Photon Deficient Bone Metastasis of Hepatocellular Carcinoma with Avid Gallium-67 Uptake

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While bone metastases producing photon deficient defects on bone scintigraphy have previously been reported, this finding has not been emphasized for hepatocellular carcinoma (HCC). Furthermore, "filling-in" of such photon deficient defects with ^{67}Ga at skeletal sites of metastatic HCC has not been described. In this case report, the combination of a photon deficient defect on bone scintigraphy and avid accumulation of ^{67}Ga in this same area was of value in confirming the diagnosis of metastatic HCC.

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The avidity of gallium-67 (^{67}Ga) for hepatocellular carcinoma (HCC) at its primary site in the liver is well known (*1*). However, although metastases of HCC are present at the time of diagnosis in a large number of patients (*2*), the demonstration of systemic HCC metastases by ^{67}Ga imaging has been reported only for pulmonary involvement (*3*). Furthermore, while the demonstration of photon deficient defects on technetium-99m methylene diphosphonate bone scintigraphy due to various malignancies has already been reported (*4*), this finding has not been emphasized for HCC.

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CASE REPORT

A 38-yr-old male alcoholic was admitted with malaise, anorexia and nausea. The liver was markedly enlarged, firm and mildly tender. Laboratory studies revealed minimal non-specific alterations in liver function tests, and the alpha-fetoprotein determination was normal.

As is shown in Figs. 1 and 2, photon deficient defects in both the liver and the skull subsequently "filled-in" with ^{67}Ga activ-

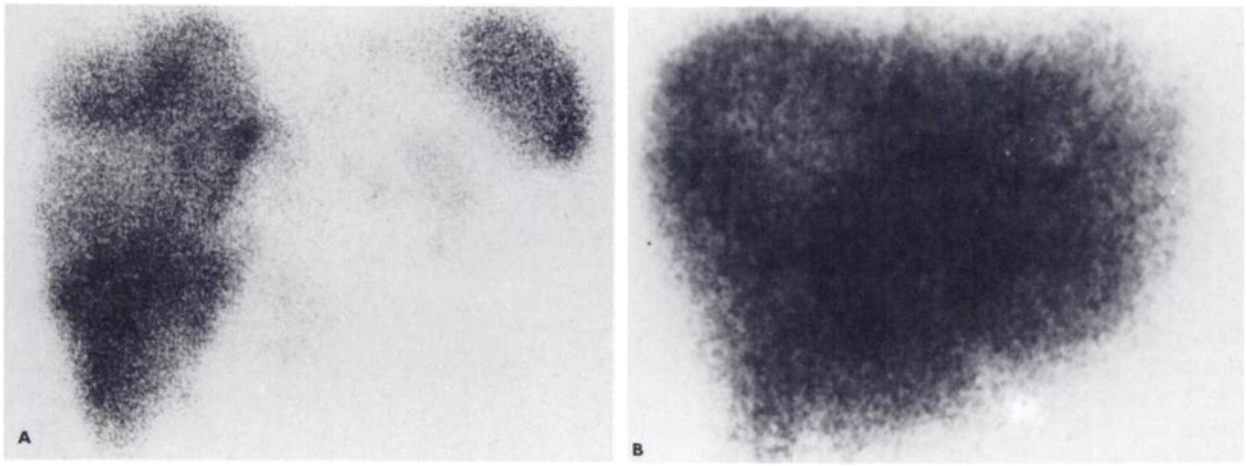

FIGURE 1
Anterior view [^{99m}Tc]SC image (A) demonstrates markedly diminished tracer uptake throughout the left lobe with focal defects in superior and lateral aspects of right lobe. Anterior view gallium image (B) shows uptake in areas that are photon deficient on radiocolloid study

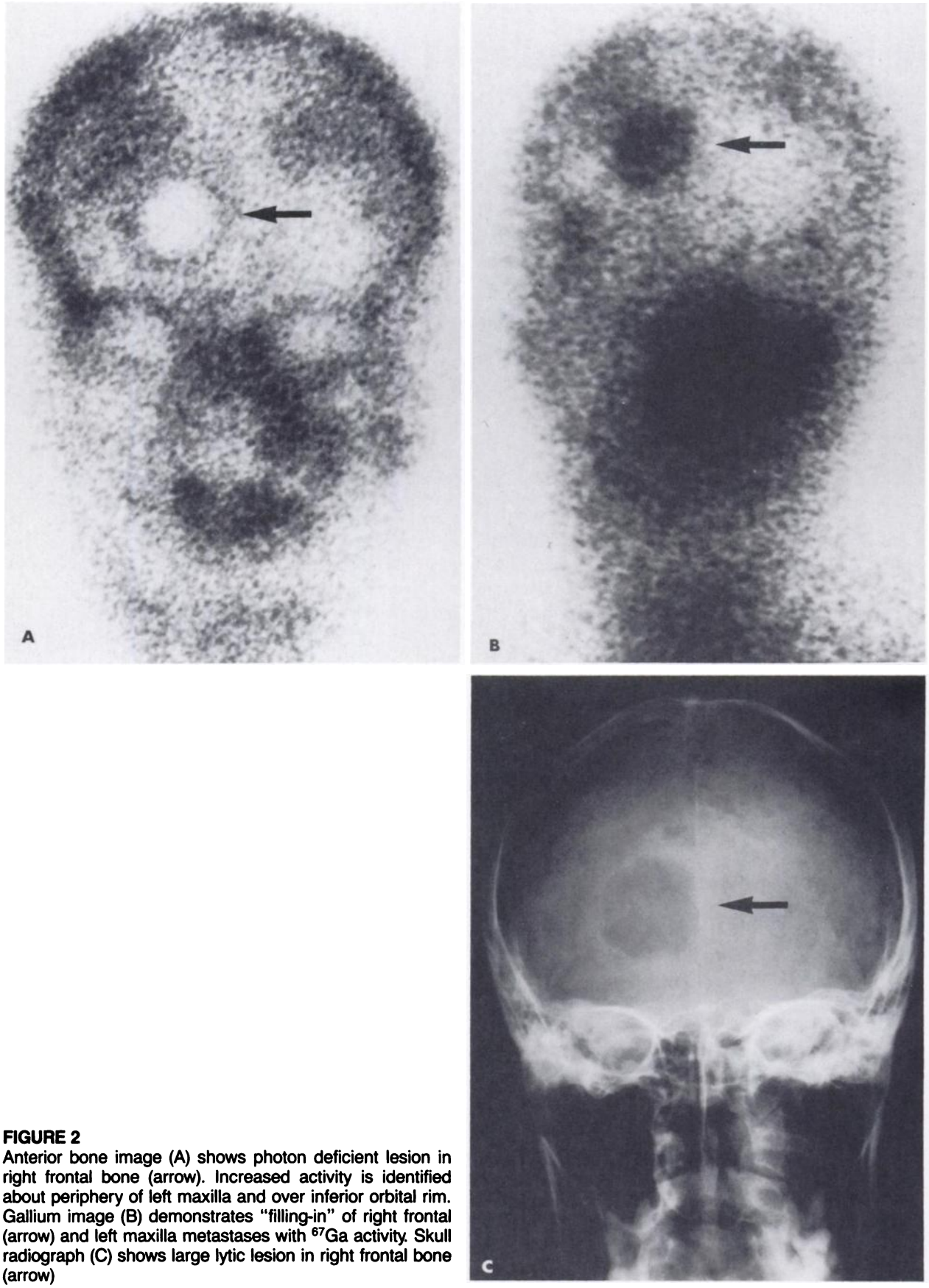

FIGURE 2
Anterior bone image (A) shows photon deficient lesion in right frontal bone (arrow). Increased activity is identified about periphery of left maxilla and over inferior orbital rim. Gallium image (B) demonstrates "filling-in" of right frontal (arrow) and left maxilla metastases with ^{67}Ga activity. Skull radiograph (C) shows large lytic lesion in right frontal bone (arrow)

ity. The combination of a large, distinct photon deficient defect in the skull on bone scintigraphy and intense concentration of ^{67}Ga was of value in confirming the diagnosis of HCC skeletal metastases.

The patient's condition rapidly deteriorated with death occuring on the 26th hospital day. Histopathological examination of biopsy and autopsy specimens from the liver, left maxillary and frontal lesions showed HCC.

DISCUSSION

Although the avidity of hepatomas for ^{67}Ga is well documented (*1,9*), the use of total body ^{67}Ga scintigraphy to screen for metastatic disease has not been emphasized. Metastases, however, occur in approximately half of the cirrhotic patients with HCC. The most common sites of hematogenous spread are the lungs (38.8%) followed by bone (8%), adrenal glands (6.9%), kidneys (3.7%), spleen (2.1%), heart (1.6%) and pancreas (1.1%) (*2*). Bone metastases most frequently involve vertebrae, followed by sternum, ribs and cranium (*5*). Radiographically these lesions are usually osteolytic (*6*), although osteosclerotic lesions may also be seen. Rarely, patients may present with pathological fractures (*7*). Distant metastases are generally associated with an unfavorable prognosis. Although median survival is ~ 4 mo, the subgroup of patients with metastatic disease at the time of diagnosis often survive only a few weeks (*8,9*).

Our case shows avid ^{67}Ga uptake in the large defects demonstrated on ^{99m}Tc sulfur colloid liver scintigraphy, and an abnormal area of increased ^{67}Ga uptake in the left maxillary lesion also identified by prior bone scintigraphy. In addition, ^{67}Ga was also avidly accumulated at the site of the biopsy-proven HCC metastasis in the right frontal region, where bone scintigraphy and radiological examinations had shown a photon deficient and lytic lesion. Since bone metastases from HCC are commonly lytic with little surrounding osteoblastic response, a photon deficient appearance on bone scintigraphy for a large metastatic deposit may prove typical. However, the combination of a photon deficient region on bone scintigraphy and a lytic radiographic lesion is not specific for HCC. Other metastatic or primary malignant bone lesions which may produce this combination of findings include breast carcinoma, lung carcinoma, transitional cell carcinoma, hypernephroma, thyroid carcinoma and multiple myeloma (*6,10*). Nonetheless, for a cirrhotic patient, if ^{67}Ga scintigraphy shows accumulation in a photon deficient ^{99m}Tc sulfur colloid liver defect in addition to avid uptake in a photon deficient and lytic bone lesion, then the diagnosis of HCC with metastases would seem most likely. Therefore, based on experience with this case, we suggest that if ^{67}Ga scintigraphy is used to detect HCC the whole body rather than just the liver should be imaged, to exclude metastatic disease elsewhere.

REFERENCES

1. James O, Wood EJ, Sherlock S: 67 gallium scanning in the diagnosis of liver disease. *Gut* 15:404–414, 1974
2. Schiff E: *Diseases of the Liver,* Fifth ed., Philadelphia, JB Lippincott Company, 1982, pp 1112–1129
3. Winchell HS, Sanchez PD, Watanabe CK, et al: Visualization of tumors in humans using 67 gallium citrate and the Anger whole body scanner, scintillation camera and tomographic scanner. *J Nucl Med* 11:459–466, 1970
4. Datz FL: *Gamuts in Nuclear Medicine.* Norwalk, CT, Appleton-Century-Crofts, 1983, pp 72–74
5. Nakashima, Toshiro, Okduda K, et al: Pathology of hepatocellular carcinoma in Japan. *Cancer* 51:863–877, 1983
6. Golimbu L, Firooznia H, Rafii M: Hepatocellular carcinoma with skeletal metastases. *Radiology* 154:617–618, 1985
7. Shepard AN, Jain AS, Hislop WS: Pathologic fracture, bone metastases and primary hepatocellular carcinoma. *Clin Oncol* 10:181–184, 1984
8. Chlebowski RT, Tong M, Weissman J, et al: Hepatocellular carcinoma: Diagnostic and prognostic features in North America patients. *Cancer* 53:2701–2706, 1984
9. Nagasue N, Yakaya H, Hanada T, et al: The natural history of hepatocellular carcinoma. A study of 100 untreated cases. *Cancer* 54:1461–1465, 1984
10. Kagan AR, Steckel RJ: Lytic spine lesion and cold bone scan. *Am J Roentgenol* 136:129–131, 1981