Al-Azhar International Medical Journal

Volume 4 | Issue 3 Article 38

2023

Role of EUS in the Diagnosis of Patients with Solid Pancreatic Mass in relation to other imaging modalities

Ahmed Khaled Shehata
Department of Hepatology, Gastroenterology, and Infectious diseases, Faculty of Medicine, Al-Azhar University, Cairo , Egypt., alshafyahmd633@gmail.com

Yasser fouad Fathallah
Department of Hepatology, Gastroenterology, and Infectious diseases, Faculty of Medicine, Al-Azhar University, Cairo , Egypt.

Mohamed Mousa Hegazi
Department of Hepatology, Gastroenterology, and Infectious diseases, Faculty of Medicine, Al-Azhar University, Cairo , Egypt.

Mohamed salah Elfeshawy
Department of Diagnostic radiology, Faculty of Medicine, Al-Azhar University, Cairo , Egypt.

How to Cite This Article

Shehata, Ahmed Khaled; Fathallah, Yasser fouad; Hegazi, Mohamed Mousa; and Elfeshawy, Mohamed salah (2023) "Role of EUS in the Diagnosis of Patients with Solid Pancreatic Mass in relation to other imaging modalities," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 3, Article 38.
DOI: https://doi.org/10.58675/2682-339X.1703

ORIGINAL ARTICLE

Role of EUS in the Diagnosis of Patients With Solid Pancreatic Mass in Relation to Other Imaging Modalities

Ahmed Khaled Shehata [a,*], Yasser fouad Fathallah [a], Mohamed Mousa Hegazi [a], Mohamed salah Elfeshawy [b]

[a] Department of Hepatology, Gastroenterology, and Infectious Diseases, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
[b] Department of Diagnostic Radiology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

Abstract

Background: **Death from solid pancreatic lesions (SPL) is rather common, ranking as the fourth-leading cause of cancer-related mortality worldwide. The use of endoscopic ultrasonography (EUS) as a diagnostic technique in PC has increased in recent years.**

Aim: **The purpose of this study is to compare EUS to other imaging modalities for the identification of individuals with SPL.**

Patients and methods: **This study conducted on fifty patients who are presented by solid pancreatic mass. All participants underwent full history taking, clinical assessment, laboratory investigation, CT, MRI, endoscopic ultrasound (EUS), and Endoscopic ultrasound fine-needle aspiration (EUS-FNA).**

Results: **Regarding CT, MRI and EUS finding of biliary pancreatic system, EUS has a higher significant dilated CBD (42%), CBD diameter (7.58 ± 3.31), dilated IHBR (44%) and detection of SPL (100%). Receiver operating curve (ROC) was used to determine the cutoff value of EUS strain ratio in diagnosis of patients with malignant pancreatic mass. Our ROC results revealed that strain ratio cutoff value is more than 73.42 and the area under the ROC curve is equal to 0.973. The sensitivity value of EUS was 93.3% and the specificity was 90.0%.**

Conclusion: **Finally, we conclude that EUS is an effective noninvasive approach for measuring SPL. The diagnostic work up of SPL should involve EUS elastography.**

Keywords: Elastography, EUS, Pancreatic cancer, Solid pancreatic mass

1. Introduction

The 5-year survival rate for patients diagnosed with pancreatic cancer (PC) is fewer than 6%.[1] According to recent research conducted in Europe, PC ranks fourth among males and females as a primary cancer killer.[2]

The diagnosis and staging of PC rely heavily on radiological investigations. Important constraints, such as inconsistent use of descriptive language to determine illness extent and inadequate documenting of disease locations, might influence clinical decision making.[3]

It is generally accepted that multidetector computed tomography (MDCT), which is carried out in accordance with a pancreatic protocol, is the technique of choice for the first examination of inpatients who have a suspicion of having PC.[3]

Both CT and MRI are very sensitive and specific, although CT is more often employed because of its wider availability, lower learning curve, lower learning cost, and superior spatial resolution.[4]

Endoscopic ultrasonography (EUS) has been more useful in recent years for the assessment of gastrointestinal cancers like PC. The ability to get tissue for pathological analysis is likewise crucial and has

Accepted 17 October 2022.
Available online 25 January 2024

* Corresponding author at: Department of Hepato Gastro Enterology and Infectious Diseases, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: alshafyahmd633@gmail.com (A.K. Shehata).

https://doi.org/10.58675/2682-339X.1703

greatly expanded its importance in PC care. When EUS and EUS-guided tissue collection are used for PC, the diagnostic yield and staging accuracy are observed to increase.[5]

Large meta-analyses and comparative studies with different imaging modalities have demonstrated that EUS had the highest sensitivity for identifying small pancreatic masses (≤2 cm), with a pooled sensitivity of approximately 95%.[6]

Pancreatic tumors may now be diagnosed histologically with the use of endoscopic ultrasound fine-needle aspiration (EUS-FNA), which has been shown to be a sensitive, specific, and safe diagnostic method. However, the operation is invasive and has a small but not insignificant chance of problems. Furthermore, in EUS-FNA of pancreatic lesions, seeding of malignant cells along the FNA needle tract has been documented.[7]

In this research, we compared EUS to different imaging modalities for the identification of patients with solid pancreatic lesions (SPL).

2. Patients and methods

A prospective study conducted on fifty patients who are presented by solid pancreatic mass at Endoscopic unit at Hepatogastroenterology and Infectious disease department, Al-Azhar University during the period from January 2021 to July 2022. Al-Azhar University's Local Ethics Committee gave its full approval to the research, and all participants provided signed permission forms.

Patients with cystic pancreatic lesions identified by radiological imaging or EUS, contraindication to the procedure (including Patients with coagulopathy, Patients unfit for deep sedation) and history of surgery with Whipple's procedure which made a successful EUS unlikely were excluded.

All participants underwent full history taking, clinical assessment, laboratory investigation (included Complete blood count Coagulation profile, Serum bilirubin level, serum transaminases, Alkaline phosphatase level, Gamma glutamyl transpeptidase level, Total protein, Albumin, Viral Markers, Carcinoembryonic Antigen, Carbohydrate Antigen 19-9(CA 19-9), Kidney function tests and electrolytes, C-reactive protein) and imaging (included chest X-ray, abdominal ultrasound, CT and Magnetic resonance cholangiopancreatography). Endoscopic ultrasound (EUS) was done for all participants. Also, endoscopic retrograde cholangiopancreatography (ERCP) in some patients for examination of pancreaticobiliary system was done.

The Hitachi EUB-7000 HV ultrasound unit was used in conjunction with a Pentax linear array EUS machine, model EG-3870-UTK (HOYA Corporation, PENTAX Life care Division, Showanomori Technology Center, Tokyo, Japan) to perform the endoscopic ultrasound examination (Hitachi Medical Systems, Tokyo, Japan). The pancreas was scanned using EUS at four major locations: directly below the papilla, in front of the papilla, at the top of the duodenal bulb, and at the gastroesophageal junction.

2.1. Elastography score

A score of 1 was defined as homogeneous soft tissue (green) and interpreted as normal tissue. A score of 2 was given to heterogeneous soft tissue (green, yellow, and red), and interpreted as fibrosis or inflammation. A score of 3 represented mixed hard and soft tissues (mixed colors) or a honeycombed elastography pattern, interpreted as indeterminate for malignancy. A score of 4 was given for hard (blue) lesions with a soft (green) central area, interpreted as malignant, hypervascularized lesions. Finally, a score of 5 represents predominantly hard (blue) lesions with dispersed heterogenic soft (green, red) areas, interpreted as advanced malignant lesions with necrotic areas.[8]

Cook needle 22 G (Echotip ®; Wilson–Cook, Winston Salem, NC, United States) was used for EUS-FNA biopsies. Cytopathological analysis of the samples provided the definitive diagnosis.

2.2. Statistical analysis

IBM SPSS Statistics version 21.1 (IBM Corp., 2011) was used to analyze the data. Armonk, NY: IBM Corp., 2015, IBM SPSS Statistics for Windows, Version 21.0. The numerical parameters were described using the mean and standard deviation (mean SD). Statistics such as frequency and percentage were employed to characterize the information that was not numerical. The levels of statistical significance were compared using the Student t-test, Mann Whitney test, and Chi square test.

3. Results

A total of 50 patients included in this study, their mean of age was 54.81 + 11.37 years and ranged from 25 to 73 years. The majority of the patients was males (76%). There are 24 (48%) patients have D.M, 17 (34%) patients have HTN and 14 (28%) patients have Chronic liver disease as shown in Table 1. There were 35 (70%) patients presented with Epigastric pain, 14 (28%) with Weight loss, 23(46%)

Table 1. Demographic data of studied patients.

	Cases ($n = 50$) No. (%)
Age (years)	
Mean ± SD.	54.81 ± 11.37
Min. – Max.	25.0–73.0
Gender	
Male	38 (76%)
Female	12 (24%)
Comorbidity	
Diabetes mellitus	24 (48%)
Hypertension	17 (34%)
Chronic liver disease	14 (28%)

with Jaundice and 19 (38%) patients with Abdominal mass.

Regarding CT, MRI and EUS finding of biliary pancreatic system, EUS has a higher significant dilated CBD (42%), CBD diameter (7.58 ± 3.31), dilated IHBR (44%) and detection of SPL (100%) (Table 2).

Regarding site of SPL detected by EUS, it was present in Head of pancreas in 26 (32%) patients, Body of pancreas in 12 (24%), Diffuse in 8 (16%), Tail of pancreas in 5 (10%) and Uncinate process in 3 (6%) patients. According to size of SPL, there were 24 (32%) patients have <2 cm SPL and 26 (24%) patients >2 cm with mean of 2.52 ± 1.33 cm. There was no significant difference among CT, MRI and EUS as regard to type, site and size of SPL (Table 3).

By elastography score, there were 4 (8%) patients with score 1, 9 (18%) with score 2, 5 (10%) with score 3, 17 (34%) with score 4 and 15 (30%) with score 5. And mean of elastography score was 3.48 ± 1.31 (Table 4).

Considering to FNA diagnosis, Chronic pancreatitis was present in 11 (22%) patients, Autoimmune pancreatitis in 4 (8%), Ductal adenocarcinoma in 27 (34%), Mucinous adenocarcinoma in 5 (10%) and one patient with Lymphoma, Neuroendocrine tumors and Metastasis (Table 5).

Receiver operating curve (ROC) was used to determine the cutoff value of EUS in diagnosis of patients with pancreatic mass. Our ROC results revealed that EUS cutoff value is more than 73.42 and the area under the ROC curve is equal to 0.973. The sensitivity value of EUS was 93.3% and the specificity was 90.0% with significant p value ($P = 0.000$) (Fig. 1, Table 6).

4. Discussion

Endosonography is the gold standard for identifying and staging a variety of pancreatic illnesses at present. When a definitive diagnosis cannot be made with routine EUS, further diagnostic tools, including as EUS-guided biopsies and tiny needle aspirations, are used to get more information. It does have certain limitations, however, such as a

Table 2. Comparison between results of EUS and CT& MRI imaging.

	Cases ($n = 50$)			Test	*P* value
	CT	MRI	EUS		
Liver deposits					
yes	6 (12%)	7 (14%)	14 (28%)	2.715	0.073
No	44 (88%)	43 (86%)	36 (72%)		
CBD dilatation					
Normal	40 (80%)	40 (80%)	29 (48%)	11.312	**<0.001**[a]
Dilated	10 (20%)	10 (20%)	21 (42%)		
CBD diameter (mm)					
Mean ± SD.	6.21 ± 2.47	6.37 ± 2.61	7.58 ± 3.31	2.193	**0.025**[a]
Min. – Max.	3.0–14.0	3.0–14.0	3.0–17.0		
IHBR					
Normal	36 (72%)	38 (76%)	28 (66%)	4.181	**0.031**[a]
Dilated	14 (28%)	12 (24%)	22 (44%)		
Pancreatic duct					
Normal	38 (76%)	37 (74%)	29 (48%)	2.358	0.072
Dilated	12 (24%)	13 (26%)	21 (42%)		
SPL					
yes	33 (66%)	35 (70%)	50 (100%)	52.631	**<0.001**[a]
No	17 (33%)	15 (30%)	0 (0%)		
Lymph node enlargement					
No	15 (30%)	16 (32%)	13 (26%)	0.433	0.510
Peripancreatic	27 (54%)	25 (50%)	27 (54%)	0.159	0.690
Celiac	8 (16%)	9 (18%)	11 (22%)	0.579	0447
Porta hepatis	15 (30%)	15 (30%)	13 (26%)	0.196	0.657

CBD: common bile duct; IHBR: intrahepatic biliary radicles; SPL: Solid pancreatic lesion.
[a] Statistically significant at $P \leq 0.05$.

Table 3. Distribution of patients regarding site of SPL detected by CT, MRI and EUS.

	Cases ($n = 50$)			Test	*P* value
	CT	MRI	EUS		
Type of SPL					
Single	49 (98%)	48 (96%)	48 (96%)	0.340	0.577
Multiple	1 (2%)	2 (4%)	2 (4%)		
Site of SPL					
Head of pancreas	25 (50%)	26 (52%)	26 (52%)	0.040	0.842
Body of pancreas	12 (24%)	12 (24%)	12 (24%)	0.000	1.000
Diffuse	7 (14%)	7 (14%)	8 (16%)	0.078	0.781
Tail of pancreas	6 (12%)	7 (14%)	5 (10%)	0.375	0.540
Uncinate process	2 (4%)	2 (4%)	3 (6%)	0.208	0.648
Size of SPL					
<2 cm	23 (46%)	24 (48%)	24 (48%)	0.040	0.842
>2 cm	27 (54%)	26 (52%)	26 (52%)		

Table 4. Distribution of patients regarding elastography score.

Elastography score	Cases ($n = 50$) No (%)
Score 1	4 (8%)
Score 2	9 (18%)
Score 3	5 (10%)
Score 4	17 (34%)
Score 5	15 (30%)
Mean ± SD	3.48 ± 1.31
Min. – Max.	1.0–5.0

steep learning curve, a high annual case volume required to maintain effectiveness, a requirement for numerous needle passes to harvest enough tissue, and a high risk of iatrogenic consequences.[9]

Elastic properties of the tissues were used to help in diagnosis by comparing B-mode color images taken before and after compression. With this, the elastography of the lesion could be calculated during endosonography, which avoided the need for any invasive procedures.[10]

Regarding imaging (CT, MRI) assessment of our studied patients, it was done for the entire 50 patients and SPL was diagnosed in 35 patients with a percentage of (70%), but it failed to reach a diagnosis in 15 patients (30%), those patients showed small (2 cm) SPL by EUS evaluation. This is not in concordance with Deerenberg et al.[11] who found that imaging failed to establish a diagnosis in their study in only (11%) of patients suspected to have pancreatic masses, this may be explained by variability of radiologists and radiology centers in which imaging was done in our study, and also difference in number of patients included in his study.

Table 5. Distribution of patients regarding FNA diagnosis.

β	Cases ($n = 50$) No (%)
Chronic pancreatitis	11 (22%)
Autoimmune pancreatitis	4 (8%)
Ductal adenocarcinoma	27 (54%)
Mucinous adenocarcinoma	5 (10%)
Lymphoma	1 (2%)
Neuroendocrine tumors	1 (2%)
Metastasis	1 (2%)

Analysis of results of EUS examination revealed that, SPL was detected in all 50 patients (100%) compared to (70%) of SPL detected by imaging studies, Al-Haddad et al.[12] shown that EUS is superior to other imaging modalities for detecting cancers less than 2 cm in diameter.

On further sub analysis of EUS results by DeWitt et al.,[13] EUS detected liver deposits in 14 patients with a percentage of (28%) while imaging could detect only seven cases out of them (14%). This findings stated that EUS may diagnose and sample metastatic liver deposits, ascites, or distant lymph nodes missed by other imaging modalities and therefore meticulous search for these lesions should be always done as it may change the whole management of patients with malignant SPL.

As regard the location of SPL, they located in the head, body, diffusely involving the pancreas, tail and the uncinate process with a percentage of (32%, 24%, 16%, 10%, and 6%, respectively) and this was similar to the study conducted by Kongkam et al.[14] who found the distribution of SPL in the head, body, tail and the uncinate process of the pancreas with a percentage of (60.5%, 21%, 13.1%, and 5.3%), respectively.

Regarding size of SPL detected by EUS, there were 24 (32%) patients have <2 cm SPL and 26 (24%) patients >2 cm with mean of 2.52 ± 1.33 cm, similar results were also found by Kongkam et al.[14] who found the mean ± SD of malignant and benign SPL to be (3.6 ± 1.52 cm) and (2.79 ± 1.36 cm) respectively, and also by Dyrla et al.[15] where mean ± SD of malignant and benign SPL found to be (3.91 ± 1.15 cm) and (3.53 ± 1.05 cm) respectively.

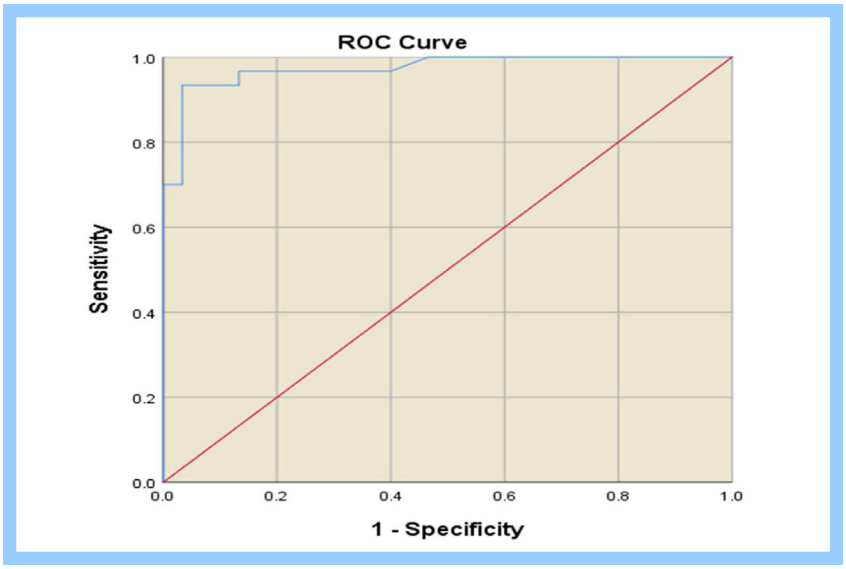

Fig. 1. ROC curve for EUS strain ratio as predictor of malignant pancreatic lesion.

Table 6. EUS strain ratio as predictor of malignant pancreatic lesion.

	Cut off[a]	AUC	*P* value		95% CI	Sensitivity	Specificity
Strain Ratio	>73.42[b]	0.973	0.000	0.938	1.00	93.3%	90.0%

AUC, area under a curve; CI, confidence intervals; *P* value, probability value.
[a] Statistically significant at $P \leq 0.05$.
[b] Cut off was choose according to Youden index.

Analysis of results of EUS in our study revealed that, EUS cutoff value is more than 73.42 and the area under the ROC curve is equal to 0.973. The sensitivity value of EUS was 93.3% and the specificity value was 90.0%.

It has been found, after reviewing the relevant literature, that additional research have investigated the benefits of SR. Iglesias-Garcia et al.[16] published the SR results of 86 consecutive patients with SPL, at a cut off value of 6.04, sensitivity, specificity, PPV, NPV, and accuracy were (100%, 92.9%, 96.7%, 100%, and 97.7%), respectively, also, Ying et al.[17] showed that SR had a sensitivity, specificity, PPV, and NPP of (96%, 76%, 78%, and 95%), respectively.

Our study had some limitations. The sample size of the study was small. The study was monocenteric. Thus, a future study with more enrolled patients is needed as results may be more significant when more patients are included in the study.

4.1. Conclusion

Non-invasive and very sensitive, EUS elastography may be used to determine SPL. EUS elastography should be included into the diagnostic work up of SPL notwithstanding the inclusion of tissue confirmation in the diagnostic algorithm.

Conflicts of interest

None declared.

References

1. Kosmidis C, Sapalidis K, Kotidis E, Mixalopoulos N, Zarogoulidis P, Tsavlis D. Pancreatic cancer from bench to bedside: molecular pathways and treat-ment options. *Ann Transl Med*. 2016;4:165.
2. Malvezzi M, Bertuccio P, Levi F, La Vecchia C, Negri E. European cancer mortality predictions for the year 2014. *Ann Oncol*. 2014;25:1650–1656.
3. Al-Hawary MM, Francis IR, Chari ST, et al. Pancreatic ductal adenocarcinoma radiology reporting template: consensus statement of the Society of Abdominal Radiology and the American Pancreatic Association. *Gastroenterology*. 2014;146:291–304.
4. Ansari NA, Ramalho M, Semelka RC, Buonocore V, Gigli S, Maccioni F. Roleof magnetic resonance imaging in the detection and characterization of solidpancreatic nodules: an update. *World J Radiol*. 2015;7:361–374.
5. Ishii Y, Serikawa M, Tsuboi T, et al. Role of endoscopic ultrasonography and endoscopic retrograde cholangiopancreatography in the diagnosis of pancreatic cancer. *Diagnostics*. 2021;11:238.
6. Wang W, Shpaner A, Krishna SG, Ross WA, Bhutani MS, Tamm EP. Use of EUSFNA in diagnosing pancreatic

neoplasm without a definitive mass on CT. *Gastrointest Endosc*. 2013;78:73–80.
7. Giovannini M. The place of endoscopic ultrasound in biliopancreatic pathology. *Gastroentrol Clin Biol*. 2010;34:436–445.
8. Giovannini M, Hookey LC, Bories E, Pesenti C, Monges G, Delpero JR. Endoscopic ultrasound elastography: the first step towards virtual biopsy? Preliminary results in 49 patients. *Endoscopy*. 2006;38:344–348.
9. Mondal U, Henkes N, Patel S, Rosenkranz L. Endoscopic ultrasound elastography: current clinical use in pancreas. *Pancreas*. 2016;45:929–933.
10. Dietrich CF, Jenssen C, Herth FJ. Endobronchial ultrasound elastography. *Endosc Ultrasound*. 2016;5:233–238.
11. Deerenberg EB, Poley JW, Hermans JJ, Ganesh S, Van Der Harst E, Van Eijck CH. Role of endoscopic ultrasonography in patients suspected of pancreatic cancer with negative helical MDCT scan. *Dig Surg*. 2011;28:398–403.
12. Al-Haddad MA, DeWitt JM, Luz LP, et al. Applications of endoscopic ultrasound in pancreatic cancer. *World J Gastroenterol*. 2014;20:7808.
13. DeWitt J, LeBlanc J, McHenry L, McGreevy K, Sherman S. Endoscopic ultrasound–guided fine-needle aspiration of ascites. *Clin Gastroenterol Hepatol*. 2007;5:609–615.
14. Kongkam P, Lakananurak N, Navicharern P, et al. Combination of EUS-FNA and elastography (strain ratio) to exclude malignant solid pancreatic lesions: a prospective single-blinded study. *J Gastroenterol Hepatol*. 2015;30:1683–1689.
15. Dyrla P, Gil J, Niemczyk S. Elastography in the diagnosis of pancreatic malignancies. *Adv Exp Med Biol*. 2019;4:41–48.
16. Iglesias–Garcia J, Larino–Noia J, Abdulkader I, Forteza J, Dominguez–Munoz JE. Quantitative endoscopic ultrasound elastography: an accurate method for the differentiation of solid pancreatic masses. *Gastroenterology*. 2010;139:1172–1180.
17. Ying L, Lin X, Xie ZL, Hu YP, Tang KF, Shi KQ. Clinical utility of endoscopic ultrasound elastography for identification of malignant pancreatic masses: a meta-analysis. *J Gastroenterol Hepatol*. 2013;28:1434–1443.