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Correlation of Neoplasms with Incidence and Localization of Skeletal Metastases: An Analysis of 1,355 Diphosphonate Bone Scans

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Detection of metastatic disease by bone scintigraphy is presently experiencing a rapid growth in nuclear medicine. Initially, bone scintigraphy was limited to ^{85}Sr, soon followed by a rapid succession of isotopes, including ^{87m}Sr and ^{18}F. Since its introduction in 1971 by Subramanian, ^{99m}Tc-polyphosphate has been responsible for a dramatic increase in the use of the bone scan for the management of patients with malignant metastatic neoplasms and osseous disorders.

Each successive radionuclide bone agent has had both higher sensitivity for detection of metastases and the ability to produce more rapidly higher quality scintigrams than roentgenography. In this report, the incidence and location of metastatic skeletal involvement, as derived from clinical trials with ^{99m}Tc-Sn EHDP, are presented and compared to previous studies of osseous metastatic detection of the most common forms of neoplasm.

During the clinical trials of ^{99m}Tc-Sn EHDP, 1,891 patients from 16 medical institutions were scanned. Patients were scanned an average 3.5 hours after administration of the agent.

Of the total number of patients, 1,355 were scanned for evaluation of metastatic involvement from nonosseous primary malignant neoplasm. The remaining indications were associated with both primary bone neoplasms and nonmalignant diseases and were excluded from this paper. The percentage of abnormal scans for all 1,355 patients with nonosseous primary malignant neoplasms, irrespective of indication, was 60%.

As expected, carcinoma of the breast (28%), lung (16%), and prostate (14%) constituted the major source of all metastatic neoplasms to bone. Except for lymphoma, bladder, and thyroid carcinomas, all the primary indications had 50% or greater incidence of metastatic skeletal involvement.

It is evident from the 60% abnormal scan level and the widespread dissemination through the skeleton that whole-body bone scans should be used in staging all forms of malignant carcinomas that are known to metastasize to bone, as well as in follow-up management of carcinoma patients. ■

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The Use of the Counting Rate Profile in Radioisotope Scanning Techniques

William J. MacIntyre, Godofredo Gomez Crespo, and James H. Christie

In the application of the automatic scintillation scanner for the visualization of large organs by means of deposited radioactivity, one of the primary problems is the differentiation of small variations in counting rate between the site of interest and its surrounding environment. For this reason, attempts have been made to accentuate such differences by means of non-linear recording devices. These systems have fallen into two forms: those utilizing a counting rate cut-off circuit in which the printing mechanism is only activated over areas exceeding a preselected rate; and those utilizing the logarithmic response of film density to light.

The disadvantages of these techniques are twofold: in the counting rate controlled technique, no record is obtained from any areas with deposition rates below a set level; and in the light recording methods, the sharp accentuation is likely to reach a density saturation over a short counting range, losing information above and below this range. For these reasons, it has been necessary to accurately measure and record the linear scan or "liver profile" for variations of counting rate during excursions of the detector over the body surface. The profiles are referred to the anatomical landmarks, permitting the evaluation of the size and position of the liver, as well as the changing pattern of activity over different areas referred to the corresponding lines of the dot scan.

In our institution, it is felt that optimum results are obtained by using pre-dot scan survey profiles for accurate setting of the cut-offs and optimum levels and utilizing both the conventional dot scan and serial profiles for interpretation. While the area scan is useful for the general organ outline, the serial profiles recorded at the time of the dot scan allow a more accurate statistical analysis of any given area for differentiation of deviation from homogeneous distribution. Since the multiple juxtaposed profiles contain all the information in a convenient visual form, it is possible that this technique may supplant our present method. ■