

Utility of $^{111}\text{In-Cl}_3$ scintigraphy for differentiating bone marrow reconversion
from bone metastasis with adenocarcinoma of the esophagus.

The type of article: case report

Shoji Okuda

Department of Radiology, Kizawa Memorial Hospital, Gifu, Japan
590 Shimokobi, Kobicho, Minokamo, Gifu, 505-8503, Japan

e-mail: shojiokudaksm@gmail.com

tel: +81-(0)574-25-2181

fax: +81-(0)574-26-2181

Hironori Nishibori

Department of Radiology, Kizawa Memorial Hospital, Gifu, Japan

Hiroaki Hoshi

Department of Radiology, Kizawa Memorial Hospital, Gifu, Japan

The word count: 1150 words

Abstract

Indium chloride ($^{111}\text{In-Cl}_3$) scintigraphy has been used to evaluate various hematological diseases for many years. However, there have been few reports on patients with bone marrow reconversion showing high uptake in $^{111}\text{In-Cl}_3$ scintigraphy. Herein, we report a case of a 68-year-old man with esophageal cancer who underwent $^{18}\text{F-FDG}$ PET/CT for staging of the disease. $^{18}\text{F-FDG}$ PET/CT demonstrated high uptake in the first lumbar vertebral body, which was difficult to distinguish bone metastasis and bone marrow reconversion. $^{111}\text{In-Cl}_3$ scintigraphy demonstrated specific findings with high uptake in the lesion, indicating bone marrow hyperplasia or reconversion.

Keywords $^{111}\text{In-Cl}_3$ scintigraphy • bone marrow reconversion • chemical shift study

Introduction

Indium chloride ($^{111}\text{In-Cl}_3$) scintigraphy is a useful modality for bone marrow imaging and has been used for evaluating various hematological diseases for many years. However, there are few reports in which high uptake helped differentiate bone marrow reconversion from bone metastasis.

This report highlights the utility of $^{111}\text{In-Cl}_3$ scintigraphy for differentiating bone marrow reconversion from bone metastasis.

Case report

A 68-year-old male patient with esophageal cancer presented to our hospital for further evaluation and surgical resection. Findings on physical examination were normal. Laboratory examination showed high blood sugar and anemia (Hb 9.7 mg/ μL) but was negative for tumor markers.

$^{18}\text{F-FDG}$ PET/CT showed a relatively high uptake (SUV_{max}: 3.33 for the early phase and 4.46 for the delayed phase) in the first lumbar vertebral body in addition to slightly high uptake in the primary lesion (chest to lower esophagus). CT showed slightly sclerotic lesion in the first lumbar vertebral body (Fig.1). MRI demonstrated decreased signal intensity in both T1WI and T2WI, which

showed enhancement with gadolinium. The MRI also showed several patchy signal changes in the thoracic vertebral bodies (Fig.2).

It was difficult to distinguish bone metastasis and bone marrow reconversion; therefore, MRI chemical shift study and bone marrow scintigraphy (48 hr after intravenous injection of 74 MBq of $^{111}\text{In-Cl}_3$) were performed. We used chemical shift imaging to assess fatty infiltrates, which would suggest bone marrow reconversion. However, no significant decrease was seen in out-of-phase images (Fig.3). $^{111}\text{In-Cl}_3$ SPECT/CT imaging demonstrated high uptake in the first lumbar vertebral body (Fig.4).

The high uptake of the $^{111}\text{In-Cl}_3$ was suggestive of bone marrow hyperplasia and not bone marrow metastasis. The patient underwent surgical resection for esophageal cancer, and the first lumbar vertebral lesion showed no changes on the follow-up MRI scan which was acquired one year later.

Discussion

In patients with cancer, it is occasionally difficult to differentiate bone

marrow reconversion from bone metastasis. There are reports in which localized bone marrow reconversion sometimes mimics malignant tumors like bone metastasis in both MRI and ^{18}F -FDG PET/CT [1,2]. Several reports recommend MRI chemical shift study[3,4]. However, no significant findings were seen in the present case. The diffusion weighted MRI is potential imaging modality to differentiate malignant from benign lesions. However, studies are controversial and it should be interpreted in line with the routine marrow sequences[3].

After the injection of $^{111}\text{In-Cl}_3$, it binds to transferrin in the same manner as ions and is distributed throughout the bone marrow system. The biological behaviors of indium and iron are similar, and bone marrow $^{111}\text{In-Cl}_3$ uptake is thought to reflect the distribution of erythropoietic marrow in many previous reports. $^{111}\text{In-Cl}_3$ has been clinically used for bone marrow studies. Approximately 30% of the administered tracer is found in the bone marrow, 20% in the liver, 7% in the kidneys, and 1% in the spleen[5].

It is a cyclotron-produced isotope with a half-life of 2.8 days emitting gamma rays with energies of 171 keV (89%) and 245 keV (94%). It decays by electron capture to stable ^{111}Cd [5]. In comparison with the $^{99\text{m}}\text{Tc}$ -labelled colloids,

the specificity to the bone marrow accumulation is thought to be higher but radiation exposure is also higher because of relatively long half-life.

We should keep in mind that $^{111}\text{In-Cl}_3$ may accumulate in tumors[6]. However, to our knowledge, there has been no report concerning bone metastasis in a patient with adenocarcinoma of the esophagus taking up $^{111}\text{In-Cl}_3$.

Conclusion

The imaging of $^{111}\text{In-Cl}_3$ scintigraphy in the present case demonstrated high uptake in the lesion and was effective for differentiating bone marrow reconversion from bone metastasis with adenocarcinoma of the esophagus.

Disclosure

No potential conflict of interest relevant to this article was reported.

References

1. Marcelo BR, Christine G, Max L, Didier C, Bruno CVB Focal Nodular Hyperplasia of the Hematopoietic Marrow Simulating Vertebral Metastasis on FDG Positron Emission Tomography. *AJR* 2003; 180: 669–671.
2. Gary U, Sinchun H Robert AL, Jonathan L, David MP. Musculoskeletal tumors and tumor-like conditions: common and avoidable pitfalls at imaging in patients with known or suspected cancer. *International Orthopaedics (SICOT)* 2013; 37: 871–876.
3. Mohamed RN, Ahmed FE. Magnetic resonance imaging of the spinal marrow: Basic understanding of the normal marrow pattern and its variant. *World J Radiol* 2015; 7: 448–458.
4. Zajick DC, Morrison WB, Schweitzer ME, Parellada JA, Carrino JA. Benign and malignant processes: normal values and differentiation with chemical shift MR imaging in vertebral marrow. *Radiology* 2005; 237: 590–5967.
5. Ali A, Andor WJMG, Hendrikus HB, Rudi A.JOD, Edo V, Riemer HJAS. Radionuclide imaging of bone marrow disorders. *Eur J Nucl Med Mol Imaging*. 2011; 38: 166–178.

6. Kakite S, Tanabe Y, Kinoshita F, Harada H, Ogawa T. Clinical usefulness of In-111 chloride and Tc-99m Sn colloid scintigraphy in the diagnosis of intrathoracic extramedullary hematopoiesis. *Annals of Nuclear Medicine* Vol. 19 No. 4, 317-320, 2005

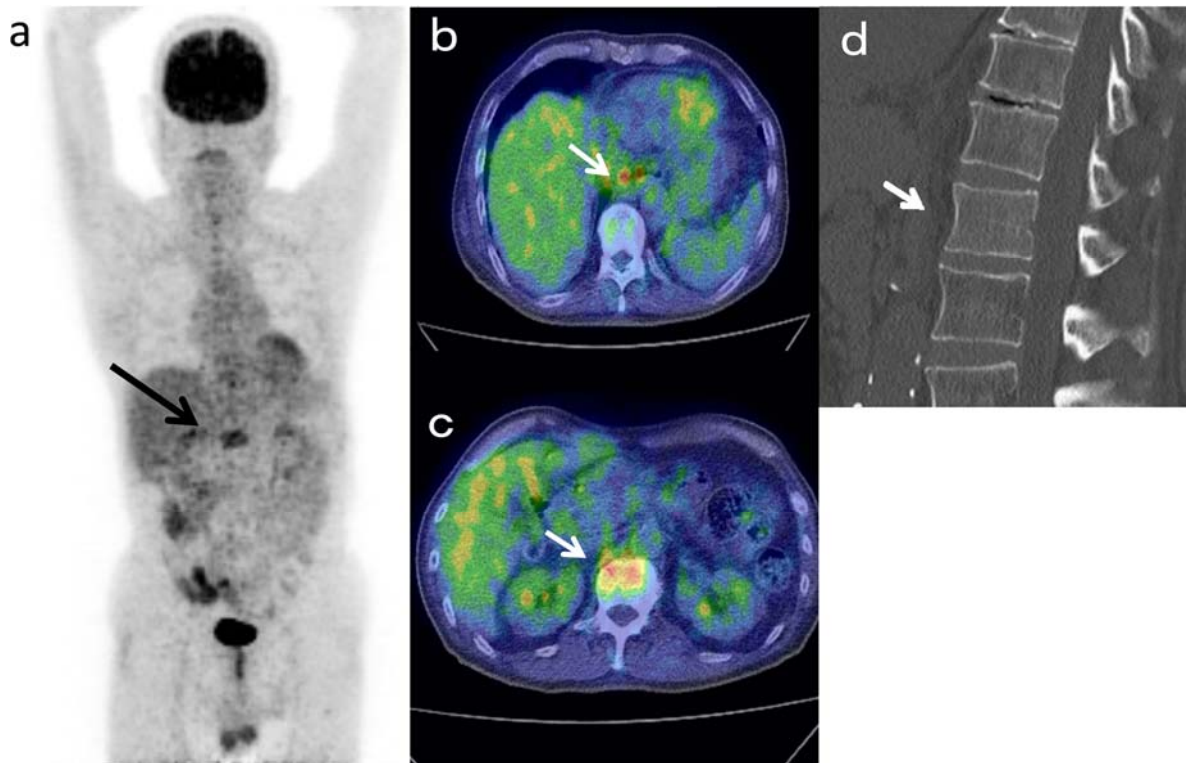


FIGURE.1 ^{18}F -FDG-PET CT showed a relatively high uptake in the L1 vertebral body. (a) MIP image of anterior view, fused axial image of the primary lesion(b) and the L1 vertebral body (c) in delayed phase. (d) Sagittal CT demonstrated slightly sclerotic lesion in the L1 vertebral body.

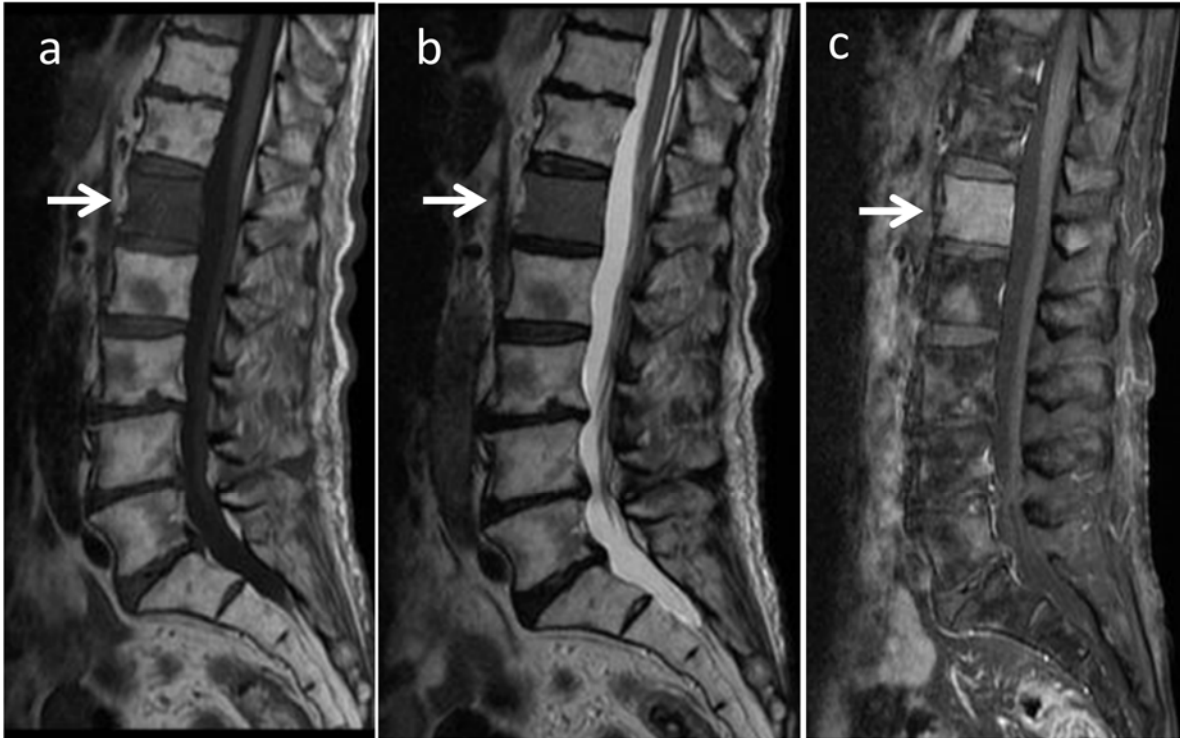


FIGURE.2 MRI demonstrated decreased signal intensity in both T1WI (a) and T2WI (b) in the L1 vertebral body, which showed enhancement (c).

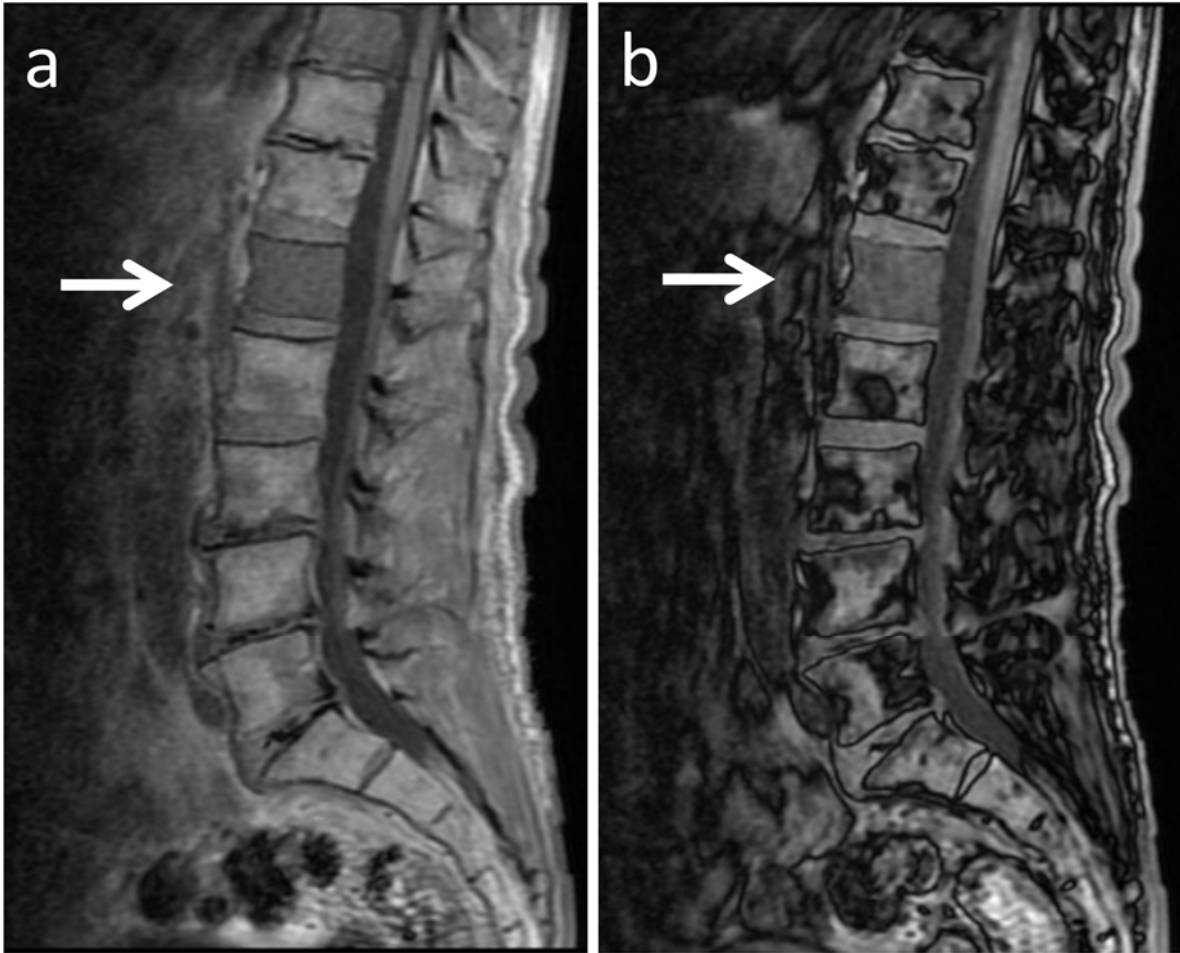


FIGURE.3 (a)in-phase, (b)out-of-phase imaging. No significant decrease was observed in the latter.

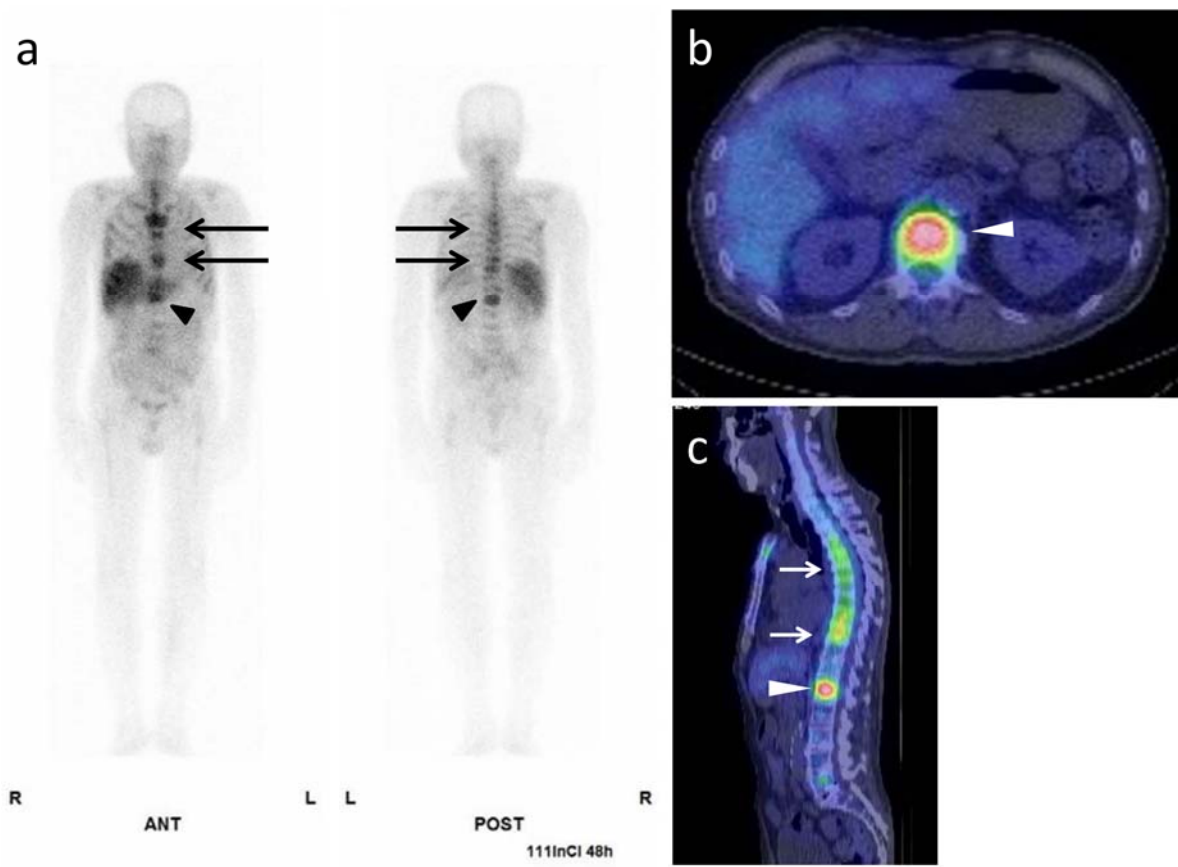


FIGURE.4 $^{111}\text{In-Cl}_3$ SPECT/CT imaging demonstrated high uptake in the L1 vertebral body. (a) MIP image, (b) fused sagittal image, (c) fused axial image.