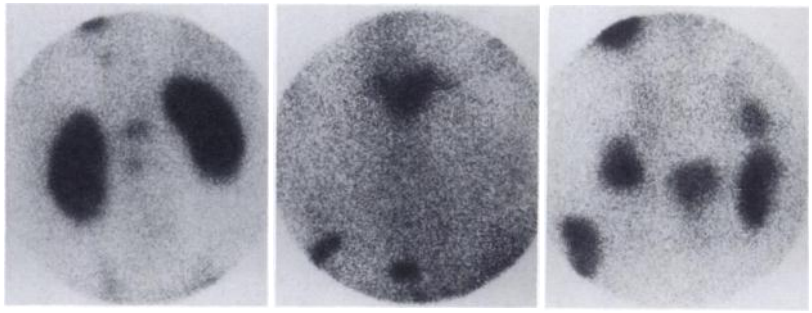

FIG. 2. In search of a primary lesion, a renal study was undertaken using Tc-99m DMSA. Kidneys were essentially normal, but there was unusual accumulation of Tc-99m DMSA in areas coinciding precisely with the Tc-99m MDP skeletal lesions. Posterior image of kidneys taken at 2 hr (left). Posterior image of lower cervical and midthoracic spine (center). Note uptake in left rib. Image of posterior pelvis taken at 7 hr, showing even more Tc-99m DMSA uptake by both acetabuli, right ilium, and intertrochanteric area of left femur (right).

Tc-99m DMSA concentrated in a hypernephroma (*2*). A case of renal tubular adenoma was also reported to concentrate Hg-203 chloromerodrin (*3*). The mechanism of the localization in both of these cases is not clear.

We report here a case of histologically proven metastatic carcinoma of the prostate that took up Tc-99m DMSA in bony metastases. A 76-yr-old man presented with bone pain and diarrhea. Six months earlier he had had a transurethral resection of the prostate for benign prostatic hypertrophy, but microscopy had detected a tiny focal adenocarcinoma felt to be consistent with his age. Serum acid phosphatase was normal both then and on this admission. Bone scintigrams on this admission (Fig. 1) showed evidence of disseminated metastases, mainly in the spine and pelvis. Renal scintigrams were made in search of the primary, using Tc-99m DMSA (Fig. 2). The renal images were found essentially normal, including the oblique views, but there was intense uptake of Tc-99m DMSA (Fig. 2) in the same skeletal lesions that are evident in Fig. 1. The accumulation of Tc-99m DMSA was more intense at 7 hr than at 2 hr, indicating that this was not a simple blood-pool effect. A biopsy of the left femoral intertrochanteric region confirmed metastatic carcinoma from the prostate.

The mechanism of the uptake of Tc-99m DMSA by the metastases is not clear in this case. Neither is the mechanism of Tc-99m DMSA uptake by normal tubular cells clear, but there is evidence pointing to the intracellular localization in the cortical region of proximal and distal tubular cells, probably with binding to metallothionein, a protein binder of heavy metals (*1*,*4*). Subcellular localization studies of Tc-99m DMSA have suggested that these complexes may be bound to cytosol protein and the mitochondria, and to a lesser extent to nuclei and microsomes (*5*). Several possibilities may be considered in attempts to explain Tc-99m DMSA localization in malignant tumors, including nonspecific binding. If the latter turns out to be the case, it might provide a potentially useful test in a search for at least some metastases. Another possibility to be considered is the nature of the cytosol proteins in some of these tumors, which may be similar to those found in renocortical tubules. The metallothionein content of the tumor is also possibly involved in this intense uptake of Tc-99m DMSA. Regarding nonspecific binding, it has been shown in Sprague-Dawley rats that several factors influence Tc-99m DMSA renal uptake, including change of acid-base balance and state of hydration (*6*). It has been suggested that in cases of severe renal impairment a late image may demonstrate Tc-99m DMSA accumulation in hypervascular tissue such as bone or hypervascular tumor (*7*). Our patient, however, had no evidence of renal impairment, with serum creatinine and blood urea nitrogen of the upper limits of normal.

We have presented a case of metastatic adenocarcinoma of the prostate that takes up Tc-99m DMSA intensely in the presence of normal renal function. We have no clear explanation for these findings but have discussed some of the possibilities. We would appreciate hearing of the experiences of others.

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ACKNOWLEDGMENTS

We thank Mr. Robert Chamberlain, Miss Rita Markowski, and Miss Kathy Zuch for their technical assistance and Ms. Jeanne Gagnier for typing.

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Visualization of the Thyroid during Cardiac Imaging

Incidental visualization of the thyroid during gated blood-pool imaging with in-vivo-labeled red blood cells (RBCs) has been observed and reported by several workers in the past 2 yr (*1*,*2*). Several possible explanations have been postulated by these workers, including trapping of pertechnetate by an avid gland, increased thyroid blood pool, and incomplete in vivo RBC labeling.

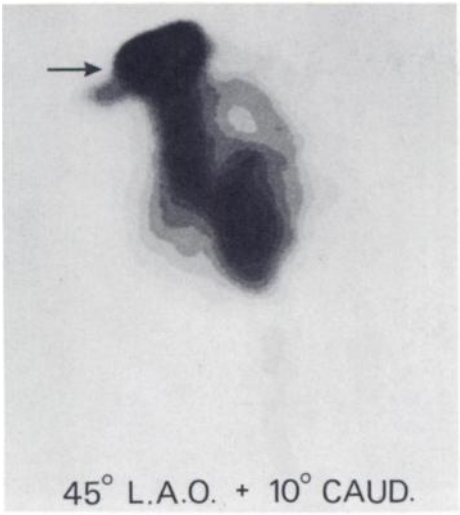

FIG. 1. First-pass frame at 15 sec after initial injection of 10 mCi (370 MBq) of Tc-99m. Thyroid is clearly visualized at top of picture (arrow).

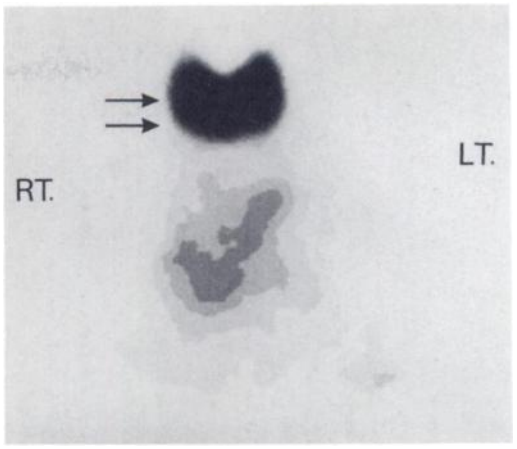

FIG. 2. Anterior view at end of MUGA study (45 min after second injection of 10 μCi (370 MBq) of Tc-99m). Thyroid is still clearly visible (double arrow).

We believe we have found the answer to this phenomenon following our recent imaging of a patient with marked hyperthyroidism.

The patient was a woman aged 45 yr, with a classical history of hyperthyroidism of 3 mo duration. Her hyperthyroid state was proven biochemically—free T_4 index = 411 (normal range 53-144)—and a Tc-99m image of the thyroid showed a diffuse goiter with a 20-min uptake of 33% (normal range 0.7-3.0%). The patient was referred for radionuclide cardiac assessment before treatment, and a combined first-pass and gated study was performed. Stannous pyrophosphate was administered intravenously and, after 20 min, 10 mCi (370 MBq) of [Tc-99m]pertechnetate was injected intravenously using the Oldendorf bolus technique. The patient was imaged in the modified left anterior oblique projection with 10° craniocaudal tilt, and during the first pass of activity, 15 sec after injection, the thyroid was clearly visualized (Fig. 1). A further 10 mCi of [Tc-99m]pertechnetate was then injected and, after 15 min to allow for adequate red-cell labeling, a multigated blood-pool study was performed. Due to the plethora of counts in the thyroid region, a poor cardiac image was obtained. Following shielding of the thyroid with lead, however, the total time taken to obtain a 16-frame gated acquisition for a standard total count of 5600 K was no longer than that needed in routine studies. A further unzoomed static anterior view, acquired at the end of the gated study, revealed no activity in the stomach or salivary glands (Fig. 2).

We believe that this chance observation yields valuable information about the phenomenon of thyroid visualization during gated blood-pool imaging. Since the thyroid is clearly seen during the first pass of Tc-99m through the gland, and as the amount of activity does not diminish following first pass, trapping of pertechnetate must be occurring within the gland. Mere visualization of an enlarged thyroid blood pool does not account for this phenomenon, since more counts are seen within the thyroid than within the heart, despite the fact that the thyroid blood pool must be the smaller. The suggestion that incomplete in vivo red-cell labeling has occurred is not substantiated, since the gated blood-pool study took the normal time to acquire once the thyroid was shielded from the field of view. This confirms that the first-pass trapping of pertechnetate by the avid thyroid gland does not significantly affect subsequent RBC labeling and blood-pool imaging. We therefore suggest that normal in vivo labeling procedures may be used but that the thyroid should be shielded or excluded from the field of view during a gated blood-pool study in a patient with hyperthyroidism.

Further study would be valuable in ascertaining the degree of hyperthyroidism that is necessary to produce this phenomenon, and whether it occurs only in patients with Graves' disease or also in those with a toxic nodular goiter.

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