

The complementary role of Indium-111 labeled leukocyte imaging, ultrasonography and computed tomography in the evaluation of postoperative infection or abscess

Kimiichi UNO,* Keiko IMAZEKI,* Noboru ARIMIZU,* Takamasa RYU,** Kaichi ISONO,** Yusuke KITAKATA,*** Hirobumi KOHEN*** and Sadao UEMATSU****

*Department of Radiology, Chiba University

**Department of Surgery II

***Kimitsu Central Hospital

****Central Division of Radiology, Chiba University Hospital

We report our experiences with the combined use of indium-111 labeled leukocyte imaging (In-111 WBC scan.), computed tomography (CT) and ultrasonography (US) for evaluation of suspected postoperative infection or abscess, and discuss the complementary roles of these modalities. Postoperative abscesses or infections were diagnosed in 9 of 20 patients. All patients were correctly diagnosed by In-111 WBC imaging and 4 patients could not be diagnosed by US because of bowel gas. One false-positive CT examination and another artifact on CT images due to respiratory movements were obtained. The three modalities were found to be complementary: CT and US were efficient imaging methods for diagnosis and treatment of abscess. In-111 WBC imaging could estimate the activity of inflammation.

Key words: Postoperative infection or abscess, US, CT, In-111 labeled leukocyte imaging

INTRODUCTION

MANY FEBRILE PATIENTS with suspected postoperative infection or abscess are severely ill. The performance of diagnostic procedure on such patients is often difficult and needs an emergency response to select either operative or conservative treatment. A variety of new noninvasive imaging techniques, including Gallium-67 citrate imaging (Ga-67 scan), computed tomography (CT), ultrasonography (US) and recent Indium-111 labeled leukocyte imaging (In-111 WBC scan) have been reported to be highly accurate in the identification of infectious foci.¹⁻⁶ US and CT have become the useful methods of detecting abscesses and also of guiding percutaneous catheter drainage.⁷⁻⁹ Ga-67 scans for infection in the abdomen are generally misinterpreted because of the

presence of colonic activity or abdominal tumor. On the other hand, the use of In-111 WBC scans represent a 'functional' approach to detecting pus whether in an abscess or in other sites, and a reliable procedure for monitoring the activity of inflammation.^{10,11} With CT or US, it is *rarely difficult* to distinguish abscess cavities from other fluid collection but frequently is in estimating the activity of inflammation. We report here our experience with the combined use of In-111 WBC scans, CT and US for evaluation of suspected postoperative infection or abscess and discuss the complementary roles of these modalities.

MATERIALS AND METHODS

The twenty cases including 18 men and 2 women, whose ages ranged from 27 to 81 years, were studied (Table 1). These patients, with fever and suspected postoperative infection or abscess, were tested with In-111 WBC scans, CT and US. Nineteen patients were evaluated with these three modalities and one was studied with CT and In-111 WBC scan. Needle

Received April 30, 1987; revision accepted April 30, 1987.

For reprints contact: Kimiichi Uno, Department of Radiology, Chiba University School of Medicine, 1-8-1 Inohana Chiba City, Chiba 280, JAPAN.

Table 1 Summary of Patients with Suspected Postoperative Infections or Abscesses

Case No./ Age(yr)/Sex	Primary Disease	Fever	Presence of Infections or Abscesses			Method of Treatment	Final Diagnosis
			In-WBC	US	CT		
1/44/M	Esophageal varices	+	+	+	+	US-guided drainage	Abscess
2/27/F	Submucosal tumor of the stomach	+	+	+	+	US-guided drainage	Abscess
3/56/M	Gastric cancer	+	+	+	+	US-guided drainage	Abscess
4/56/F	Cholangioma	+	+	+	+	US-guided drainage	Abscess
5/81/M	Diaphragmatic hernia	+	+	+	+	Surgical drainage	Infected wound
6/38/M	Esophageal varices	+	+	+	+	Surgical drainage	Abscess
7/40/M	Gastric cancer	+	+	+	+	Surgical drainage	Abscess
8/32/M	Appendicitis	+	+	not done	+	Surgical drainage	Abscess
9/49/M	Pseudocyst of the pancreas	+	+	?	?		Infected cyst
10/47/M	Carcinoma of the papilla of Vater	+	-	?	+		No abscess
11/77/M	Gastric cancer	+	-	?	-		No abscess
12/75/M	Esophageal cancer	+	-	?	? artifact		No abscess
13/35/M	Renal transplant	+	-	-	-		No abscess
14/81/M	Colon cancer	+	-	?	-		No abscess
15/31/M	Hepatoma	+	-	-	-		No abscess
16/65/M	Gastric cancer	+	-	-	-		No abscess
17/42/M	Hepatoma	+	-	-	-		No abscess
18/42/M	Esophageal cancer	+	-	-	-		No abscess
19/54/M	Perforation of duodenal ulcer	+	-	-	-		No abscess
20/48/M	Cholangioma	+	-	-	-		No abscess

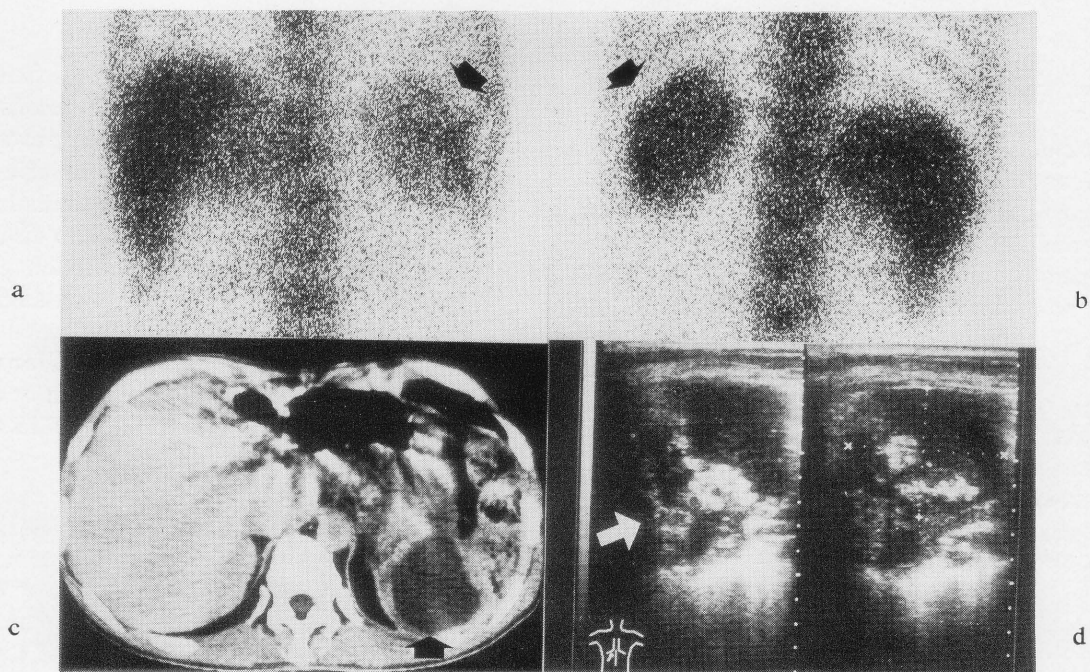


Fig. 1 Case 3. Patient postgastrectomy and splenectomy with fever. In-111 WBC images (a. anterior view, b. posterior view) show accumulation in area of the left upper quadrant (black arrow). CT and US clearly demonstrate an abscess in that lesion (c. black arrow, d. white arrow).

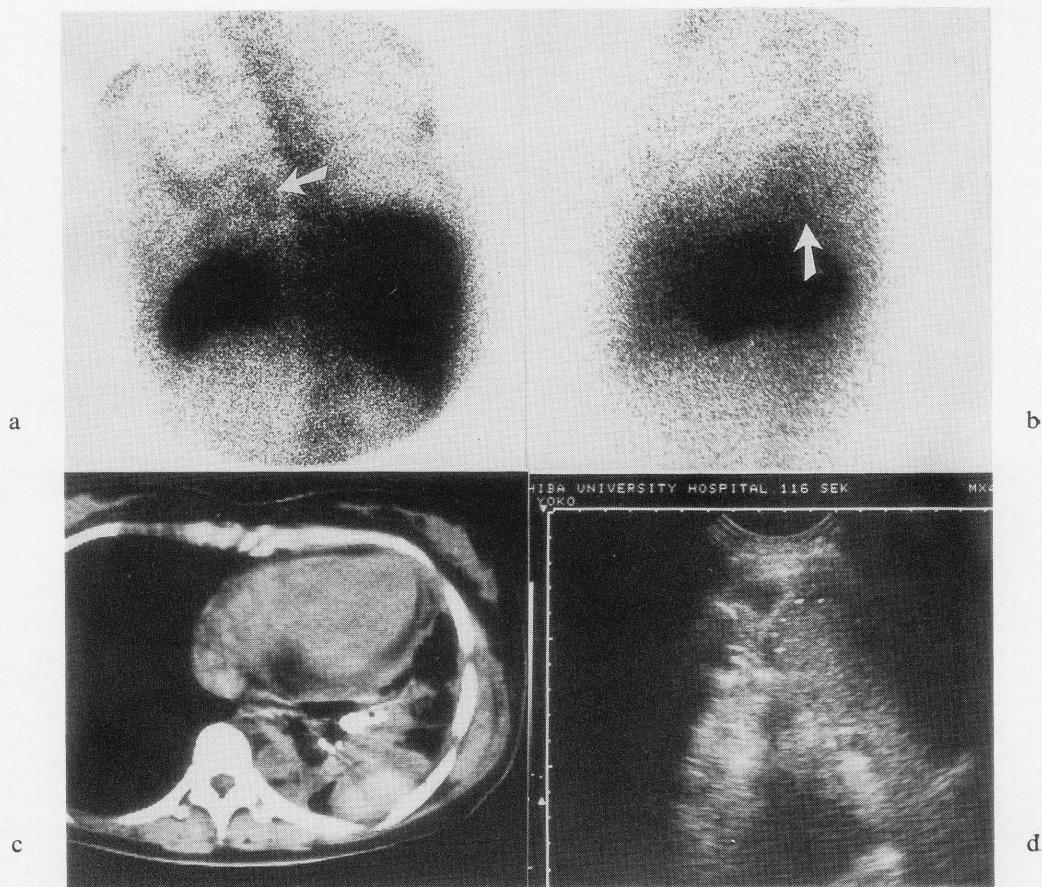


Fig. 2 Case 2. Patient post-esophagogastrectomy with fever. In-111 WBC images (a. LPO view, b. left lateral view) show a spotty accumulation in the intrathoracic lesion (white arrow). A CT scan demonstrates an abscess (c) and an intercostal US scan demonstrates fluid collection (d).

drainages were performed under US guidance in four cases and the other four cases were drained surgically. Approximately 500 μ Ci of In-111-labeled autologous leukocytes[§] using a modification of Thakur's method^{12,13} were injected intravenously. Whole-body images and spot views were obtained 24 hours following injection by using a gamma camera with medium energy collimator. US was performed with a commercially available real-time gray scale ultrasonic scanner using 3.5 MHz focused transducer (U-sonic Model RT3000 and Toshiba SAL90A). CT was performed on the General Electric CT/T 8800 without contrast enhancement.

RESULTS

Postoperative abscesses or infections were diagnosed in 9 of 20 patients. Eight of the 9 diagnoses proved correct and were treated with needle aspirations under US guidance and surgical drainage (Figs. 1, 2).

[§]Indium-111 oxine: Amersham International PLC.

One case with infected cyst showed rapid resolution of symptoms with administration of antibiotics. In the eleven patients with no surgical confirmation, the subsequent clinical course indicated that no infection had been present. All patients were correctly diagnosed by In-111 WBC imaging and 4 patients could not be diagnosed by US because bowel gas limited viewing, and the inflammation activity could not be estimated by US in one patient with infected cyst. One false-positive CT examination was obtained and another patient showing respiratory artifact could not be diagnosed by CT. The patient with esophageal varices (Case 6) was followed up four times by In-111 WBC imaging and showed varied activity of infection in the left upper quadrant during the subsequent clinical course (Figs. 3, 4).

DISCUSSION

Abdominal abscesses or infections are usually post-operative complications. CT and US proved to be efficient imaging methods for diagnosis, for planning

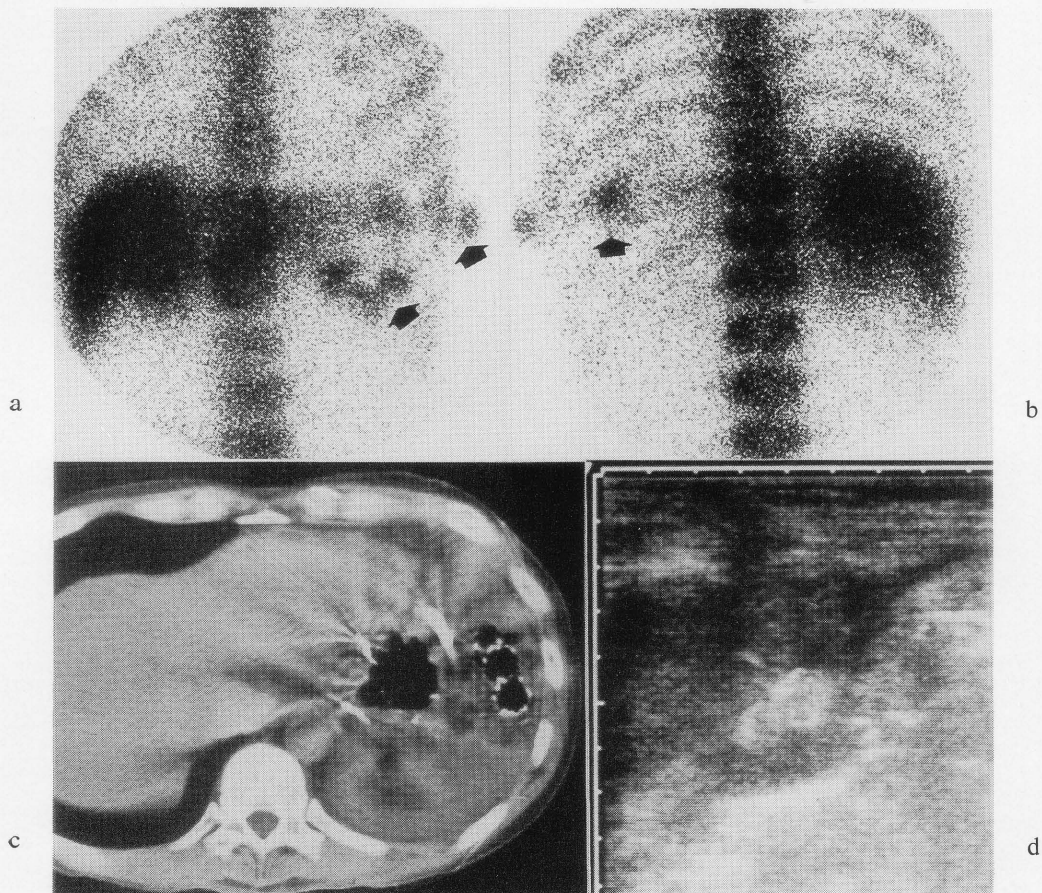


Fig. 3 Case 6: A 38-year-old patient underwent esophageal mucosal transection, splenectomy and devascularisation. In-111 WBC images (a. anterior view, b. posterior view) show spotty areas in that lesion. This lesion was demonstrated larger than In-111 uptake (c). US shows sonolucent fluid (d).

of therapeutic procedures, and in monitoring response to operative or conservative treatment.¹⁴ A good US examination requires considerable technical expertise. The presence of postoperative ileus, open wounds, abdominal dressings and abdominal tenderness may prevent optimal examination¹⁵. In our series US imaging was disturbed by intestinal gas in 5 cases. However, US may be used as a guide for percutaneous drainage of an abscess. CT is also of proven benefit in both the diagnosis and treatment of abscesses and can be used to guide percutaneous drainage of an abscess. As with US, there are limitations on CT and the performance of CT is hampered by respiratory movement of severely ill patients with pain. This problem will be solved by the new fast scan CT.¹⁶ In fact, although CT and US are extremely sensitive tools for delineating fluid collection, they usually cannot determine whether or not the fluid is infected. The use of In-111 WBC imaging represents a functional approach to detect pus and a reliable procedure for monitoring the activity of inflammation, except for a few reports of

the false positive results due to swallowed leukocytes and bleeding.¹⁷ The three modalities were found to be complementary. CT and US were better when symptoms were focal and In-111 WBC scan was valuable when focal signs were absent and it could be used to estimate the activity of inflammation.

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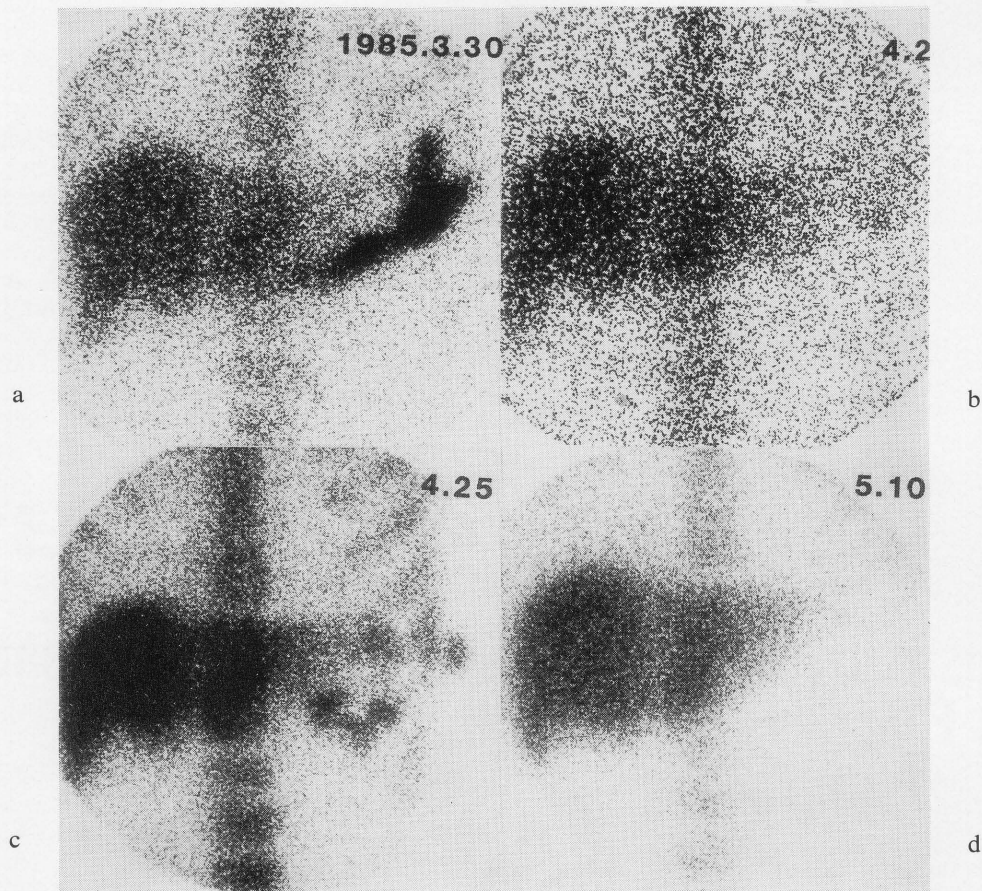


Fig. 4 Same patient as in Fig. 3. In-111 WBC shows accumulation in drainage site with higher uptake than in liver (a). After three days from (a), In-111 uptake disappeared (b). Spiky fever appeared again and In-111 uptake increased in the left upper quadrant (c). There was no accumulation in that area after surgical treatment (d).

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