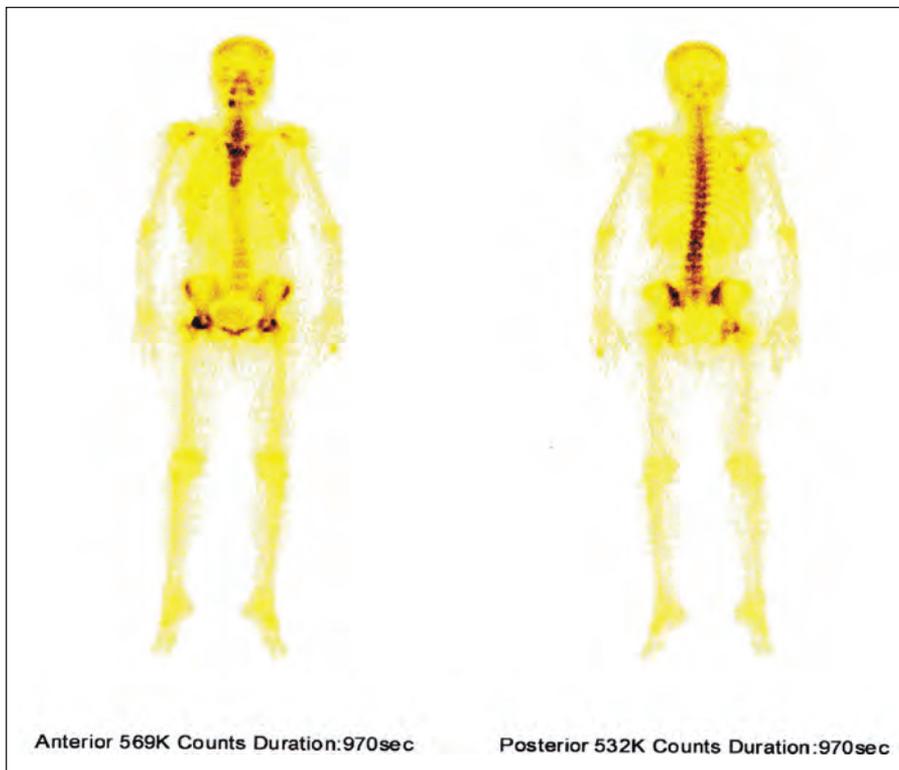


Figure 1: Delayed planar images of ^{99m}-Tc MDP bone scan in the patient having low back pain showing photon deficient areas with increased rim of activity in both femoral heads (right > left). Focal uptake in right lower jaw represents dental cause.

Transaxial, coronal and sagittal SPECT images of pelvic region showed photon deficient areas in heads of both femurs with increased rim of activity (right > left) (Figure 2). Rest of the skeleton showed symmetrical and uniform tracer distribution.

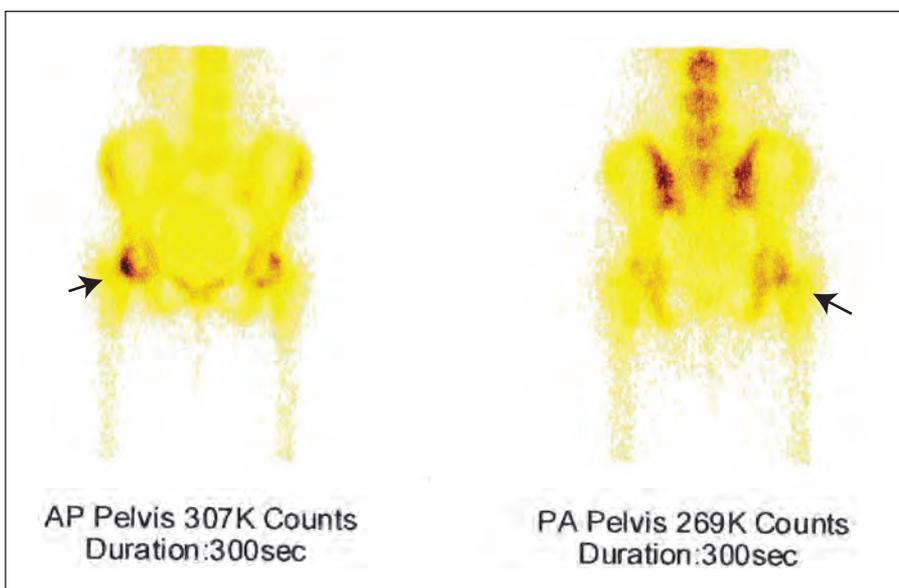


Figure 2: Delayed planar spot images of ^{99m} Tc-MDP bone scan showing photon deficient areas with increased rim of activity in both femoral heads (more intense on right)

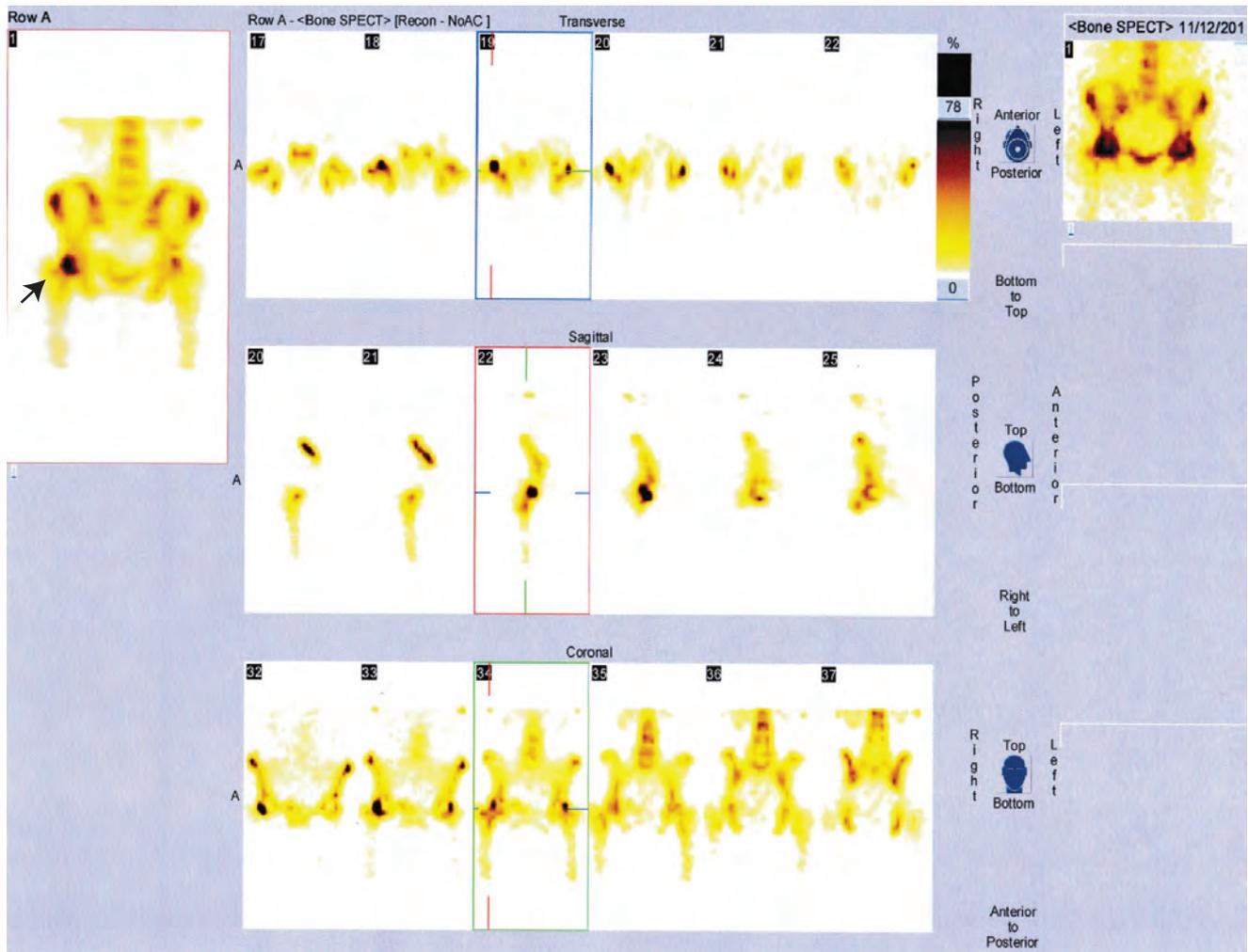


Figure 3: SPECT images of pelvic region demonstrated photon deficient areas in heads of both femurs with increased rim of activity (right > left)

Osteoblastic and osteolytic lesions were consistent with avascular necrosis of both femoral heads. Further MRI was done which was also consistent with our finding.

DISCUSSION

AVN occurs mostly in the hip joint (2). Majority of cases are traumatically induced and only in 25% cases, AVN pertains to non-traumatic causes (3). Multiple studies and reviews have confirmed that plain radiographs are highly specific for advanced disease but exhibit very low sensitivity for the earliest stages of the disease (4,5). MRI is the gold standard of diagnosis and staging. However, it may not be as effective in identifying sun-chondral fractures as tomography or CT scan.

As AVN is an evolving process, the findings of bone scan vary with the stages of the disease. In acute stages, no radiotracer is delivered to the bone tissue. Therefore,

initially for 7-10 days after the event, AVN generally appears in bone imaging as a photopenic area (Figure 1) After 1-3 weeks, increased radiotracer concentration is seen in a subchondral distribution due to osteoblastic activity at the reactive interface around the necrotic segment (6). Imaging with pinhole collimator is useful as it increases the resolution. Overall sensitivity of bone scan for diagnosis of AVN of femoral head is from 78% to 91% (6). This variation in sensitivity is probably due to different etiology of AVN of femoral head. Sensitivity is high in AVN following femoral neck fracture due to interruption of blood supply rather than chronic non-traumatic processes. Some studies have shown that bone scan is superior to conventional MRI in early detection of AVN (7). It can give valuable information in fractured femoral neck due to AVN with metallic fixation device.

However, on planar bone scan image, the earliest and most evident finding of AVN i.e. photopenic region in the femoral head may be obscured by the superimposed acetabular and other bone activity (7). As SPECT provides three dimensional images, it is possible to separate the femoral head from other overlying bony structures (Figure 3). Siddiqui et al (8) demonstrated that both MRI and bone SPECT are complimentary to each other in detecting subclinical AVN. The study of Ryu et al (7) revealed 100% sensitivity of SPECT in detection of AVN of femoral head, compared to 66% for MRI. Several other studies have shown that in diagnosis of AVN of femoral head, the sensitivity of MRI ranges from 85% to 100% and that of SPECT bone imaging ranges from 85% to 97% (9). Hence, SPECT bone scan could be equally informative. So, here we present our case of AVN of femoral head, the diagnosis of which was aided by ^{99m}Tc bone scan (characterized) incorporated with SPECT.

CONCLUSION

Plain radiographs and MRI are conventionally used to diagnose AVN. But in the present clinical scenario, i.e. in atraumatic AVN, bone scan can be used as a valuable tool. This case brings to light the possibility of use of bone scan along with SPECT in the diagnosis of AVN with atypical presentation. Diagnosis of the disease at a very early stage can guide the physician in their proper

planning of treatment for ultimate benefit of the patient.

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