

A Comparison of Gallium-67 Single Photon Emission Computed Tomography and Computed Tomography in Mediastinal Hodgkin's Disease

S. Karimjee, M. Brada, J. Husband and V.R. McCready

The role of gallium-67 single photon emission computed tomography (Ga-67 SPECT) in the assessment of mediastinal Hodgkin's disease was evaluated prospectively. Ga-67 SPECT and computed tomography (CT) were compared and correlated with clinical findings at initial presentation in 30 patients, 6 weeks after treatment, and 6 months later in 20 of the 30 patients. At initial presentation, active disease was detected on both imaging modalities on all occasions. 6 weeks after treatment CT showed residual mediastinal abnormality in 7 patients, whereas Ga-67 SPECT showed abnormal mediastinal tracer uptake in 3 patients. 6 months later CT showed residual mediastinal abnormality in 5 patients whereas all the Ga-67 SPECT studies were negative. Ga-67 SPECT imaging is a useful tool in assessing response to therapy in mediastinal Hodgkin's disease.

Eur J Cancer, Vol. 28A, No. 11, pp. 1856–1857, 1992.

INTRODUCTION

THE USE of gallium scanning in the evaluation of mediastinal Hodgkin's disease has been controversial mainly because of the poor predictive value of a negative gallium scan, based on results using conventional doses of gallium [1–3]. However, Anderson *et al.* [4], in a retrospective study of 52 patients reported a sensitivity of 97% and specificity of 100% in the detection of Hodgkin's disease using high-dose gallium and optimum imaging.

The current clinical problem in the management of mediastinal Hodgkin's disease is the prediction of disease activity in residual mediastinal masses after therapy. In the present study we therefore prospectively examined previously untreated patients with biopsy-proven Hodgkin's disease involving the mediastinum before treatment, 6 weeks after completion of initial therapy and 6 months later, in order to assess the role of Ga-67 SPECT in the management of mediastinal Hodgkin's disease.

PATIENTS AND METHODS

Previously untreated patients with biopsy-proven Hodgkin's disease presenting to the Royal Marsden Hospital between June 1986 and August 1987 were studied prospectively. 30 consecutive patients had both computed tomography (CT) scans of the thorax and gallium-67 single photon emission computed tomography (Ga-67 SPECT) scans at initial presentation. 20 of these patients were scanned 6 weeks after treatment and 6 months later. CT and Ga-67 SPECT scans were carried out within 7 days of each other. The SPECT studies were assessed in detail without knowledge of other results and the SPECT results were withheld until the end of the study.

The 20 patients studied after treatment comprised 15 males and 5 females with an age range of 20–67 years. 4 were stage IA, 1 was stage IB, 8 were stage IIA (2 with bulky disease), 1 was stage IIIA (1 with bulky disease), 5 were stage IIIB and 1 was stage IVB. 3 (stage IA) patients had radiotherapy only, 17 had chemotherapy as the initial treatment and 15 out of the 17 went on to have adjuvant radiotherapy.

Ga-67 imaging was performed 72 h after the intravenous administration of 300 MBq of Ga-67 citrate. All images were obtained using a LFOV gamma camera (IGE Starcam) using a medium-energy, parallel-hole collimator and 20% windows centred on the 93, 184 and 296 keV photon peaks. Planar anterior and posterior chest images were obtained (500 000 counts per image). SPECT images were obtained using 64 projections (20 000 counts per projection) in a 360° orbit at 20 s per projection. A filtered back-projection technique was used to reconstruct the raw data and an attenuation correction was applied. The transaxial slices generated were approximately 6.4 mm thick.

CT of the thorax was carried out using a Siemens Somatom 11 scanner. 10 mm contiguous cuts were obtained and intravenous contrast enhancement was administered only when considered necessary. Three nodal sites were scored per patient, mediastinum and each hilum as either negative or positive for the presence of disease. Comparisons were made with previous studies to evaluate regression or recurrence of disease, and activity in a distribution that was believed not to represent disease was scored as negative.

RESULTS

At initial staging prior to therapy there were no false negative Ga-SPECT studies; active disease was detected on both imaging modalities on all occasions (Table 1). The only discrepancy in the pretreatment results was in the region of the hila. There were six CT-positive, SPECT-negative hilar sites and six CT-negative, SPECT-positive hilar sites. The hilar area is known to be difficult to assess on CT, and even with intravenous contrast enhancement there were discrepancies that are difficult to explain unless there is occasional non-specific uptake of gallium by the hilar nodes.

Correspondence to S. Karimjee.

S. Karimjee is currently at the North Middlesex Hospital, London N18 1QX; S. Karimjee is also at, and V.R. McCready is at the Department of Nuclear Medicine; M. Brada is at the Department of Radiotherapy and Oncology; and J. Husband is at the Department of Radiology, Royal Marsden Hospital and Institute of Cancer Research, Sutton, Surrey, U.K.

This paper was presented at an international symposium on Hodgkin's disease, Royal Marsden Hospital, London, on 15–16 April 1991.

Received 22 Nov. 1991; accepted 30 Apr. 1992.

Table 1. Pretreatment: 30 patients

		SPECT	
		+	-
CT	+	24	0
	-	0	6

Table 2. Post-treatment: 20 patients

		SPECT	
		+	-
CT	+	2*	2
	-	1*	12

*2 SPECT-positive patients relapsed.

Post-treatment scan results (Table 2) showed that 7 patients were CT-positive and that 3 patients were still Ga-SPECT-positive for residual disease. 2 of the 3 SPECT-positive patients relapsed before any adjuvant therapy (1 CT-positive and 1 CT-negative). The 1 other Ga-SPECT-positive patient received adjuvant radiotherapy as planned and SPECT images reverted to negative. In the detection of residual disease, CT had a false positive detection rate of 30% and a false negative rate of 5%. 6 months later (Table 3) all 20 patients were Ga-67 SPECT-negative but 5 patients remained CT positive.

Table 4 is a comparison of planar imaging of the thorax vs. SPECT scanning in the untreated patients and it demonstrates that planar imaging was negative in 6 of the 24 patients that were positive on both CT and SPECT imaging.

DISCUSSION

Despite the reported effectiveness of gallium scanning in the detection of mediastinal Hodgkin's disease, it has never achieved great acceptance and this is in part due to the varying techniques used for gallium imaging and the associated difficulties in comparing the published results [5]. Evaluation of Ga-67 SPECT results requires careful attention to detail and, as shown in our results, the tomographic technique will demonstrate abnormal uptake in the anterior mediastinum that may be obscured by the normal sternal uptake seen on planar scintigraphy. Another potential source of confusion in the literature is the timing of

the post-treatment scans [6]. All our post-treatment scans were carried out at least 6 weeks after completion of treatment because either chemotherapy or radiotherapy can cause false positive uptake of gallium, as can recent bone marrow aspirations or lymphangiography.

Pretreatment scans were of value in assessing the post-treatment studies, in particular in the case of patients with bulky disease where initially only minimal increased tracer uptake was seen. 6 patients were negative initially on both imaging modalities and remained so throughout the study, a form of internal control. However, the pretreatment Ga-67 SPECT studies did not add to the anatomical definition of the mediastinal disease obtained from CT.

The management of residual mediastinal masses following treatment of Hodgkin's disease remains unclear [7, 8]. Residual masses following chemotherapy alone carry a higher predicted risk of relapse, while the risk of recurrence following combined chemotherapy and radiotherapy is low [9, 10]. The overall proportion of patients with residual mediastinal abnormality who subsequently relapse is low [11]. It would be of advantage to detect patients with active disease to avoid unnecessary therapy, particularly in the form of mediastinal irradiation in patients with residual fibrotic masses only. This study demonstrates the effectiveness of Ga-SPECT in this situation and its potential value in trials of adjuvant therapy.

Although these are small numbers, our post-treatment results clearly indicate the value of this non-invasive technique. 3 patients had positive Ga-SPECT scans after treatment. 2 patients relapsed at 2 and 4 months after treatment and this was predicted by the Ga-SPECT studies. The third Ga-SPECT-positive patient received adjuvant therapy and subsequently became negative. Although further follow-up and evaluation is necessary, Ga-SPECT scanning in the mediastinum is a valuable diagnostic technique in the post-treatment assessment of residual mediastinal disease and would be useful in the context of trials of adjuvant therapy.

Table 3. Six months later: 20 patients

		SPECT	
		+	-
CT	+	0	6
	-	0	14

Table 4. Pretreatment: 30 patients

		SPECT	
		+	-
Planar imaging	+	18	0
	-	6	6

- McCaffrey JA, Rudders RA, Kahn PC, Harvey HA, DeLellis RA. Clinical usefulness of 67 gallium scanning in the malignant lymphomas. *Am J Med* 1976, **60**, 523-530.
- Johnston GS, Go MF, Benna RS, *et al.* Gallium-67 citrate imaging in Hodgkin's disease; final report of cooperative group. *J Nucl Med* 1977, **18**, 692-698.
- King DJ, Dawson AA, McDonald AV. Gallium scanning in lymphoma. *Clin Radiol* 1980, **31**, 729-732.
- Anderson KC, Leonard RCF, Canellos GP, Skaram AT, Kaplan WD. High dose gallium imaging in lymphoma. *Am J Med* 1983, **75**, 327-331.
- McLaughlin AF, Magee MA, Greenough R, *et al.* Current role of gallium scanning in the management of lymphoma. *Eur J Nucl Med* 1990, **16**, 755-771.
- Wylie BR, Southee AE, Joshua DE, McLaughlin AF, *et al.* Gallium scanning in the management of mediastinal Hodgkin's disease. *Eur J Haematol* 1989, **42**, 344-347.
- Jochelson MS, Herman TG, Stomper PC, *et al.* Planning mantle radiation therapy in patients with Hodgkin's disease: the role of gallium-67 scintigraphy. *Am J Roentgenol* 1988, **151**, 1229-1232.
- Front D, Israel O, Epelbaum R, *et al.* Ga-67 SPECT before and after treatment of lymphoma. *Radiology* 1990, **175**, 515-519.
- Jochelson M, Mauch P, Bakkian J, Rosenthal D, Canellos GP. The significance of the residual mediastinal mass in treated Hodgkin's disease. *J Clin Oncol* 1985, **3**, 637-640.
- Canellos GP. Residual mass in lymphoma may not be residual disease (editorial). *J Clin Oncol* 1988, **6**, 931-933.
- Radford JA, Cowan RA, Flanagan M, *et al.* The significance of the residual mediastinal abnormality on the chest radiograph following treatment for Hodgkin's disease. *J Clin Oncol* 1988, **6**, 940-946.