Tokai J Exp Clin Med., Vol. 26, No. 4-6 , pp.147-151, 2001

A Case of Duodenal Involvement of Multiple Myeloma Imaged by Positron Emission Tomography with ^{18}F-fluorodeoxyglucose

Seiei YASUDA, Tatsuhiko HOSHIKAWA, Naoki YAZAWA, Hiroshi FUKUMITSU, Kenji ISHIKAWA, Toshiyuki SUZUKI, Sotaro SADAHIRO, Yasuhito SHIMAKURA *, Makoto SHIBUYA **, Seiji NASU ***, Tomoo TAJIMA, and Hiroyasu MAKUUCHI

*Department of Surgery, * Internal Medicine, and ** Pathology, Tokai University School of Medicine*
*** *Department of Radiology, Yokohama Stroke and Brain Center*

(Received October 11, 2001; Accepted December 14, 2001)

A 61-year-old woman had been treated for multiple myeloma for 4 years when she developed abdominal pain. Ultrasonography and computed tomography revealed a tumor in the abdomen. Positron emission tomography (PET) with ^{18}F-fluorodeoxyglucose (FDG) showed increased FDG uptake in the tumor. In previous bone marrow lesions, which were in clinical remission after chemotherapy and radiotherapy, abnormal FDG uptake was not recognized. Pathological examination after surgery revealed the tumor to be a plasmacytoma of the duodenum. Plasmacytoma of the duodenum is rare but can be seen during the clinical course of multiple myeloma. A few reports have described FDG PET findings of plasmacytoma. Those previous reports and our present case suggest a potential value of FDG PET in the evaluation of multiple myeloma.

Key words : Multiple myeloma, Plasmacytoma, Duodenal tumor, PET, FDG

INTRODUCTION

Positron emission tomography (PET) with ^{18}F-fluorodeoxyglucose (FDG) is used to evaluate tissue glucose metabolism *in vivo*. Increased glucose metabolism is one of the biochemical properties of malignant tumors, and tumors with increased glucose metabolism show high FDG uptake on PET images. To date, PET imaging has been shown to have clinical value for evaluating various tumors including lung cancer, esophageal cancer, colorectal cancer, lymphoma, melanoma, and head and neck cancers [1]. However, only a few reports have described PET findings of multiple myeloma [2, 7, 8, 10].

We used FDG PET to examine a patient who developed an abdominal tumor during a course of multiple myeloma. Increased FDG uptake was noted in the tumor. Pathological study after surgery revealed the tumor to be a plasmacytoma of the duodenum. Plasmacytoma of the duodenum is rare but can occur during a course of multiple myeloma [5, 12]. Our case suggests a potential value of FDG PET in the evaluation of multiple myeloma. We report our case along with a review of the relevant literature.

CASE REPORT

A 61-year-old woman was diagnosed as having multiple myeloma in April 1997. A biopsy from a lesion of the left humerus showed atypical plasmacytes of immunoglobulin D (IgD) lambda type. She had lesions in the left humerus, sternum, and lumbar spine, and received combination chemotherapy (vincristine, cyclophosphamide, melphalan). After the chemotherapy, the serum level of IgD ($N < 9$ mg/dl) had decreased from 226 mg/dl to 8.8 mg/dl, and complete clinical remission was obtained. In March 1999, however, the serum level of IgD was elevated to 30.3 mg/dl, and the chemotherapy regimen was switched to melphalan and prednisolone. In

Seiei YASUDA, Department of Surgery, Tokai University School of Medicine, Isehara, Kanagawa 259-1193, Japan
Tel: +81-(0)463-93-1121 (ex.2290) FAX: +81-(0)463-95-6491 E-mail: yasuda@is.icc.u-tokai.ac.jp

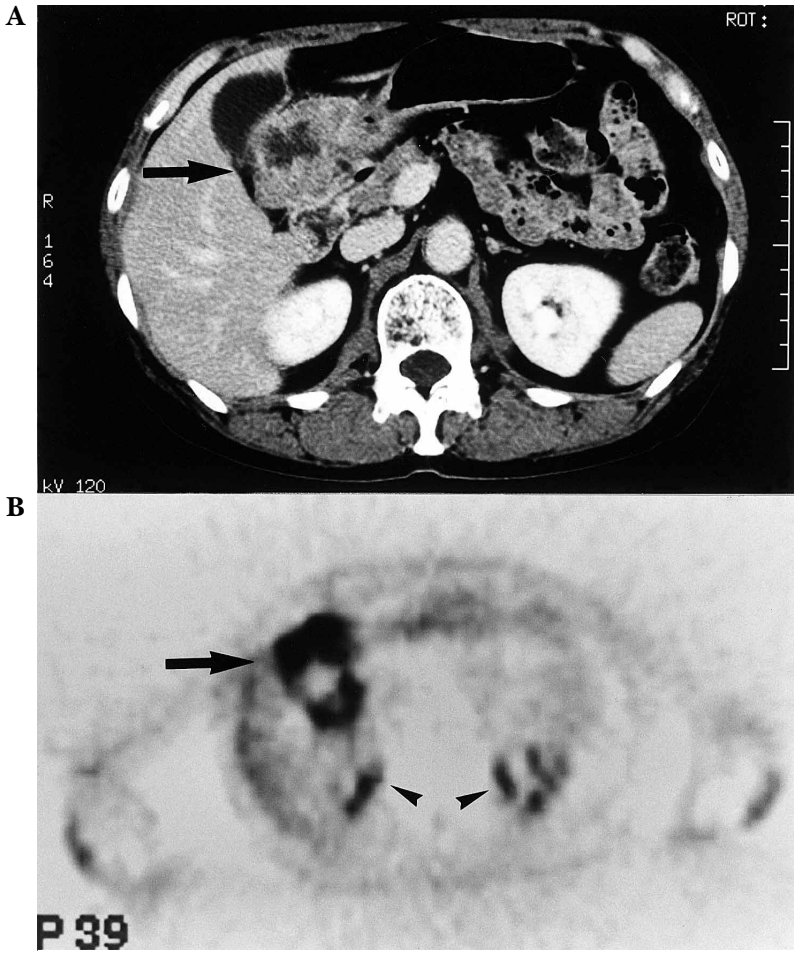

Fig. 1
A: Contrast-enhanced computed tomography of the abdomen shows a large tumor displacing the antrum and duodenum anteriorly (arrow).
B: On an axial image of PET, high FDG accumulation is noted in the tumor (arrow). Arrow heads indicate physiological FDG accumulation in the urine.

July 1999, recurrence was noted in the 5th lumbar spine, and 30 Gy radiation dose was administered to the lesion.

In April 2001, the patient complained of right upper abdominal pain. Ultrasonography and computed tomography (CT) revealed an abdominal tumor (Fig. 1A). On physical examination, mild tenderness was noted, but no mass was palpable. Laboratory test results were as follows: 6200/ μl white blood cell count, and 11.0 g/dl hemoglobin, 13.0×10^4/ μl platelet, 97 mg/dl glucose, 18 mg/dl blood urea nitrogen, 0.6 mg/dl creatinine, 0.4 ($N < 7$ ng/dl) carcinoembryonic antigen, and 5.6 mg/dl IgD levels.

Previous bone scintigraphy (February 1998) and magnetic resonance imaging of the lumbar spine (March 2001) had shown no abnormality. Endoscopy of the esophagus, stomach, and duodenum also detected no abnormality. Angiography of the celiac artery and superior mesenteric artery showed that the main feeding artery of the tumor was the gastroduodenal artery.

From her clinical course, extramedullary involvement of multiple myeloma was strongly suspected, although other benign or malignant tumors could not be ruled out. PET study was performed, and high FDG

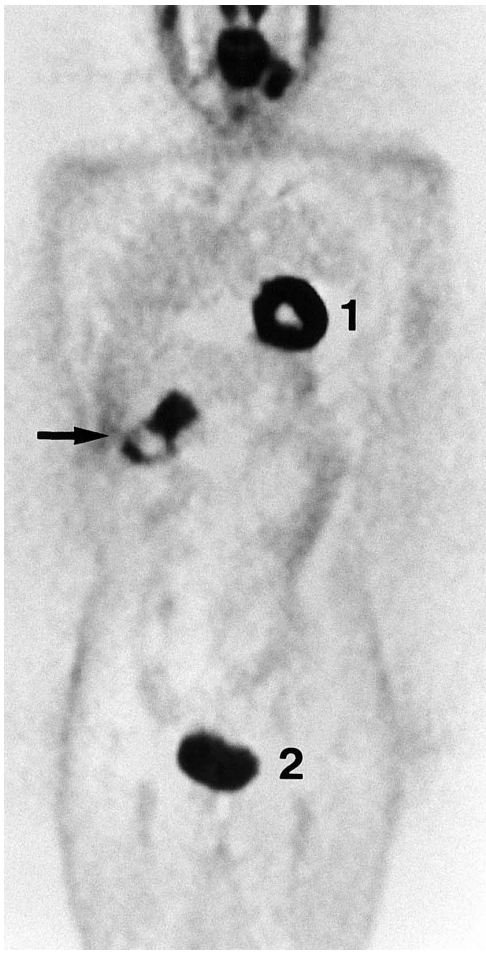

Fig. 2 On a coronal PET image, intense FDG accumulation is noted (arrow). Physiological myocardial FDG uptake (1) and urinary accumulation of FDG (2) are also seen.

uptake was noted in the tumor (Fig. 1B, Fig. 2). No abnormal uptake was recognized at other sites. Surgery was planned under a preoperative diagnosis of extramedullary plasmacytoma.

During surgery, a large tumor was found displacing the transverse colon, stomach, duodenum, and pancreas. The tumor was removed with partial resection of the stomach and duodenum. Macroscopically, the tumor was 65×50 mm in size protruding from the duodenal bulb. Most of the tumor was outside the duodenal wall. An ulceration was noted in the mucosa of the duodenal bulb, indicating direct tumor invasion to the mucosa. Microscopically, the tumor consisted of atypical plasma cells, and the pathological results were the same as those previously obtained from a bone biopsy. Tumor cells were seen in the thickened submucosa of the duodenum. In a small area of the tumor, sparsely interspersed muscle tissues of the duodenal wall were observed (Figs. 3, and 4). These pathological features led us to conclude that the tumor originated in the duodenum.

DISCUSSION

Multiple myeloma is characterized by malignant proliferation of plasma cells, and is called plasmacytoma. Plasmacytomas usually occur in the bone marrow. During the course of multiple myeloma, however, extramedullary involvement is seen in a high percentage of cases. Pasmentier *et al.* [9] described extra-skeletal spread in 65% of patients in a series of 57 autopsies. The most common site of extramedullary involvement of plasmacytoma is the upper respiratory tract, including the oropharynx, nasopharynx, nasal cavities and sinuses, and larynx [6]. Involvement of the gastrointestinal tract is rare [3]. In a review of 36 patients with gastrointestinal plasmacytomas, the stomach was most frequently involved, followed by the jejunum, ileum, colon, rectum, and finally rarely the duodenum [3]. Plasmacytomas were seen during a course of multiple myeloma [5, 12] or as a solitary tumor [11]. Our case is similar to one previously reported case in that the duodenal lesion in that case appeared in a patient who was in clinical remission from multiple myeloma [4].

FDG PET has been successfully applied to imaging tumors with increased glucose metabolism. However, the value of FDG PET in multiple myeloma has not been established since only a few reports have described PET findings of multiple myeloma [2, 7, 8, 10]. In one such case, high FDG uptake was noted in a bone lesion of negative bone scintigraphy [10]. In another case, high FDG uptake was recognized at the sites of active tumor proliferation in bone lesions [2]. In a patient with metastatic cervical lymphadenopathy and unknown primary tumor, a 3-mm plasmacytoma was successfully detected with PET at the base of tongue [8]. In one patient, FDG PET successfully detected early phases of bone marrow involvement whereas skeletal survey and

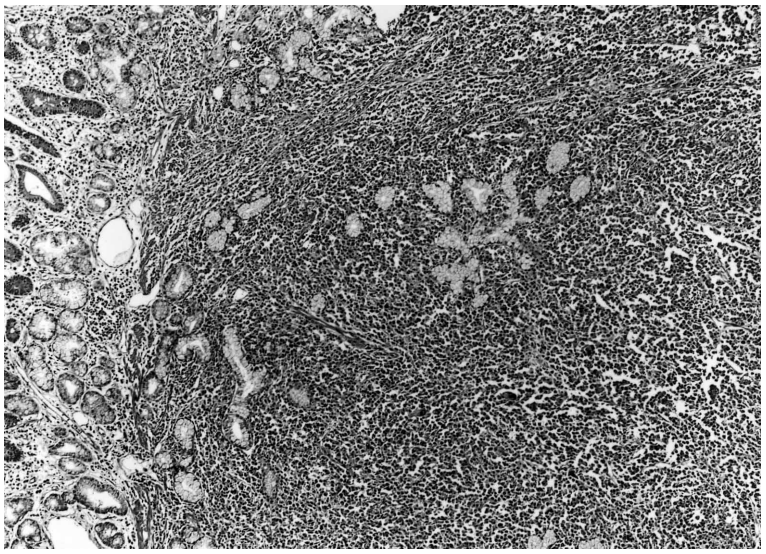

Fig. 3 Microscopically, plasma cell infiltration is seen in the submucosa of the duodenum. Muscle tissues of the duodenum are seen sparsely in the tumor (hematoxylin-eosin, × 60).

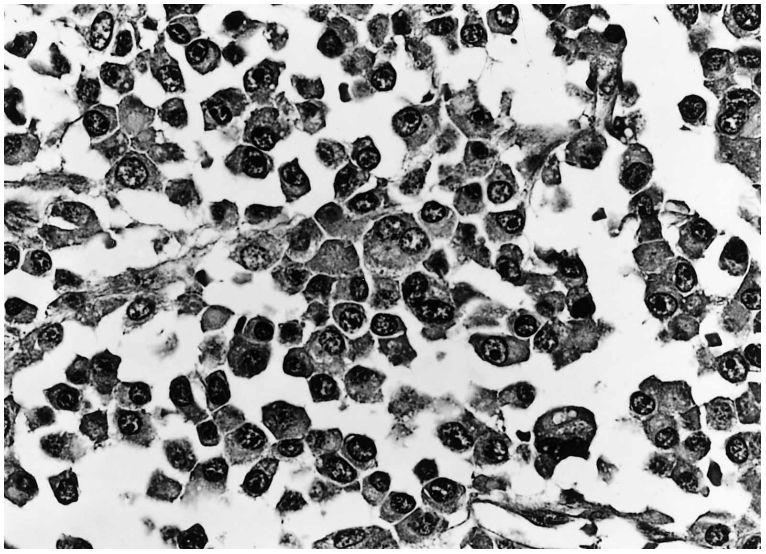

Fig. 4 High power view of the tumor shows infiltration of atypical plasma cells (hematoxylin-eosin, × 600).

bone scintigraphy failed to detect the lesions [7]. We previously experienced a case of plasmacyte-rich chronic maxillary sinusitis in which high FDG uptake was noticed in the lesion [13]. Although the maxillary lesion was benign, the case suggested that plasma cell-rich lesions exhibited glucose hypermetabolism. Perhaps malignant plasma cells exhibit even greater glucose hypermetabolism.

The findings of our present case of plasmacytoma of the duodenum and previous similar reported cases suggest the potential value of FDG PET imaging in the evaluation of multiple myeloma.

REFERENCES

1) Coleman RE, Tesar R, Phelps M.: HCFA and expanded coverage of PET. J Nucl Med 2001; 42: 11N–12N.

2) El-Shirbiny AM, Yeung H, Imbriaco M, Michaeli J, Macapinlac H, Larson SM.: Technetium-99m-MIBI versus fluorine-18-FDG in diffuse multiple myeloma. J Nucl Med 1997; 38: 1208–1210.
3) Goldstein WB, Poker N.: Multiple myeloma involving the gastrointestinal tract. Gastroenterology 1966; 51: 87–93.
4) Gradishar W, Recant W, Shapiro C.: Obstructing plasmacytoma of the duodenum: first manifestation of relapsed multiple myeloma. Am J Gastroenterol 1988; 83: 77–79.
5) Griffiths AP, Shepherd NA, Beddall A, Williams JG.: Gastrointestinal tumor masses due to multiple myeloma: a pathological mimic of malignant lymphoma. Histopathology 1997; 31: 318–323.
6) Grogan TM, Spier CM.: B-cell immunoproliferative disorders, including multiple myeloma and amyloidosis. In: Knowles DM, ed. Neoplastic Hematopathology, 2nd ed. Philadelphia, Lippincot Williams & Wilkins, 2001; 1557–1587.
7) Kato T, Tsukamoto E, Nishioka T, *et al*.: Early detection of bone marrow involvement in extramedullary plasmacytoma by whole-body F-18 FDG positron emission tomography. Clin Nucl Med 2000; 25: 870–873.
8) Kole AC, Nieweg OE, Pruim J, *et al*.: Detection of unknown occult primary tumors using positron emission tomography. Cancer 1998; 82: 1160–1166.
9) Pasmantier MW, Azar HA.: Extraskeletal spread in multiple plasma cell myeloma. Cancer 1969; 23: 167–174.
10) Sasaki M, Ichiya Y, Kuwabara Y, *et al*.: Fluorine-18-fluorodeoxyglucose positron emission tomography in technetium-99m-hydroxymethyolenediphosphate negative bone tomors. J Nucl Med 1993; 34: 288–290.
11) Schoretsanitis G, Livingstone JI, El-Japour JN, Watkins N, Wastell C.: Duodenal plasmacytoma: a rare extramedullary localization simulating carcinoma of the head of the pancreas. Postgrad Med J 1994; 70: 378–379.
12) Siddique I, Papadakis KA, Weber DM, Glober G.: Recurrent bleeding from a duodenal plasmacytoma treated successfully with embolization of the gastroduodenal artery. AJR 1999; 94: 1691–1692.
13) Yasuda S, Shohtsu A, Ide M, Takagi S, Kijima H, Horiuchi M.: Elevated F-18 FDG uptake in plasmacyte-rich chronic maxillary sinusitis. Clin Nucl Med 1998; 23: 176–178.