Lymph Node Scanning and Imaging Using Colloidal ^{198}Au

Janet Drewett

Reading Hospital, Reading, Pennsylvania

Colloidal ^{198}Au lymph scanning has proven useful in the detection of pelvic and retroperitoneal lymph node metastases. It causes less discomfort than lymphangiography, is less time consuming, and frequently provides information equal in value to the lymphangiogram. Lymph node scans are particularly helpful to the radiotherapist for early detection of lymph node involvement, for localization of radiation therapy fields, and in some cases for post-treatment followup examinations (Fig. 1). The purpose of this paper is to present a radioisotope technique satisfactory for demonstration of the lymph nodes.

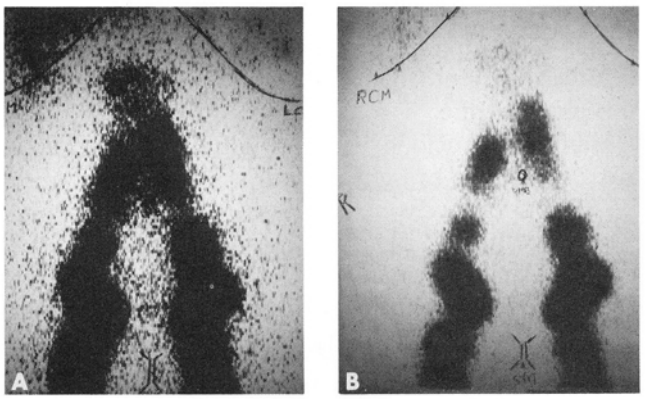

FIG. 1. Abnormal lymph scan (A) using Technique I (Channel A) and (B) using Technique II (Channel B)

The method uses the subcutaneous injection of approximately 100 μCi of colloidal ^{198}Au contained in a volume of 0.2-0.8 ml into the first interdigital space of each foot. The patient is instructed to exercise as much as possible over the next 24 hr. In patients unable to exercise, the radionuclide probably will not progress as rapidly and may produce what appears to be an abnormal scan. Patients with extensive lymphedema of their lower extremities were found to retain the radionuclide at injection site. Scanning and imaging were performed routinely at 24 hr postinjection and in some instances at 48 and 72 hr. Scans have been more helpful than gamma camera imaging because they can be superimposed on the patients' abdominal x-ray films and are an aid in localizing radiation therapy fields (Fig. 2). Gamma camera imaging is used only if the patient has difficulty lying still for the longer periods of time necessary for rectilinear scanning (Fig. 3).

The technique for our present procedure consists of the use of a Raytheon dual-probe scanner using only one probe with a high-energy collimator and both channels. The spectrometer of the pulse-height analyzer is set with a window of

For reprints contact: Janet Drewett, Dept. of Nuclear Medicine, Reading Hospital, West Reading, Pa. 19602.

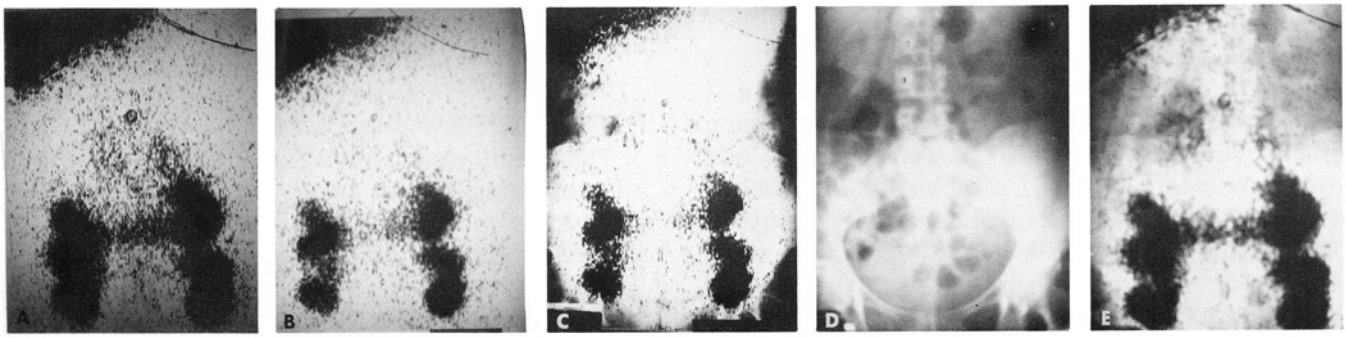

FIG. 2. Abnormal lymph scan (A) using Technique I; (B) using Technique II; (C) composite radiograph and lymph scan; (D) radiograph of abdomen; and (E) lymph scan superimposed on radiograph of abdomen.

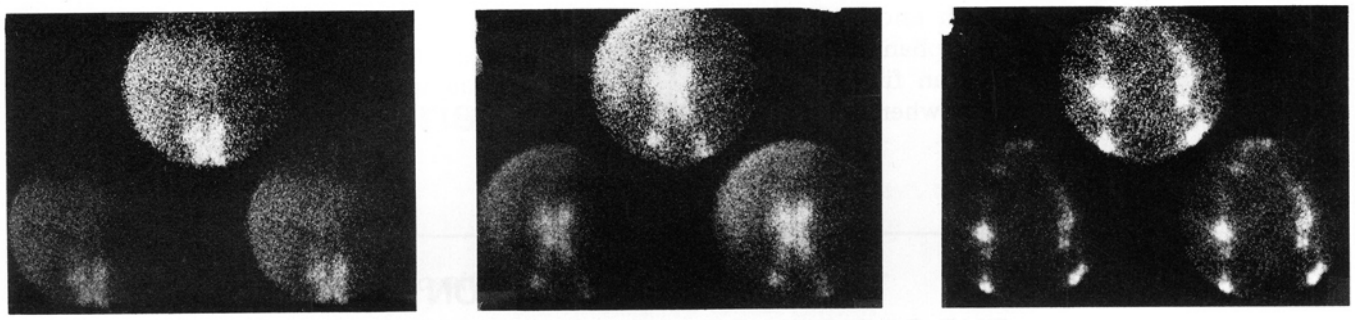

FIG. 3. Normal lymph scan done on gamma camera.

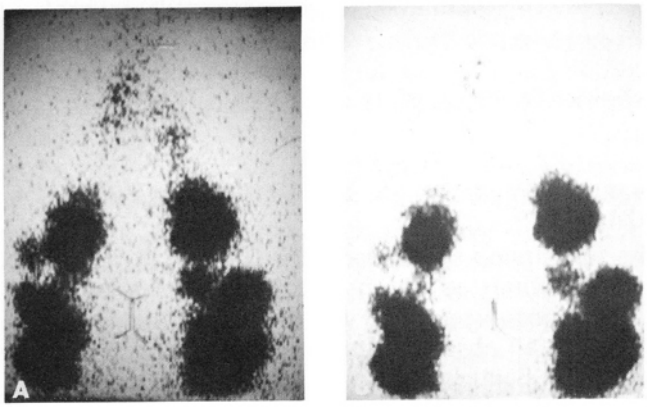

FIG. 4. Abnormal lymph scan (A) using Technique I and (B) using Technique II.

360-460 keV. Photoscans and dot scans are done simultaneously. With the patient in the supine position, the zyphoid, costal margin, umbilicus, iliac crests, and symphysis pubis are marked as external landmarks. Due to the marked disparity between the inguinal and retroperitoneal activity, separate techniques are used for each channel of the dual-probe system (Figs. 4 and 5).

The first technique, namely Channel A, demonstrates the retroperitoneal and hepatic activity optimally (Figs. 1A, 2A, 4A, and 5A). It uses a low information density, a moderate speed, a medium normalization of film density, and low contrast and background erase factors. A site over the retroperitoneal area, carefully avoiding the liver, is used to determine these factors. The information density on our scanner is generally set between 25 and 200 on the low range with a 3-mm line spacing and a speed between 45 and 125 cm/min. Normalization or film density is set as high as possible, usually between 30 and 80%, but should not exceed 80. Maximum film density is considered to be 100%. The contrast and background erase are set at 20%. On this film, the inguinal and femoral areas will be quite dark and possibly nondiagnostic.

The second technique, namely Channel B, demonstrates inguinal and femoral activity more satisfactorily but still allows detection of the retroperitoneal and liver areas (Figs. 1B, 2B, 4B and 5B). It uses a higher information density, a moderate speed, a high normalization of film density, and low contrast and background erase factors. A new information density is chosen for Channel B depending on the original information density of Channel A. The new information density should be between two and six times the original and is found by moving the probe to an area of more activity which will give an information density of between 100 and 500. The new information density is inversely proportional to the original information density and also depends on how well the radiogold has been absorbed by the inguinal and retroperitoneal lymph nodes. For example, if Channel A has an information density of 50, then Channel B should be approximately 250. However, if Channel A has an information density of 150, then Channel B should be approximately 400. The normalization or film density is set at 110% giving a larger gray scale, therefore eliminating some of the blackness of the inguinal areas. The contrast and background erase are again set at 20%. Scanning time is between 40 and 90 min.

It is recommended that if only one technique is planned, factors similar to Channel A should be followed so as not to minimize activity in the retroperitoneal and hepatic areas.

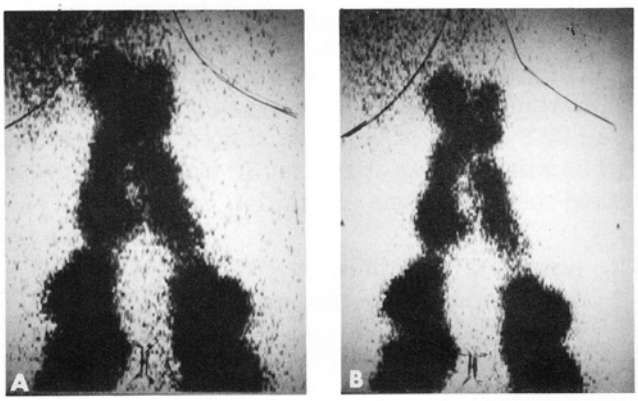

FIG. 5. Normal lymph scan (A) using Technique I and (B) using Technique II.

Pelvic-abdominal lymph node scans have been performed on 78 patients with known malignant disease. Wherever possible, lymphangiograms were done to confirm the lymph scan findings. Operative reports were also compared when available.

Acknowledgment

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