Nucl Med Mol Imaging
Vol. 41, No. 5, Oct 2007

Invited Interesting Image

# 열 손상에 의한 경골의 무혈관성 괴사 진단에서 $^{99m}$Tc-HDP의 유용성: 다중 영상검사로 분석한 1예

의료재단 성애병원 펫/시티 센터
박 용 휘

# The Value of $^{99m}$Tc-HDP Scan in the Diagnosis of Tibial Avascular Necrosis Caused by Thermal Injury: A Case with Multi-Image Correlation Analysis

Yong-Whee Bahk, M.D.
*PET/CT Center Sung-Ae General Hospital, Seoul, Korea*

Various skeletal lesions including osteonecrosis and scar contracture may result from thermal and freezing injuries as well as electrical and radiation burns of bone and soft tissue. Understanding of individual pathological changes in these conditions is a prerequisite to attain best possible results of treatment. Recently, the importance and mechanisms of burn-induced bone loss have been emphasized[1] and a novel approach to radiation skin burn treatment using stem cell has been introduced.[2]

Basic pathology in thermal injury is coagulative soft tissue necrosis[3] that may occasionally be complicated by infection and later by scarring and vascular changes. Radiological features were discussed in detail by Resnick.[4] The early changes consist of soft tissue defect, porosis and periostitis and the late changes include osteophytosis, periarticular calcification or ossification and arthropathy with ankylosis. Acromutilation can occur when small bones of the hand and foot are burned and scarred.

This communication describes $^{99m}$Tc-HDP pnhole bone scan manifestations of thermal bone injuries observed in a case of skin-bone burns of the mid-tibial shaft that was complicated by infection, soft tissue scarring and osteonecrosis.

Patient was a 49-year-old female with thermal burn involving a mid-tibial shaft segment along with overlying skin. The injury was accidental to medullary rimming to fit intramedullary nail to fix fracture. The heat produced during drilling spread to burn the pretibial skin that is sparse in subcutaneous buffer tissue and vessels. The soft tissue burn was infected and healed by repeated skin grafts and scar over a period of 2 years. Concomitantly, the underlying bone was infected locally and treated but ensued in osteonecrosis that was accompanied by osteolysis. However, the segment was maintained uncollapsed by live lateral cortex. It was considered to be the result of adequate blood supply from newly formed vessels as indicated by contrast enhanced MDCT and pinhole scan. It is obvious that such a cortex can act as a buttress in bone grafting.

Indeed, pinhole $^{99m}$Tc-HDP scan played a unique role in this case in detecting that live lateral cortex had sustained the large dead bone that involved the main volume of the mid-tibial shaft (Fig. 1 A, B). Importantly, the scan could confirm live cortex to have sustained dead bone uncollapsed. Anatomical and metabolic data gained from bone scanning prompted us to systematically scrutinize radiograph and CT to specifically identify the preserved lateral cortex. As mentioned the existence of healthy cortex is biomechanically and tactically vital to surgically replace and restore the devitalized bone (Fig. 1 C).

Color photograph of the injured right leg demonstrated scarring around and in patchy skin grafts that surrounded vertical ovoid excavation with a heaved-up inner edge and a

• Received: 2007. 8. 2. • Accepted: 2007. 10. 15.
• Address for reprints: Yong-Whee Bahk, MD, PET/CT Center and Department of Nuclear Medicine, Seoul Sung-Ae Hospital, Shingil-1-dong, Youngdeungpo-gu, Seoul 150-960, Korea
E-mail: ywbahk@hanmail.net

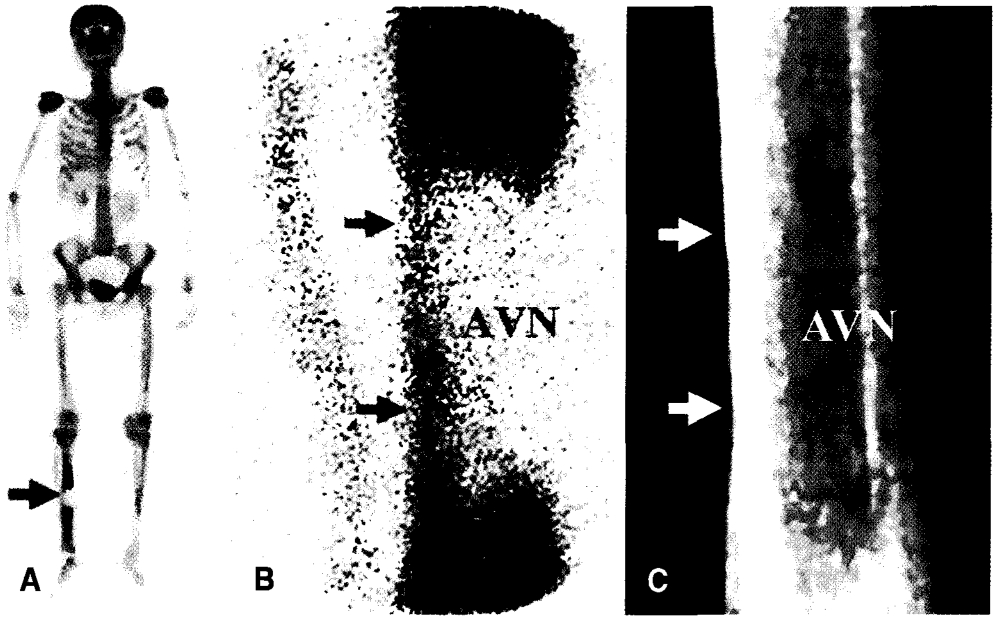


**Fig. 1 A-C.** Value of bone scan in diagnosing segmental avascular osteonecrosis caused by thermal injury. (A) Whole-body bone scan shows small segmental photon defect in mid-shaft of right tibia (arrow). (B) Pinhole scan shows a well defined segmental photon defect of avascular necrosis (AVN) with survived lateral cortex (arrows). (C) AP radiography of the right tibial shaft shows survived lateral cortex (arrows) and dead bone (AVN) with patchy osteolysis and porosis.

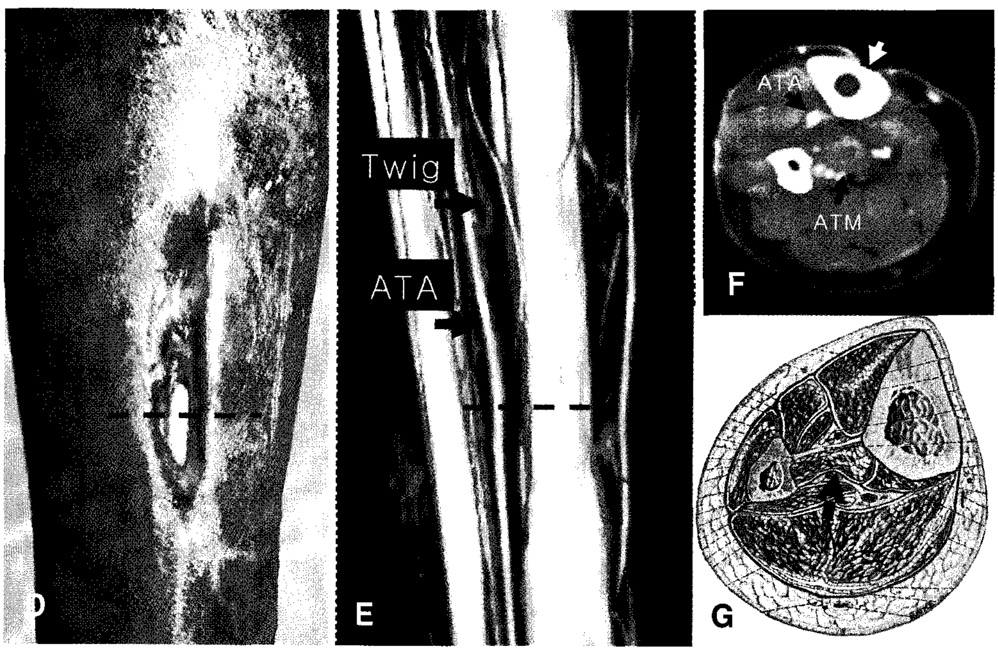


**Fig. 1 D-G.** Avascular osteonecrosis due to pre-tibial soft tissue burn defect and chronic osteomyelitis. (D) Photograph shows scar and yellowish denuded cortex in mid-tibial shaft. Dotted line is transversely sectioned for Figure 1 F. (E) MDCT shows dilated altered vessels. Note that anomalous twigs of anterior tibial artery (ATA) supply survived lateral cortex region (arrow). (F) Contrast enhanced transverse CT of denuded bone (dotted line in Figs. D & E) shows dilated anterior tibial artery (ATA) and anterior tibial muscle (ATM). Devitalized bone is hyperdense on CT (white arrow). (G) Normal transverse topography of the region of interest shows vessels, muscles, and interosseous membrane (Adopted from Fig. 422 of Anatomy: A regional atlas of the human body. Clemente CD, Urban & Schwarzenberg, 1981)

small yellowish denuded bone (Fig. D). The contrast enhanced three dimensional MDCT revealed moderate dilatation of the anterior tibial artery and newly formed arterial twigs that richly supply the survived lateral cortex (Fig. 1 E). Transverse CT sectioned in the plane of the denuded bone showed well maintained anterior tibial muscle and anterior tibial artery as well as the excavation of scarred soft tissue (Fig. 1 F).

## References

1. Klein GL. Burn-induced bone loss: importance, mechanism, and management. ***Burns Wounds*** 2006;5:e5.
2. Lataillade JJ, Doucet C, Bey E, et al. New approach to radiation burn treatment by dosimetry-guided surgery combined with autologous mesenchymal stem cell therapy. ***Regen Med*** 2007;2(5):785-94.
3. Order SE, Moncrief JA. *The burn wound.* Springfield. Ill: Charles C Thomas: 1965 (Quoted from Resnick).
4. Resnick D. Thermal and electrical injuries. In: Resnick D editor. *Diagnosis of bone and joint disorders*. 4th ed. Philadelphia: WB Saunders: 2002. pp 3379-92.