Article published online: 2022-05-23

Case report

False Negative ^{99m}Tc-Hydroxymethane Diphosphonate Three-phase Bone Scintigraphy and ^{99m}Tc-besilesomab Scan in Detecting Tibia Osteomyelitis Concomitant with Necrotizing Fasciitis

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Abstract

We described a case of 51-year-old female patient presented with a right calf necrotising fasciitis (NF) where osteomyelitis (OM) was suspected. ^{99m}Tc-hydroxymethane diphosphonate three-phase bone scintigraphy and ^{99m}Tc-besilosomab scan failed to demonstrate classical features of OM. The final diagnosis was only made by isolating *Acinetobacter* sp. in both intra-operative bone and tissue cultures from below-knee amputation. As conclusions, the detection of lower limb OM by ^{99m}Tc-besilosomab scan is not easy when there is concurrence overlying NF. The unusual three-phase bone scan finding of pericortical accumulation of tracer as an early sign of OM is highlighted in this case.

Keywords: ^{99m}Tc-besilosomab scan, ^{99m}Tc-hydroxymethane diphosphonate three-phase bone scintigraphy, necrotising fasciitis, osteomyelitis

Introduction

The diagnosis of early osteomyelitis (OM) is always a challenge. Three-phase bone scintigraphy and radiolabelled-leucocytes imaging are always needed to reach the correct diagnosis. Recent development of radiolabeled antigranlocyte monoclonal antibody imaging has provided an easy and simple labeling method when compared with radiolabelled-leucocytes imaging. In our institution, ^{99m}Tc-besilosomab is used as a tracer for antigranuclocyte monoclonal antibody scan. This case demonstrates the false negative of Tc-99m hydroxymethane diphosphonate (HDP) three-phase bone scintigraphy and ^{99m}Tc-besilosomab scan in detecting OM when there is concomitant overlying necrotizing fasciitis.

Access this article online

Quick Response Code:

Website: www.wjnm.org

DOI: 10.4103/1450-1147.144820

Case Report

This was a case of a 51-year-old newly diagnosed diabetic female patient presented with 2-week history of severe and progressive bilateral calves' pain and ulcers. She was afebrile. Examination of right calf revealed large area of edematous and erythematous skin with multiple ulcers and blisters, whereas examination of left calf revealed a small ulcer over the mid shin with no sign of overlying cellulitis. Clinical diagnosis of right calf necrotizing fasciitis (NF) and left shin diabetic ulcer was made. Random blood glucose was 16.5 mmol/l, erythrocyte sedimentation rate was 111 mm/h and leukocyte count was 12 × 10^3 cells/uL. No abnormality was detected by tibia-fibula X-ray. Apart of aggressive antibiotics regime, she also underwent several emergency surgical debridement. Post-operatively, her temperature remained persistently high. Wound and blood cultures were taken on several occasions but no significant pathogens were isolated. 17 days later, ^{99m}Tc-besilosomab scan was performed and showed diffuse localization of tracer overlying the skin of the right calf. No suspicious faint focal uptake was noted in the bone [Figure 1]. ^{99m}Tc-HDP three-phase bone scan was carried out a week

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after ^{99m}Tc-besilosomab scan. The bone scan showed increased arterial and blood pool phase over the right calf. Delayed images showed heterogeneous pericortical accumulation of tracer over the right tibia [Figure 2]. The conclusions of both studies were made as localized infection or post-surgical inflammation over the skin of the right calf with reactive changes (periosteal reaction) in the right tibia. Intravenous antibiotics were continued but her temperature remained high. At 5 days after the bone scan, patients underwent right below-knee amputation. Intra-operative findings revealed pus collection in the bone. *Acinetobacter* sp. was isolated in both intra-operative bone and tissue cultures.

Discussion

NF is a severe, life-threatening infection in the deep fascia. The presence of concomitant NF and OM in the lower limb is not uncommon. These conditions are usually predisposed by diabetic mellitus. Early diagnosis of OM is important as it alters surgical treatment options and improves clinical outcome.

Radionuclide imaging plays a vital role in diagnosing OM. Radiolabelled-leucocytes scan in conjunction with bone scan is the commonly used techniques. However, the drawbacks of radiolabelled-leucocytes scan are laborious preparation, need of special equipment's and potential hazard of handling infectious blood product.

Recent development of radiolabelled antigranlocyte monoclonal antibody such as ^{99m}Tc- besilesomab has provided an easy and simple labeling method as compared with radiolabelled-leucocytes. Besilesomab is a murine monoclonal IgG class antibody with Fab fragments that specifically binds to nonspecific cross-reacting antigen 95. The mechanism of action of besilesomab has not been fully elucidated. Increased vascular permeability and specific binding of ^{99m}Tc-besilesomab to already migrated and activated granulocytes have been suggested as a major part of signal detection.[1,2] Overall, it has higher sensitivity than ^{99m}Tc-labeled leukocyte scan in detecting peripheral OM.[3] The specificity is slightly lower but acceptable.[4] Similarly to ^{99m}Tc-labeled leukocyte scan, the lack of anatomical detail in ^{99m}Tc-besilosomab scan makes differentiation between bone and soft-tissue impossible. Therefore, it is important to a couple this modality with bone scan.

The above case demonstrates false negative of three-phase bone scan and ^{99m}Tc-besilosomab scan in detecting OM. The final diagnosis was only made by positive intra-operative bone and tissue culture.

On ^{99m}Tc-besilosomab scan, intense tracer accumulation overlying the soft-tissue masks the tracer uptake seen in the bone. This lesser apparent uptake in the bone may be mistaken as normal physiological marrow uptake.

The coupling three-phase bone scan does not demonstrate classical increased focal bony uptake. The observed pericortical accumulation of tracer indicates the presence of periosteitis. This unusual finding may be explained by the pathogenesis of diabetic OM. In diabetic infection, the common route of bone involvement is via direct extension from adjacent overlying soft-tissue infection.[5] During the initial process, the pathogens invade the periosteum producing periosteitis. Osteitis and OM occur when the infection extends further into the cortex and marrow.[5] Hence, pericortical accumulation of tracer may indicate an early sign of bony involvement.

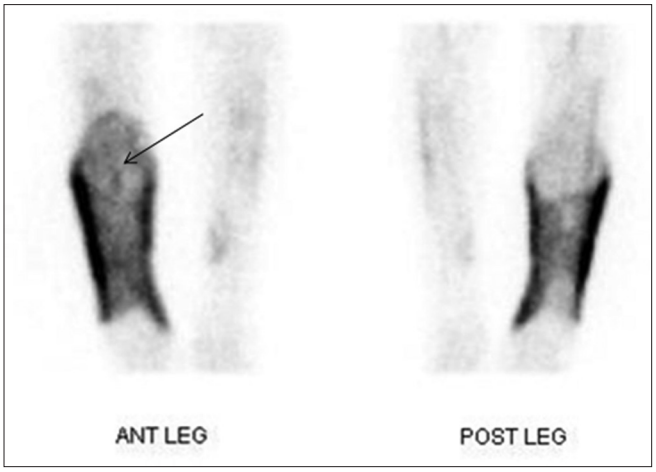

Figure 1: 5 h post-injection of Tc-99m besilesomab. There is intense accumulation of tracer in the cutaneous region of the right calf. Faint uptake is seen in the bone (arrow)

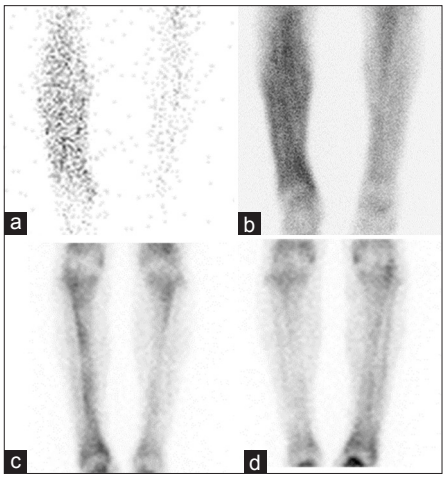

Figure 2: Three-phase bone scan. (a) Early hyperemia is seen in the right calf. (b) Blood pool phase shows increased tracer uptake in the same area. (c and d) Delayed phase shows heterogenous pericortical accumulation of tracer in the right tibia which is more prominent anteriorly

Extensive soft-tissue involvement may trigger reactive response in the periosteum and results in periosteitis as well.

In summary, the detection of lower limb OM by ^{99m}Tc-besilosomab scan is not easy when there is concurrence overlying NF. To increase the specificity, ^{99m}Tc-besilosomab scan can be coupled with three-phase bone scan. The unusual three-phase bone scan finding of pericortical accumulation as an early sign of OM is highlighted in this case.

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How to cite this article: Tan TH, Lee BN. False negative ^{99m}Tc-hydroxymethane diphosphonate three-phase bone scintigraphy and ^{99m}Tc-besilesomab scan in detecting tibia osteomyelitis concomitant with necrotizing fasciitis. World J Nucl Med 2014;13:190-2.

Source of Support: Nil, **Conflict of Interest:** None declared.