Advantage of Indium-111 Leukocytes over Ultrasound in Imaging an Infected Renal Cyst

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Indium-111-labeled leukocyte scanning is a highly sensitive and specific method of detecting abscesses. This report describes a patient with polycystic kidneys and a single infected cyst. Ultrasound could not determine which cyst was infected, but the infected cyst could be localized by \([^{111}\text{In}]\) leukocyte imaging in conjunction with a \([^{99m}\text{Tc}]\) DMSA renal scan. The two radionuclide studies were used to identify an infected renal cyst and direct ultrasound guided aspiration.


Ultrasound and computed tomography (CT) are useful techniques for diagnosing and localizing fluid collections, but they often cannot determine whether a particular fluid collection is infected. This report describes a febrile patient with polycystic kidneys in whom combined indium-111- \(([^{111}\text{In}])\) labeled leukocyte and technetium-99m \((^{99m}\text{Tc})\) DMSA renal scans identified an infected renal cyst which was not correctly identified by ultrasound. These radionuclide imaging agents can be used to direct the ultrasound guided percutaneous drainage of an infected cyst in a patient with multiple renal cysts.

CASE REPORT

A 37-yr-old white male was admitted with right flank pain, fever, and chills. Six weeks prior to admission he had presented at an outside hospital with similar symptoms. At that time, an i.v. pyelogram showed multiple bilateral simple renal cysts. A gallium scan and a leukocyte scan demonstrated uptake of gallium-67 citrate and \(^{111}\text{In}\) by the right kidney. The patient underwent open surgical drainage of two infected cysts and \(E.\) coli was cultured from the drainage fluid. The patient was treated with a 3-wk course of i.v. antibiotics. He subsequently did well for 2 wk following discharge until he presented at our hospital with a temperature of 103.4°F, moderate right flank tenderness, and a white count of 14,800 with 80% segmented polys. The blood urea nitrogen and creatinine were 14 mg/dl and 1.3 mg/dl, respectively. Urinalysis showed moderate bac-
	eria, 10–12 red cells and greater than 100 white cells per high powered field. A urine culture subsequently grew \(E.\) coli. On the first hospital day the patient was started on antibiotic therapy and injected with autologous leukocytes labeled with 500 \(\mu\)Ci of \(^{111}\text{In}\)oxine.

A 24-hr leukocyte scan revealed a focal area of uptake in the region of the right kidney consistent with a renal abscess (Fig. 1A). Renal ultrasound showed multiple bilateral renal cysts (Fig. 2). No internal debris suggestive of infection was apparent in any of the cysts on the real-time images. A 7.1 F catheter was placed into one of the dominant cysts in the right kidney and 50 cc of dark brown fluid were removed. The catheter was flushed with 5 cc of normal saline and aspirated; counts in the aspirate were no greater than background. Since the \(^{111}\text{In}\) leukocyte scan was abnormal, we expected to find increased \(^{111}\text{In}\) activity in the aspirate. Absence of \(^{111}\text{In}\) activity suggested that a noninfected cyst may have been punctured. For that reason, another \(^{111}\text{In}\) leukocyte image was obtained immediately following ultrasound guided aspiration of the renal cyst. This image demonstrated that the area of uptake had not significantly changed from the pre-aspirate images. No organisms or white cells were seen on the gram stain of the cyst fluid. The catheter was left in place and flushed three times per day with normal saline. Plate cultures were subsequently negative and there were only scant amounts of \(E.\) coli in the broth medium.

Five days following the injection of the labeled leukocytes the \(^{111}\text{In}\) images still had not significantly changed. At that time, a combined DMSA renal/leukocyte scan was performed to determine which cyst was infected. The patient was injected with 5 mCi \([^{99m}\text{Tc}]\text{DMSA}\) and renal images were obtained 4 hr later. There were multiple cold defects due to the bilateral renal cysts including two large cysts in the right kidney (Fig. 1B). Three computer acquisitions of the abdomen were obtained without moving the patient. The anterior projection was chosen because it showed the best separation of the two
A: Anterior abdominal images show uptake of $^{111}$In-labeled leukocytes in infected renal cyst. B: $[^{99m}Tc]$DMSA image shows at least two dominant cysts in right kidney. C: Drainage catheter placed in presumably infected cyst under ultrasound guidance is injected with $[^{99m}Tc]$-O$_4$. Activity is seen within cyst as well as small focus of activity in catheter. D: Computer generated composite $[^{111}$In]leukocyte and $[^{99m}Tc]$DMSA image reveals that leukocytes are located in more inferior cyst. E: Composite $[^{99m}Tc]$-O$_4$ and $[^{99m}Tc]$DMSA image demonstrates that superior cyst was drained under ultrasonic guidance; this cyst did not accumulate $[^{111}$In] leukocytes and gram stain of aspirated fluid failed to demonstrate neutrophils or bacteria. F: Composite of all three images shows superior draining and inferior infected cysts to be spatially discrete.

Dominant cysts. The first image (Fig. 1A) was done with the camera peaked over the 247 keV photopeak of $[^{111}$In]leukocytes. The second image (Fig. 1B) was acquired with the camera peaked over the $^{99m}$Tc 140 keV photopeak of $[^{99m}$Tc] DMSA. The catheter which had previously been inserted under ultrasonic guidance into a cyst in the right kidney was then injected with 50 $\mu$Ci of $[^{99m}$Tc]pertechnetate and the third image was acquired again using the $^{99m}$Tc photopeak (Fig. 1C).

Composite images of $[^{111}$In]leukocytes/$[^{99m}$Tc]DMSA (Fig. 1D) and $[^{99m}$Tc]DMSA/$[^{99m}$Tc]pertechnetate (Fig. 1E) were generated on the computer. Figure 1F shows a composite image of all three separately obtained images. From these images it is clear that the indium leukocyte-filled cyst corre-
sponds to the more inferolateral cyst on the DMSA images while the drainage catheter is in a cyst located more superiorly.

Although small amounts of E. coli were cultured from the draining cyst, the rest of the laboratory and imaging data indicated that it was not the primary cause of the patient's clinical symptoms. For that reason, the catheter was removed. No attempts were made to place a catheter into the infected cyst because the patient was clinically responding to antibiotics. After 10 days of i.v. antibiotics the patient was observed for 3 days off antibiotics and remained asymptomatic. He was doing well clinically 1 mo following discharge, but has subsequently been lost to follow-up.

DISCUSSION

Indium-111-labeled autologous leukocytes migrate to sites of inflammation and have been shown to be highly sensitive and specific for the localization of abscesses (1-4). Since [\(^{111}\text{In}\)]leukocytes are normally not taken up by the kidneys or bowel, this technique is particularly useful for detection of pelvic and abdominal abscesses.

Ultrasound distinguishes fluid from solid structures and has been reported to be a sensitive method for detection of abdominal abscesses (5). However, false positives frequently arise due to the presence of other fluid filled structures which may mimic the appearance of an abscess (6). The patient described above had multiple renal cysts and the ultrasonic appearance of the infected cyst was identical to that of the noninfected cysts.

Technetium-99m DMSA is a radionuclide that binds to cortical tubules in the kidney and has proven to be an excellent agent for imaging the renal parenchyma (7,8). The complementary acquisition of [\(^{99m}\text{Tc}\)]DMSA and [\(^{111}\text{In}\)]leukocyte scans identified the single infected renal cyst in a patient with multiple renal cysts. These imaging modalities can be useful in confirming the presence of an infected cyst and in guiding ultrasound and CT directed aspiration. Furthermore, [\(^{111}\text{In}\)]leukocyte imaging alone or in combination with another scintigraphic procedure may be very useful in guiding drainage when CT or ultrasound demonstrate multiple fluid collections in a patient with suspected abdominal or pelvic abscess.

REFERENCES