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FOOTNOTE

* Proctor & Gamble by courtesy of Byk-Mallinckrodt, one vial contained 3.0 mg of HMDP and 0.24 mg of $SnCl_2$, five patients per vial, 10.8 mCi (400 MBQ) per patient.

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Reply

We can indeed welcome the additional data provided by Drs. Buell, Kirsch, Kleinhans, and Jager comparing Tc-99m hydroxymethylene diphosphonate (HMDP) and Tc-99m methylene diphosphonate (MDP). Since their comparative imaging data were obtained 2 hr following injection, and ours were obtained at 4 hr bone-to-soft tissue ratios are not strictly comparable. Also, we used the entire contents of a single reaction vial for each study rather than "loading" the reaction vial with a large amount of Tc-99m and dispensing several doses from one vial. Whether and how this may influence labeling efficiency or biodistribution is unknown.

Regarding our study, care was taken to prepare all radiopharmaceuticals in a similar manner and the order of administration was randomized.

The effect of incubation time on the biodistribution of MDP, demonstrated by Henkin and associates as well as Buell and associates (*1*,*2*), is of interest and deserves additional study.

We agree with the statement "more work is needed to explain the differences in biokinetics (of the various diphosphonates) at the target rather than solely describe them."

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Tc-99m MDP and Ga-67 Citrate Accumulation in Cutaneous Metastases from Colon Carcinoma

A 58-yr-old male who had undergone resection of an adenocarcinoma of the colon the previous spring, presented at our institution in the fall of 1982 with abdominal discomfort and multiple subcutaneous nodules on the thorax, abdomen, and lower extremities. Biopsy of these nodules revealed adenocarcinoma consistent with the patient's known colonic primary.

Whole-body bone scintigraphy was performed following intravenous injection of 20 mCi of Tc-99m MDP; gallium scintigraphy was performed 48 hr after intravenous injection of 5 mCi of Ga-67 citrate.

Bone imaging demonstrated abnormalities of the thoracolumbar spine and sternum without definite evidence of abnormal soft-tissue accumulation of the tracer in the thorax or abdomen (Figs. 1 and 2). Focal soft-tissue accumulation of the Tc-99m MDP was noted in both lower extremities, and these foci corresponded to the subcutaneous nodules (Fig 3).

On gallium scintigraphy, abnormal soft-tissue accumulation was seen in the left anterior hemithorax (Fig 1). The osseous abnormalities were less clearly appreciated on this study. Initially, no corresponding abnormality was seen on bone scintigraphy, but in retrospect such a focus could have been obscured by underlying rib activity. A solitary focus of abnormal gallium accumulation in the left flank (Fig 2) did not accumulate the bone agent; it was

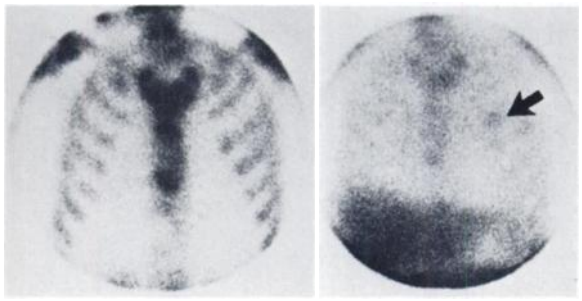

FIG. 1. Anterior thorax: Bone image (left): Irregular uptake of Tc-99m MDP in sternum—no definite abnormal soft-tissue activity. Gallium image (right): Abnormal accumulation of imaging agent in subcutaneous nodule (arrow); irregular uptake in sternum.

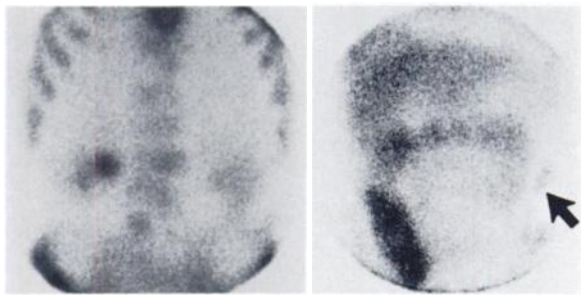

FIG. 2. Anterior abdomen: Bone image (left): No focal soft-tissue abnormality. Gallium Image (right): Abnormal activity in left flank nodule (arrow).

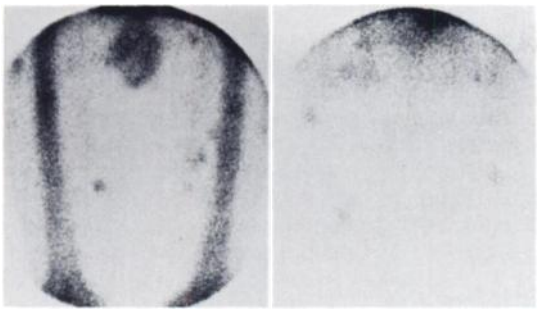

FIG. 3. Anterior thighs: Bone image (left): Multiple foci of soft-tissue accumulation of MDP, corresponding to subcutaneous nodules. Gallium image (right): Several nodules concentrate gallium, some of which also concentrated bone-imaging agent.

not visible even when the MDP images were re-evaluated in retrospect.

Gallium imaging of the lower extremities demonstrated abnormal soft-tissue accumulation in the same nodules that previously concentrated the bone agent (Fig 3).

Extraosseous localization of the technetium phosphate bone imaging agents is known to occur in a variety of soft-tissue lesions, including primary breast carcinoma (*1*), interstitial pulmonary calcification (*2*), extraosseous metastases from osteogenic sarcoma (*3*), and hepatic metastases from colon carcinoma (*4*). The mechanism of localization of these radiopharmaceuticals in such lesions is not completely understood, but there is evidence to suggest that local alterations in mineral metabolism in the lesions account for the soft-tissue accumulation of the bone-imaging agents (*5*).

In the 14 yr since the discovery of Ga-67 accumulation in soft-tissue tumors by Edwards and Hayes (*6*), this agent has become the most widely used tumor-imaging agent in current practice. Multiple studies attest to its usefulness, not only for tumor detection, but for evaluation of inflammatory lesions as well (*7*).

Despite several years of research, the exact mechanism of gallium localization in malignancy and inflammation is still not clear. It has been demonstrated that the intracellular binding of Ga-67 occurs primarily in the lysosomes (*8*). It has also been noted that lactoferrin binds Ga-67, and while little is known about tumor lactoferrin, it is speculated that the affinity of lactoferrin for gallium may play a role in the tumor localization of this imaging agent (*9*).

Gallium imaging has met with great success in a variety of neoplasms, especially the lymphomas and bronchogenic carcinomas, but the reported range of gallium sensitivity in tumors of the gastrointestinal tract is very low, ranging from about 15% to 40% (*10*).

This case not only adds another instance of abnormal soft-tissue accumulation of both the technetium bone-imaging agents and Ga-67 citrate to the literature, but also serves to remind those of us who must interpret these studies of the importance of evaluating the entire image, not just the organ system on which a particular study is focused.

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Polarity in a Hexagonal Collimator

Recently, a strange artifact image of a point source was observed using a low-energy parallel-hole collimator. The collimator holes are hexagonal, therefore, an image of a point source due to septal penetration was expected to be star-shaped, with six projections. However, the image seen had eight projections instead (Fig. 1). The following experiments were carried out to explain the finding, and also to evaluate the effect on the system resolution.

Experiment 1. A small quantity of Tc-99m at the tip of a small syringe was used as a point source. A star image with eight projections was seen (Fig. 1). As expected, these projections became more prominent when the point source was placed farther from

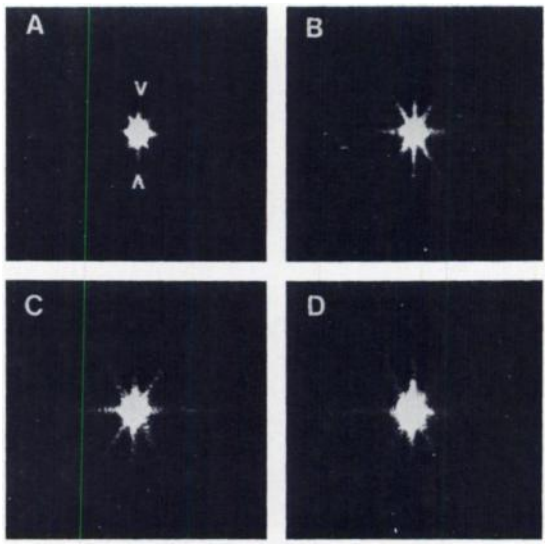

FIG. 1. Shows point source images on hexagonal collimator at distance of 7 cm. Note star-shaped image with eight projections. Arrows indicate two unexpected projections that cause polarity of collimator.