

고칼슘혈증 환자에서 폐와 위에 나타난 Ga-67 Citrate와 Tc-99m MDP의 섭취 증가 소견

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Ga-67 Citrate and Tc-99m MDP Uptake in the Lung and Stomach Associated with Hypercalcemia

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Ga-67 scintigraphy demonstrated increased uptake in the lungs and stomach in a 26-year-old man with hypercalcemia. A primitive neuroectodermal tumor was confirmed by bone marrow examination. Tc-99m MDP uptake in the same locations as Ga-67 revealed by bone scintigraphy was consistent with metastatic calcification. Although the mechanism of Ga-67 uptake in metastatic calcification is not understood, the presence of an inflammatory process is suggested. (Nucl Med Mol Imaging 2009;43(4):366-367)

Key Words: Hypercalcemia, primitive neuroectodermal tumor, Tc-99m MDP, Ga-67 citrate, bone scintigraphy

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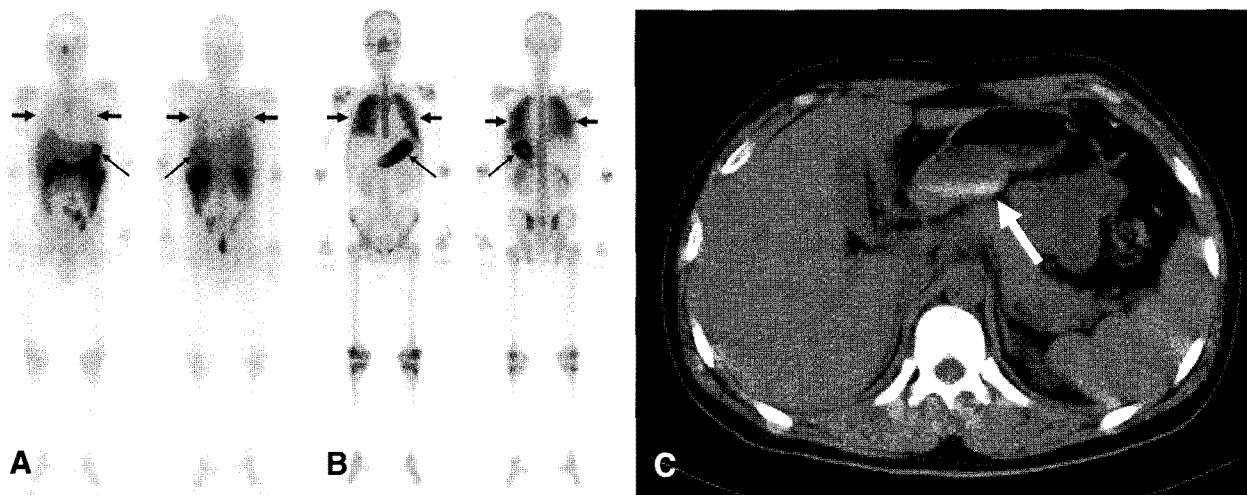


Figure 1. A 26-year-old man presented with a 2-week history of lethargy, fever, and weakness in both lower legs. The laboratory findings showed anemia and acute renal failure with hypercalcemia (total calcium, 18.1 mg/dl; normal range, 8.4~10.2 mg/dl). The phosphate level (6.3 mg/dl; normal range, 2.5~4.5 mg/dl) was also elevated. The parathyroid hormone (0.01 pg/ml; normal range, 11~62 pg/ml) and 1,25(OH)₂ vitamin D₃ levels (3.1 ng/ml; normal range, 10~55 ng/ml) were decreased. Parathyroid hormone-related protein (PTHrP) was elevated (31.2 pmol/l; normal range, <1.3 pmol/l). Results of a subsequent bone marrow examination revealed a primitive neuroectodermal tumor. (A) Anterior and posterior whole body scintigraphy images performed 48 hours after injection of 185 MBq (5 mCi) Ga-67 showed abnormally increased uptake in the lung (thick arrows) and stomach (thin arrows). Three days later, a Tc-99m MDP bone scintigraphy was performed. (B) Anterior and posterior whole body images demonstrated increased uptake in the same sites as those revealed by the Ga-67 scintigraphy. The findings on bone scintigraphy were consistent with metastatic calcifications. Although a plain radiograph and CT of the chest showed no abnormalities, (C) a CT of the abdomen demonstrated calcification in the gastric wall (arrow).

Hypercalcemia is a paraneoplastic syndrome in various type of cancers. PTHrP has been implicated in the pathogenesis of hypercalcemia.¹⁾ When the calcium-phosphorous product in serum exceeds the saturation point (58-60) in severe hypercalcemia,²⁾ metastatic calcification can occur anywhere in the body, although the lung, stomach, and kidneys are the most common sites, reportedly because of the high intracellular pH.³⁾ Calcium deposits likely first consist of amorphous forms, with later transformation into hydroxyapatite.⁴⁾ Tc-99m MDP is known to bind to hydroxyapatite crystal, probably by chemisorption.⁵⁾ Tc-99m MDP bone scintigraphy of metastatic calcification shows diffusely increased uptake in organs, such as lung, stomach, and kidneys. Ga-67 citrate uptake in the same locations as Tc-99m MDP associated with metastatic calcification on bone scintigraphy has been reported.⁶⁻⁹⁾ Although the mechanism of Ga-67 uptake in metastatic calcification is not understood, the presence of an added inflammatory process suggested.⁹⁾ Diffuse lung uptake of Ga-67 is a non-specific abnormality typically associated with infection, active inflammation, or tumor. However, if metastatic calcification is considered a cause of diffuse lung uptake of Ga-67, we could obviate the need for an invasive diagnostic procedure.

References

1. Broadus AE, Mangin M, Ikeda K, Insogna KL, Weir EC, Burtis WJ, et al. Humoral hypercalcemia of cancer. Identification of a novel parathyroid hormone-like peptide. *N Engl J Med* 1988;319:556-63.
2. Hebert L A, Lemann J Jr, Petersen J R, Lennon E J. Studies of the mechanism by which phosphate infusion lowers serum calcium concentration. *J Clin Invest* 1966;45:1886-94.
3. Heck LL. Extra-osseous localization of phosphate bone agents. *Semin Nucl Med* 1980;10:311-3.
4. Alfrey AC, Solomons CC, Ciricillo J, Miller NL. Extrasosseous calcification. Evidence for abnormal pyrophosphate metabolism in uremia. *J Clin Invest* 1976;57:692-9.
5. Fleisch H, Russell RG, Francis MD. Diphosphonates inhibit hydroxyapatite dissolution in vitro and bone resorption in tissue culture and in vivo. *Science* 1969;165:1262-4.
6. Yeo E, Miller JH. Pulmonary gallium-67 uptake in diffuse pulmonary calcinosis. *Pediatr Radiol* 1996;26:825-6.
7. Sullivan WT, Orzel JA, Reed KD, Bower JH. Abnormal lung and liver uptake of gallium-67 and technetium-99m MDP in hypercalcemia of lymphoma with metastatic pulmonary calcification. *Clin Nucl Med* 1986;11:545-8.
8. Castaigne C, Martin P, Blocklet D. Lung, gastric, and soft tissue uptake of Tc-99m MDP and Ga-67 citrate associated with hypercalcemia. *Clin Nucl Med* 2003;28:467-71.
9. Gupta SM, Sziklas JJ, Spencer RP, Rosenberg R. Significance of diffuse pulmonary uptake in radiogallium scans: concise communication. *J Nucl Med* 1980;21:328-32.