Focal Uptake in the Left Upper Quadrant on an In-111 White Blood Cell Study

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Case Presentation

A 59-year-old man with a history of a splenectomy presented with bacteremia from an uncertain source. In-111 white blood cell (WBC) imaging was performed. An indeterminate round focus of uptake was noted in the left upper quadrant (LUQ) of the abdomen (Figure A). For further characterization, a SPECT/CT of the abdomen was performed (Figures B, C).

FIGURES A-C. Anterior and posterior planar images from an In-111 WBC scan (A) demonstrate an indeterminate round region of increased uptake within the LUQ (arrows). Unfused (B) and fused (C) axial images from SPECT/CT better characterize the rounded region of increased uptake (arrows) with absence of the spleen from a prior splenectomy.
Differential Diagnosis

Infection
Neoplasm
Residual splenic tissue

Discussion

Leukocyte scintigraphy is useful for the detection and localization of suspected infectious processes and has largely replaced Ga-67 imaging. WBCs are most commonly labelled using either Tc-99m or In-111. Biodistribution and imaging times differ for the two radiopharmaceuticals. Both imaging agents demonstrate physiologic uptake within the liver, spleen and bone marrow. Tc-99m WBC scans additionally show physiologic uptake in the gastrointestinal and genitourinary tracts 2 to 4 hours post injection. Therefore, early imaging is usually obtained with Tc-99m WBC scans as this physiologic uptake may obscure potential pathology in the abdomen and pelvis. Given the relatively short 6-hour half-life of Tc-99m, imaging can be continued up to 24 hours.¹

In-111 WBC scans are typically imaged 4 to 24 hours post injection, and the primary advantage of the scans is lack of physiologic bowel and genitourinary activity. Additionally, the much longer 67-hour half-life of In-111 allows for imaging beyond 24 hours. Often needed in patients with neuropathic joints and prostatic joints, simultaneous acquisition with Tc-99m sulfur colloid marrow imaging is possible due to In-111’s 173 keV and 247 keV photopeaks.¹

Although leukocyte scintigraphy is a powerful tool, the relatively long imaging times in what are often critically ill patients is a limitation. One potential alternative to leukocyte scintigraphy is imaging with F-18 fluorodeoxyglucose (FDG) PET/CT. Like oncologic imaging, FDG accumulates at sites of infection. With imaging obtained one hour after injection and CT localization, FDG offers a relatively quick, but nonspecific, alternative to leukocyte imaging.²

Post splenectomy, no uptake would be expected in the LUQ, making this finding suspicious. On SPECT/CT, the uptake localizes to a small round soft-tissue mass. Differential diagnosis could be based on either the nuclear or CT findings and are best categorized as: infectious, neoplastic, and normal variant (residual splenic tissue).

Infection

A variety of infectious processes demonstrate focal increased uptake on leukocyte scintigraphy. Both radiolabeled and nonradiolabeled leukocytes accumulate at sites of infection due to the immune system inflammatory cascade resulting in chemotaxis, a shift of leukocytes from the blood stream to the site of infection.¹ Although nearly any infectious process could be responsible for the uptake, the differential is primarily based on location within the LUQ and includes diverticulitis, pancreatitis, and abdominal abscess.

Diverticulitis is a common complication of colonic diverticular disease often resulting from diverticular obstruction and subsequent infection. If left untreated, diverticulitis may progress to abscess formation and or peritonitis. On CT imaging, diverticulitis can be suggested by wall thickening and inflammatory changes in the pericolonic fat adjacent to diverticula.³

Pancreatitis most commonly results from gallstone obstruction or alcohol use. The revised Atlanta classification categorizes acute pancreatitis into two subtypes: interstitial edematous pancreatitis and necrotizing pancreatitis. Each subtype has suggestive imaging characteristics including pancreatic enlargement, edema, and adjacent fat stranding with areas of nonenhancement being indicative of the necrotic subtype.⁴

An abdominal abscess is a localized collection of purulent infected fluid. Typical CT appearance of an abscess is a hypodense, loculated fluid collection with rim enhancement. Internal gas in the absence of surgical intervention is highly suspicious for an infected collection. In the LUQ, an abscess may result from pancreatitis, diverticulitis, or from a postsurgical complication such as from a splenectomy.

Neoplasm

Whenever an abnormal soft-tissue lesion is encountered on CT, neoplasm should be considered by the interpreting physician as a diagnostic possibility. Although the mechanism is not well understood, a variety of noninfected malignancies occasionally demonstrate increased uptake on radiolabeled leukocyte imaging.⁵ The differential is usually limited based on the organ in which the mass is visualized. However, this case presents as a stand-alone soft-tissue mass in the LUQ without a clear visceral origin. Given this anatomic finding, a variety of malignancies should be considered.

Peritoneal carcinomatosis is a result of peritoneal spread of certain neoplasms, most commonly ovarian and gastrointestinal adenocarcinomas. The classic “omentum caking” results in conglomerate masses and nodularity throughout the omentum. However, occasionally more discrete soft-tissue nodules (peritoneal seeds) are the primary finding.

Although much less common than metastases, primary malignancies arising from the peritoneum, such as malignant mesothelioma, should be considered. Malignant mesothelioma is a rare condition with an extremely poor prognosis. Most mesotheliomas arise from the lung pleura, while primary peritoneal mesotheliomas account for only 6% to 10% of cases.⁶ As with pleural mesothelioma, peritoneal mesothelioma is associated with asbestos exposure. Omental caking and malignant ascites are often present.

Residual Splenic Tissue

Splenules are benign foci of congenitally ectopic splenic tissue, often...
considered variations of normal anatomy. They appear as small rounded nodules most commonly near the splenic hilum. Splenules demonstrate similar characteristics to the normal spleen on all imaging modalities. Given that it is part of the hematopoietic system, splenic tissue demonstrates intense uptake on radiolabeled leukocyte imaging and is considered part of a normal biodistribution of the radiopharmaceutical.

Splenosis is the autotransplantation of splenic tissue into ectopic locations following traumatic or surgical disruption of the normal spleen. Splenosis is often found incidentally, most frequently after trauma, and is usually asymptomatic. In splenosis, foci of splenic tissue are usually identified in the abdomen and pelvis. However, other locations, including thoracic and subcutaneous foci, have been reported.

Whether congenital or post-traumatic, these splenic foci can often be mistaken for other pathology, including malignancy. Further complicating the diagnosis, these foci of residual splenic tissue can enlarge if the spleen is removed, mimicking a more aggressive process.

**Diagnosis**

Residual splenic tissue (splenule)

**Summary**

Leukocyte scintigraphy plays a useful role in the workup of patients with suspected infection. This case is an example of a relatively nonspecific focus of uptake on planar scintigraphy being better characterized on hybrid SPECT/CT imaging due to improved resolution and precise anatomic localization. An initially broad differential was narrowed combining imaging findings with the clinical history. Although infection is usually the primary consideration of any abnormal focus of uptake on leukocyte scintigraphy, the CT appearance in this case was not consistent with infection. Additionally, it would be unusual to see intense focal radiopharmaceutical uptake on leukocyte scintigraphy in a peritoneal malignancy without other evidence of malignancy on this exam or by history. The clinical, CT, and scintigraphy findings were all concordant with residual splenic tissue, making this the most appropriate diagnosis. An awareness of the normal biodistribution of radiolabeled leukocytes combined with the precision of SPECT/CT correctly identified this focus of unusual uptake as a variant of normal anatomy, avoiding the misdiagnosis of an infection in the abdomen.

**References**