

Differentiation of Malignant from Benign Pancreatic Mass by Tl-201 Abdominal SPECT

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The aim of the present study was to evaluate the ability of Tl-201 abdominal SPECT to differentiate between chronic focal pancreatitis and pancreatic malignancy. Seventeen patients (12 men, 5 women; mean age, 56 years; 9 pancreatic cancer, 8 chronic pancreatitis) with pancreatic mass were prospectively investigated with Tl-201 abdominal SPECT. In all patients, CT and/or US could not clarify the nature of the pancreatic mass. Focal hot uptake was present in 8 of 9 patients with pancreatic cancer, while it was present in 2 of 8 patients with chronic pancreatitis. Therefore, the sensitivity and specificity of the present study were 89% and 75%, respectively. A significant difference of Tl-201 uptakes was noted between benign and malignant masses ($p < 0.05$).

Therefore, we concluded that Tl-201 abdominal SPECT was a useful test in differentiation of malignant from benign pancreatic mass, especially when the differentiation could not be made by other imaging modalities.

Key Words: Tl-201 SPECT, Pancreatic cancer, Chronic pancreatitis

INTRODUCTION

Although several new imaging modalities have been developed in the imaging diagnosis of pancreatic tumors, the differential diagnosis between focal or diffuse chronic pancreatitis and pancreatic carcinoma is a problem which has remained unsolved. Even ultrasonography(US)- or computed tomography(CT)-guided fine-needle biopsy have shortcomings of sampling errors (Brandt et al., 1993).

Thallium-201 chloride (Tl-201), a myocardial perfusion imaging agent, has been shown to concentrate

in malignant tumors of the lungs, lymphoreticular neoplasia, thyroid, breast, and soft-tissue sarcomas (Tonami et al., 1977; Hisada et al., 1978). Recently, an important role for Tl-201 in imaging viable tumors has been recognized in malignant tumors of the brain, bones, soft tissue sarcomas and breast (Kim et al., 1990; Ramannah et al., 1992; Caluser et al., 1992; Waxman et al., 1993). The aim of the present study was to evaluate the ability of Tl-201 abdominal SPECT to differentiate between chronic focal pancreatitis and pancreatic malignancy. Tl-201 SPECT results were validated with surgery or by clinical follow-up.

MATERIALS AND METHODS

Subjects

Seventeen patients (12 men, 5 women; mean age,

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56 years) with pancreatic mass were prospectively investigated with Tl-201 abdominal SPECT. In all patients, CT and/or US could not clarify the nature of the pancreatic mass. They were referred to the department of nuclear medicine to evaluate the nature of the mass. Informed consent to participate in the study was obtained from all patients.

SPECT imaging

Ten minutes after intravenous injection of Tl-201 (111MBq), scintigraphic data from overnight fasted patients were acquired using a rotating large-field-of-view single-headed gamma camera (Sopha DSX, France). Sixty-four projections over 360 degrees (angular increment : 5.6 degrees) were obtained, in a 64X64 matrices for 20 sec per image. Filtered back

projection was performed with a Hamming-Hann filter (cut-off frequency : 0.45 Nyquist). An attenuation correction was done using Chang's protocol.

Analysis of image

The hot uptake than surrounding intestinal activity interpreted as a positive uptake by at least two observers (Fig. 1). Disagreement between observers was resolved by consensus. The chi-square test was done for the statistical comparison of Tl-201 uptakes in benign and malignant pancreatic masses.

RESULTS

Surgical or needle biopsy was done in 12 of 17 patients investigated with Tl-201 SPECT. Pancreatic

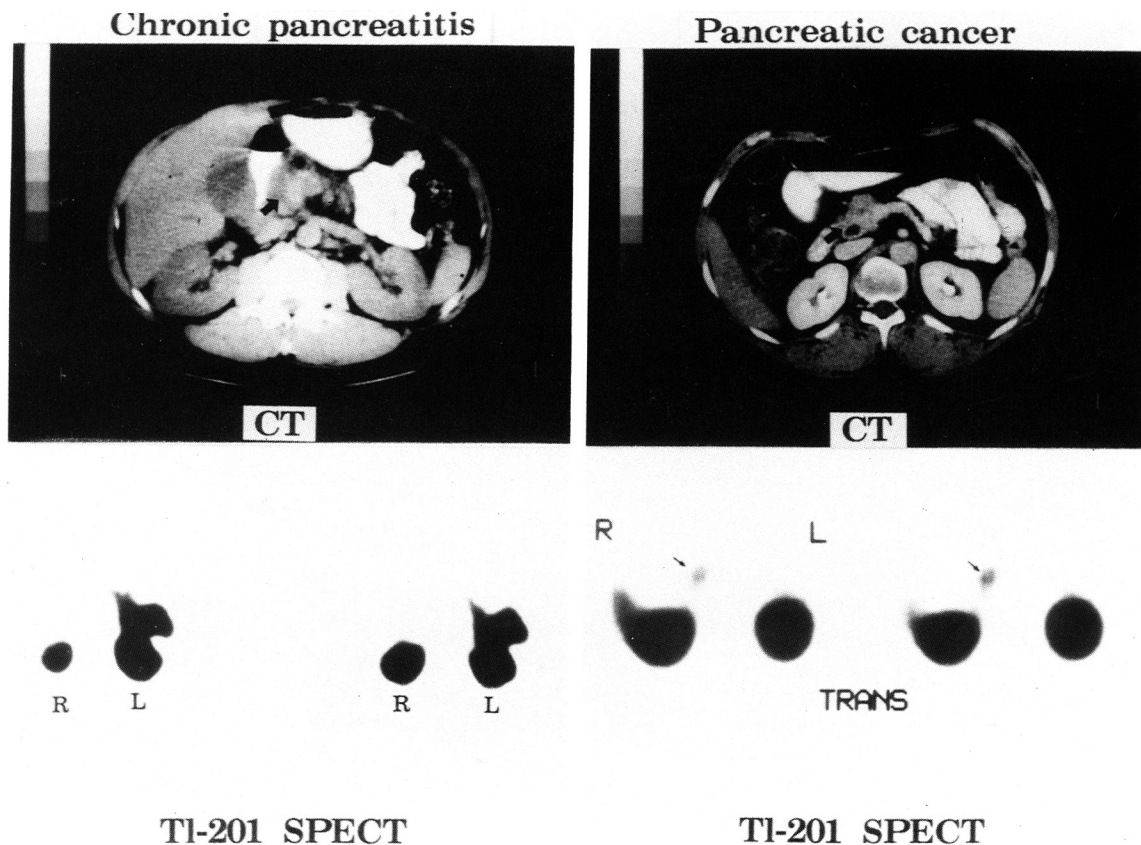


Fig. 1. Abdominal CT and Tl-201 SPECT images of patients with chronic pancreatitis and pancreatic cancer. Pancreatic masses are marked with arrows. CT diagnosis was pancreatic cancer in both patients, however, Tl-201 SPECT showed a clear hot uptake only in the malignant mass.

adenocarcinoma was present in nine patients. In two patients, the preoperative diagnosis of malignant disease could not be confirmed with laparotomy. Resected tissue specimens showed chronic pancreatitis. The five patients who did not undergo surgery were based on clinical follow-up of more than 12 months. Since CT and US findings remained unchanged during the follow-up periods, these patients were considered to have chronic pancreatitis.

All pancreatic tumors was located in the pancreatic head portion. Size of them was varied from 2 cm to 6 cm. Focal hot uptake was present in eight of nine patients with pancreatic cancer, while it was present in two of eight patients with chronic pancreatitis (Table 1). One false negative case was 3.5 cm sized pancreatic head cancer. Two false positive cases were 2.5 and 4.5 cm sized masses of chronic pancreatitis. Therefore, the sensitivity and specificity of the present study were 89% and 75%, respectively. A significant difference was noted between Tl-201 uptakes in benign and malignant masses ($p < 0.05$).

Table 1. Uptake of Tl-201 according to the final diagnosis of pancreatic mass

	Uptake of Tl-201	
	positive	negative
Pancreatic cancer	8	1
Chronic pancreatitis	2	6

DISCUSSION

The present study confirmed the previous reports on the usefulness of Tl-201 abdominal SPECT in the diagnosis of pancreatic cancer (Togawa et al., 1991; Fujita et al., 1993). The sensitivity and specificity of the present study were 89% and 75%, respectively. Although the sensitivity and specificity of endoscopic US, dynamic CT, and MRI have been reported at over 90% (Mueller et al., 1994), a diagnostic problem that has remained unsolved is the differential diagnosis between chronic focal pancreatitis and pancreatic malignancy. Usually, Tl-201 tumor imaging is justified whenever there are clinical problems that cannot be solved accurately by other imaging modalities. These are mainly the following: differentiating benign from malignant lesions, determining the grade of malignancy of the tumor, predicting the response to preopera-

tive treatment, and detecting and differentiating local recurrence from radiation necrosis or fibrosis (Waxman, 1991). The subjects in the present study were referred to the department of nuclear medicine for the differential diagnosis of pancreatic mass, which was not possible with CT or US.

There are several theories for the intratumoral accumulation of Tl-201. Waxman summarized the possible factors influencing Tl-201 uptake by tumor cells: blood flow, viability, tumor type, sodium-potassium ATPase system, co-transport system, calcium ion channel system, vascular immaturity due to leakage, and increased cell membrane permeability (Waxman, 1991). Compared to the conventional tumor imaging agent Ga-67, Tl-201 has several advantages: shorter waiting time for Tl-201 imaging of about 20 min. versus 48 hr. for Ga-67, higher specificity for differentiating tumors from acute inflammatory lesions, not affected by steroid administration, chemotherapy, or radiation therapy (Abdel-Dayem, et al., 1994). Tl-201 also has the limitations of poor resolution, lack of quantitation and attenuation corrections, as well as high intestinal activity which makes the diagnosis of intraabdominal and pelvic tumors difficult. In this study, the latter problem was solved by comparison of SPECT images to those of CT or US. Usually the uptake in the pancreatic mass was clearly visualized and was not interfered with by intestinal activities. Tl-201 uptake in chronic inflammatory lesions such as pulmonary tuberculosis was reported (Kim et al., 1994). Although the mechanism of Tl-201 uptake in the chronic inflammatory lesion is yet to be determined, two false positive uptakes in patients with chronic pancreatitis could be related the similar mechanisms. Positron emission tomography using F-18 FDG, C-11 methionine or Ga-68 EDTA has shown very high accuracy in the diagnosis of many tumors (Strauss et al., 1991; Bares et al., 1994; Inokuma et al., 1994). However, there are limitations for its widespread use. Several reports have shown good correlations between Tl-201 and F-18 FDG (Macapinlac et al., 1992; Hoh, et al., 1992). Accordingly, Tl-201 can substitute for PET in certain clinical situations for those who cannot afford the cost of PET technology.

Therefore, we concluded that Tl-201 abdominal SPECT was a useful test in differentiation of malignant from benign pancreatic mass, especially when the differentiation could not be made by other imaging modalities.

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