

ADENOCARCINOMA OF THE LUNG WITH MARKED UPTAKE OF ^{99m}Tc -PERTECHNETATE: CASE REPORT

Dennis D. Patton and David B. Hertsgaard

Vanderbilt University, Nashville, Tennessee, and St. Joseph Hospital, Orange, California

Following biopsy of a hilar mass, a heart scan performed with ^{99m}Tc -pertechnetate showed intense uptake in the mass. The degree of radionuclide concentration suggested that the mass was glandular tissue, most likely an adenoma or adenocarcinoma. Biopsy revealed a mucin-secreting adenocarcinoma. Review of the literature showed examples of active glandular concentration of pertechnetate in the thyroid, gastric mucosa, salivary glands, choroid plexus, nasal mucosa, breast, lacrimal glands, and colon. This case provides an example of reasoning by which the scan interpretation came closer to the actual tissue diagnosis than is usually possible.

A 45-year-old white woman with a 3-month history of cough and weight loss had a large dense left hilar mass with some lung consolidation superior to it (Fig. 1). On the basis of the chest radiographs the mass was thought to be probably malignant. Open surgical biopsy of the left hilar mass resulted in considerable bleeding. During the next few days the

patient became increasingly dyspneic, and a repeat chest radiograph 4 days after biopsy (Fig. 2) revealed a marked change in cardiac shape. A large new density had developed at the cardiac apex; the heart was shifted to the right, but the left hilar mass was unchanged. The differential diagnosis of the heart changes included pericardial effusion and hemopericardium. Immediately after the chest radiograph a cardiac scan was performed with intravenous administration of 15 mCi of ^{99m}Tc -pertechnetate. The radionuclide image showed a large elliptical area of decreased activity (C in Fig. 3) which corresponded to the abnormal contour of the heart on the left. The diagnostic impression was hemopericardium or loculated effusion, probably the former. The heart chambers (H) are shifted to the right, as indicated by the chest roentgenogram. There was a surprising concentration of radioactivity in the left hilar mass (M). Thyroid (T) and stomach (S) were clearly visible.

Received April 22, 1975; revision accepted July 11, 1975.

For reprints contact: Dennis D. Patton, Div. of Nuclear Medicine, Univ. of Arizona Medical Center, Tucson, Ariz. 85724.

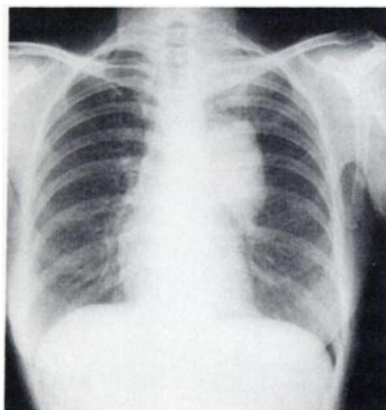


FIG. 1. Chest radiograph taken at admission shows large left hilar mass.



FIG. 2. Chest radiograph following open biopsy of left hilar mass shows marked increase in cardiac size.

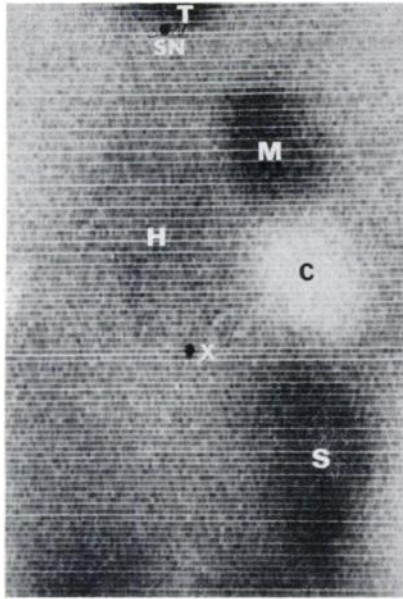


FIG. 3. Heart scan (^{99m}Tc -pertechnetate): T, thyroid; M, hilar mass; H, heart blood pool; C, abnormal zone of decreased uptake; S, stomach; SN, sternal notch; X, xiphoid.

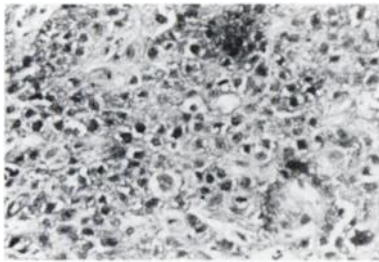


FIG. 4. Mucin stain of tissue from left hilar mass. Mucin is produced in quantity by tumor (poorly differentiated adenocarcinoma).

The avid tumor uptake of pertechnetate generated a great deal of interest. Since the heart did not contain as much activity as the tumor mass, the concentration of radioactivity could not be explained on the basis of hypervascularity alone. The marked uptake could only be explained as an active concentration, and the mass was thought to represent a glandular type of tissue that actively accumulated pertechnetate. Since there was no evidence of primary malignancy elsewhere and since the mass seemed to have arisen in the thorax, it was postulated that the lesion was a primary intrathoracic-glandular-type tumor mass sufficiently differentiated to concentrate pertechnetate.

Biopsy of the lesion was interpreted as a "poorly differentiated adenocarcinoma." A special mucin stain (Fig. 4) showed malignant-appearing cells with no particular degree of organization. Although the adenocarcinoma was poorly differentiated, it was still capable of producing mucin in significant

amounts. The patient died 6 weeks after admission. Autopsy was not obtained.

DISCUSSION

The affinity of ^{99m}Tc -pertechnetate for glandular tissue has been recognized since its first use in medical applications (1). It is avidly trapped by the thyroid gland (2,3); in gastric mucosa, whether in the stomach (4), an intrathoracic gastrogenic cyst (5), or a Meckel's diverticulum (6); in the salivary glands (7); and in the choroid plexus (3,8). Pertechnetate concentrates in the nasal mucosa [although the exact site has not been determined as yet (8)], in active breast tissue [it may be secreted into the milk (9)], and in lacrimal glands (10). The radioisotope is also taken up in the splenic flexure of the colon, probably by concentration in the mucin-secreting goblet cells of that region (11) rather than by intraluminal transit since it appears there within 10–15 min after intravenous injection.

The literature provides few examples of lesions that have been identified as glandular tumors, either primary or metastatic, on the basis of their ability to concentrate the pertechnetate ion. Brain metastases have been reported from the stomach and breast (12,13), and in both cases the unusual brightness of the lesion suggested active accumulation and therefore a glandular type of tissue. Unfortunately, in brain scanning, the correlation between metastatic adenocarcinomas and very active concentration of ^{99m}Tc is not sufficiently consistent to be reliable.

This case was interesting in that it provided an exercise in reasoning, through which the scan interpretation of a mass came closer to the actual tissue diagnosis than is usually possible. It would be worthwhile to find out whether the concentration of pertechnetate by pulmonary lesions carries enough prognostic information to be clinically useful.

ACKNOWLEDGMENT

We are indebted to William H. Hartmann, Chairman of the Department of Pathology at Vanderbilt University Medical Center, for guidance in the use and interpretation of the special stains.

REFERENCES

1. HARPER PV, LATHROP KA, JIMINEZ F, et al: ^{99m}Tc -technetium as a scanning agent. *Radiology* 85: 101–109, 1965
2. ATKINS HL: ^{99m}Tc -technetium uptake and scanning in the evaluation of thyroid function. *Semin Nucl Med* 1: 345–355, 1971
3. ATKINS HL, KLOPPER JF, LAMBRECHT RM, et al: A comparison of technetium-99m and iodine-123 for thyroid imaging. *Am J Roentgenol Radium Ther Nucl Med* 117: 195–201, 1973
4. MIKOLAJKOW A, CHOMICIKI OA: Scanning of the stomach with ^{99m}Tc . *Digestion* 3: 357–367, 1970

5. MARK R, YOUNG L, FERGUSON C, et al: Diagnosis of an intrathoracic gastrogenic cyst using ^{99m}Tc pertechnetate. *Radiology* 109: 137-138, 1973
6. LEONIDAS JC, GERMANN DR: Technetium-99m pertechnetate imaging in diagnosis of Meckel's diverticulum. *Arch Dis Child* 49: 21-26, 1974
7. GROVE AS, DiCHIRO G: Salivary gland scanning with technetium-99m pertechnetate. *Am J Roentgenol Radium Ther Nucl Med* 102: 109-116, 1968
8. MACK JF, WEBBER MM, BENNETT LR: Brain scanning: Normal anatomy with technetium-99m pertechnetate. *J Nucl Med* 7: 633-640, 1966
9. WYBURN JR: Human breast milk excretion of radio-

nuclides following administration of radiopharmaceuticals. *J Nucl Med* 14: 115-117, 1973

10. O'NAN WW, WIRTSCHAFTER JD, PRESTON DF: Sodium pertechnetate Tc-99m in lacrimal secretion. *Arch Ophthalmol* 91: 187-189, 1974

11. PATTON DD, CRENSHAW RT: Colon scanning with technetium-99m pertechnetate. *J Nucl Med* 8: 394, 1967

12. BEKIER A: Eine selten "heisse" Metastase im Hirnszintigramm. *Fortschr Geb Roentgenstr Nuklearmed* 117: 727, 1972

13. PATTON DD, OAKS WA: Clinical brain scanning. *MEDCOM Famous Teachings in Modern Medicine*. New York, MEDCOM, 1973

Accepted Articles To Appear in Upcoming Issues

Serial Bone Scan Changes in Recurrent Bone Infarction. Accepted 5/6/75.

H. David Greyson and Edward E. Kasses
Osteoblastomas of the Axial Skeleton Shown by Skeletal Scanning (Case Report). Accepted 6/27/75.

Norman L. Martin, David F. Preston, and Ralph G. Robinson
Abnormal Radionuclide Angiogram in Proven Intracranial Fibromuscular Dysplasia (Case Report). Accepted 6/27/75.

P. M. Fitzer and Italo Rinaldi
Displacement of the Spleen in Infected Pancreatic Pseudocyst (Case Report). Accepted 7/3/75.

Roderick W. Grant and Duncan Ackery
Residual Splenic Function in Presence of Thorotrast-Associated Hepatic Tumor (Case Report). Accepted 9/1/75.

Richard P. Spencer, John W. Turner, and Ibrahim B. Syed
False-Negative Chemodectomas (Letter to the Editor). Accepted 9/20/75.

Mohammed Moinuddin and John F. Rockett
Reply. Accepted 9/20/75.

C. D. Russell, H. P. Jander, and E. V. Dubovsky
Breast Scintigraphy with ^{99m}Tc -Pertechnetate and ^{67}Ga -Citrate (Letter to the Editor). Accepted 9/20/75.

G. Hör, P. Heidenreich, H. Kriegel, and H. Langhammer
Reply. Accepted 9/20/75.

Steven D. Richman
Laminar Flow (Letter to the Editor). Accepted 9/20/75.

David A. Krause
Preparation of ^{68}Ga Radiopharmaceuticals (Letter to the Editor). Accepted 9/20/75.

Lelio G. Colombetti
Reply. Accepted 9/20/75.

Donald J. Hnatowich
Comparison of Inulin, Iothalamate, and ^{99m}Tc -DTPA for Measurement of Glomerular Filtration Rate (Concise Communication). Accepted 9/20/75.

Galen L. Barbour, Charles K. Crumb, Charles M. Boyd, Robert D. Reeves, Shiva P. Rastogi, and Rodney M. Patterson
Comparative Evaluation of Renal Transplant Rejection with Radioiodinated Fibrinogen, ^{99m}Tc -Sulfur Colloid, and ^{67}Ga -Citrate. Accepted 9/23/75.

Erica A. George, John E. Codd, William T. Newton, Helmut Hainbach, and Robert M. Donati
Selenium-75-19-Selenocholesterol—A New Adrenal Scanning Agent with High Concentration in the Adrenal Medulla. Accepted 9/24/75.

Sailil D. Sarkar, Rodney D. Ice, William H. Beierwaltes, Satinder P. Gill, Suppiah Balachandran, and Garabed P. Basmadjian
Rat Model for Acute Myocardial Infarction: Application to Technetium-Labeled Glucoheptonate, Tetracycline, and Polyphosphate. Accepted 9/25/75.

Norman Adler, Leopoldo L. Camin, and Peter Shulkin
Differential Diagnosis of Brain Lesions with ^{99m}Tc -Labeled Pharmaceuticals (Letter to the Editor). Accepted 9/26/75.

Peter Josef Ell and Karl Heinz Lotritsch
Reply. Accepted 9/26/75.

Keith C. Fischer
Technetium Labeling of Streptokinase at Low pH (Letter to the Editor). Accepted 9/26/75.

Terence I. Hale
Reply. Accepted 9/26/75.

Bertil Persson
Epidermoid Cyst of the Spleen (Case Report). Accepted 9/26/75.

Felix Garfunkel
Bone Accumulation of ^{99m}Tc -Labeled Leucocytes (Concise Communication). Accepted 10/1/75.

B. A. Bagwe and S. M. Sharma

Jugular Vein Reflux (Letter to the Editor). Accepted 10/8/75.

David B. Hayt and Louis A. Perez
"Ear" Artifact in Brain Scans (Concise Communication). Accepted 10/15/75.

Dennis D. Patton and Daniel L. Brasfield
Distribution and Retention of ^{35}S -Sodium Sulfate in Man. Accepted 10/15/75.

H. W. Woodard, K. S. Pentlow, K. Mayer, J. S. Laughlin, and R. C. Marcove
Inclusion of Physiologic Data into Computerized Nuclear Medicine Dynamic Studies. Accepted 10/22/75.

R. J. Nickles, J. E. Holden, A. J. Kiuru, and R. E. Polcyn
A New 80-Lens Oscilloscope Camera for Routine Dynamic Organ Scintigraphy. Accepted 10/22/75.

Leo V. dos Remedios, Paul M. Weber, and Hal O. Anger
Radiation Dosimetry of ^{204}Bi - and ^{208}Bi -Citrate. Accepted 10/22/75.

Rodney E. Bigler, Gerald A. Russ, and John S. Laughlin
Comparison of ^{99m}Tc and ^{125}I for Thyroid Imaging. Accepted 10/22/75.

John E. Arnold and Steven Pinsky
Localization of Myocardial Disorders Other than Infarction with ^{99m}Tc -Labeled Phosphate Agents. Accepted 10/22/75.

Louis A. Perez, David B. Hayt, and Leonard M. Freeman
Measures of Clinical Efficacy. III. The Value of the Lung Scan in the Evaluation of Young Patients with Pleuritic Chest Pain. Accepted 10/25/75.

Barbara J. McNeil, Samuel J. Hessel, William T. Branch, Lars Bjork, and S. James Adelstein
Gallium-67 Uptake in the Regenerating Rat Liver (Letter to the Editor). Accepted 10/27/75.

Peter A. G. Hammersley and Maureen A. Zivanovic
Technetium-99m-HEDP Concentration in Calcified Myoma (Letter to the Editor). Accepted 10/27/75.

Peter J. Ell, Gerhard Breitfellner, and Manfred Meixner
Bone Scan Patterns of Patients with Diffuse Axial Skeletal Metastatic Carcinoma. Accepted 11/4/75.

Lynn R. Witherspoon, Lawrence Blonde, Stanton E. Shuler, and Donald B. McBurney
Long-Distance Transmission of Digital Scintillation Camera Signals (Concise Communication). Accepted 11/4/75.

Lee W. Stanton, Frank S. Prato, and Norman Aspin
Thyroid Scanning with Gallium-67 and Cesium-131. Accepted 11/4/75.

D. A. Koutras, P. G. Pandos, J. Sfontouris, A. Koukoulommat-Spenza, A. Psarras, and B. Malamos
Rapid Radioimmunoassay of Triiodothyronine on Sephadex G-25 by the Ames Kit (Concise Communication).

P. J. N. Howorth and P. Marsden
Iodine-131 Thyroid Uptakes: Further Comparison of Capsules and Liquid Preparations (Concise Communication). Accepted 11/11/75.

J. P. Green, J. R. Wilcox, J. D. Marriott, S. E. Halpern, and Q. E. Crews
Circulation Clearance Rate of Radioiodine during Fibrinogen Uptake Tests. Accepted 11/11/75.

J. G. Hardy and G. M. Newble
Stasis of ^{111}In -DTPA in the Posterior Fossa in Patients with Cerebellar Degeneration. Accepted 11/11/75.

John Lusins
Lymphangitic Carcinomatosis: Lung Scan Abnormalities. Accepted 11/11/75.

Nathan Green, Leonard Swanson, William Kern, Ralph Homann, Lowell Irwin, and Clarence J. Berne
Tumor Model Studies of ^{131}I -Tetracycline and Other Compounds. Accepted 11/21/75.

Depew M. Chauncey, Samuel E. Halpern, Phillip L. Hagan, and Naomi P. Alazraki
Information, Policies, and Procedures of the American Board of Nuclear Medicine