

Demonstration of Achilles tendon rupture by three phase bone scintigraphy and MRI

Wei-Jen SHIH and Calixto PULMANO

Nuclear Medicine Service and Radiology Service, VA Medical Center, and Division of Nuclear Medicine, Department of Diagnostic Radiology, University of Kentucky Medical Center, KY, USA

A man with complaint of soreness in the right medial ankle underwent three-phase bone scintigraphy; the results of the study suggested chronic active osteomyelitis or cellulitis, he was on antibiotics and was not experiencing any improvement. MR imaging confirmed Achilles tendon rupture. This case illustrates that a positive three-phase study is non-specific disease entity.

Key words: three-phase bone scintigraphy, MR imaging, Achilles tendon rupture

REPORT OF A CASE

A 63-yr-old man with a history of hypertension, coronary artery heart disease, carotid stenosis, and cardiovascular accident complained of sores in the right medial ankle for about one year. He had a previous medial malleolus ulcer on his right leg, which had healed; but he had also had chronic swelling and pain of the left leg. On physical examination, there was a 0.5–1 cm dark scab with 2-mm erythema surrounding it in the medial aspect of the right ankle. CBC revealed WBC 5.7 k/cmm ($n = 5-10$), RBC 4.1 m/cmm ($n = 4.6-6.2$), HGB 12.4 g/dl ($n = 14-18$), PLT 122 k/cmm ($n = 150-450$); initial ESR was 6 mm/hr ($n = 0-20$) and became 23 mm/hr. Because of suspected chronic active osteomyelitis, the patient underwent three-phase bone scintigraphy: Rapid sequential imaging every 5 seconds of both legs showed increased radioactivity in the lower end of the right leg (Fig. 1A). The blood pool image showed increased uptake in the lower two-thirds of the right tibia with a focal area of increased uptake in the end of the right tibia (Fig. 1A). Two-hour posterior image showed diffusely increased uptake in the right knee, lower leg, and right foot especially in the right ankle region (Fig. 1B). Two-hour anterior images of both lower extremities showed mild and diffuse uptake in the soft tissue in the

right leg, especially at the end of the right tibia. These findings were consistent with chronic active osteomyelitis or cellulitis (Fig. 1C). The patient was placed on antibiotics. Despite the use of antibiotics, his left leg pain did not improve. Then he was referred for orthopedic consultation. Radiographic examination of the left foot and the left leg showed no bone erosion. MRI with T-2 weighted fat saturated sagittal section at the level of the right distal leg and ankle three months after the bone scintigraphy showed fluid collection in the site of retracted Achilles tendon and gastrocnemius muscle (Fig. 2A). MRI with T-1 weighted sagittal section at the level of the right distal leg and ankle showed absent tendon; discontinuity or disruption and retraction of the proximal tendon segment is seen (Fig. 2B). MRI with T-2 weighted transaxial section at the level of the right distal leg and ankle showed fluid collection (Fig. 2C). These findings are consistent with rupture of the right Achilles tendon just above its insertion into the os calcis and retraction of the tendon and gastrocnemius.

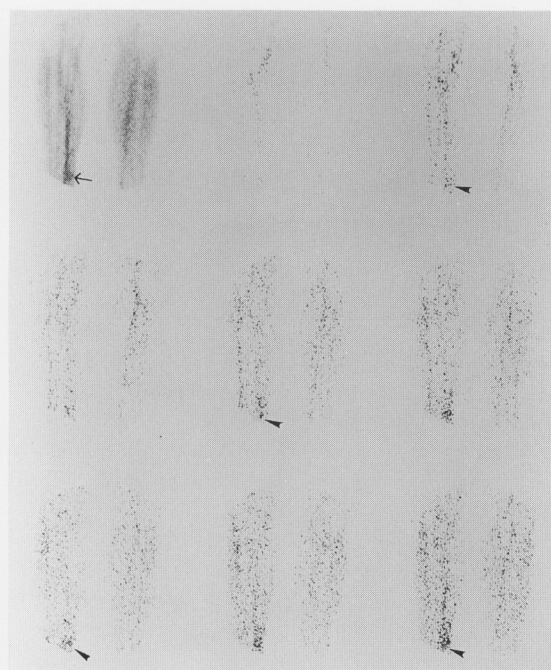
DISCUSSION

Three-phase bone scintigraphy is sensitive and specific for osteomyelitis¹; Schauwecker reported that sensitivity was 94% and specificity was 95%.² Despite of this, it is some time non-specific; three-phase bone scintigraphy might be positive in non-inflammatory bone disease such as giant cell tumor,³ synovial sarcoma,³ sarcoma,⁴ gouty arthritis^{3,5} and Reiter's syndrome.^{3,6} Also it might be positive with bone scintigraphy included in stress

Received August 16, 1999, revision accepted November 25, 1999.

For reprint contact: Wei-Jen Shih, M.D., Nuclear Medicine Service, VA Medical Center, Lexington KY 40501, USA.

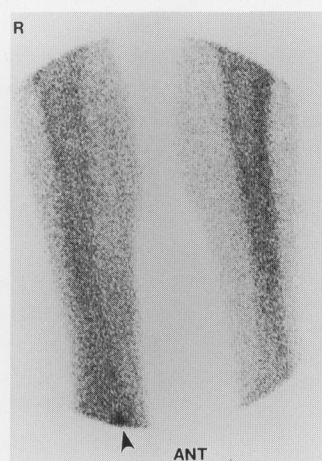
E-mail: wshih0@pop.uky.edu



1A

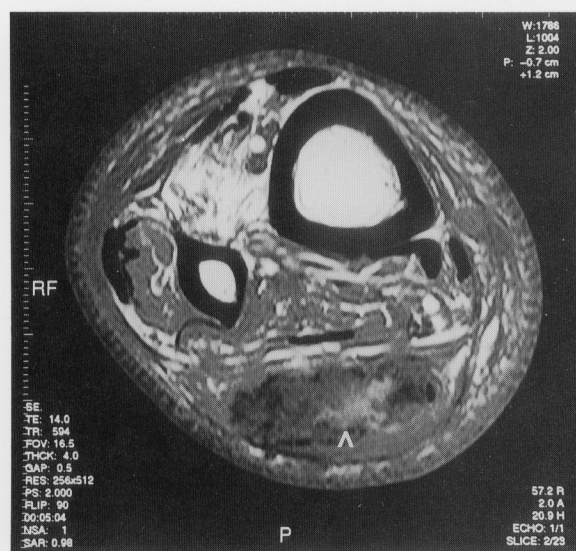


1B

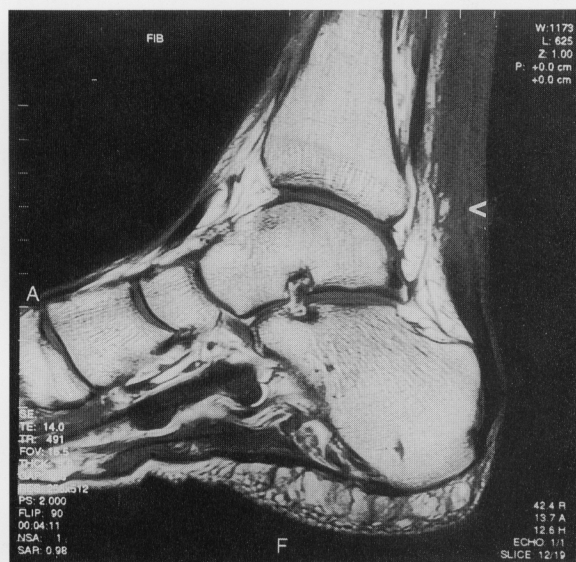


1C

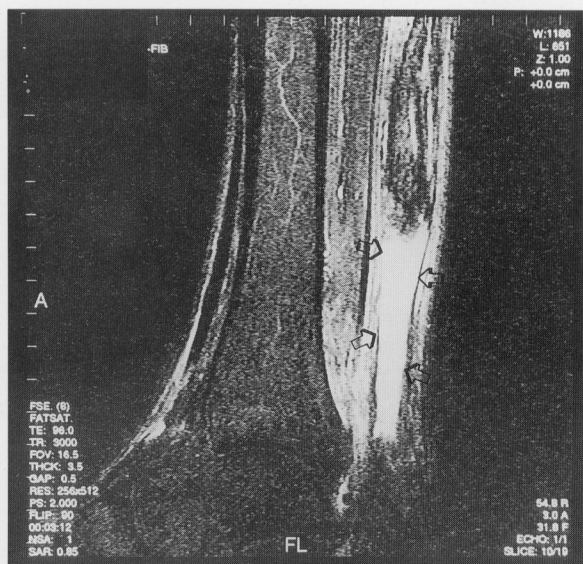
Fig. 1 A: Rapid sequential imaging every 5-seconds of both legs show increased tracer accumulation in the low end of the right leg, as indicated by an arrowhead. The blood pool image (in the right upper corner) shows increased uptake in the lower two-thirds of the right tibia with a focal area of increased uptake in the end of the right tibia, as indicated by an arrow. B: Two-hour posterior image shows diffusely increased uptake in the right knee, lower leg, and right foot especially in the right ankle region as indicated by an arrow. C: Two-hour anterior images of both lower extremities show mild and diffuse uptake in the soft tissue in the right leg, especially at the end of the right tibia, as indicated by an arrowhead.



2A



2B



2C

Fig. 2 A: MRI with T-2 weighted fat saturated (fast spin echo, fat saturation TE 96, TR 3000, field of view 16.5 cm, thickness 3.5 mm, flip angle 90 degrees) sagittal section at the level of the right distal leg and ankle shows fluid collection as indicated by white open arrows in the site of retracted the Achilles tendon and gastrocnemius muscle. There is no evidence of osteomyelitis. B: MRI with T-1 weighted (regular spin echo, TE 14, field of view 16.5 cm, thickness 3.5 mm, TR 490, flip angle 90 degrees) sagittal section at the level of the right distal leg and ankle shows absent tendon as indicated by a white open arrowhead; discontinuity or disruption and retraction of the proximal tendon segment is seen. C: MRI with T-1 weighted (TE 14, TR 594, field of view 16.5 cm, flip angle 90 degrees) transaxial section at the level of the right distal leg and ankle shows hematoma/old blood as indicated by open arrowheads.

fractures,^{7,8} non-union fracture,⁹ infarction,¹⁰ and traumatic myositis.¹¹ In our case the focal area of increase uptake in the distal right leg on the three-phase bone study might reflect locally inflammatory reaction secondary to ruptured Achilles tendon that was responsible for the positive three-phase bone study. In comparison with left lower extremity, diffusely increased radioactivity in the right knee, soft tissue of the right leg, and right foot, as shown on the Figures 1B and 1C, might be explained by sympathetic reflect dystrophy. Because this patient had suffered from a standing right ankle pain.

MR imaging provides a great potential in the evaluation of tendon, because of its excellent differentiation of tendons from surrounding inflammatory changes, hematoma, fluid collection in the ankle; and MR is well suited to image patients with suspected Achilles tendon

rupture.¹² Thus, MR imaging is an excellent method for revealing a rupture and confirming the diagnosis.¹³

ACKNOWLEDGMENT

We appreciate Barbara Circle RT, MR. For her MRI technical assistance.

REFERENCES

1. Palestro CJ, Torres MA. Radionuclide imaging in orthopedic infections. *Semin Nucl Med* 27: 334-345, 1997.
2. Schauwecker DS. The scintigraphic diagnosis of osteomyelitis. *AJR* 158: 9-18, 1992.
3. Delbeke D, Habibian MR. Noninflammatory entities and the differential diagnosis of positive three phase bone imaging. *Clin Nucl Med* 18: 844-851, 1988.
4. Van-der-Aoude HJ, Bloem JL, Schipper J, Hermans J, et al. Changes in tumor perfusion induced by chemotherapy in bone sarcoma: color Doppler flow imaging compared with contrast-enhanced MR imaging and three phase bone scintigraphy. *Radiology* 191: 421-431, 1994.
5. Pickhardt PJ, Shapiro B. Three phase skeletal scintigraphy in gouty arthritis: an example of potential diagnostic pitfalls in radiopharmaceutical imaging of the extremities for infection. *Clin Nucl Med* 21: 33-39, 1996.
6. Al Nahhas AM, Collins CD, Jawad AS, McCready VR. Reversible findings of methylene diphosphonate bone scintigraphy in Raynaud's phenomenon: case report and review of the literature. *Eur J Nucl Med* 21: 258-260, 1994.
7. Rockett JF, Magill HL, Moinuddin M, Buchhignani JS. Scintigraphic manifestation of iliotibial band injury in an endurance athlete. *Clin Nucl Med* 16: 836-838, 1991.
8. Patel NH, Jacobson AF, Williams J. Scintigraphic detection of sequential symmetrical metatarsal stress fractures. *J Am Pediat Med Assoc* 85: 162-163, 1995.
9. Schelstraete K, Danels F, Obrie E. Tc-99m diphosphonate, Ga-67 and labeled leukocyte scanning techniques in tibial nonunion. *Acta Orthopaedica Belgica* 58 (Suppl 1): 168-172, 1992.
10. Marks PH, Goldenberg JA, Vezina WC, Chamerlain MJ, Vellet AD, Fowler PJ. Subchondral bone infarction in acute ligamentous knee injuries demonstrated on bone scintigraphy and MR imaging. *J Nucl Med* 33: 516-520, 1992.
11. Maurer AH, Paczolt EA, Myers AR. Diagnosis of traumatic myositis of the intrinsic muscles of the hand by the use of three phase skeletal scintigraphy. *Clin Nucl Med* 15: 535-538, 1990.
12. Stiskal M, Szolar DH, Stenzel I, Steiner E, et al. Magnetic resonance imaging of Achilles tendon in patients with rheumatic arthritis. *Investigative Radiology* 31: 602-608, 1997.
13. Khoury NJ, El-Khoury GY, Saltzman C, Brandser EA. Rupture of the anterior tibial tendon: Diagnosis by MR imaging. *AJR* 167: 351-354, 1996.