# Indium-111 Imaging of an Inflammatory Abdominal Aortic Aneurysm

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Indium-111-labeled leukocyte scanning has been shown to be a highly sensitive and specific imaging modality in the detection of abscess formation. Leukocyte infiltration occurs in a variety of inflammatory states as well as some noninflammatory states, leading to false-positive results. We report a case of an inflammatory abdominal aortic aneurysm imaged by $^{111}$In. It is not clear whether the activity noted is due to the inflammatory nature of the aneurysm or to hemorrhage present within the wall of the aneurysm.

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Indium-111-white blood cell (WBC) scanning has proven highly effective in the detection of abscesses and in many institutions has replaced $^{67}$Ga-citrate in the localization of abscesses (*1*). There have been, however, reports of false-positives, with uptake in hematomas, rheumatoid arthritis, renal transplant rejection, tumors, cerebral infarction and other lesions (*1,2*). We present a case of indium localization in an inflammatory abdominal aortic aneurysm.

## CASE REPORT

An 81-yr-old male with no significant past medical history was admitted with a complaint of generalized weakness, resulting in difficulty with ambulation. No history of weight loss, anorexia, abdominal pain, ureteral colic or fever was noted. On physical examination, his temperature was 98.2°F, pulse 68, and blood pressure 160/80. Palpation of his abdomen revealed a 4-cm in diameter, pulsatile, mid-abdominal mass. A bruit was present. This was felt to represent an abdominal aortic aneurysm. The patient's WBC count on admission was 12,300, with a differential of 74% granulocytes, 23% lymphocytes and 2% monocytes. No erythrocyte sedimentation rate was obtained during the hospitalization. On the fourth day of admission, the patient began complaining of diffuse abdominal pain. On examination, his temperature was 102°F and diffuse abdominal tenderness was noted with guarding. The elevated temperature was attributed to a pneumonic infiltrate for which he was treated with resolution of the fever. The abdominal pain temporarily resolved, but over the next few weeks, during which multiple unrelated issues were addressed, the patient did intermittently complain of abdominal pain and continued to have an elevated white count with a left shift. For this reason, the patient was sent to the department of nuclear medicine for an $^{111}$In-labeled leukocyte scan.

The patient's blood was labeled according to the technique described by Thakur (*3*). The white cells were a mixed population. Using an aseptic technique and working in a liminar flow hood, 100 ml of venous blood were collected in two 50-ml syringes containing 1000 units of heparin/50 ml of blood. Hespan was added to the syringe at one part Hespan to 10 parts whole blood. The red cells were allowed to sediment in the tube for 1 hr. The supernatant containing the WBC-rich plasma was removed and centrifuged with formation of a soft WBC button. The WBC button was gently washed with saline and resuspended. Indium-111-oxine (850 $\mu$Ci) was slowly added in a drop-wise fashion. Platelet-poor plasma (2 ml) was added to the suspension allowing for transferin in the plasma to bind to any free $^{111}$In. The WBC suspension was centrifuged. An additional 8 ml of platelet-poor plasma was introduced, thus resuspending the indium-labeled WBCs. The suspension was drawn up through a filter needle and prepared for injection into the patient. Labeling efficiency was determined to be 88%. Macroscopic clumping was not present. The labeled WBCs (500 $\mu$Ci) were injected directly into the patient. Total preparation time was about 2 hr.

The patient was imaged on a LFOV gamma camera using a medium-energy collimator. Twenty percent windows were centered on the two gamma peaks (173 and 247 keV) of $^{111}$In. Twenty-minute spot scinitphotos were obtained at 24 hr postinjection. A plain film of the abdomen revealed a 5-cm calcified abdominal aortic aneurysm (Fig. 1). The leukocyte scan revealed curvilinear uptake in the mid-abdomen (Fig. 2), which corresponded to the patient's known abdominal aortic aneurysm. Because of the WBC localization, this was felt to represent an inflammatory aneurysm. Uptake in the right groin was related to the right femoral line present. During imaging, the patient began to complain of acute abdominal pain and was taken to surgery immediately for repair of his abdominal aneurysm.

At surgery, a 10-cm abdominal aortic aneurysm was noted, beginning just below the left renal artery. The aneurysm appeared inflammatory in nature, with dense adhesions to the duodenum and both ureters. A clot was present within the aneurysm and the posterior wall appeared to have a hemorrhagic component with impending hemorrhage. Pathology confirmed that there was hemorrhage within the wall of the aneurysm, within the media and adventitia, but no free retroperitoneal blood was noted. A culture of the aneurysm wall revealed no growth.

## DISCUSSION

Inflammatory aneurysms represent a distinct surgical entity, characterized by dense perianeurysmal fibrosis and

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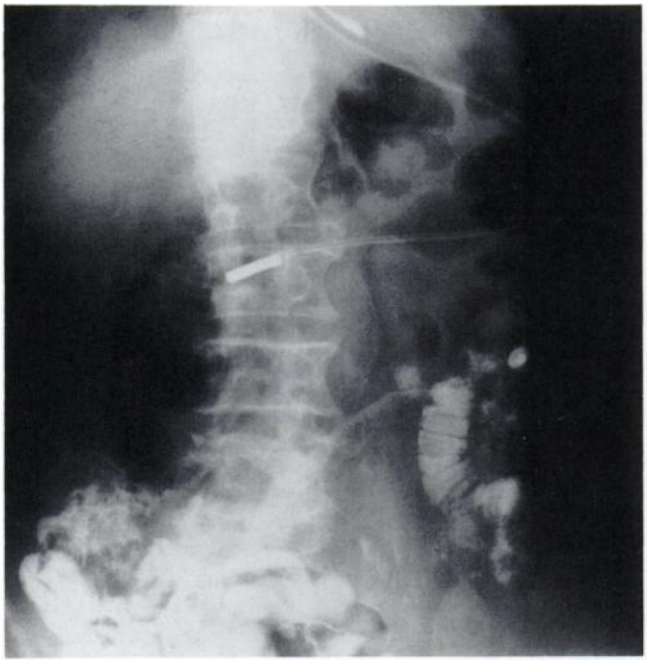

**FIGURE 1.** Supine abdominal x-ray demonstrating a 5-cm calcified abdominal aortic aneurysm.

**FIGURE 2.** Anterior image of the abdomen and pelvis obtained at 24 hr after the injection of $^{111}$In-labeled leukocytes shows focal curvilinear uptake in the mid-abdomen, corresponding to the patient's known abdominal aneurysm.

marked aortic wall thickening of the anterior and lateral walls. They are considered a variant of atherosclerotic aneurysms and represent 5%–23% of all abdominal aortic aneurysms (*4*). They are more common in men. Dense adherence to surrounding structures occurs, most commonly involving the duodenum (79%), left renal vein (32%) and ureters (26%) (*5*). They are more likely to produce symptoms than ordinary atherosclerotic aneurysms. The triad of abdominal pain, weight loss and an elevated erythrocyte sedimentation rate is considered highly suggestive of an inflammatory aneurysm (*5*). Its etiology is unknown.

On microscopic examination, the intima is thickened and fibrotic, typical of atherosclerotic disease. There is an increase in the number of vasa vasora with infiltration of lymphocytes, plasma cells and histiocytes. There is a significant decrease in the amount of elastic tissue in the media. Smooth muscle is totally absent in places. The adventitia is significantly thickened, but preserved, with infiltration of lymphocytes, plasma cells and histiocytes. Fibrinoid necrosis often in combination with hemorrhage has also been noted. The amount of adventitial fibrosis varies (*6*).

Preoperative diagnosis is important since the repair of an aneurysm is associated with a higher morbidity and mortality (*7*) and can alter the preoperative management and the surgery itself. Some advocate treatment with steroids prior to surgery to reduce inflammatory reaction (*8*). Computed tomography is considered the most diagnostic of all imaging modalities (*9*). It demonstrates extensive soft tissue anterior and anterolateral to a thickened aortic wall with sparing posteriorly. The soft tissue shows slight delayed contrast enhancement. These features help distinguish inflammatory aneurysms from retroperitoneal fibrosis, lymphoma and aortic dissection. On ultrasound, a nearly echo-free band is noted anterior and anterolateral to the aorta, with the thickened aortic wall appearing very echogenic. Angiography does not add much to the evaluation, because it does not indicate the size and extent of the inflammatory mass (*4*).

Indium-111-labeled leukocytes scanning has been shown to have a sensitivity of 72%–79% and a specificity of 90%–100% in the detection of abscesses (*10,11*). False-positives, as stated before, do occur. This may be due in part to the fact that during labeling all leukocytes are labeled along with a small percentage of red blood cells and platelets. For this patient, the cause of the curvilinear uptake is not entirely clear. It may be due to inflammatory cells within the perianeurysmal fibrosis. The activity, however, may also be due to the hemorrhage present within the posterior wall of the aneurysm, which was infiltrated with lymphocytes.

Leukocyte scanning may aid in the evaluation of abdominal aortic aneurysms. Indium uptake in the aneurysm

should alert the clinician to the possibility of an inflammatory aneurysm or the presence of hemorrhage within the aneurysm wall with impending rupture, as well as the possibility of infection.

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