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Original Article

Clinical Efficacy of Endoscopic Ultrasound-guided Fine Needle Aspiration (EUS-FNA) Performing in Upper Abdomen: A Single Center Experience

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Abstract

Background: **Endoscopic ultrasound with fine needle aspiration (EUS-FNA) is a useful procedure for the evaluation and tissue acquisition of lesions located in organs close to the upper gastrointestinal tract, such as the pancreas, periceliac lymph nodes, aortocaval lymph nodes, left lobe of liver, bile duct, retroperitoneal masses or lesions located in the wall of upper gastrointestinal tract itself, and also masses located in mediastinum. EUS-FNA can provide tissue samples for cytological or pathological analysis that is helpful for the diagnosis, tumor staging, and management of many surgical conditions. The authors conducted the present study to evaluate the accuracy of EUS-FNA performed at Rajavithi Hospital.**

Objective: **To evaluate the results of diagnostic accuracy, sensitivity, specificity, positive predictive value and negative predictive value of EUS-FNA performed at a tertiary gastrointestinal endoscopic center of the Department of Surgery, Rajavithi Hospital.**

Material and method: **The authors retrospectively reviewed the EUS-FNA database obtained between October 2014 and September 2016. Data obtained, including demographics, organ of examination, results of cytological and/or pathological reports, size of the needles and follow-up data, were analyzed and reported.**

Results: **EUS-FNA was performed in 172 patients (90 males, 82 females), with a mean age of 54.8 years (range 17-89 years). The overall diagnostic accuracy was 91.9%, with a sensitivity of 88.1%, specificity of 100%, positive predictive value (PPV) of 100% and negative predictive value (NPV) of 81.8%. Patients were divided into four groups according to anatomical location, i.e., pancreas, stomach, lymph nodes and other locations. The majority of the EUS-FNA was performed on the pancreas, which included 124 patients. There were 15 patients with stomach lesions, 19 with lymphadenopathy and 14 with other lesions. The sensitivity of EUS-FNA for each group varied from 84.6% to 93.7%. The specificity was 100% for every group due to no false positive result, and the accuracy ranged from 86.7 to 94.7%. No serious complications occurred in all patients.**

Conclusion: **EUS-FNA performed at the Gastrointestinal Endoscopic Center, Department of Surgery, Rajavithi Hospital, is a safe and accurate diagnostic procedure which is very useful for management planning.**

Keywords: **Endoscopic ultrasound, fine needle aspiration, efficacy, EUS-FNA**

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Background

Endoscopic ultrasound guided-fine needle aspiration (EUS-FNA) is recently a very useful procedure for evaluation and tissue acquisition of the lesions located in the wall of upper gastrointestinal tract itself such as subepithelial mass or thickening wall of esophagus or stomach following a negative biopsy in esophago-gastroscopy, and many organs located close to upper gastrointestinal tract such as pancreas, periceliac lymph nodes, aortocaval lymph nodes, left lobe of liver, bile duct,ampulla, retroperitoneal mass, and mass in mediastinum. EUS-FNA can provide tissue samples for cytological and/or pathological analysis which is very helpful for making diagnosis, tumor staging and leads to proper management. As EUS-FNA is a diagnostic tool that requires good sensitivity, specificity and accuracy and there are many factors involved in the effectiveness of the procedure, the authors conduct this study to evaluate the result of EUS-FNA performing at the gastrointestinal endoscopic center, Department of Surgery, Rajavithi Hospital.

Objective

To evaluate the effectiveness of EUS-FNA in diagnostic accuracy, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and safety performing at a single-tertiary gastrointestinal endoscopic center of the Department of Surgery, Rajavithi Hospital.

Material and Methods

Retrospective data collection was carried out from all patients who were sent to gastrointestinal endoscopic center of the Department of Surgery, Rajavithi Hospital to perform EUS-FNA from October 2014 to September 2016. Patient characteristics, indications for EUS-FNA, anatomical locations, size of needle, cytological and/or pathological results of FNA, surgical pathology if available and clinical follow-up were recorded and analyzed.

Results

One hundred and eighty-five consecutive patients were sent to perform EUS-FNA on various indications. Thirteen patients were excluded from the study due to loss to follow-up (2 patients), loss of data (5 patients), EUS for intervention without tissue acquisition (5 patients) and error of tissue processing (1patient). One hundred and seventy-two patients (90 males and 82 females) were included in this study, mean age was 54.8 years (range 17-89 years). EUS-FNA was performed mainly on pancreas for 124 patients, 15 patients on stomach, 19 patients on intra-abdominal lymph nodes, and on other 6 organs which had small numbers of patients, i.e., 5 patients from liver, 2 from ampulla, 1 from mediastinal mass, 2 from bile duct,1 from esophagus and 3 from retroperitoneal mass. The patients were classified into four groups due to anatomical locations of FNA such as pancreas, gastric, intra-abdominal lymph nodes and others, including all 6 organs which had small number of patients as described in Table 1.

Indications of tissue acquisition from pancreas are to confirm diagnosis of unresectable pancreatic cancer planned for chemo-radiation, mass forming chronic pancreatitis, solid or cystic pancreatic lesions which had inconclusive diagnosis from other imaging modalities and small number of cystic fluid analysis for cytology from pancreatic pseudocyst. Major indications of FNA from stomach were subepithelial mass for diagnosis of gastric GIST and some of thickening gastric wall suspicious of gastric lymphoma or adenocarcinoma but had negative result from ordinary

Table 1 Characteristic of the patients

Character	Number (%)
Age (mean, range)	54.8 (range 17-89)
Sex	
Male	90 (52.3)
Female	82 (47.7)
Organs	
Pancreas	124
Stomach	15
Intra-abdominal lymph node	19
Others	14
Liver	5
Ampulla	2
Mediastinal mass	1
Bile duct	2
Esophagus	1
Retroperitoneal mass	3

gastroscopy with mucosal biopsy. Two most common indications of FNA from intra-abdominal lymph nodes were for staging of metastasis cancers and tissue diagnosis of lymphomas. The other indications are tissue diagnosis of retroperitoneal tumors, suspicious of left lobe liver metastasis or tumor of biliary system that had negative tissue biopsy or brush cytology from performing of endoscopic retrograde cholangiography (ERC).

The results were classified into true positive when cytological and/or pathological report identified the disease correctly; false positive when the positive result incorrectly identified the disease after clinical follow-up of the patient or when the result did not correspond to the surgical pathological report; true negative when the cytological report was not the same as provisional diagnosis but same as the clinical follow-up result and false negative when the negative result incorrectly rejected the disease clinically and/or was in contrast to the pathological report.

Total correct classification rate (accuracy) ranged from 87% to 95% (combining true positive and true negatives) and false negative rates of each organ varied from 6% to 15%. The highest false negative rate was for the stomach (15%) which could be due to relatively small number of this group and no false positive of every group (Tables 2 and 3).

As there was no false positive, the specificity and positive predictive value (PPV) of FNA from every organ were 100%. Overall sensitivity, accuracy and negative predictive value (NPV) were 88.1%, 91.9% and 79.4%, respectively. The results of each anatomical location were also in good range, e.g., pancreas had sensitivity 87%, accuracy 92%, NPV 82%, stomach had sensitivity of 85%, accuracy 87% but had lowest NPV of only 50%. Intra-abdominal lymph nodes and the other organs also had excellent sensitivity (94%, 90%), high accuracy (95%, 93%) and good NPV (75%, 80%) (Table 3).

Considering each anatomical location (except the other group), there were variety of indications and characteristics of conditions and/or mass that probably influence the efficacy of EUS-FNA, so we made subgroup analysis of sensitivity, specificity, accuracy, PPV and NPV of each anatomical location, i.e., pancreas, stomach and intra-abdominal lymph nodes.

Among 124 cases of the pancreas group, 10 EUS-FNA was performed in pancreatic pseudocyst for routinely fluid analysis of amylase, culture for bacteriologic study, and cytology which all negative for malignancy cell corresponded to primary diagnosis, so subgroup analysis was only done on the unresectable

Table 2 Results of EUS-FNA for cytological and /or pathological examination of each organ

Organs	Results (Number)			
	True positive	True negative	False positive	False negative
Pancreas	69	45	0	10
Stomach	11	2	0	2
Lymph node	15	3	0	1
Others	9	4	0	1
Overall	104	54	0	14

Table 3 Sensitivity, specificity, accuracy PPV and NPV of each anatomical location

Organs	Results				
	Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)	NPV (%)
Pancreas	87.3	100.0	91.9	100.0	81.8
Stomach	84.6	100.0	86.7	100.0	50.0
Lymph node	93.7	100.0	94.7	100.0	75.0
Others	90.0	100.0	92.8	100.0	80.0
Overall	88.1	100.0	91.9	100.0	79.4

Table 4 Sensitivity, specificity, accuracy, PPV and NPV of pancreatic lesions (N=124)

Disease/condition	Number	Results				
		Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)	NPV (%)
Unresectable pancreatic cancer	46	44/46 (96)	NA	NA	NA	NA
Provisional diagnosis of solid/cystic pancreatic lesion	48	16/24 (67)	(100)	40/48 (83)	(100)	24/32 (75)
Chronic pancreatitis	20	9/20 (45)	NA	NA	NA	NA
Pancreatic pseudocyst	10	10/10 (100)	NA	NA	NA	NA

NA: not applicable

pancreatic cancer to confirm diagnosis and plan for chemo-radiation, inconclusive diagnosis of solid/cystic pancreatic lesions, and mass forming chronic pancreatitis (Table 4).

Among 46 patients with unresectable pancreatic cancer, 44 patients had cytological diagnosis of adenocarcinoma of pancreas (true positive) which could have palliative chemo-radiation as planned. There were 2 false negative cases; one patient was sent to surgery and intraoperatively found advanced pancreatic cancer and received enterobiliary bypass, another died from liver metastasis after follow-up. Thus the sensitivity was 96%, and false negative rate was 4%.

There were 48 patients who had a provisional diagnosis of solid/cystic pancreatic lesions on the imaging studies and were sent for EUS-FNA. Sixteen patients had positive cytological reports (true positive) and were diagnosed of adenocarcinoma of pancreas (6), intraductal papillary mucinous neoplasm (IPMN) (3), pancreatic neuroendocrine tumor (pNET) (3), serous neoplasm of the pancreas (SCN) (2), tuberculosis (1) and lymphoma (1). Twenty-four patients had (true) negative malignancy cell and lived well on clinical follow-up. Eight patients (6 solid lesions and 2 cystic lesions) had false negative. There were 4 adenocarcinoma of pancreas (3 were diagnosed after operation and 1 by repeat EUS-FNA), 3 pNET and one solid pseudopapillary epithelial neoplasm (SPEN) also diagnosed by pathological report after operation. There was no false positive. False negative was relatively high and lowered the sensitivity to 66.7% but other parameters were still in good range, i.e., specificity 100%, accuracy 83.3%, PPV 100%, and NPV 75%.

For the 20 cases of mass forming chronic pancreatitis, cytological report revealed 9 cases of true positive of inflammatory cell confirming the diagnosis of chronic pancreatitis. Thus the sensitivity was 45%.

Eleven patients with subepithelial mass at stomach suspicious of gastric GIST were sent for tissue acquisition, nine patients had confirmed diagnosis by pathological reports (true positive). Two false negative cases were confirmed diagnosis of gastric GIST after surgery. Thus the sensitivity was 82% with a false negative rate of 8% (Table 5).

Among four patients with thickening gastric wall, two patients were diagnosed of gastric lymphoma by EUS-FNA same as primary diagnosis (true positive), another two had true negative results of cytological reports; one who was suspicious of infiltrative gastric cancer but with negative result on FNA showed improvement after being followed up clinically and received repeated esophagogastroduodenoscopy (EGD) while another with carcinomatosis from advanced ovarian cancer with negative FNA cytology confirmed no gastric involvement after follow-up as well. As there were only true positive and true negative cases of this group, all sensitivity, specificity, accuracy, PPV and NPV were 100%.

Eight patients were suspicious of advanced intra-abdominal cancer with metastasis to celiac lymph nodes or aortocaval lymph node (3 cholangiocarcinoma, 2 pancreatic tumor and 3 of carcinoma unknown primary). Six patients were confirmed diagnosis by positive of malignant cell of the lymph nodes (true positive) and two of malignant cell negative cytology (true negative) was confirmed diagnosis by following up the patients clinically and/or imaging. All sensitivity, specificity, accuracy, PPV and NPV were 100% (Table 6).

Table 5 Sensitivity, specificity, accuracy, PPV and NPV of stomach lesions (N=15)

Disease/condition	Number	Results				
		Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)	NPV (%)
Gastric GIST	11	9/11 (82)	NA	NA	NA	NA
Provisional diagnosis of gastric malignancy	4	2/2 (100)	2/2 (100)	4/4 (100)	(100)	(100)

NA: not applicable

Table 6 Sensitivity, specificity, accuracy, PPV and NPVof intra-abdominal lymphadenopathy (N=19)

Disease/condition	Number	Results				
		Sensitivity (%)	Specificity (%)	Accuracy (%)	PPV (%)	NPV (%)
Cancer metastasis to lymph nodes	8	6/6 (100)	2/2 (100)	8/8 (100)	(100)	(100)
Lymphoma	11	9/10 (90)	1/1 (100)	10/11 (91)	(100)	1/2 (50)

Eleven patients suspicious of malignant lymphomas had confirmed diagnosis by pathological report in nine patients (true positive). One true negative case was diagnosed with SLE and another one false negative case was still diagnosed with a high suspicion of lymphoma by repeated CT scan and MRI. He died later. There was no false positive case in this group and sensitivity, specificity, accuracy, PPV and NPV were 90%, 100%, 91%, 100% and 50 %, respectively.

There were three sizes of needle used to perform EUS-FNA which were 25G, 22G and 19G. Practically, 25G and 22G needle are used in almost every location if the tissue acquisition indicated cytology. In situation that core tissue is needed for pathological examination or special stain such as thickening of gastric wall with negative biopsy, diagnosis of gastrointestinal stromal tumor (GIST) or other subepithelial tumor in gastrointestinal tract, or special immunohistochemistry stain were needed for diagnosis such as lymphoma both in stomach or intra-abdominal lymph nodes, we usually prefer to use 19G needle or special design of 22G needle that could get core tissue or request for cell block if 19G needle could not be used in some situations. So, the needles mainly used for FNA of pancreas are 22G needle (46%) and 25G needle (31.5%), and less frequently used is 19G needle (22.6%) but 46.7% of both 19G needle and 22G needle were used for stomach. Both 19G and 22G needles are also frequently used to get tissue in intra-abdominal lymph nodes which is 47.4% and 31.6%, respectively. For six organs from the other group (liver, ampulla, mediastinal mass, bile duct, esophagus, retroperitoneal mass) every size of needle is used varying widely, i.e., 28.6% of 25G needle, 21.4% of 22G needle and 50% of 19G needle (Table 7).

Table 7 Type of needle used for each organ

Organs	Type of Needle (N, %)		
	25G	22G	19G
Pancreas	39 (31.5)	57 (46.0)	28 (22.6)
Stomach	1 (6.7)	7 (46.7)	7 (46.7)
Lymph node	4 (21.1)	6 (31.6)	9 (47.4)
Others	4 (28.6)	3 (21.4)	7 (50.0)

Discussion

Endoscopic ultrasound (EUS) has been used for diagnosis and treatment in various clinical contexts. Numerous studies demonstrated that EUS has an important role in the diagnosis and staging of GI malignancy[1]. For pancreatic solid tumors, EUS-FNA has a high diagnostic accuracy. Comparing with ultrasound-guided or computed tomography (CT)-guided FNA, EUS-FNA seems to have a higher diagnostic accuracy, particularly for small lesions (smaller than 2-3 cm) of which its sensitivity reaches

99 %[1-2] and also has shown superiority in pancreatic tumor detection and staging compared with CT[1]. EUS has a very high negative predictive value (NPV), and thus EUS can reliably exclude pancreatic cancer[1].

Previous studies have shown that EUS-FNA for pancreatic cancer has sensitivity, specificity of 80.3-95%, 92.3-96%, PPV 94-100% and NPV 75-85% in range respectively[3-5] and most of our results were within these ranges.EUS-FNA for unresectable pancreatic cancer and pancreatic pseudocyst yielded over 95% sensitivity. For solid/cystic pancreatic lesions, the sensitivity was only 66.7% in the diagnosis of pancreatic tumors, with an accuracy of 83% due to false negative cases, more for solid compared to cystic lesions (6:2). In these 8 cases, there was no variation in the needle size used (2 patients using 25G needle, 3 patients using 22G needle and 3 patients using 19G needle for FNA), but 5 out of 8 procedures were performed by less experienced endosonographer. Although the sensitivity of diagnosing mass-forming chronic pancreatitis was 45% (9/20), in all 20 cases pancreatic cancer could be excluded by FNA.

Three quarters of gastric subepithelial tumor larger than 2 cm are GISTs and EUS-FNA can be omitted in most of cases, except for poor surgical candidates, for tumors located at areas which are difficult to resect such as the cardia, or for unresectable GIST. Data on diagnostic yield of EUS-FNA and EUS-true cut biopsy (TCB) in diffuse gastric wall thickening are limited and diagnostic accuracy of EUS-FNA was significantly lower for diffuse GI wall thickening as compared with other conditions[2]. In a multicenter study, the sensitivity, specificity and accuracy for the diagnosis of cancer for 115 gastrointestinal wall lesions were 61%, 79%% and 67%, respectively[6]. One recent study on performed EUS-FNA for gastric subepithelial tumor using 19, 22, 25 G needles found that 62% had a definite diagnosis with IHC, and 22% yielded results suspicious for GIST using side-port needle[7]. Another recent study reported EUS-FNA in the diagnosis of all types of gastric lesions such as lymphoma, adenocarcinoma, and most of submucosal tumors (SMT) such as gastrointestinal stromal tumor (GIST) and leiomyoma found a sensitivity of 87.3%, specificity of 100%, PPV of 100%, NPV of 85.2%, and accuracy of 92.7%[8]. In our study, all 11 gastric subepithelial masses were GISTs, and the sensitivity of EUS-FNA was 82% (9/11). In the 4 cases with gastric wall thickening, cancer was correctly diagnosed in 2 cases and correctly excluded in another 2 cases, achieving a sensitivity, specificity and accuracy of 100% for this condition. But because of a very small number of cases, the high accuracy rates must be interpreted with caution.

EUS-FNA allows accurate determination of the nature of lymph nodes of unknown origin both from intra-abdomen and mediastinum. EUS-FNA is thus recommended if the lymph nodes are easily accessible via EUS, as pathological results would be helpful for management planning[2]. Reports of sensitivity, specificity, and accuracy of EUS-FNA for various diseases and conditions were within the ranges of 89.7-97.1%, 98.3-100% and 93.5-98%, respectively, and no serious complications occurred with the procedure[9-12]. In our study EUS-FNA was performed in 19 cases of intra-abdominal lymphadenopathy; in patients with proven cancer metastasis (8 patients) and those suspicious of having lymphoma (11 patients). The results were comparable to those of previous studies.

Standard upper GI endoscopy carries a risk of perforation of 0.03%, while for upper EUS, according to a prospective study, cervical esophageal perforation rate was 0.06% (3 of 4,894 patients, with curvilinear-array devices used in all). A systematic review of EUS-FNA adverse events found that the risk of these events was highest among patients with ascites, liver lesions and perirectal lesions. Various adverse events included infection (e.g., bacteremia, sepsis), pancreatitis, hemorrhage, bile peritonitis, and malignant seeding[13]. A study of EUS-FNA for various anatomical locations demonstrated a 1.3% complication rate (3 of 233 patients)[14]. In our study, no serious complications were observed.

Conclusion

EUS-FNA is a safe and effective diagnostic tool for tissue acquisition and has high diagnostic yield which can affect management planning. The accuracy and safety of EUS-FNA in our center were comparable with those reported in the literature, despite the small number of patients with certain conditions or organ involvement. The acquisition of more data should allow more accurate assessment in the future.

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บทคัดย่อ **ประสิทธิภาพของการตรวจวินิจฉัยด้วยการส่องกล้องระบบทางเดินอาหารด้วยคลื่นความถี่สูงร่วมกับการใช้เข็มเจาะเพื่อนำเซลล์ไปตรวจทางเดินอาหารส่วนบนและอวัยวะต่าง ๆ ใกล้เคียง ของศูนย์ส่องกล้องทางเดินอาหารศัลยกรรม โรงพยาบาลราชวิถี**

แพทย์หญิงกรรณิการ์ เลาหวิจิตร, นายแพทย์ทวี รัตนชูเอก

ศูนย์ส่องกล้องทางเดินอาหาร กลุ่มงานศัลยศาสตร์ โรงพยาบาลราชวิถี คณะแพทยศาสตร์ มหาวิทยาลัยรังสิต กรุงเทพฯ

หลักการและเหตุผล: การส่องกล้องระบบทางเดินอาหารด้วยคลื่นความถี่สูงร่วมกับการใช้เข็มเจาะเพื่อนำเซลล์มาตรวจเมื่อมีข้อบ่งชี้ (endoscopic ultrasound with fine needle aspiration: EUS-FNA) จัดเป็นหัตถการที่ขณะนี้เป็นที่ยอมรับโดยทั่วไปในการตรวจเพื่อการวินิจฉัยและวางแผนการรักษา โดยส่วนใหญ่มักใช้ในการวินิจฉัยโรคในอวัยวะต่าง ๆ ที่อยู่ใกล้เคียงทางเดินอาหารส่วนบน อาทิ ตับอ่อน ต่อมน้ำเหลืองที่อยู่โดยรอบหลอดเลือดแดง celiac (peri-celiac lymph nodes) หรือต่อมน้ำเหลืองที่อยู่ใกล้หลอดเลือดแดงใหญ่และหลอดเลือดดำใหญ่ (aortocaval lymph nodes) ตำแหน่งตับกลีบซ้าย ท่อน้ำดี ก้อนที่อยู่บริเวณช่องท้องด้านหลัง (retroperitoneal mass) ตลอดจนการตรวจความผิดปกติของก้อนที่อยู่ใต้ผนังทางเดินอาหารส่วนบน (subepithelial tumor) ได้แก่ หลอดอาหาร กระเพาะอาหาร และลำไส้เล็กส่วนต้น หรือใช้เข็มเจาะผนังทางเดินอาหารส่วนบนที่หนาตัวผิดปกติ แต่ตรวจชิ้นเนื้อไม่พบความผิดปกติจากการส่องกล้องทางเดินอาหารทั่วไป และยังสามารถใช้ตรวจก้อนหรือต่อมน้ำเหลืองที่อยู่บริเวณช่องอก (mediastinum) ได้อีกด้วย และเนื่องจากการทำ EUS-FNA นี้เป็นหัตถการที่ต้องการความไว ความจำเพาะ และความแม่นยำในการตรวจสูง และประสิทธิภาพของการตรวจขึ้นอยู่กับหลายปัจจัย ดังนั้นผู้เขียนจึงต้องการทำงานวิจัยนี้เพื่อประเมินประสิทธิภาพของหัตถการดังกล่าวที่ทำโดยศูนย์ส่องกล้องทางเดินอาหาร กลุ่มงานศัลยศาสตร์โรงพยาบาลราชวิถี

วัตถุประสงค์ของการวิจัย: เพื่อศึกษาความแม่นยำ (accuracy) ความไว (sensitivity) ความจำเพาะ (specificity) ค่าทำนายผลบวก (positive predictive value : PPV) และค่าทำนายผลลบ (negative predictive value : NPV) ของการทำ EUS-FNA ที่ทำโดยศูนย์ส่องกล้องทางเดินอาหาร กลุ่มงานศัลยศาสตร์ โรงพยาบาลราชวิถี

วิธีการดำเนินการ: ผู้เขียนได้เก็บข้อมูลย้อนหลังของการทำ EUS-FNA ในช่วงเวลาระหว่าง ตุลาคม พ.ศ. 2557 ถึง กันยายน พ.ศ. 2559 โดยเก็บข้อมูลลักษณะทางคลินิกของผู้ป่วย อวัยวะที่ทำการตรวจ ผลการตรวจทางเซลล์วิทยาและหรือพยาธิวิทยา ขนาดของเข็มที่ใช้ในการทำ FNA และข้อมูลการติดตามผู้ป่วยทางคลินิก ตลอดจนผลชิ้นเนื้อจากการผ่าตัดถ้ามี เพื่อนำมาวิเคราะห์ข้อมูลในแง่มุมต่าง ๆ ดังกล่าวข้างต้น

ผลการศึกษา: ผู้ป่วยที่ได้รับการทำ EUS-FNA จำนวน 172 คน (ชาย 90 คน หญิง 82 คน) อายุเฉลี่ย 54.8 ปี (ช่วงอายุ 17-89 ปี) โดยมีความแม่นยำของการตรวจโดยรวมร้อยละ 91.9 ความไวร้อยละ 88.1 ความจำเพาะร้อยละ 100 ค่าทำนายผลบวกร้อยละ 100 และค่าทำนายผลลบร้อยละ 81.8 และเมื่อแบ่งผู้ป่วยเป็น 4 กลุ่มย่อยตามตำแหน่งของอวัยวะที่ทำการตรวจ ได้แก่ กลุ่มตับอ่อน กระเพาะอาหาร ต่อมน้ำเหลือง และอื่น ๆ พบว่าตับอ่อนเป็นกลุ่มที่มีจำนวนผู้ป่วยมากที่สุด ได้แก่ 124 ราย และกระเพาะอาหาร 15 ราย ต่อมน้ำเหลือง 19 ราย และ กลุ่มอื่น ๆ ซึ่งรวบรวมจาก 6 อวัยวะที่มีจำนวนผู้ป่วยน้อยรวมกันเป็นจำนวน 14 ราย โดยความไวของแต่ละกลุ่มสูงอยู่ในช่วงระหว่างร้อยละ 84.6 ถึง 93.7 ความจำเพาะของทุกกลุ่มร้อยละ 100 เท่ากัน เนื่องจากไม่มีผลบวกลวง (false positive) และความแม่นยำอยู่ในช่วงระหว่างร้อยละ 86.7 ถึง 94.7 และค่าทำนายผลบวกของทุกกลุ่มเท่ากับร้อยละ 100 เนื่องจากไม่มีผลบวกลวงเช่นกัน และไม่พบภาวะแทรกซ้อนรุนแรงจากการทำหัตถการ EUS-FNA ในผู้ป่วยทุกราย

สรุป: การทำ EUS-FNA ของศูนย์ส่องกล้องทางเดินอาหารศัลยกรรม โรงพยาบาลราชวิถีมีความปลอดภัยและประสิทธิภาพสูง และมีประโยชน์มากในการให้การวินิจฉัยและวางแผนการรักษา