INTRODUCTION

Pancreatic cancer (PC) is one of the most fatal cancers. However, patients with small resectable tumors of 2 cm or smaller are known to have better survival rates in PC than patients with larger tumors. Therefore, the detection of small PC may be helpful for better patient outcome. Furthermore, a better understanding of the growth rate of PC is essential to evaluate its natural course, prognosis and to provide recommendations on the optimal screening interval for high-risk patients. The present case reports the growth rate of a small ductal adenocarcinoma of the pancreas from imaging studies in which the tumor volume doubling time (TVDT) was 62 days.

CASE

A 78-year-old man was referred to our gastroenterology clinic for the evaluation of a pancreatic mass revealed on contrast-enhanced computed tomography (CT) scan. The patient, who was a current smoker, was also being followed-up for chronic obstructive lung disease. He underwent abdominal CT 2 years prior and presented no abnormal findings in the pancreas (Fig. 1(A)).

Five months ago, when he was hospitalized with pneumonia at a general hospital, his chest CT incidentally showed dilatation of the pancreatic duct. Subsequently, a pancreatobiliary CT scan was performed, and it showed pancreatic ductal dilatation with no definite mass lesion seen (Fig. 1(B)). Laboratory results for aspartate aminotransferase (AST), alanine aminotransferase (ALT), total bilirubin, amylase and lipase were
normal. The serum carcinoembryonic antigen (CEA) and carbohydrate antigen 19–9 (CA 19–9) levels were 3.8 ng/ml and 36.88 U/ml, respectively. After one month and because the initial diagnosis was uncertain, the physician decided to observe the lesion using magnetic resonance imaging (MRI) which still showed a pancreatic ductal dilatation with no definite tumorous lesion (Fig. 2(A)). Even though no definite mass was noticed after serial imaging testing, considering the high risk of pancreatic adenocarcinoma, the physician recommended surgery. However, the patient refused to be treated due to his general condition, and the lesion was examined 2 months later.

A CT scan taken 2 months later revealed a hypodense mass of 13 mm in diameter located in the pancreatic body, with distal dilatation of the pancreatic duct (Fig. 1(C)). Subsequently, the patient was admitted to our hospital for evaluation and treatment of the pancreatic mass. At the time, the serum CEA and CA 19–9 levels were 9.75 ng/ml and 21.3 U/ml, respectively. Because of the presence of several low attenuating lesions on the liver CT scan, magnetic resonance cholangiopancreatography (MRCP) was requested. MRCP demonstrated that the mass, which had increased in size to 19 mm in diameter with multiple small nodules in the liver, suggested pancreatic metastasis (Fig. 2(B)).

Retrospectively, prior CT scan and MRI images were reviewed by an expert radiologist, who observed a hypodense mass of 9 mm in diameter on the initial CT scan (Fig. 1(B)) and 10 mm on MRI (Fig. 2(A)), that was not visualized on the CT scan from 2 years ago (Fig. 1(A)). Lastly, endoscopic ultrasonography (EUS) guided needle aspiration biopsy was performed and the cytology confirmed invasive ductal adenocarcinoma of the pancreas (Fig. 3).

We recommended diagnostic laparoscopy to verify liver metastasis or peritoneal dissemination. However, the patient refused further treatment and was discharged.
DISCUSSION

The growth rate of PC is important because it could lead to recommendations on the optimal screening interval for high-risk patients to detect small PC.

Since Collins et al. studied cancer growth rate with the assumption that cancer growth is exponentially stable and defined the time needed for the tumor volume to increase two-fold as the "tumor volume doubling time (TVDT)," many articles have been published on the topic such as the growth rate of hepatocellular carcinoma, breast cancer, and primary or metastatic lung cancers.

In our case, although no definite mass was observed at the initial CT at the other general hospital, the pancreatic ductal dilatation was present, and the patient was a current smoker. Therefore, we decided to repeat examination at short-term intervals. The TVDT was calculated using the formula developed by Schwartz. The tumor volume was calculated as follows, the tumor to have a spheroidal shape: $V = \frac{4}{3} \times \pi \times (a/2)^3$ where $a$ indicates the maximum tumor diameter. The TVDT was calculated using the following equation:

$$TVDT = \left( \frac{T_2 - T_1}{\log V_2 - \log V_1} \right) \times \log2$$

where $(T_2 - T_1)$ represents the time interval between 2 measurements and $V_1$ and $V_2$ denote the TVDT at 2 points of measurement. The calculated TVDT of the PC on CT imaging in this case was 62 days. It was shorter than the TVDT reported by previous studies, which were 159±67 (median, 144) days according to Furukawa et al. and 252 days as indicated by Hisa et al. The reason for this difference may be related to the fact that liver metastases have been detected on serial examinations, and advanced tumors, which may have undergone more significant genetic changes, can grow faster. In agreement with our results, Amikura et al. and Nishida et al. reported TVDT of liver metastasis of PC of 99.5 days and 66.5 days, respectively.

In previous studies of other type of cancers, the screening interval was estimated based on the TVDT. For example, Kubota et al. reported the CT screening intervals of 3 months is optimal for detecting small (< 20 mm) HCC nodules in high-risk patients for HCC and Taouli et al. suggested an interval follow-up of 4.5 months based on the mean TVDT (127 days). However, in our literature review, there were no studies regarding the optimal screening interval of PC. Because distant metastases often appear in PC even when the primary lesion is small as in this case, there may be difficulties in clarifying a follow-up interval to detect small PC. Further analysis of more cases on this subject is needed to suggest more accurate recommendations on the ideal screening interval for high-risk patients of PC.

REFERENCES