

# Detection of Deep Venous Thrombosis by Indium-111 Leukocyte Scintigraphy

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Indium-111-labeled leukocyte ( $^{111}\text{In}$ WBC) scintigraphy has been used successfully for detection of inflammation. Occasionally, noninflammatory collections of white blood cells such as hematomas or hemorrhage have been localized. We report a case in which unsuspected femoral deep venous thrombosis was diagnosed on an  $^{111}\text{In}$ WBC leukocyte scan performed for detection of osteomyelitis. Readers are advised to avoid interpreting all vascular  $^{111}\text{In}$ WBC localization as necessarily infectious. This may be of particular significance in patients with vascular grafts.

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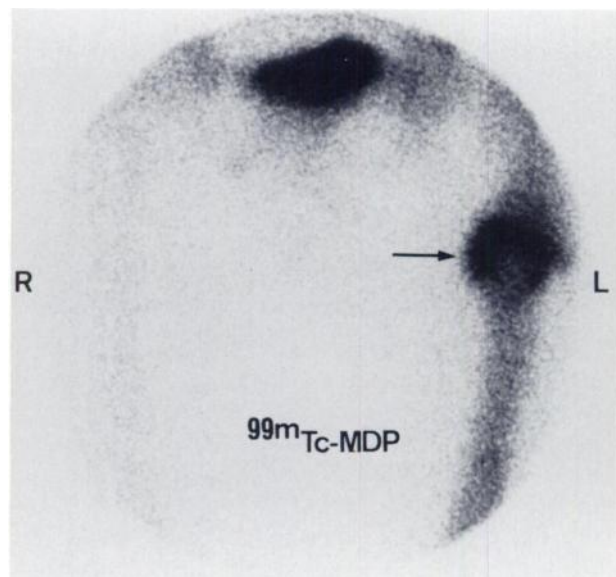
With the introduction of indium-111-labeled leukocytes ( $^{111}\text{In}$ WBC) for the scintigraphic detection of inflammation, reports have appeared on successful applications, including abscesses (1), inflammatory bowel disease (2), and osteomyelitis (3). Several reports of nonspecific  $^{111}\text{In}$ WBC uptake have also appeared. False-positive cases have included renal transplants (4), intramuscular injection sites (5), histiocytic lymphoma (6), and noninfected hematomas (7). We recently diagnosed unsuspected deep venous thrombosis (DVT) by  $^{111}\text{In}$ WBC scintigraphy in a patient studied to exclude femoral osteomyelitis. No prior cases of DVT localization by  $^{111}\text{In}$ WBC have been described to our knowledge.

## CASE REPORT

A 51-yr-old diabetic black man sustained a transverse subtrochanteric fracture of the left femur in a motor vehicle accident 1 yr prior to admission. An intramedullary rod was inserted and removed 6 mo later. Subsequently, a spica cast was applied. The fracture was complicated by nonunion and a superimposed osteomyelitis was a diagnostic consideration. There was no fever, leukocytosis, or elevation of erythrocyte sedimentation rate at the time of admission.

Two days after removal of the spica cast, a bone scan revealed intense tracer uptake on both sides of the left femoral

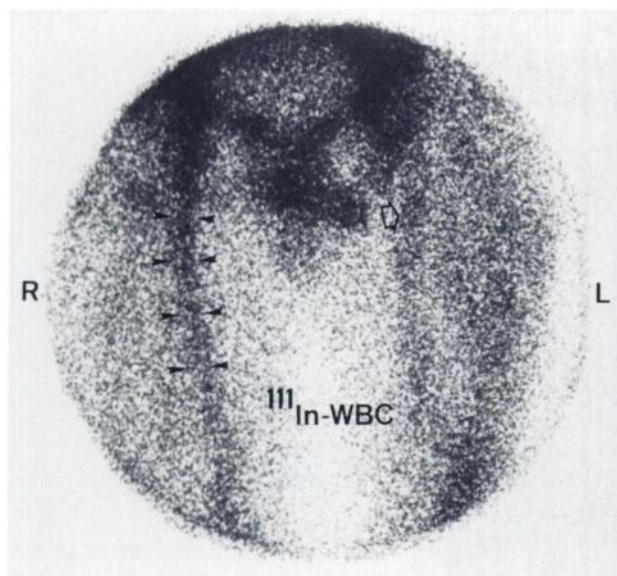
fracture site (Fig. 1), consistent with nonunion but indeterminate for co-existing osteomyelitis. An  $^{111}\text{In}$ WBC scan was performed utilizing autologous leukocytes labeled by a modification of well-described methods (8). Images of the pelvis and proximal lower extremities were obtained 24 hr following injection of the labeled leukocytes. The scan revealed abnormal localization within both femoral veins suggesting DVT (Fig. 2). Images of the thorax and abdomen revealed no generalized blood-pool activity (Fig. 3). A left leg venogram



**FIGURE 1**  
Anterior image from bone scan reveals intense uptake within nonunion fracture in proximal left femur (arrow)

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**FIGURE 2**  
Anterior 24-hr image from [ $^{111}\text{In}$ ]WBC scan shows abnormal tracer localization corresponding to both femoral veins (arrowheads and open arrow). Note absence of significant WBC accumulation in fracture site

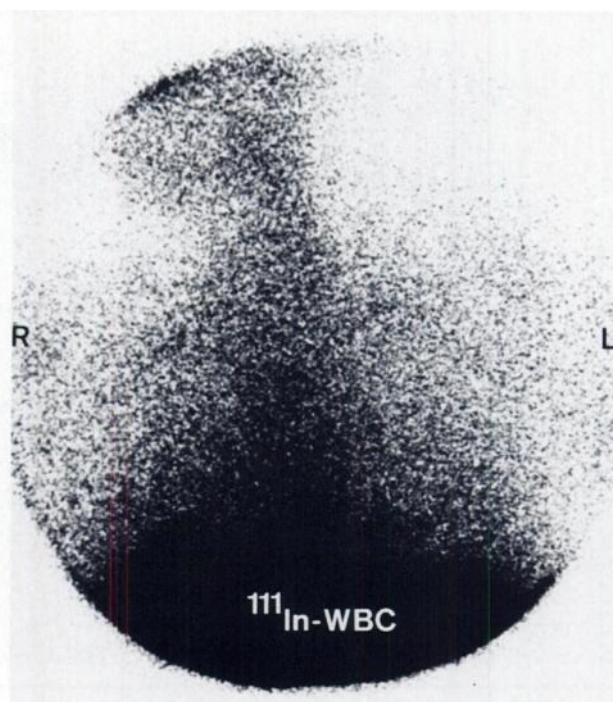
was performed documenting fresh thrombus in the femoral vein (Fig. 4), in spite of the absence of clinical signs and symptoms of DVT. The [ $^{111}\text{In}$ ]WBC scan showed no significant tracer uptake within the fracture site. The absence of osteomyelitis was confirmed by open biopsy performed 2 wk later.

The patient was treated with anticoagulants for DVT and surgical debridement with capacitive coupling for the nonunion fracture and has done well.

## DISCUSSION

The availability of  $^{111}\text{In}$ -labeled blood products has provided an important tool in research and clinical diagnosis. Indium-111-labeled platelets have recently been used to detect thrombus in the arterial (9) as well as the deep venous (10) systems. While [ $^{111}\text{In}$ ]WBC scintigraphy has been used successfully to detect inflammatory processes, noninflammatory blood cell collections have resulted in misleading diagnoses of infection.

In the case presented, there was no evidence of venous infection or adjacent osteomyelitis as confirmed by subsequent clinical course. The precise mechanism of tracer localization in the femoral veins is unknown, but three possibilities should be considered. First and most likely is the presence of leukocytes within any substantial collection of blood cells such as thrombus. The second possibility is unintentional  $^{111}\text{In}$ -labeling of erythrocytes or platelets that may be visualized as thrombi or as blood pool. It has been stated that com-

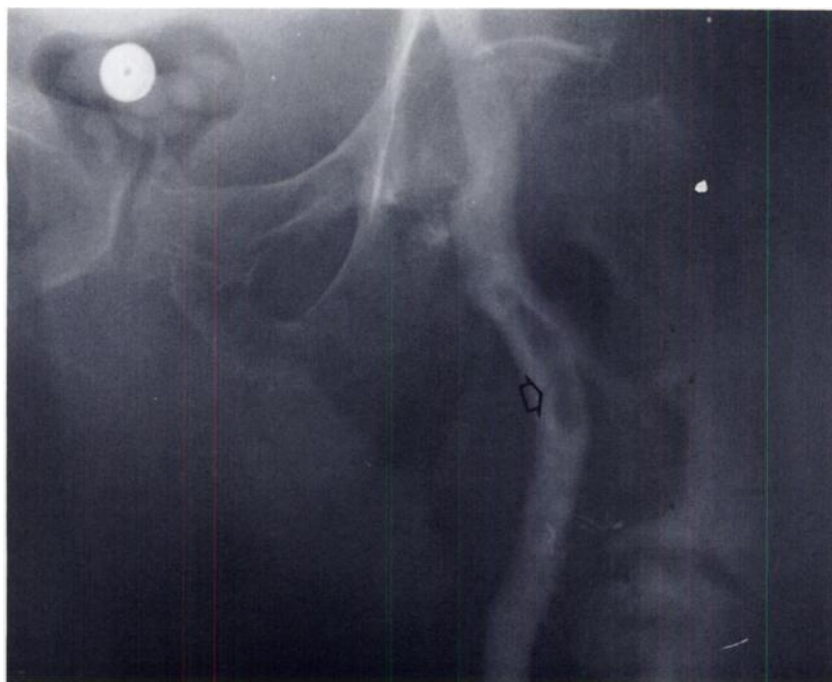


**FIGURE 3**  
Anterior view of thorax from [ $^{111}\text{In}$ ]WBC scan was obtained immediately after Fig. 2. Note normal intense liver-spleen uptake with scatter into lower chest. There is no substantial cardiac blood-pool activity

plete separation of leukocytes from platelets and erythrocytes is virtually impossible by the centrifugation techniques commonly employed (11). Images of the thorax excluded substantial generalized blood pool labeling (Fig. 3); however, the contribution of labeled platelets to the visualization of the femoral thrombi could not be excluded without microscopic examination of the cell preparation. The third possibility is [ $^{111}\text{In}$ ]WBC localization within the venous walls, presumably inflamed in any active thrombophlebitis. The possibility of fibrinogen labeling can be easily ruled out, since the cells were completely washed before they were mixed with [ $^{111}\text{In}$ ]oxine.

The detection of [ $^{111}\text{In}$ ]WBC within deep venous thrombosis is significant for several reasons. The use of [ $^{111}\text{In}$ ]WBC scintigraphy for the diagnosis of infection within the vascular system, particularly within surgical grafts may prove to be extremely limited despite earlier reports (12). Moreover, as scintigraphy for osteomyelitis is more commonly being employed in bed-ridden patients with a higher risk of DVT, early diagnosis by serendipity on [ $^{111}\text{In}$ ]WBC imaging may prove quite useful.

In conclusion, [ $^{111}\text{In}$ ]WBC scanning may prove to be a useful and reliable technique in the evaluation of patients suspected of suffering from DVT.



**FIGURE 4**

Left leg venogram performed shortly after [ $^{111}\text{In}$ ]WBC scan revealed fresh thrombus (open arrow) in left femoral vein. Note corresponding locus in Fig. 2 (open arrow)

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