

# Comparison of 5:1 Rectilinear Scans with Scintillation Camera Images in Bone Scanning

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Using technetium-labeled radiopharmaceuticals, we obtained bone scans on 138 patients with both a dual-probe rectilinear scanner in 5:1 mode and a scintillation camera. A comparison made later of the recordings of identical anatomic areas produced by each scanning method showed that the scintillation camera images were almost uniformly more "visible." Other advantages, such as improved patient comfort, greater statistical information in a reasonable amount of time, and an ultimately higher detection ratio, suggest that the scintillation camera may be the best instrument available for current bone-scanning studies.

For a 1-year period using technetium-labeled bone-scanning agents, we routinely employed a dual-probe rectilinear scanner with 5:1 minification to obtain total-body scans. A research project involving scintillation camera bone images drew our attention to the seemingly frequent cases of improved detection of osseous disease with the camera system. A brief clinical protocol was instituted to compare the studies performed with each instrument. The methods and results are discussed in this report.

## Materials and Methods

Bone scans were performed 4 hr after injection of a technetium-labeled radiopharmaceutical on 138 patients. The agents employed were either  $^{99m}\text{Tc}$ -polyphosphate,  $^{99m}\text{Tc}$ -diphosphonate, or  $^{99m}\text{Tc}$ -pyrophosphate in doses of 10–15 mCi. The images were recorded by an Ohio-Nuclear dual-probe scanner and either a Searle Pho/Gamma HP camera or a Picker dynacamera. Diverging collimators were used on the cameras when available to cover a larger field of view in order to shorten the exam time. Each patient was examined with the scanner and with one of the two cameras in a

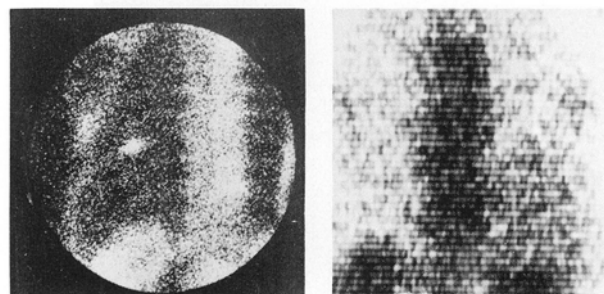
random order, but with both exams occurring within 1 hr of each other. Total-body 5:1 minified scans were obtained with an Ohio-Nuclear dual-probe rectilinear scanner. A low-energy 5-in. focusing collimator was used with  $\frac{1}{4}$ -in. line spacing and 2:1 light pipes. Anterior and posterior views of the trunk were obtained with a 45% background erase that was decreased to 15% for scanning of the legs. The camera scintiphotos recorded 100,000 counts in each view. Average information density recorded over the thoracic spine was about 240 for the scanner and 300–320 for the cameras. Measured information density over the ribs (posterior) was 120 in the scintiphotos. The rectilinear scan examination required 45 min, and the camera scintiphotos took 30 min in a more limited area.

## Results

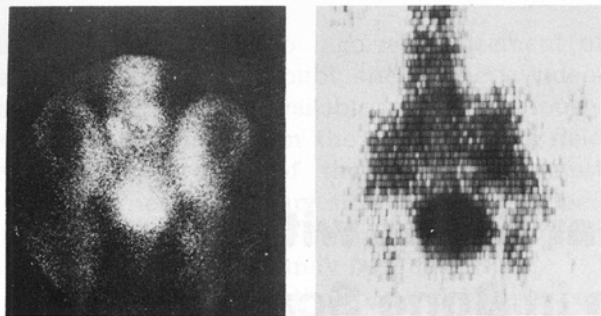
Fifty-four (30%) of the 138 patients examined demonstrated a total of 223 abnormal areas of

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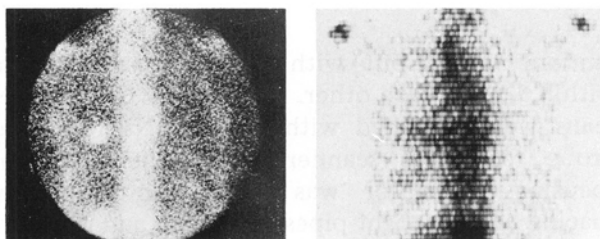
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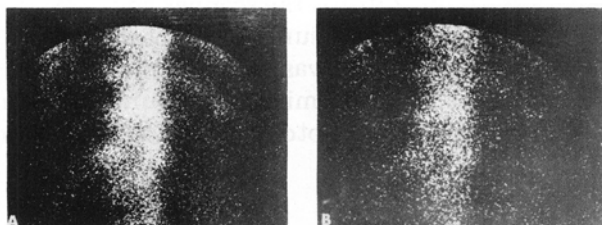
**FIG. 1.** Fifty-year-old man with adenocarcinoma of colon with metastases to left rib. Lesions seen on camera scintiphotos are not seen on 5:1 rectilinear scan.



**FIG. 2.** Seventy-year-old man with partially collapsed fifth lumbar vertebral body. Note improved visibility of L5 and right iliac abnormalities on camera scintiphoto.



**FIG. 3.** Seventy-nine-year-old woman with breast carcinoma. Metastases to rib and lumbar spine. Rib lesion not clearly defined on rectilinear 5:1 scan.



**FIG. 4.** Scintiphotos recording 200,000 counts (A) and 100,000 counts (B). Resolution shows slight improvement with 200,000-count image.

which 206 were identified by both imaging methods. Seventeen (8%) were retrospectively identified on the scintiphotos only. The 17 areas

were located in 17 different patients and represented 30% of the total positive patient cases. When abnormal areas were shown to be present by both methods, the camera scintiphotos consistently produced the more distinct images of the lesion (Figs. 1, 2, and 3).

## Discussion

The increased visibility of bone scan abnormalities on the scintillation camera recordings may be explained in part by the higher information density technique employed with the camera in this study. An additional factor may have been the tomographic effect (1) of the scanner itself, particularly in areas such as the ribs and pelvis. To examine the whole body with a scintillation camera would require at least as much time as with the 5:1 scanner if the 100,000-count scintiphotos were continued. In order to increase the information density of the scintiphotos, we have proposed using 200,000-count views of the anterior and posterior axial skeleton, reserving the 100,000-count anterior views for the extremities (Fig. 4). Such exams will probably require 30% more time than our current 45-min rectilinear scans. The extended technique will mean increased work for the technologists but generally improved comfort for the patient since he will remain on his own stretcher. The loss of exact symmetry of camera views may occasionally present a diagnostic problem, and there will be a loss of the appreciation of soft-tissue activity as the "tomographic" effect is eliminated. These deficits should be more than compensated for by the improved sensitivity and resolution the camera will offer in a similar time frame study.

## Reference

1. Brucer M: The field of vision of a focused (scanning) collimator. In *Vignettes in Nuclear Medicine*, No 42, St. Louis, Mallinckrodt Chemical Works, 1969