Gallium-67 Citrate Scanning—A New Adjunct in the Detection and Follow-up of Extrapulmonary Tuberculosis: Concise Communication

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Gallium-67 citrate scans were obtained in 11 patients considered at risk for extrapulmonary tuberculosis. Radiographic and bacteriologic studies were performed routinely and tissue biopsy selectively. Of five patients with proven extrapulmonary tuberculosis, there were three with renal tuberculosis, one with Pott's disease, and one with peritoneal tuberculosis. The Ga-67 scan correctly predicted presence or absence of active extrapulmonary foci in all 11 patients. Follow-up scans correlated well with clinical response to therapy. The diagnosis of extrapulmonary tuberculosis is often overlooked because of nonspecific symptoms and frequent lack of concurrent lung involvement. Scanning with Ga-67 citrate offers a reliable and simple means of screening patients at risk and of monitoring response to treatment.

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The clinical diagnosis of extrapulmonary tuberculosis is difficult because of nonspecific symptoms and frequent absence of concurrent lung involvement (*1-5*). In addition, there may be more than one extrapulmonary focus. As part of the initial workup in all high-risk patients, plain and contrast radiography of multiple organs is undesirable. Since gallium-67 citrate is known to concentrate in active lung tuberculosis (*6*), the present study was undertaken to determine if whole-body Ga-67 scanning could provide a simple method of locating active foci of extrapulmonary tuberculosis and of demonstrating response to treatment (*7*).

METHODS

Patients. These belonged to one of the following groups at the time of presentation: a) those with far-advanced pulmonary tuberculosis (such patients are expected to have a higher risk of bowel involvement) (*8*); b) those with a previous diagnosis of pulmonary or extrapulmonary tuberculosis and no active pulmonary tuberculosis; and c) those with no previous history of tuberculosis. All had constitutional symptoms including weight loss, weakness, and night sweats. Some patients in groups b and c had localizing symptoms such as bone pain, abdominal pain, and diarrhea. In all, 11 patients were studied.

Diagnostic tests. Two to four sequential whole-body scans were obtained in every patient, at 6-120 hr after i.v. administration of 3 mCi of Ga-67 citrate. A dual-headed rectilinear scanner with 5-in. crystals was used. The window included all four photopeaks of Ga-67.

Scan findings were correlated with the following studies: a) plain radiographs of bone; b) contrast radiographs of small bowel, colon, and kidneys; c) bacteriologic examination for acid-fast bacilli and

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TABLE 1. PATIENT DATA

Case No.	Clinical data*	Ga-67 uptake†	Pertinent findings by x-rays‡ and ultrasound	Acid-fast bacilli (smear/culture)	Histo-pathology
1	Previous diagnosis of pulmonary and ileocecal TB; status postresection of ileum and right colon.	Left kidney	IVP—mild left hydronephrosis and hydroureter; renal ultrasound unsatisfactory	Sputum—negative, urine—positive	
	Improvement after 1½ mo	Decreased	IVP—no change	Sputum—negative, urine—positive	
	Clinical remission after 4 mo	Normal		Sputum—negative, urine—negative	
2	Pain and gibbus of dorsal spine; weakness of lower extremities	Cervicodorsal and dorsolumbar spine	Spine (tomography)—bone erosion and sclerosis of lower cervical, mid-dorsal (with compression of T8) & lumbar spine	Sputum—negative, vertebral specimen—positive	Caseating granuloma of vertebrae
	Improvement after 4 mo	Decreased	Spine—bone healing		
3	? Past history of pulm. TB; pain and tenderness of abdomen; ascites	Diffuse uptake in left abdomen and pelvis	Small bowel—serosal changes near ileum compatible with peritonitis; no enteritis. Barium enema—normal. Abdominal ultrasound—normal.	Sputum—negative, peritoneal fluid-positive	Caseating granuloma of peritoneum
	General improvement after 1 mo; persistent abdominal pain	Decreased			
4	On treatment (? noncompliant) for pulmonary and renal TB diagnosed at another hospital 3 mo before admission. Cystoscopy-caseous material from right ureteral orifice	Right kidney	IVP—right hydronephrosis. Renal ultrasound—negative. Small bowel—negative	Sputum—negative,‖ urine—negative‖	
	Improvement after 6 mo	Normal			
5	Noncompliant with medications for pulmonary TB; abdominal pain	Normal	Small bowel—negative, IVP—negative, barium enema—colon polyps	Sputum—negative, urine—negative	
6	Pulmonary TB; back pain, diarrhea, chronic fistula-inano	Normal	Small bowel—negative, barium enema—negative, spine—compression fractures of upper dorsal vertebrae	Sputum—positive, urine—negative, perineal discharge—negative	
7	On treatment for pulmonary and rectal TB diagnosed at another hospital 1 mo before admission; back pain; no clinical evidence of rectal disease	Normal	Spine—degenerative changes, small bowel—negative, barium enema—negative	Sputum—positive, urine—negative	
8	Far advanced pulmonary TB	Normal	Small bowel—negative, IVP—negative	Sputum—positive, urine—negative	
9	Far advanced pulmonary TB	Normal	Small bowel—negative, IVP—negative	Sputum—positive, urine—negative	
10	Far advanced pulmonary TB	Normal	Small bowel—negative, IVP—negative	Sputum—positive, urine—negative	
11	Far advanced pulmonary TB	Kidneys	Small bowel—negative, IVP not done	Sputum—positive, urine—positive	

* All patients had constitutional symptoms.
† Excludes lung findings.
‡ Plain films, upper GI and small bowel series, barium enema, and IVP.
‖ Urine and sputum were positive before starting chemotherapy.

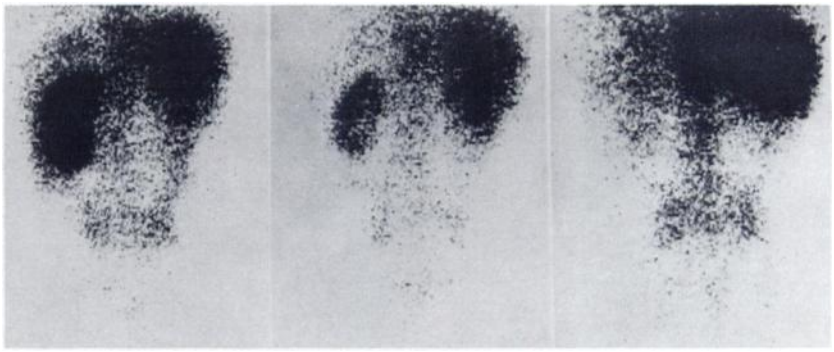

FIG 1. (Left) Posterior view of abdomen in Patient 1, 48 hr after tracer injection. Left renal tuberculosis produces marked uptake of Ga-67 in left kidney. (Uptake on right side results from operation.) (Center) After 1½ mo of chemotherapy, image at 48 hr shows decreased uptake. (Right) After 4 mo of chemotherapy, with clinical improvement, image at 48 hr shows negligible L. renal uptake.

other organisms in sputum and urine routinely, and in tissue fluids where necessary; d) histopathologic examinations of biopsy specimens, when available; and e) ultrasonography.

Follow-up. Four patients with abnormal initial workup indicating active extrapulmonary tuberculosis had followup studies while on treatment.

RESULTS

The Ga-67 scan correctly predicted the presence of active foci of extrapulmonary tuberculosis in Patients 1-4 (Table 1).

In Patient 1, with the clinical suspicion of recurrent bowel tuberculosis, involvement of the left kidney was discovered incidentally by Ga-67 scan (Fig. 1). An IVP was then performed and showed mild left hydronephrosis. Follow-up scans, 1½ mo later, demonstrated decreased uptake correlating well with the clinical response to treatment, whereas the IVP showed no significant change. After 4 mo of chemotherapy, the scan was normal.

In Patient 2, with Pott's abscess of the spine, the scan clearly demonstrated the spatial extent of soft-tissue involvement (Fig. 2), with dramatic decrease in activity after a spinal fusion operation followed by 4 mo of chemotherapy.

In Patient 3 the scan provided the only noninvasive means of demonstrating the presence and extent of peritoneal involvement (Fig. 3). Some decrease in Ga-67 activity was noted with clinical improvement 1 mo later, after which the patient was lost to follow-up.

In Patient 4, with right renal tuberculosis and positive Ga-67 scans, the negative urine cultures were attributed to previous antituberculous chemotherapy. Follow-up scans 6 mo later, with the patient in clinical remission, were normal.

Patients 5–10, with normal Ga-67 scans, had no evidence for active extrapulmonary disease.

Patient 11, with bilateral renal uptake of Ga-67, was lost to follow-up and did not have an i.v. pyelogram. Urine cultures grew acid-fast bacilli.

Chest roentgenograms in the five patients with extrapulmonary tuberculosis, taken at the time of their initial Ga-67 scan, showed active pulmonary tuberculosis in two (Nos. 4 and 11), chronic changes suggestive of old tuberculosis in one (No. 1), and no evidence of tuberculosis in two (Nos. 2 and 3).

DISCUSSION

Extrapulmonary tuberculosis accounts for approximately 13% of all cases of tuberculosis in the United States (*9*). Some of the common forms of the disease—including skeletal, renal, and peritoneal tuberculosis—often go unrecognized for prolonged periods because of their insidious nature and the frequent absence of concurrent lung involvement (*1-4*). Delay in detection of these extrapulmonary foci leads to serious complications, and occasionally to death (*1, 2, 10, 11*). A definitive

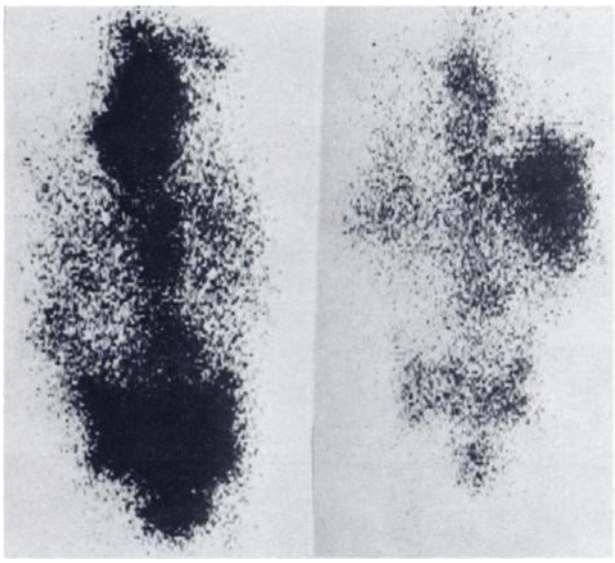

FIG. 2. (Left) Posterior whole-body Ga-67 scan in Patient 2, 24 hr after tracer injection. Large mass (Pott's abscess) is seen in region of upper dorsal spine, as well as involvement of lower dorsal and lumbar spine. (Right) After spinal fusion operation and 4 mo of clinical improvement under chemotherapy, image at 48 hr shows markedly decreased activity in involved areas.

FIG. 3. (Left) Anterior view of abdomen in Patient 3, 72 hr after tracer injection. Tuberculous peritonitis produces diffuse Ga-67 activity in left and lower abdomen. (Right) After 1 mo of chemotherapy and some clinical improvement, image at 48 hr shows decrease in uptake.

diagnosis often requires histopathologic examination.

Standard radiographic tests have been used to identify those patients who need further workup for a conclusive diagnosis. However, localizing manifestations may be lacking and more than one extrapulmonary focus can be present. This necessitates radiographic studies of several sites including bone (selected areas), kidneys, and bowels, which are cumbersome. Furthermore, peritoneal tuberculosis can still be missed on radiography (*2*).

In this study, the Ga-67 scan correctly predicted presence or absence of active extrapulmonary tuberculosis in all patients. The spatial extent of disease in the spine (Pott's abscess), kidney, and peritoneum was clearly demonstrated. Gallium-67 uptake in peritoneal tuberculosis is also supported by a case report that appeared during this study (*12*).

Thus, Ga-67 scanning offers the convenience of a single reliable test to detect multiple sites of involvement, and may prove to be ideal for routine screening of all patients at risk. Positive scans can be followed by more definitive tests. In this regard, it is interesting that in Patient 1 the incidental finding of renal uptake on the Ga-67 scan (Fig. 1) prompted further workup, resulting in a diagnosis of renal tuberculosis.

Follow-up scans in our patients showed good correlation between scan findings and clinical response to treatment. Gallium-67 scanning may well play an important role in the long-term management of extrapulmonary tuberculosis.

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ERRATUM

In the Letter to the Editor entitled "In-111-labeled Platelets or Iodinated Fibrinogen for the Detection of Deep Venous Thrombosis" by Milo M. Webber, et al., appearing in *J Nucl Med* 20: 459, 1979, coauthor Leslie R. Bennett's name was omitted.