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Evaluating EUS and CT for the Detection of Pancreatic Cysts: Which is More Accurate?

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Abstract

Background: Pancreatic cysts involve a wide spectrum of pathologies, including non-neoplastic post-inflammatory cysts as well as benign and malignant neoplastic cystic tumors. Pancreatic cystic lesions are classified according to epithelial lining into true cysts (lined with the epithelium) and pseudocysts (without the epithelium). There are multiple imaging modalities in the diagnosis of pancreatic cancer, such as CT, EUS, and MRI.

Aim of Study: This study aims to evaluate the diagnostic accuracy of EUS and CT versus MRI in the detection of pancreatic cystic lesions.

Patients and Methods: Patients with epigastric pain suggestive of pancreatic origin who were referred from an outpatient clinic of the Endemic Medicine Department and the Endosonography Unit between April 2021 and September 2021 underwent magnetic resonance imaging and were divided into two groups based on their findings (33 patients with pancreatic cysts, who will act as the case group, and 34 patients with chronic pancreatitis and pancreatic stones as the control group).

Results: For the findings, the average age of the case patients was 43.9 years, with 55% being female. In contrast, the average age of control cases was 49 years, with 56% being male. We discovered that CT was more sensitive and specific than EUS in detecting the type, location, and size of pancreatic cysts, vascular invasion, and lymphatic affection in Case Group. In contrast, EUS was more sensitive than CT in the diagnosis of chronic pancreatitis and pancreatic stones in the control group.

Conclusions: Based on our findings, we can conclude that CT is more sensitive than EUS in the diagnosis of pancreatic cysts and that there is no significant difference in the detection of pancreatic cysts between CT and MRI. In terms of the control group, we discovered that EUS was more sensitive than CT at detecting chronic pancreatitis and pancreatic stones.

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Introduction

PATHOLOGIES associated with pancreatic cysts include non-neoplastic post-inflammatory cysts as well as benign and malignant neoplastic cystic tumors. True cysts (with epithelial lining) and pseudocysts (without epithelial lining) are the two types of pancreatic cystic lesions. They are also divided into primary and secondary cysts based on their developmental type and etiology. Pathologies classified as primary lesions include pseudocysts, serous cystic neoplasms, and mucinous non-neoplastic cysts. Secondary lesions are caused by solid pancreatic tumors (adenocarcinomas and neuroendocrine tumors) transforming into cystic forms **[1]**.

Currently, computed tomography (CT), magnetic resonance imaging (MRI), and endoscopic ultrasound with or without fine-needle aspiration are the main imaging methods used to diagnose PCN **[2]**.

When a pancreatic cyst is discovered on cross-sectional imaging, an MRI is ordered. Although MRI is considered the gold-standard imaging method for evaluating these cysts during follow-up visits, it has some limitations, including a high cost and a lengthy process. Both CT and MRI contrast agents were nephrotoxic. Contrast-enhanced sonography (CEUS), which uses microbubbles, a blood-pool contrast agent, has recently been shown to be non-nephrotoxic and is being used more frequently in the evaluation of pancreatic lesions **[3]**.

Recent studies have shown that EUS can be used to diagnose PCNs due to its high spatial resolution, which can describe internal structures such as septa and mural nodules. The detailed imaging provided by EUS provides morphologic criteria for distinguishing between different subtypes of PCN. Furthermore, EUS with FNA allows for the guidance of biopsy for suspicious lesions as well as the analysis of cystic fluid cytology and biochemistry **[4]**.

As is reported, EUS is safe and well-tolerated, with a complication rate of less than 1%. With the help of the high quality of the images combined with the ability to direct FNA of cystic lesions, endoscopists can distinguish among benign, malignant, and inflammatory cystic lesions of the pancreas **[5]**.

Patients and Methods

Study population: Patients with epigastric pain suggestive of pancreatic origin who were referred from an outpatient clinic of the Endemic Medicine Department and the Endosonography Unit between April 2021 and September 2021 underwent magnetic resonance imaging and were divided into two groups based on their findings (33 patients with pancreatic cysts, who will act as the case group, and 34 patients with chronic pancreatitis and pancreatic stones as the control group). Patients with acute pancreatitis, pancreatic necrosis, or pancreatic mass were excluded, as were patients with contraindications for tissue biopsy, such as coagulopathy or a low platelet count.

All enrolled patients underwent full history taking, clinical examination, and laboratory investigations, including a complete blood count (CBC), serum albumin, INR, PC, serum bilirubin (total and direct), urea, creatinine, ALT, AST, CEA, and CA1 9. A radiological review of the patients was done first using MRI images at the diagnosis as a gold standard, and then patients were evaluated using CT and EUS using an EUS scope (Pentax UTK3870) and an ultrasound machine (Hitachi Avius). MRI and CT data will be compared with endoscopic ultrasound findings in the form of cyst size, shape, content, type, and heterogeneity.

Statistical analysis: The sample size was calculated by using the PASS software (PASS 11, NCSS, LLC, Kaysville, Utah, USA). There will be crosstabulation between the results of the gold standard (MRI) and the results of the EUS to assess the sensitivity and specificity.

Statementof ethics: This study was approved by the Ethics Committee of Cairo University Hospital number (MS-167-2021) and carried out in accordance with the Helsinki Declaration The purpose and methods of the study were explained to all participants. Written informed consent was obtained from each participant prior to enrollment.

Results

Clinical features of case and control groups: The mean age of the case patients was 44 years. 55% were females. On the other hand, the mean age of control cases was 49, and 56% were males. As regards laboratory parameters, we found that total bilirubin is elevated among case patients, with a mean of 2.2mg/dl.

EUS vs. CT data in comparison to MRI findings: We found that CT was more accurate than EUS in the detection of the size of pancreatic cysts, with an interclass correlation of 0.9, as shown in Table (1). CT was also more accurate than EUS in the detection of type and size of pancreatic cysts and pseudocysts, with the same sensitivity and specificity as MRI. However, EUS could detect nine cases of pancreatic cysts and four cases of pseudocysts not detected by MRI. Also, CT was more accurate than EUS in the detection of pancreatic duct abnormalities with higher specificity (100% vs. 92%) and more accurate than EUS in the detection of vascular invasion and regional and distant lymph node metastasis, as shown in Table (2).

On the other hand, Table (3) shows that EUS was more sensitive than CT in the detection of chronic pancreatitis, with sensitivity values of 100% vs. 50%, respectively.

Table (1): Intraclass correlation coefficient.

	Intraclass Correlation**b**	95% Confidence Interval		Sig.
		Lower Bound	Upper Bound	
CT measures	.997**c**	.993	.998	<0.001
EUS measures	.667**c**	.295	.842	0.002

Table (2): EUS vs. CT in case group.

		MRI findings		Sensitivity	Specificity	PPV	NPV	Accuracy
		Yes	No					
		No. (%)	No. (%)					
Mass type (cystic):								
EUS	Yes	18	9	81.8	18.2	66.7	33.3	60.6
	No	4	2					
CT	Yes	22	0	100	100	100	100	100
	No	0	11					
Mass type (pseudocyst):								
EUS	Yes	0	4	0	86.2	0	86.2	75.8
	No	4	25					
CT	Yes	4	0	100	100	100	100	100
	No	0	29					
Mass type (mixed):								
EUS	Yes	3	2	50	92.6	60.0	89.3	84.8
	No	3	25					
CT	Yes	6	0	100	100	100	100	100
	No	0	27					
Mass site (Head):								
EUS	Yes	14 (70)	5 (38)	70.0	61.5	73.7	57.1	66.7
Row %		73.7	26.3					
	No	6 (30)	8 (61)					
Row %		42.9	57.1					
CT	Yes	20 (100)	0	100	100	100	100	100
Row %		100	0					
	No	0	13 (100)					
Row %		0	100					
Vascular invasion (SMA):								
EUS	Yes	1	0	50	100	100	96.9	96.9
	No	1	31					
CT	Yes	2	0	100	100	100	100	100
	No	0	31					
Vascular invasion (SMV):								
EUS	Yes	3	0	100	100	100	100	100
	No	0	30					
CT	Yes	3	0	100	100	100	100	100
	No	0	30					
LN-regional:								
EUS	Yes	4	0	66.7	100	100	93.0	93.9
	No	2	27					
CT	Yes	6	0	100	100	100	100	100
	No	0	27					

Table (3): EUS vs. CT in control group.

		MRI findings		Sensitivity	Specificity	PPV	NPV	Accuracy
		Yes	No					
		No. (%)	No. (%)					
Chronic pancreatitis:								
EUS	Yes	22	4	100	66.7	84.6	100	88.2
	No	0	8					
CT	Yes	11	1	50.0	91.7	91.7	50.0	64.7
	No	11	11					
Pancreatic stones:								
EUS	Yes	8	0	100	100	100	100	100
	No	0	26					
CT	Yes	7	0	87.5	100	100	96.3	97.1
	No	1	26					

Discussion

This outcome is consistent with Visser BC et al.'s finding that CT and MRI have comparable accuracy. However, Khashab MA et al.'s study found that although CT and MRI are better than EUS for diagnosing pancreatic cysts, FNA increases EUS's diagnostic and therapeutic accuracy [6,7].

Describing the type of pancreatic cyst, our result supports Visser BC et al.'s observation that CT and MRI accuracy are equivalent. Although EUS is less accurate than CT and MRI at detecting pancreatic cysts, Khashab MA et al., demonstrated that the use of FNA increases EUS's diagnostic and therapeutic precision [6,7].

We discovered that CT is more reliable than EUS in detecting the size of pancreatic cysts since the ICC is equal to 0.9. This finding is consistent with that of Yoon Suk Lee et al., who found that while all three imaging modalities-CT, EUS, and MRI-have good reliability in determining the size of pancreatic cysts, CT is more precise than EUS. In contrast to CT and MRI, EUS cyst size measures had the best correlation with pathologic specimens, according to Tri Huynh et al. A total of 52 females and 16 males were assessed in comparison to Chen Du et al., who found that EUS is more reliable than CT and MRI in the detection of the size of pancreatic cysts [8,9].

We conclude from our study that CT is more sensitive and specific than EUS in the identification of vascular invasion because one case involving vascular invasion was diagnosed solely by MRI and was undetectable by EUS with a sensitivity of 50% and specificity of 100%. These findings concur with those of Tian YT et al., who suggested that CT be regarded as the most accurate method to assess vascular invasion. Soriano A et al., discovered different findings and suggested that CT and EUS together are the most beneficial individual imaging techniques in the staging of pancreatic neoplasms. The best imaging modality for determining stage and vascular invasion, according to Lu ZC et al. (2006), is EUS [11,12].

We came to the conclusion that, when compared to MRI as the gold standard, CT is more sensitive and specific than EUS in the identification of LN invasion by pancreatic cystic neoplasms.

Additionally, these outcomes are consistent with those of Tian YT et al., who suggested that CT is the most effective technique for preoperative TNM staging of pancreatic neoplasms. The patient must have both imaging modalities, not just one, as EUS is the best tool for assessing lymph node metastases [11].

We discovered that EUS is more sensitive than CT when it comes to the control group that has chronic pancreatitis. With a sensitivity of 100% and 50%, respectively, EUS can detect four cases that MRI cannot, whereas CT can only detect one such case. These findings contrasted with those of Issa et al., who suggested that EUS, CT, and MRI have excellent diagnostic sensitivity for chronic pancreatitis and that the selection of imaging modalities can therefore be made based on invasiveness, local availability, experience, and costs. Additionally, for diagnosing chronic pancreatitis, EUS, CT, and MRI offer great diagnostic sensitivity. All diagnostic techniques have comparable diagnostic specificity. 43 studies, including 3460 patients, were included. Endoscopic ultrasonography (EUS), magnetic resonance imaging (MRI), and computed tomography (CT) each had sensitivity estimates of 81 percent, 78 percent, and 75 percent that were comparable to one another. Estimates of specificity for EUS (90 percent; 95% CI: 82 percent-95 percent), CT (91 percent; 95% CI: 81 percent-96 percent), and MRI (96 percent; 95% CI: 90 percent-98 percent) were comparable [14].

The need for sedation and endoscopy, with their difficulties, reliance on the operator, and cost, limits the use of EUS, a developing method for the examination of chronic pancreatitis. Contrary to Iglesias-Garca J et al.'s statement that EUS, CT, and MRI can all provide useful and complementary information, EUS provides the unique ability to obtain samples for histological diagnosis [15].

According to research by He XK et al. (2017), we found that EUS is more accurate and sensitive than CT at detecting pancreatic stones in cases where they have been diagnosed as such. The imaging techniques used in this instance have the following sensitivity for detecting pancreatic duct stones: Because of this, CT (71%) and EUS (73%) have good sensitivity in the detection of pancreatic duct stones [16].

Conclusion:

Our study's findings lead us to the conclusion that CT is more sensitive than EUS for diagnosing pancreatic cysts from all angles, including type, place, size, vascularity, and lymphatic invasion, but that EUS is more sensitive in the control group. However, our investigation revealed that EUS is essential since it picks up cases that CT and MRI miss.

We also come to the conclusion that CT can take the place of MRI as the gold standard because it has the same diagnostic accuracy as MRI. Given that there is no discernible difference in accuracy between CT and MRI, we advise patients who have a suspicion of having a pancreatic lesion to have one performed before having an EUS. It is distinctive and improves sensitivity and accuracy in identifying pancreatic lesions when combined with FNA in addition to EUS. In the future, researchers should use a bigger sample size to figure out how well different imaging methods can find pancreatic cysts.

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قياس الدور التشخيصى لمنظار الموجات الصوتية فى تشخيص تكيسات البنكرياس بالمقارنة مع الأشعة المقطعية والرنين المغناطيسى

تكيسات البنكرياس تنطوى على مجموعة واسعة من الأمراض بما فى ذلك تكيسات ما بعد الورم غير الأورام وكذلك الأورام الكيسية الأورام الحميدة والخبيثة. تصنف الآفات الكيسية البنكرياس وفقاً لبطانة الظهارية فى التكيسات الحقيقية (اصطف مع الظهارة) و pseudocysts (دون ظهارة). أيضاً، يتم تصنيفها وفقاً لنوع النمو والمسببات فى التكيسات الأولية والثانوية. تشمل الافات الأولية الأمراض التالية الكيسات الزائفة، الأورام الكيسية المصلية (الورم الكيسى والكيسات الكيسية)، التكيسات غير البلاستيكية المشوشة، الأورام الكيسية المشوشة الورم الكيسى والكيسات، الأورام المخاطية داخل الرحم، أورام الدم الصلبة والتكيسات اللمفاوية.

الآفات الثانوية هى بسبب تحول أورام البنكرياس الصلبة (الأورام الغدية والغدد الصماء العصبية) فى الأشكال الكيسية. التشخيص الدقيق للخراجات البنكرياس مهم جداً لاتخاذ قرار بشأن الإدارة. من المهم جداً التمييز بين الكيسات الزائفة والتكيسات النيوبلاستيكية حيث أن الإدارة مختلفة. يمكن ملاحظة السيستات الزائفة والأورام الكيسية الحميدة، أو تجفيفها وإزالة التكيسات البنكرياسية الأخرى جراحياً. لذلك فهى مشكلة أساسية لأطباء الجهاز الهضمى والأشعة والجراحين.

حالياً طريقة التصوير الرئيسية لتشخيص الأورام الكيسية البنكرياس وتشمل التصوير المقطعى المحوسب، التصوير بالرنين المغناطيسى، والموجات فوق الصوتية بالمنظار مع أو بدون شفط إبرة دقيق.

التصوير المقطعى متعدد الحاصدات لا يزال يعتبر المعيار الذهبى لتقييم الآفات الصلبة المحورية فى البنكرياس فى حين يتم التحقيق بشكل أفضل فى أورام البنكرياس الكيسية مع التصوير بالرنين المغناطيسى.

أجرينا هذه الدراسة لتقييم الدور التشخيصى لمنظار القنوات المرارية ومقارنة الدقة مع الأشعة المقطعية كوسيلة تشخيصية للآفات الكيسية البنكرياسية.

وشملت هذه الدراسة ٦٧ مريضاً مقسمة إلى مجموعتين ٣٣ مريض يعانون من كيس بالبنكرياس تم تشخيصها عن طريق التصوير بالرنين المغناطيسى بمثابة حالات و ٣٤ مريضاً يعانون من آفات حميدة أخرى بالبنكرياس بدلا من كيس البنكرياس وتعمل كمجموعة مراقبة (التهاب البنكرياس المزمن وحصوات البنكرياس).

استنادا إلى نتائج دراستنا يمكننا أن نستنتج أن الأشعة المقطعية أكثر حساسية من منظار الموجات الصوتية فى تشخيص تكيسات البنكرياس.

فيما يتعلق مجموعة التحكم، وجدنا أن منظار الموجات الصوتية هو أكثر حساسية من الأشعة المقطعية فى تشخيص التهاب البنكرياس المزمن وحصوات البنكرياس.

كما ذكر من قبل أن الأشعة المقطعية أكثر حساسية من منظار الموجات الصوتية فى جميع النواحى من حيث الحجم والنوع والمو قع والأوعية الدموية المتأثرة والغزو الليمفاوى. ولكن فى دراستنا وجدنا أن منظار الموجات الصوتية يحقق نفس النتائج مثل الأشعة المقطعية فى الكشف عن تكيسات رأس البنكرياس.

نستنتج أيضاً أن التصوير المقطعى المحوسب والتصوير بالرنين المغناطيسى متفو قة على منظار الموجات الصوتية كمودالى التشخيص ولكن إذا أضفنا إليه ابره الشفط هذا يجعل منظار الموجات الصوتية متفوق على الأشعة المقطعية والرنين المغناطيسى بسبب القدرة على أخذ عينة وعمل تحليل نسيجى لها.

المرضى المشتبه فى أن يكون آفة البنكرياس يجب أن تقوم بعمل أشعة مقطعية على البطن كما لا يوجد فرق كبير فى الدقة بين الأشعة المقطعية والرنين المغناطيسى. كما أن الاشعة المقطعية أكثر دقة وحساسية من منظار الموجات الصوتية فى تشخيص كيس البنكرياس فى شكل موقع، نوع، حجم والقناة البنكرياس والأوعية الدموية المتأثرة والغدد الليمفاوية المتأثرة.

ينصح بعمل منظار الموجات الصوتية فى الحالات التى يشتبه فى أن تكون التهاب البنكرياس المزمن وحصوات البنكرياس كما هو أكثر حساسية من الأشعة المقطعية.

قد يحتاج المريض فقط إلى إجراء الاشعة المقطعية أو الرنين المغناطيسى ليس كلاهما معاً حيث لا يوجد فرق كبير فى الدقة بينهما.

منظار الموجات الصوتية لا يفضل كوسيلة تشخيصية كما أن لديه العديد من عوامل الحد لأنها تحتاج التنظير / التخدير مع تعقيدها والاعتماد على الطبيب الذى يقوم بعمل المنظار.

بإضافة ابرة الشفط إلى منظار الموجات يجعله فريد من نوعه بسبب القدرة على الحصول على عينات وعمل التحليل النسيجى.