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Diagnostic performance of endoscopic ultrasound-guided fine-needle aspiration in pancreatic lesions

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Abstract. – OBJECTIVE: This aim of this study is to investigate the diagnostic performance of endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) in pancreatic lesions.

PATIENTS AND METHODS: Patients with pancreatic lesions after CT (or MRI) and EUS-FNA examination were retrospectively enrolled. Cytopathological diagnosis of pancreas tissue were obtained by surgery or EUS-FNA. Clinical follow-up results were used as golden standard for diagnosis of pancreatic lesions. Statistical analysis was performed by Student's t-test for continuous data and Fischer exact test for categorical data.

RESULTS: A total of 18 patients with pancreatic lesions were included in this study, 7 of which were diagnosed as benign lesions and 11 were diagnosed as malignant lesions. Endoscopic ultrasonography (ESU) showed that most of the lesions were in pancreatic body (42.9%), followed by pancreatic head, pancreatic tail, and pancreatic neck. The maximum diameter of malignant lesions was larger compared with that of benign and the difference was statistically significant ($p < 0.05$). The sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV) of EUS-FNA for differentiating diagnosis of malignant and benign pancreatic lesions was 83.3%, 80%, 83.3%, 90.9%, and 71.4%, respectively.

CONCLUSIONS: EUS-FNA cytological diagnosis is safe and effective for differentiating diagnosis of malignant and benign pancreatic lesions.

Key Words:
Pancreatic lesions, Endoscopic ultrasonography, Fine-needle aspiration, Cytology.

Introduction

Pancreatic lesions have been increasingly detected in recent years. It is very important to investigate better it for making a correct diagnosis in clinical practice. Traditional imaging technology, such as CT and MRI, is not effective enough to differentiate malignant and benign pancreatic lesions because of the overlapping images. Recently, endoscopic ultrasound (EUS) has become one of the preferred imaging techniques in evaluating pancreatic lesions[1]. Biopsy of pancreatic tissues can be obtained by EUS-guided fine-needle aspiration (EUS-FNA). Cytological evidence based on EUS-FNA demonstrates high diagnostic accuracy for most pancreatic solid lesions compared with CT or MRI[2]. In this investigation, we retrospectively collect the clinical data of patients with pancreatic lesions performed by EUS-FNA examination and analyze the diagnostic value of EUS-FNA cytology in pancreatic lesions.

Patients and Methods

Patients

Patients with pancreatic lesions after CT (or MRI) and EUS-FNA examination were enrolled from September 2012 to June 2017 in Beijing Tiantan Hospital of Capital Medical University. All patients had complete clinical records. The patients were told to withdraw anticoagulants for one week and fast food more than 4-6 h before operation.

Endoscopic ultrasonography EG-3870UTK was applied to EUS guided puncture performance. Avious/preirus independent ultrasonic mainframe host Hitachi (ER Lang Shen Series) was used to observe blood vessels, blood flow, and froze images after the Doppler examination. Special puncture needles were from American Medi-Globe or Wilson-cook Company with outer diameter of 19G/22 G.

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Patients lied in left lateral position with teeth protection. According to the conventional approach, the probe of endoscopy was inserted into the gastric antrum and duodenum. Local of the stomach and duodenum were observed carefully. Then, the endoscopic ultrasound system was opened and converted into line mode. Continuous explorations of the pancreas were performed. For suspected mass under ultrasound, the size, shape, location, echo changes extent of invasion and peripheral lymph node were carefully observed. Fine-needle aspiration biopsy was performed after pancreatic blood flow signal showed by Doppler ultrasound. Blood vessels damage should be avoided during the puncture. Each EUS-FNA was repeated for 2-4 times. About 5 ml exfoliated cells aspirated under subatmospheric pressure were immediately collected and send to Pathological Department. EUS-FNA and cellular pathological analysis were performed by two experienced pathologists.

The final diagnosis was defined by the following criteria: (1) Malignant lesions: malignant cytopathological diagnosis of the pancreatic tissue obtained by surgery or EUS-FNA; malignant progression or metastasis of the lesion after 6-12 months follow-up of clinical symptoms, imaging examination, and tumor markers. (2) Benign lesions: benign cytopathological findings and 6-12 months follow-up with no evident malignant progression or metastasis combined with endoscopic presentation.

Written informed consent was obtained from all patients before enrollment and the study was approved by the Research Ethics Committee of Beijing Tiantan Hospital, Capital Medical School.

Statistical Analysis

Statistical analysis for continuous data was performed by Student's *t*-test and categorical data by Fischer exact test. $p < 0.05$ was defined as statistically significant. EUS-FNA cytopathological performance for diagnosis of pancreatic lesions was showed by sensitivity, specificity, accuracy, positive predictive value (PPV) and negative predictive value (NPV).

Results

Clinical Characteristics of the Patients

A total of 21 patients diagnosed as pancreatic lesions with EUS-FNA data were enrolled in this study and 18 cases were finally confirmed according to the diagnostic criteria. Among the 18 cases, 11 (61.1%) were male and 7 (38.9%) were female and the median age was 61.5 years old (55.3 to 70.5). Chief complaints of the patients were abdominal pain, abdominal distension, jaundice or weight loss at the first visit and the percentage was 57.1%, 9.5%, 14.3%, and 14.3%, respectively (shown in Table I). Mild elevated amylase and lipase were detected in 2 patients after EUS-FNA. Complications such as bleeding, perforation or infections were not found.

Table I. Clinical and EUS characteristics of the patients.

Characteristics	Total	Malignant group	Benign group	*p*-value
Gender (N, Male/Female)	11/7	7/5	4/2	0.261
Age (year, median)	61.5	62.5	59.5	0.325
Symptoms (N)				
With	17	11	6	
Without	1	1	0	
Location of lesions (N)				
Pancreatic head	8	5	3	
Pancreatic body	9	5	4	
Pancreatic neck	1	1	0	
Pancreatic tail	6	2	4	
Uncinate process	1	1	0	
Largest diameter (cm)	3.2 ± 1.1	3.9 ± 1.3	2.7 ± 1.1	0.015
Cystic lesions	2	1	1	
Solid lesion	17	12	5	
Echoic characteristics (N)				
Hyperechoic	4	1	3	
Hypoechoic	10	8	2	
Mixed echoic	4	2	2	
Pancreatic duct dilatation (N)	6	4	2	

EUS Results

Most of the pancreatic lesions located in pancreatic body by EUS and the number is 9 (36.0%), followed by pancreatic head, pancreatic tail, and pancreatic neck. The maximum diameter of malignant lesions under ultrasonic endoscope was larger compared with that of benign ones and the difference was statistically significant ($p < 0.05$). The average diameter of the benign pancreatic masses was 2.7±1.1 cm, with 2 hypoechoic masses, 2 mixed-echoic masses, and 3 hyperechoic masses. Dilation of main pancreatic duct or branch pancreatic duct was detected in 2 lesions. The mean diameter of the malignant lesions is 3.9 ± 1.3 cm, with 8 lesions showing hypoechoic irregular border and 2 lesions showing mixed-echoic. The number of the pancreatic duct dilatation is 4 (Table I).

EUS-FNA Results

A total of 27 fine-needle aspirations were performed in 18 patients. The needle was seen after successful puncture (Figure 1). Malignant lesions were diagnosed by EUS-FNA cytopathology. No definite malignant signs (inflammatory cells or pancreatic epithelium) were identified in benign lesions such as pancreatitis (Figure 2). According to cytopathological results, the number of malignant and benign lesions was 11 and 7. The sensitivity, specificity, accuracy, positive predictive value (PPV), and negative predictive value (NPV) of EUS-FNA for diagnosis of malignant and benign pancreatic lesions is 83.3%, 80%, 83.3%, 90.9%, and 71.4%, respectively.

Discussion

EUS-FNA is the best method to identify early malignant pancreatic lesions. EUS-FNA cytopathology is recommended as the first step for unresectable pancreatic cancer before chemotherapy and/or radiotherapy by the National Comprehensive Cancer Network (NCCN) for about 10 years[3].

The pancreatic lesions can be shown as solid or cystic lesions. Solid lesions include solid tumors and inflammatory masses. Pancreatic cysts are mainly divided into pseudocyst, mucinous cyst neoplasm (MCN), intraductal mucinous neoplasm (IPMN), serous cystic neoplasm (SCN), and solid-pseudopapillary neoplasm (SPN). MCN tends to become cancer. These cystic neoplasms have different treatment principles and prognoses. So it is very important to make the correct diagnosis. Currently, the diagnosis of pancreatic mass is mainly based on CT, MRI, and surface ultrasound. But pathological diagnosis is still the golden standard for the diagnosis of benign or malignant lesions. The endoscopic ultrasound-guided high-frequency probe was used to detect the digestive tract and adjacent organs. For lesions in digestive system, EUS can show

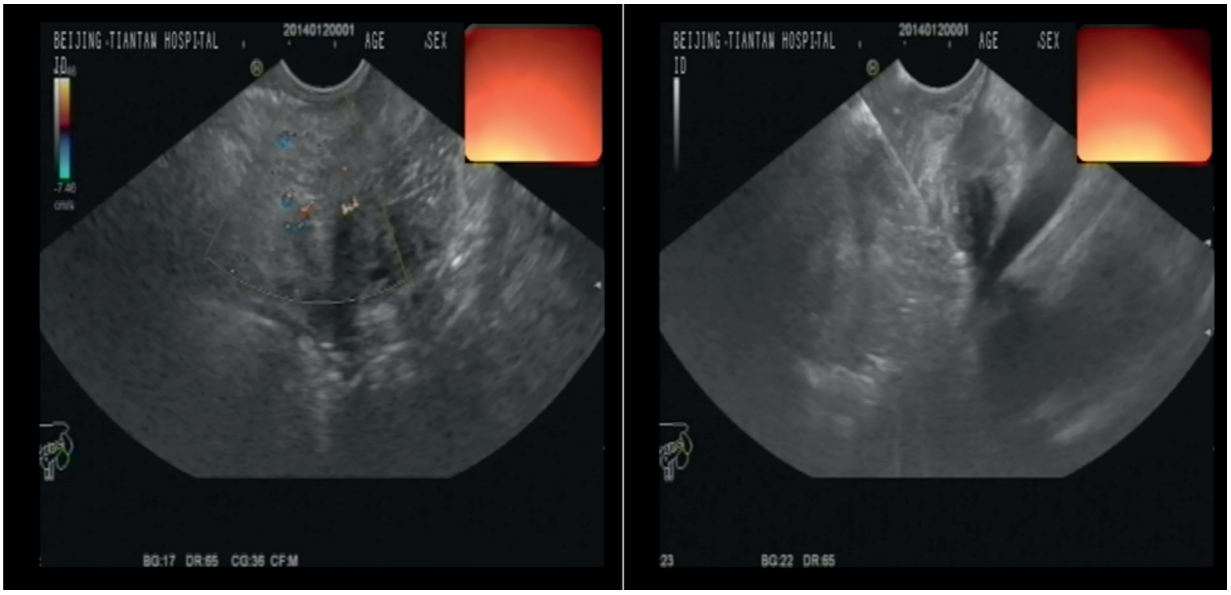

Figure 1. Process of EUS-FNA. ***A,*** Fine-needle aspiration was performed after pancreatic blood flow signal showed by Doppler ultrasound. ***B,*** Fine-needle could be seen after successful puncture.

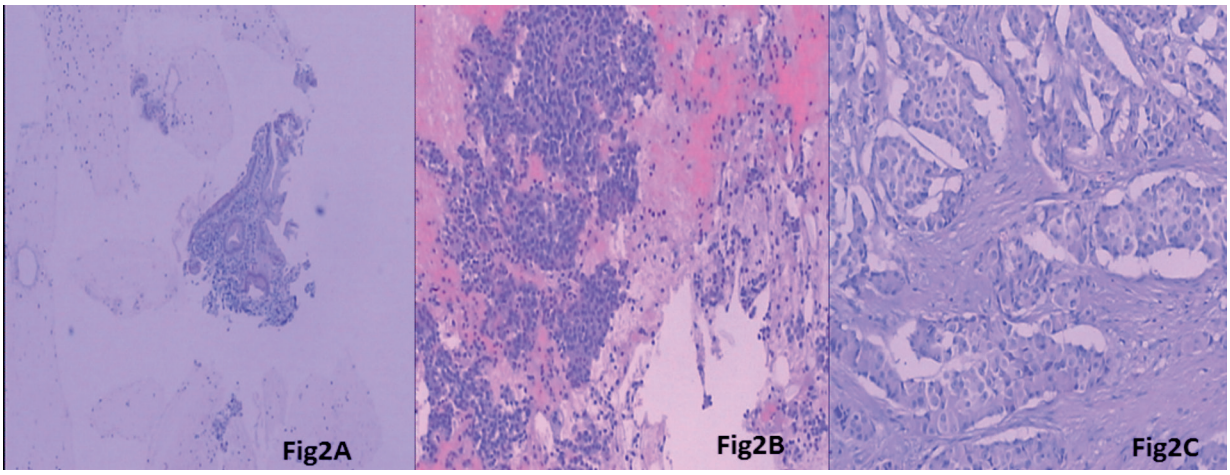

Figure 2. Morphological properties of pancreatitis and pancreatic tumor by EUS-FNA cytopathology (HE). ***A,*** Inflammatory cells and pancreatic epithelium are shown in pancreatitis. ***B,*** Polygonal cells with round or oval nuclei grow solidly with perivascular invasion, finally verified as endocrine tumor by EUS-FNA cytology. ***C,*** Pathological result of surgical resection is paired with Figure B, which is a kind of endocrine tumor.

the size, border, and depth of invasion accurately. EUS-FNA cytopathology is based on the examination of fine-needle biopsy of suspicious lesions and it can provide important information for clinical diagnosis and treatment. Khashab et al[4] found that the sensitivity of endoscopic ultrasonography (or combined with fine-needle aspiration) in diagnosis of pancreatic lesions was 75.6%, which is significantly higher than that of CT and MRI (48.3% and 34%). In addition, endoscopic ultrasonography can effectively predict the possibility of surgery for patients with pancreatic cancer. The benefit of TNM stage is significantly higher than that of CT, which can further improve the patient's survival rate. Compared with surface ultrasound examination, EUS-FNA can effectively avoid the interference of intestinal gas and subcutaneous fat. It can obtain high-resolution ultrasound images and improve the positive diagnosis rate of puncture cytology[5]. A retrospective study[6] found that the positive diagnosis rate of EUS-FNA for advanced pancreatic cancer was 94.6%, which was significantly higher than that of surface ultrasound-guided biopsy (78.6%, $p < 0.05$). Savides et al[7] showed that the accuracy of EUS-FNA in diagnosing malignant pancreatic tumors was 71%. In our study, the diagnostic rate for malignant pancreatic tumors was 80%, indicating that EUS-FNA cytological examination can distinguish benign and malignant pancreatic lesions effectively.

For further treatment of pancreatic lesions, consensus has been reached that resection should be applied if lesions in pancreatic head were highly suspected as malignant[8]. Malignancy must be determined before chemotherapy or radiotherapy. Brush cytology during ERCP should be performed in patients with obstructive jaundice. Most of them have indications for biliary stent placement and EUS-FNA is the necessary diagnostic method[9]. For chronic pancreatitis patients with highly suspected malignant lesions, surgery is recommended. For patients with highly suspected autoimmune pancreatitis, EUS-FNA IgG4 biopsy should be the best choice.

However, EUS-FNA still has some shortcomings. Woolf et al[10] showed that EUS-FNA had a high false negative rate (23%), mainly due to the sampling error.

Conclusions

We suggest that multi-point sampling, cytology of rapid on-site evaluation (ROSE), and detection of K-ras gene mutation should be combined to improve the diagnostic accuracy of EUS-FNA.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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