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RESEARCH REPORT

Influence of the safety and diagnostic accuracy of preoperative endoscopic ultrasound-guided fine-needle aspiration for resectable pancreatic cancer on clinical performance

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Abstract

AIM: To evaluate the safety and diagnostic accuracy of endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) in a cohort of pancreatic cancer patients.

METHODS: Of 213 patients with pancreatic cancer evaluated between April 2007 and August 2011, 82 were thought to have resectable pancreatic cancer on the basis of cross-sectional imaging findings. Of these, 54 underwent EUS-FNA before surgery (FNA+ group) and 28 underwent surgery without preoperative EUS-FNA (FNA- group).

RESULTS: All 54 lesions were visible on EUS, and all 54 attempts at FNA were technically successful. The diagnostic accuracy according to cytology and histology findings was 98.1% (53/54) and 77.8% (42/54), respectively, and the total accuracy was 98.1% (53/54). One patient developed mild pancreatitis after EUS-FNA but was successfully treated by conservative therapy. No severe complications occurred after EUS-FNA. In the FNA+ and FNA- groups, the median relapse-free survival (RFS) was 742 and 265 d, respectively (P = 0.0099), and the median overall survival (OS) was 1042 and 557 d, respectively (P = 0.0071). RFS and OS were therefore not inferior in the FNA+ group. These data indicate that the use of EUS-FNA did not influence RFS or OS, nor did it increase the risk of peritoneal recurrence.

CONCLUSION: In patients with resectable pancreatic cancer, preoperative EUS-FNA is a safe and accurate diagnostic method.

Key words: Pancreatic cancer; Diagnosis; Biopsy; Endoscopic ultrasound-guided fine-needle aspiration; Preoperative diagnosis

Core tip: Whether preoperative endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) is safe and effective for resectable pancreatic cancer has not yet been established. In the present study, patients who underwent EUS-FNA had better relapse-free survival

and overall survival than did those who did not, although it should be noted that more patients in the FNA before surgery group received adjuvant chemotherapy. Our findings suggest that preoperative EUS-FNA does not adversely affect surgery or prognosis in patients with resectable pancreatic cancer. EUS-FNA can also potentially reduce the inappropriate performance of pancreatic surgery by facilitating an accurate diagnosis. These findings are important because the use of preoperative EUS-FNA is becoming more widespread.

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INTRODUCTION

Pancreatic cancer is the fourth and fifth leading cause of cancer-related deaths in the United States and Japan, respectively, with 227000 deaths per year worldwide[1,2]. Patients with unresectable pancreatic cancer have a much worse prognosis than do those with resectable disease[2], making a sensitive screening examination and early diagnosis essential.

Endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) was first reported by Vilmann *et al*[3] in 1992 and has been increasingly used worldwide to diagnose pancreatic tumors, because it can be difficult to distinguish between benign and malignant tumors using conventional imaging modalities. EUS-FNA can be used to make a pathological diagnosis of pancreatic tumors and has several advantages over computed tomography (CT)- or ultrasound (US)-guided biopsy with respect to its success rate and safety[1]. However, whether the use of preoperative EUS-FNA for diagnosing pancreatic tumors is safe, given the risk of complications such as bleeding, perforations, pancreatitis, and tumor seeding, is still a matter of debate[4-13]. Previous studies have found that EUS-FNA used for pancreatic cancer is associated with only a very low risk of complications[13] and that there was no significant increase in pancreatic adenocarcinoma seeding, suggesting that the risk associated with EUS-FNA is outweighed by the likely benefit of making an accurate and early pathological diagnosis[6,8,11,12].

The utility and safety of EUS-FNA for the diagnosis of cancer in the body and tail of the pancreas has also been reported recently[14]. However, the safety and efficacy of preoperative EUS-FNA in diagnosing pancreatic cancer and the long-term prognoses of patients who have undergone preoperative EUS-FNA have not yet been reported[4].

The need for a more accurate diagnostic test is emphasized by cases in which benign pancreatic disease has been misdiagnosed as cancer and resected, increasing the associated risk of morbidity and mortality. Preoperative EUS-FNA may also reduce the misdiagnosis of benign pancreatic diseases[15]. The purpose of this study was to evaluate the efficacy and safety of preoperative EUS-FNA for diagnosing pancreatic cancer and the long-term prognosis of patients after surgery.

MATERIALS AND METHODS

Patients

We evaluated 213 consecutive patients with pancreatic cancer between April 2007 and August 2011. Among them, 91 patients were diagnosed with resectable pancreatic cancer, 9 of whom underwent neoadjuvant chemotherapy or chemoradiotherapy to treat local invasion. After excluding these 9 cases, 82 patients were enrolled: 54 patients underwent EUS-FNA before surgery (FNA+ group) and 28 patients underwent surgery without preoperative EUS-FNA (FNA- group) (Figure 1). We performed EUS-FNA when requested by the surgeon or if patients were hospitalized at our department. The preoperative levels of tumor markers such as carcinoembryonic antigen (CEA), carbohydrate antigen 19-9 (CA19-9), SPan-1, and DU-PAN- 2, were examined in all cases. US or CT was performed in all cases.

EUS-FNA procedure

Preoperative EUS-FNA was performed by a single experienced endoscopist (H.K.) using a curvilinear echoendoscope (GF-UCT240-AL5; Olympus Medical Systems Co., Tokyo, Japan) and 19, 22 and 25-gauge needles (Echotip® ultra; Cook Japan, Tokyo, Japan) under conscious sedation. Briefly, the lesions were visualized by EUS, after which, the needle was advanced into the lesion through the gastric or duodenal wall. The central stylet was removed, and a syringe was attached to the needle hub to apply negative suction pressure. The needle was then moved back and forth within the lesion at least 10 times, it was removed from the lesion through the scope, and the stylet was inserted back into the needle. The specimen obtained by aspiration was placed on a slide, air-dried, alcohol-fixed, and used to prepare smears. These were then stained using the rapid Romanowsky technique allowing them to be quickly interpreted and assessed for sample adequacy (Diff-Quik stain; Kokusai Shiyaku, Kobe, Japan). Diff-Quik staining was performed on all specimens by a cytotechnologist. Cytological and histological diagnoses were made for the specimens obtained by EUS-FNA.

Outcome measurements

The characteristics of the patients, operative procedures, pathological stage according to the Union Internationale Contre le Cancer (UICC) classification, microscopic margin, the use of adjuvant chemotherapy, and the diagnostic accuracy and complications of EUS-FNA were investigated. An EUS-FNA diagnosis was considered to be

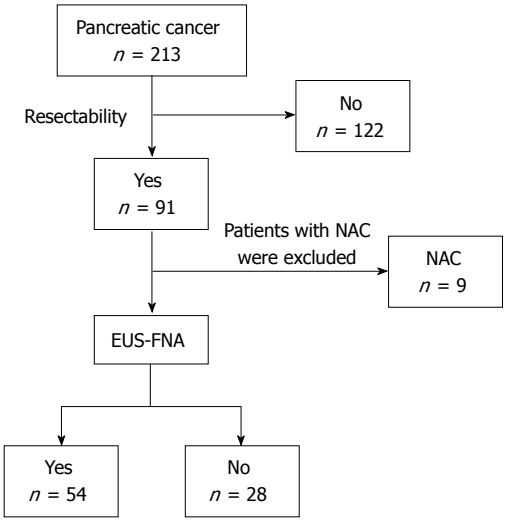

Figure 1 Study participants. This flowchart explains how the final sample size was arrived at and which patients were included. Ninety-one patients with pancreatic cancer underwent radical surgery. Nine patients were treated with chemotherapy or chemoradiotherapy preoperatively and were therefore excluded. The remaining 82 patients were divided into 2 groups. One group consisted of patients who underwent endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) before the operation (FNA+ group; *n* = 54), and the other group included patients who did not undergo EUS-FNA before the operation (FNA- group; *n* = 28). The decision to use preoperative EUS-FNA was made by a surgeon. NAC: Neoadjuvant chemotherapy or chemoradiotherapy; EUS-FNA: Endoscopic ultrasound-guided fine-needle aspiration.

accurate if it matched the pathological diagnosis of the corresponding resected specimens.

Diagnostic accuracy was assessed by comparing biopsy results with those of the final pathological diagnosis. Complications arising from the use of EUS-FNA (as described by Eloubeidi *et al*[5]) were monitored until surgery was performed. Pancreatitis and its severity were defined according to the criteria proposed by Cotton *et al*[16]. We referred to the Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy workshop[17] for the definition of other complications.

All the procedures were performed on an inpatient basis. Our institute's review board approved the study. All patients provided written, informed consent.

Statistical analysis

Statistical analyses were performed using JMP software version 8 (SAS Institute, Cary, NC, United States). Patient characteristics were compared using the Fisher's exact test and chi-square test. The median relapse-free survival (RFS) and overall survival (OS) time were calculated in October 2011 and were estimated using the Kaplan-Meier method and the log-rank test. The Cox proportional hazard model was used to analyze the prognostic factors for OS, including age ($\geq$ 65 years *vs* < 65 years), serum CEA and CA19-9 levels prior to surgery, tumor size (> 20 mm *vs* $\leq$ 20 mm), portal vein invasion (yes *vs* no), pathological stage according to the UICC classification (IIB-4 *vs* 0-IIA), microscopic margin (positive *vs* negative), the use of adjuvant chemotherapy (yes *vs* no), and EUS-FNA before surgery (yes *vs* no). CEA and CA19-9 were categorized into two groups according to the median value of the total study population. All reported *P* values are the results of two-sided tests, with $P < 0.05$ considered statistically significant.

Table 1 Patient characteristics

	FNA+	FNA-	
Number of patients	54	28	
Median age (range), yr	68 (43-82)	70 (45-84)	NS[1]
Gender (M/F)	34/20	16/12	NS[2]
Location (Ph/Pb/Pt)	33/17/4	20/6/2	NS[2]
Median CEA (95%CI), ng/mL	4.89 (3.6-5.3)	5.18 (-0.6-45.1)	NS[1]
Median CA19-9 (95%CI), U/mL	46.1 (71.5-248.9)	96.7 (-158.9-1,661.9)	NS[1]
Median SPan-1 (95%CI), U/mL	33.65 (40.3-191.0)	64.5 (-58.3-945.3)	NS[1]
Median DU-PAN-2 (95%CI), U/mL	129 (215-726)	303 (211-630)	NS[1]

[1]Mann-Whitney *U* test; [2]Fisher's exact test. FNA+: The patient group who underwent endoscopic ultrasound-guided fine-needle aspiration before surgery; FNA-: The patient group who did not undergo endoscopic ultrasound-guided fine-needle aspiration before surgery; NS: No significant difference; Ph: Pancreas head; Pb: Pancreas body; Pt: Pancreas tail; CEA: Carcinoembryonic antigen; CA 19-9: Carbohydrate antigen 19-9.

RESULTS

Patient characteristics and the locations of the lesions are shown in Table 1. Patient characteristics did not differ significantly between the FNA+ and FNA- groups. The preoperative levels of tumor markers such as CEA, CA19-9, SPan-1, and DU-PAN-2, did not differ significantly between the 2 groups (Table 1).

All lesions could be visualized using EUS, and all 54 procedures to puncture the lesions were successful. Among them, 25 procedures were performed via the gastric wall and 29 procedures were performed via the duodenal wall. The mean number of needle passes was 2.6 (range, 1-5). We used a 22-gauge, 25-gauge, and 19-gauge needle in 43, 9, and 5 procedures, respectively (in 4 cases, we used both a 22-gauge and a 25-gauge needle). The mean duration from EUS-FNA to surgery was 22.3 d (range, 5-57 d).

All procedures yielded specimens for diagnosis by cytology or histology. The accuracy of diagnoses based on cytology and histology findings was 98.1% (53/54) and 77.8% (42/54), respectively (Table 2), and the overall accuracy was 98.1% (53/54). One patient developed mild pancreatitis after EUS-FNA, but this was successfully treated by conservative therapy. In that particular case, a 22-mm lesion was found in the head of the pancreas. This was assessed using EUS-FNA with a 22-gauge needle and by making 2 punctures through the duodenal wall.

All patients underwent curative surgical resection. One patient in the FNA+ group was found to have

Table 2 Endoscopic ultrasound-guided fine-needle aspiration procedure and its diagnostic accuracy

Puncture position	Stomach/duodenum	25/29
Needle size	19-gauge	5
	22-gauge	43
	25-gauge	9
Puncture number, range (mean)		1-5 (2.6)
Mean duration from EUS-FNA to surgery (d)		22.3
Accuracy of cytology diagnosis		98.1% (53/54)
Accuracy of histology diagnosis		77.8% (42/54)

EUS-FNA: Endoscopic ultrasound-guided fine-needle aspiration.

Table 3 Operative method, outcome, tumor size, histological type, pathological stage, and adjuvant chemotherapy

	FNA+	FNA-	
Number of patients	54	28	
Operative method (%)			
PD	59.3 (32/54)	75 (21/28)	NS[1]
DP	38.9 (21/54)	17.9 (5/28)	
TP	1.9 (1/54)	3.6 (1/28)	
Partial resection	1.9 (1/54)	3.6 (1/28)	
Outcome (%)			
R0	96.3 (52/54)	96.4 (27/28)	NS[1]
R1	3.7 (2/54)	3.6 (1/28)	
R2	0 (0/54)	0 (0/28)	
Tumor size (mm)	30.0 ± 1.9 SD	29.5 ± 2.5 SD	NS[1]
Histological type			
Adenocarcinoma	53	26	NS[1]
Adenosquamous carcinoma	1	0	
IPMC	0	2	
UICC (%)			
0	0 (0/54)	3.6 (1/28)	NS[1]
Ⅰ A	3.7 (2/54)	7.1 (2/28)	
Ⅰ B	1.9 (1/54)	0 (0/28)	
Ⅱ A	48.1 (26/54)	21.4 (6/28)	
Ⅱ B	38.9 (21/54)	53.6 (15/28)	
Ⅲ	3.7 (2/54)	3.6 (1/28)	
Ⅳ	3.7 (2/54)	10.7 (3/28)	
AC administration (%)	74.1 (40/54)	50 (14/28)	$P < 0.05$[1]

[1]Pearson's χ^2 test. FNA+: The patient group who underwent endoscopic ultrasound-guided fine-needle aspiration before surgery; FNA-: The patient group who did not undergo endoscopic ultrasound-guided fine-needle aspiration before surgery; PD: Pancreatoduodenectomy; DP: Distal pancreatectomy; TP: Total pancreatectomy; SD: Standard deviation; IPMC: Intraductal papillary mucinous carcinoma of the pancreas; UICC: Pathological stage of the Union Internationale Contre le Cancer; AC: Adjuvant chemotherapy.

malignant cells in a peritoneal lavage cytology sample. However, there was no sign of peritoneal dissemination, for example, omental inflammation or a nodule in the peritoneum. Table 3 summarizes the operative methods, surgical outcome, tumor size, histological type of the resected specimen, UICC stage of resected specimens, and the use of adjuvant chemotherapy. We pathologically checked for lymph node metastasis, perineural and lymphovascular invasion, histological type of the lesion, and transfusion rates. No significant differences were found with respect to any of these factors between the 2 groups (data not shown). However, adjuvant chemotherapy was

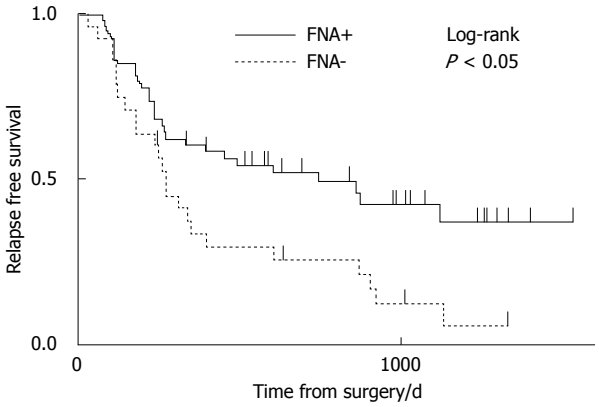

Figure 2 Kaplan-Meier curves for relapse-free survival in pancreatic cancer patients. Kaplan-Meier curves for relapse-free survival in patients who underwent resection for pancreatic cancer. The solid line indicates the Kaplan-Meyer curve for the FNA+ group and the dotted line represents that for the FNA- group. The median relapse-free survival time of the FNA+ and FNA- groups was 742 and 265 d, respectively (Log-rank test; $P < 0.05$). FNA+: The group of patients who underwent endoscopic ultrasound-guided fine-needle aspiration before surgery; FNA-: The group of patients who did not undergo endoscopic ultrasound-guided fine-needle aspiration before surgery.

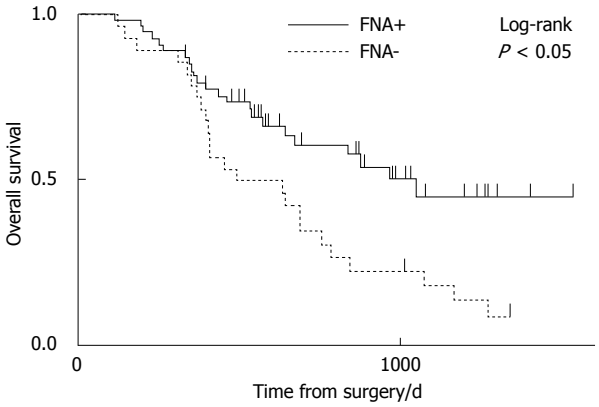

Figure 3 Kaplan-Meier curves for overall survival in pancreatic cancer patients. Kaplan-Meier curves for overall survival in patients who underwent resection for pancreatic cancer. The solid line indicates the Kaplan-Meyer curve for the FNA+ group and the dotted line represents that for the FNA- group. The median survival time of the FNA+ and FNA- groups was 1042 and 557 d, respectively (Log-rank test; $P < 0.05$). FNA+: The group of patients who underwent endoscopic ultrasound-guided fine-needle aspiration before surgery; FNA-: The group of patients who did not undergo endoscopic ultrasound-guided fine-needle aspiration before surgery.

significantly more common among patients in the FNA+ group than among those in the FNA- group ($P < 0.05$).

The median RFS times in the FNA+ and FNA- groups were 742 d (range, 69-1528 d) and 265 d (range, 24-1330 d), respectively ($P < 0.05$) (Figure 2). The median OS times in the FNA+ and FNA- groups were 1042 d (range, 114-1528 d) and 557 d (range, 119-1337 d), respectively ($P < 0.05$) (Figure 3). Recurrent lesions occurred in the liver (14 in the FNA+ group and 11 in the FNA- group), peripancreatic soft tissue (7 in the FNA+ group and 6 in the FNA- group), peritoneum (7 in the FNA+ and 5 in the FNA- group), lymph nodes, lungs, bone, and adrenal body. RFS and OS were also analyzed

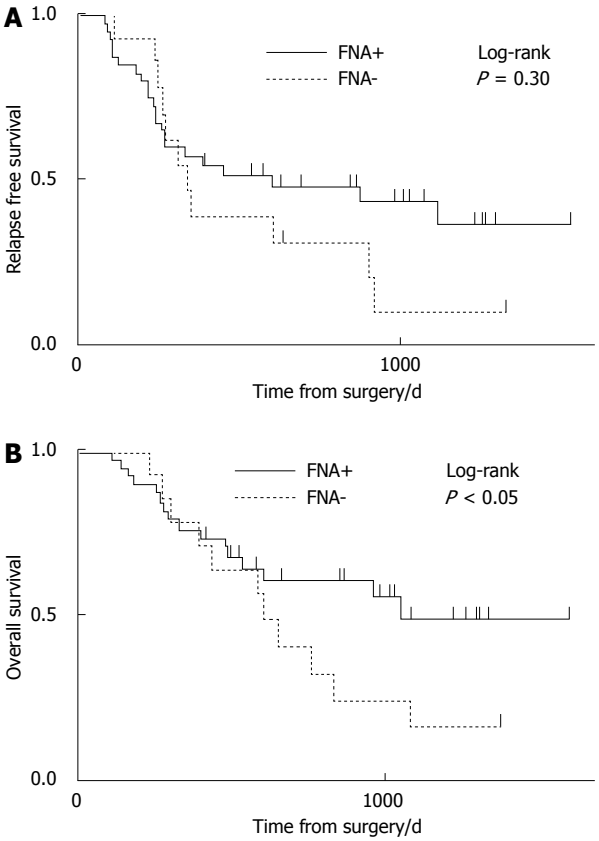

Figure 4 Kaplan-Meier curves for relapse-free survival and overall survival in patients who received adjuvant chemotherapy. A: Kaplan-Meier curves for relapse-free survival in patients who underwent resection for pancreatic cancer and who received adjuvant chemotherapy. The solid line indicates the Kaplan-Meyer curve for the FNA+ group and the dotted line represents that for the FNA- group. The median relapse-free survival time of the FNA+ and FNA- groups was 596 and 332 d, respectively (Log-rank test; $P = 0.30$); B: Kaplan-Meier curves for overall survival in patients who underwent resection for pancreatic cancer and who received adjuvant chemotherapy. The solid line indicates the Kaplan-Meyer curve for the FNA+ group and the dotted line represents that for the FNA- group. The median overall survival time of the FNA+ and FNA- groups was 1042 and 636 d, respectively (Log-rank test; $P < 0.05$). FNA+: The group of patients who underwent endoscopic ultrasound-guided fine-needle aspiration before surgery; FNA-: The group of patients who did not undergo endoscopic ultrasound-guided fine-needle aspiration before surgery.

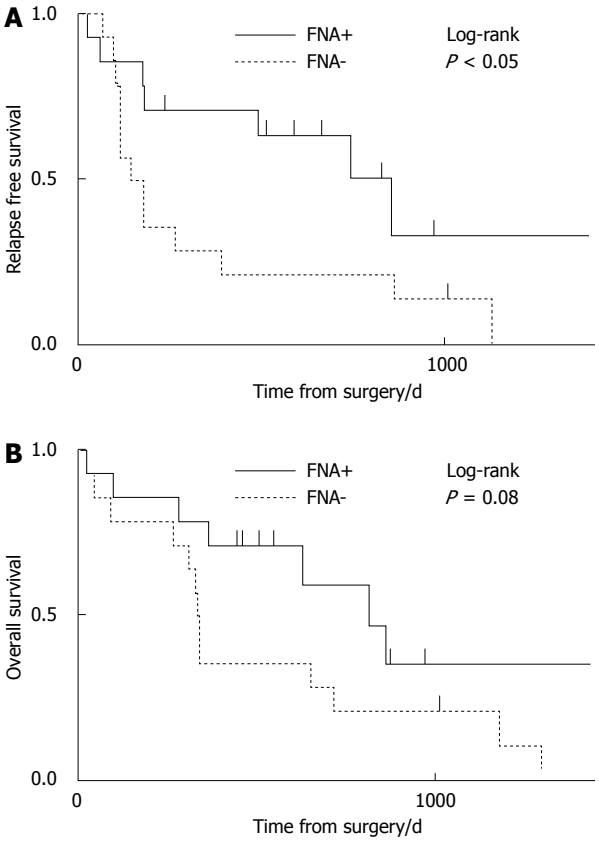

Figure 5 Kaplan-Meier curves for relapse-free survival and overall survival in patients who did not receive adjuvant chemotherapy. A: Kaplan-Meier curves for relapse-free survival in patients who underwent resection for pancreatic cancer without adjuvant chemotherapy. The solid line indicates the Kaplan-Meyer curve for the FNA+ group and the dotted line represents that for the FNA- group. The median relapse-free survival time of the FNA+ and FNA- groups was 852 and 158 d, respectively (Log-rank test; $P = 0.04$); B: Kaplan-Meier curves for overall survival in patients who underwent resection for pancreatic cancer without adjuvant chemotherapy. The solid line indicates the Kaplan-Meyer curve for the FNA+ group and the dotted line represents that for the FNA- group. The median overall survival time of the FNA+ and FNA- groups was 829 and 400 d, respectively (Log-rank test; $P = 0.08$). FNA+: The group of patients who underwent endoscopic ultrasound-guided fine-needle aspiration before surgery; FNA-: The group of patients who did not undergo endoscopic ultrasound-guided fine-needle aspiration before surgery.

according to the administration of adjuvant chemotherapy. The RFS of patients in the FNA+ ($n = 40$) and FNA- ($n = 14$) groups who were treated with adjuvant chemotherapy was 596 d and 332 d, respectively ($P = 0.30$, log-rank test) (Figure 4A). The median OS of patients treated with adjuvant chemotherapy in the FNA+ and FNA- groups was 1042 d and 636 d, respectively ($P < 0.05$, log-rank test) (Figure 4B). For patients who did not receive adjuvant chemotherapy the RFS of the FNA+ ($n = 14$) and FNA- ($n = 14$) groups was 852 d and 158 d, respectively ($P = 0.04$, log-rank test) (Figure 5A). However, the median OS of patients not treated with adjuvant chemotherapy in the FNA+ and FNA- groups was 829 and 400 d, respectively ($P = 0.08$, log-rank test) (Figure 5B). In addition, we performed univariate and multivariate analyses for OS (Table 4) and RFS (Table 5). The hazard ratios of EUS-FNA for OS and RFS were 0.46 ($P < 0.05$) and 0.46 ($P = 0.060$), respectively, indicating that EUS-FNA was not an adverse prognostic factor for pancreatic surgery. These data indicate that the use of EUS-FNA did not influence RFS and OS, nor did it increase the risk of peritoneal recurrence.

DISCUSSION

The sensitivity and specificity of diagnostic tests for pancreatic neoplasms are gradually improving with the technological progress of imaging modalities. However, the diagnostic accuracy of pancreatic neoplasms based on imaging studies alone remains unsatisfactory. Approximately 10% of resected specimens that are preoperatively diagnosed as malignant pancreatic neoplasms[18] are subsequently found to be benign lesions, including focal autoimmune pancreatitis or chronic pancreatitis[19-21]. The

Table 4 Univariate and multivariate analyses of factors affecting overall survival

	Univariate		Multivariate	
	HR (95%CI)	*P* value	HR (95%CI)	*P* value
Age (over 65 years old)	0.95 (0.53-1.73)	0.8640	0.98 (0.48-2.01)	0.9460
CEA ≥ 3.85 ng/mL	1.72 (0.93-3.28)	0.0827	1.49 (0.74-3.07)	0.2650
CA19-9 ≥ 56.8 U/mL	2.61 (1.38-5.15)	0.0030	1.98 (0.92-4.36)	0.0798
Tumor size (> 20 mm)	1.46 (0.78-2.88)	0.2420	3.27 (1.13-10.1)	0.0283
Portal vein invasion	1.88 (1.00-3.49)	0.0487	0.67 (0.28-1.59)	0.3640
UICC ≥ ⅡB	1.57 (0.89-2.88)	0.1210	0.78 (0.37-1.62)	0.5030
R1/R0	2.59 (0.41-8.96)	0.2590	2.29 (0.36-9.38)	0.3460
Adjuvant chemotherapy	0.68 (0.38-1.24)	0.2040	0.46 (0.23-0.93)	0.0312
EUS-FNA	0.46 (0.26-0.83)	0.0093	0.44 (0.20-0.95)	0.0365

UICC: Pathological stage of the Union Internationale Contre le Cancer; EUS-FNA: Endoscopic-ultrasound-guided fine-needle aspiration.

Table 5 Univariate and multivariate analyses of factors affecting relapse-free survival after surgery

	Univariate		Multivariate	
	HR (95%CI)	*P* value	HR (95%CI)	*P* value
Age (over 65 years old)	0.81 (0.47-1.43)	0.8640	0.84 (0.42-1.68)	0.6300
CEA ≥ 3.85 ng/mL	1.28 (0.72-2.28)	0.0827	1.12 (0.57-2.19)	0.7360
CA19-9 ≥ 56.8 U/mL	2.58 (1.43-4.82)	0.0030	2.34 (1.14-4.92)	0.0798
Tumor size (> 20 mm)	1.67 (0.92-2.28)	0.2420	3.31 (1.15-10.3)	0.0254
Portal vein invasion	2.12 (1.18-3.78)	0.0123	0.61 (0.24-1.47)	0.2752
UICC ≥ ⅡB	2.44 (1.39-4.42)	0.0016	1.97 (0.98-4.16)	0.0588
R1/R0	1.98 (0.32-6.54)	0.2590	1.96 (0.29-7.60)	0.4266
Adjuvant chemotherapy	0.78 (0.44-1.40)	0.2040	0.43 (0.22-0.85)	0.0168
EUS-FNA	0.5 (0.29-0.87)	0.0150	0.46 (0.20-1.03)	0.0606

UICC: Pathological stage of the Union Internationale Contre le Cancer; EUS-FNA: Endoscopic ultrasound-guided fine-needle aspiration.

overall mortality rate after pancreatic surgery generally ranges from 0% to 10%[22,23]. Pancreatoduodenectomy is associated with relatively high mortality and morbidity rates, ranging from 0% to 7.1% and 20.8% to 59%, respectively[24], as is distal pancreatectomy, with mortality and morbidity rates ranging from 0% to 6% and 10% to 47%, respectively[25]. Thus, surgery for patients with benign pancreatic lesions must be avoided.

EUS-FNA provides an accurate preoperative diagnosis of pancreatic solid tumors, compared to other imaging modalities, with a diagnostic accuracy[14] of 75%-95%[26-30]. The performance of EUS-FNA depends to a large extent on the ability of the endoscopist, and indeed, the diagnostic accuracy of EUS-FNA for adenocarcinoma of the pancreas has been shown to increase with operator experience[31]. It is noteworthy that the reported specificity of EUS-FNA for pancreatic solid neoplasms is almost 100%[32] and that the associated complication rate is < 1%[13].

Major complications of EUS-FNA are rare, but can include pancreatitis, bleeding, and post-procedural pain[13], although tumor seeding following EUS-FNA has been reported in 7 cases, 4 of which involved adenocarcinoma[6-12]. Preoperative EUS-FNA is avoided by some surgeons and physicians because of the risk of these complications, and it remains controversial as to whether preoperative EUS-FNA for pancreatic solid masses is always necessary[33]. Therefore, we reviewed the prognosis of postsurgical patients with pancreatic cancer and examined whether EUS-FNA adversely affected survival after pancreatic surgery. The results revealed no significant differences in complications or sites of recurrent lesions between patients who underwent FNA before surgery and those who did not.

In our study, patients who underwent EUS-FNA had better RFS and OS than did those who did not, although it should be noted that more patients in the FNA+ group underwent adjuvant chemotherapy. Multivariate analysis revealed that tumor size and adjuvant chemotherapy were both prognostic factors for OS and RFS in this study. EUS-FNA, however, was not a prognostic factor for RFS. Thus, it is possible that patients in the FNA+ group benefited from the chemotherapy administered immediately after surgery. Furthermore, neither RFS nor OS were significantly different between the 2 groups when the administration of adjuvant chemotherapy was accounted for. These data indicate that preoperative EUS-FNA does not adversely affect surgery or prognosis in patients with resectable pancreatic cancer. EUS-FNA can also potentially improve the outcomes of pancreatic surgery by providing a more accurate diagnosis. These findings are important because the use of preoperative EUS-FNA is becoming more widespread.

This study had some limitations. First, it was conducted in a single center with a small sample size, and a population bias is possible because our institute is a pancreatobiliary cancer referral center. Second, this was a retrospective study and some selection bias was observed between the 2 groups as described above. A randomized controlled trial in a multicenter setting is needed to confirm our results.

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COMMENTS

Background

Endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) has been developed as a practical method for obtaining specimens for the definitive diagnosis of pancreatic lesions, with a low risk of adverse events. However, it is not yet fully established whether preoperative EUS-FNA is safe and effective for resectable pancreatic cancer, and there have been very few studies to address this.

Research frontiers

As it is now possible to resect some pancreatic cancers, the key research question is whether preoperative EUS-FNA is associated with an increased risk of adverse surgical events and whether preoperative EUS-FNA affects relapse-free survival (RFS) and overall survival (OS).

Innovations and breakthroughs

The diagnostic accuracy of EUS-FNA based on cytology and histology findings was 98.1% (53/54) and 77.8% (42/54), respectively, and the overall accuracy was 98.1% (53/54). No severe complications occurred after EUS-FNA. In the EUS-FNA and non-EUS-FNA groups, the median RFS was 742 and 265 d, respectively (P = 0.0099), and the median OS was 1042 and 557 d, respectively (P = 0.0071).

Applications

The study results suggest that preoperative EUS-FNA does not adversely affect surgery or prognosis in patients with resectable pancreatic lesions.

Terminology

Relapse-free survival: In cancer cases, the length of time after the end of primary treatment for a cancer for which the patient survives without any signs or symptoms of that cancer. In a clinical trial, measuring relapse-free survival is one way to determine the efficacy of a new treatment.

Peer review

This is a good descriptive study in which preoperative EUS-FNA is shown to be a practical and safe technique for acquiring pancreatic specimens. These results are interesting and suggest that preoperative EUS-FNA does not adversely affect surgery or prognosis in patients with resectable pancreatic lesions.

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