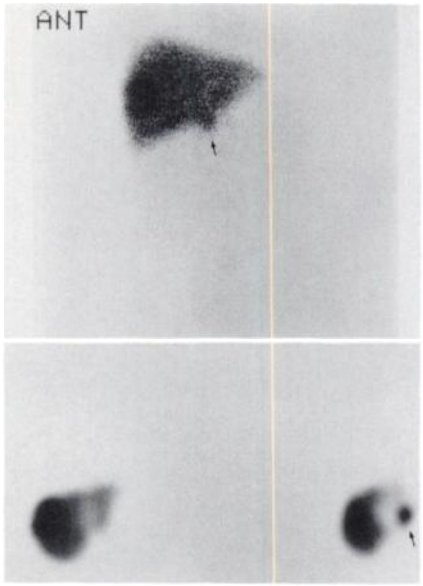

FIGURE 1. Planar and SPECT images.

antibody) in 100 ml of normal saline by slow intravenous infusion. Two days after infusion, planar and SPECT images were obtained. As shown in Figure 1, focal uptake of ^{111}In was clearly visualized in the lymph nodes at the site of the hepatic hilum as well as in the liver metastasis. We insisted that these two lymph nodes be resected during surgery, which was performed nine days after antibody injection, although the lymph nodes positively visualized in the scintigram were unlikely to be metastatic in the aspect of lymphatic flow. The localization index of two resected lymph nodes were much higher than that of the primary tumor in the colon (Table 1). Surgical exploration of lymph nodes, however, showed no gross or microscopic evidence of metastases of the colon Ca. The lymph node homogenates did not contain high CEA compared with those of the primary tumor or liver metastases (Table 1). The resected lymph nodes were stained positively by polyclonal anti-CEA antibody, but weakly by ZCE-025. The histology of the resected lymph nodes did not show any evidence of inflammatory lesions.

Beatty et al. (*2*) indicated shedding CEA as one of the causes of antibody localization in tumor-free tissues. In our case, the plasma-CEA level and the CEA contents in the lymph nodes were not high enough to support their idea completely. Abdel-Nabi et al. (*3*) also reported some possible mechanisms for nonspecific accumulation in lymph nodes. In the plasma obtained from the patient, free ^{111}In, not attached to the antibody, could not be found. The fact that great uptake of ^{111}In was seen in only two distinct lymph nodes and not in the regional ones cannot be explained. Kairemo et al. (*4*) reported a false-positive finding in a patient with a parapharyngeal hemangiopericytoma. They pointed out that the antibody recognized new epitopes nonspecifically. We have believed that ZCE-025 did not react with normal granulocytes. Eventually this fact has raised doubt about the efficacy of immunoscintigraphy amongst surgeons, although this might apply to only a few cases among many clinical radioimmunodetections.

TABLE 1
Resected Specimens from Surgery

Resected samples	Localization index*	CEA contents† (ng CEA/mg protein)
Normal colon tissues	—	17
Primary tumor tissues (in sigmoid colon)	4.58	771
Normal liver tissues	—	19
Liver metastases	1.69	862
Lymph node $12b_1$	160	86
Lymph node $12b_2$	5.30	37

* Radioactivity/g of resected tissues/radioactivity/g of normal colon tissues.

† Resected samples were homogenized with phosphate buffer and their CEA contents were measured by the enzyme-like assay followed by the determination of protein concentration.

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Diagnosing Prosthetic Joint Infection

TO THE EDITOR: We have read Dr. Alazraki's interesting editorial on diagnosing prosthetic joint infections (*1*). We share Dr. Alazraki's view that some serious difficulties are related to the use of ^{111}In-labeled leukocytes for the diagnosis of prosthetic joint infections. In a recent paper, we reported our first experience with ^{111}In labeled human nonspecific immunoglobulin G (IgG) scintigraphy in patients with bone and joint infections (*2*). Five patients with prosthetic joints were included in this study. Since that time, scintigraphy with ^{111}In-IgG was performed in an additional 35 patients with prosthetic joints.

Of the 40 patients studied, 34 had total-hip arthroplasty and 6 had total knee prostheses. All patients had clinical signs of loosening and/or chronic infection. A conventional ^{99m}Tc-methylene diphosphonate skeletal scintigraphy was abnormal in all patients. All patients also underwent scintigraphic imaging after intravenous injection of 1 mg IgG (Sandoglobulin, Sandoz AG, Nurenberg, FRG) radiolabeled with 75 MBq ^{111}In (^{111}In-chloride, Amersham International Ltd., Buckinghamshire, UK) at 4, 24 and 48 hr (*2*). Scintigraphic results were evaluated by bacterial cultures obtained at surgery in 25 patients and by clinical follow-up and serial radiography in 12 patients. Three patients had productive fistulae.

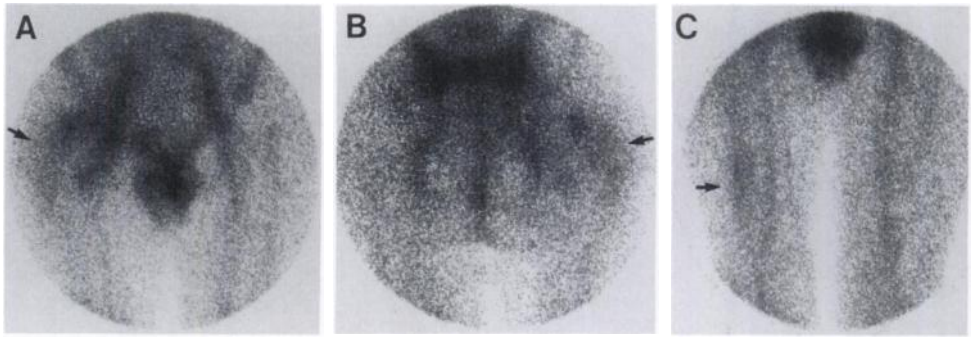

FIGURE 1. Indium-111-IgG images (48 hr postinjection) of an infected right total-hip arthroplasty. (A) Anterior view of the pelvis: increased uptake in the acetabular region with soft-tissue extension (arrow). (B) Posterior view of the pelvis: increased uptake in the acetabular region with soft-tissue extension (arrow). (C) Anterior view of the upper legs: increased uptake around the tip of the femoral component (arrow).

Figure 1 is a typical example of an ^{111}In-IgG scintigram of an infected total hip arthroplasty with increased uptake in the right acetabular region with extension in the surrounding soft-tissue (Fig. 1A-B) and increased uptake around the tip of the femoral component of the prosthesis (Fig. 1C).

Fourteen patients were categorized as true-positive, 22 as true-negative, 3 as false-positive and 1 as false-negative. In all false-positive studies, a sterile inflammatory process could be identified: active periarticular ossifications, necrotic tissue around the neck of the femoral component of a total-hip prosthesis, and a hemorrhage in the total-knee prosthesis in a hemophilic patient. In the one patient with a false-negative ^{111}In-IgG scintigraphy, a single culture revealed *Staphylococcus aureus* in low counts.

In this group of patients sensitivity of ^{111}In-IgG scintigraphy was 93%, specificity for infection 88%, specificity for inflammation 100%, positive predictive value for infection 82%, positive predictive value for inflammation 100%, and negative predictive value for infection and/or inflammation 96%.

In our opinion, ^{111}In-IgG scintigraphy overcomes most of the difficulties with ^{111}In-labeled leukocytes addressed by Dr. Alazraki (*1*). Using the physiologic activity uptake in the soft-tissues around bone and prosthesis as a landmark, it is possible to discriminate pathologic ^{111}In-IgG accumulation in bone from soft-tissue uptake. Comparing the marrow uptake per pixel per MBq in the iliac crest, the uptake of ^{111}In-leukocytes typically exceeded ^{111}In-IgG uptake by 50%. In this series of patients, ^{111}In-IgG uptake in bone marrow did not interfere with image interpretation. Our results indicate that ^{111}In-IgG scintigraphy has no decreased sensitivity in chronic infection.

Like all radiopharmaceuticals used for imaging infection, ^{111}In-IgG accumulates not only in infectious foci, but also in sterile inflammatory processes. In our study, this is demonstrated by the three patients that were categorized as false-positive, including a patient with heterotopic bone formation.

The very important concern about the handling of whole blood for ^{111}In-leukocyte scintigraphy and the possibility of iatrogenic errors does not apply to ^{111}In-IgG (*1,3*). The IgG-DTPA conjugate is readily available as a sterile, pyrogen-free kit. Additional advantages of ^{111}In-IgG are the rapid labeling procedure and the constant, high quality of the radiopharmaceutical.

In conclusion, we feel that ^{111}In-IgG scintigraphy is an excellent method for imaging infection, especially in the notoriously difficult field of chronic low-grade bone and prosthetic joint infections.

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