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Role of EUS in Evaluating Causes of Biliary Obstruction Not Detected by Other Imaging Modalities

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ABSTRACT

Background: Transabdominal Ultrasound (TUS) and other imaging modalities like Computed tomography (CT) or magnetic resonance cholangiopancreatography (MRCP) can't demonstrate all the causes of biliary obstruction.
Aim of the work: This work aimed to evaluate the role of Endoscopic Ultrasound (EUS) in cases with obstructive jaundice with no definite cause detected by other imaging modalities.
Patients and Methods: This is a prospective cohort study conducted on 80 patients presented with manifestations suggestive of obstructive jaundice. Patients underwent history taking, clinical examination, and routine laboratory investigations as well as tumor markers. All Patients were examined by TUS, CT, MRCP, and EUS. The final diagnosis was determined by tissue pathology and a four-month follow-up. Patients with CBD stones were referred for Endoscopic retrograde cholangiopancreatography (ERCP), while patients with operable tumors were sent for surgery. Patients with inoperable tumors were referred for oncology consultation.
Result: In this study 80 patients presented with obstructive jaundice (58.7% female). As regard, the mean age of the patients was 50.7years. The common bile duct (CBD) mean diameter for all patients in TUS, CT, MRCP, and EUS was 10.7mm, 11mm, 11.5mm, and 12.4mm, respectively.The most common finding were choledocholithiasis 26 (32.5%), pancreaticobiliary malignancy 44 (55.1%), chronic pancreatitis 4 (5%), portal biliopathy 1 (1.3%), and no pathological obstruction 5 (6.3%). The overall accuracy and sensitivity of EUS for patients diagnosed with pancreaticobiliary malignancy were 95.1%, 95.9%, respectively.
Conclusion: EUS is thought to be the best diagnostic imaging modality for diagnosing the causes of biliary obstruction with inconclusive, other imaging modalities.

Keywords: *Biliary obstruction; CBD; TUS; MRCP; EUS.*

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INTRODUCTION

Obstructive jaundice is the increased serum bilirubin levels produced or blockage to the normal bile outflow induce yellow coloring of the skin and mucous membranes (average serum bilirubin level is 0.2 - 0.8 mg/dl). Any obstruction of the biliary tree, such as a stone, stricture, tumor, secondary deposits, external pressure, ligation, or injury anywhere in the biliary channels, causes bile flow to be obstructed.[1]

The role of different imaging modalities to know the level and the cause of obstruction to help for further management. When determining the degree of biliary blockage, TUS should be the first imaging method used. Overlying intestinal gas and obesity, on the other hand, frequently conceal the distal bile duct, ampulla, and pancreas. As a result, TUS alone is insufficient to determine the cause of obstructive jaundice. Some authors claim that ultrasound accuracy in determining the level and origin of biliary tract obstruction is 27-60% and 23-38%, respectively.[2]

The extrahepatic biliary tree can be evaluated with CT, which has the advantages of noninvasiveness, operator independence, and a high technical achievement rate. Nonetheless, CT exposes patients to radiation, and the use of contrast chemicals might cause kidney damage or an allergic reaction..[3]

MRCP is effective for examining the extrahepatic biliary tree. Still, its accuracy suffers when fat planes are few, or the CBD contains little fluid.

Furthermore, MRCP cannot be used on individuals who have claustrophobia or who have electronic gadgets implanted. The pancreaticobiliary region can be evaluated sonographically with EUS.[4]

The goal of this study to evaluate the role of Endoscopic Ultrasound (EUS) in cases with obstructive jaundice with no definite cause detected by other imaging modalities.

PATIENTS AND METHODS

This research study was done in parentship with the department of hepatogastroenterology and infectious diseases at El-Hussein University Hospital and El-Ebrashi unit, Internal Medicine Hospital, Cairo University, from November 2020 to June 2021 with subsequent 4- month follow-up. A total of 80 individuals with obstructive jaundice were included in this prospective cohort research as proved by history, clinical examination, and investigations had a laboratory, TUS, CT or MRCP, EUS, and Tissue biopsy either FNA or FNB.

The study protocol was evaluated by ethical committee of Al-Azhar School of Medicine, Cairo and its university hospitals and an approval for the study was obtained and IRB number:000052.

Inclusion criteria: patients with obstructive jaundice and TUS, CT, and MRCP showed CBD dilatation above the normal in relation to the age(CBD>7mm) with no apparent cause for biliary obstruction.

Exclusion criteria: surgery including gastroenteric anastomosis (Roux-en-Y gastrojejunostomy or Whipple's procedure) or choledochjejunostomy, making a successful EUS improbable. Patients with obstructive jaundice (intrahepatic causes) and TUS show normal CBD diameter. Patients with coagulopathy. Patients unfit for deep sedation. Patients who refused to participate in this study after receiving written informed permission. All the patients were subjected to the following: History with special stress on risk factors: Age, gender, family history, abdominal surgery, and other co-morbidity.

Thorough clinical examination regarding Jaundice, Abdominal pain, change in color of urine or stool, history of gallstones, weight loss and anorexia, fever, ecchymosis, and scratch marks.

The following laboratory tests are performed: complete blood count (CBC), Erythrocyte Sedimentation Rate (ESR), and Erythrocyte Sedimentation Rate (ESR) (ESR). Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) are two liver function assays.

Serum bilirubin, total protein, serum albumin, alkaline phosphatase (ALP), and gamaglutamyltranspeptidase (GGT). Conventional lab tests use the prothrombin time (PT) and international normalized ratio (INR) to determine the coagulation profile. Renal Function Tests: serum creatinine and urea. Tumor markers include CA19-9, AFP, and CEA.

The following imaging studies include TUS (HITACHI Avius, Curvilinear probe 2-5 MHZ, Japan) to measure the diameter of CBD, detect IHBRDs, EHBRDs, Gall bladder, and pancreas if visualized. Either abdominal CT (TOSHIBA, Japan) or MRCP (Siemens, Germany) to measure the diameter of CBD, degree of IHBRD.

EUS was performed with Linear EUS EG-3870UTK Ultrasound video Endoscopy, PENTAX (3.8), Japan. All patients were lying in the left lateral position, deeply sedated with propofol. Dual frequencies of 7.5 MHz and 12 MHz were included in the echoendoscope. Comments were provided on pancreatic texture and pancreatic duct, ampulla of Vater, CBD diameter and pathology, GB content and pathology, LN, Lt lobe of the liver, Lt suprarenal gland, spleen, Lt kidney, and mediastinal LN. Signs of obstructive jaundice include dilation of CBD, IHBRDs, EHBRDs, and well visualize distal CBD lesion including stones, cholangiocarcinoma, pancreatic head lesions, and ampullary lesions.

Tissue diagnosis was done using EUS-fine-needle aspiration (FNA), (EUS FNA19,22, Gauge, USA) and cook biopsy core in case of suspected malignancies of the pancreatic head, ampulla of Vater and, distal biliary duct lesions to prove the final diagnosis. Ninety-five percent alcohol was used to fix the substance on a glass slide. And also was put in formalin (30%) then sent to a single experienced cytologist.

Statistical analysis was carried out using the IBM® SPSS® Statistics version 25.0 software package **(IBM® SPSS® Statistics release 25.0, USA).** Numerical data were represented as mean and slandered deviation, while numbers and percentages represent categorical variants. For comparison, For numerical data, we utilized the t-test, and for categorical data, we used the chi-square test. The conventional formulas were used to compute sensitivity, specificity, positive and negative predictive values (PPV and NPV), and accuracy.

RESULTS

Table 1 shows that most of the patients were female (58.7%). The patients in this study were on average 50.7 years old (range 13-74 years). The majority of the patients complained of abdominal pain (48.8%), followed by weight loss (26.2%) and jaundice (25%). **Figure 1** shows that TUS, CT, MRCP, and EUS groups had mean CBD diameters of 10.7mm, 11.5mm, and 12.4mm, respectively. (P-value<0.001).

Variables	N	(%)
Female	47	(58.7%)
Male	33	(41.3%)
Age(year); mean (SD)	50.7 ± 12.6	
Presentation:		
1. abdominal pain	39	(48.8%)
2. weight loss	21	(26.2%)
3. jaundice	20	(25%)

Table 1: baseline characteristics in all studied patients.

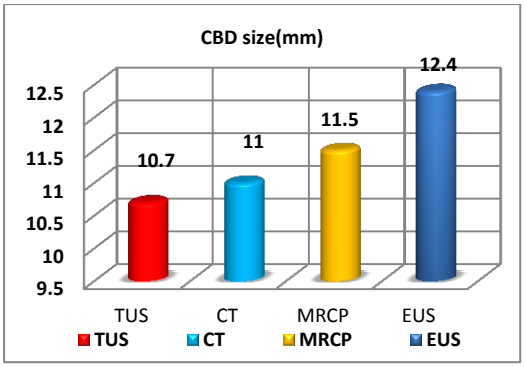
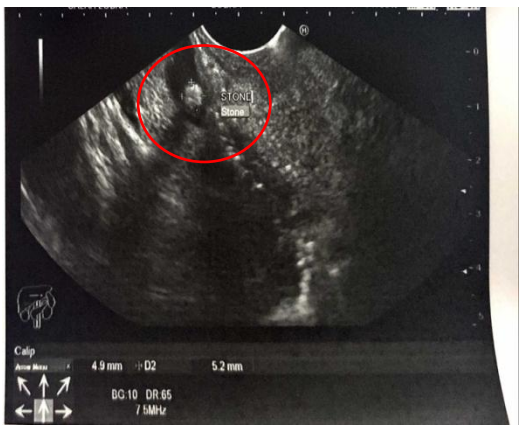


Fig. 1: comparisons between studied groups as regard CBD size.

As shown in **Table 3,** the common finding by EUS in this study included; CBD stone (26 cases), pancreatic mass (24 cases), CBD mass (15 cases), ampullary mass (5 cases), chronic pancreatitis (5 cases), portal biliopathy (1 case), no pathological finding (5 cases). The mean size of masses and CBD stones detected by EUS were 20mm and 5.57mm, respectively. For all masses or suspected malignancy, further evaluation by EUS-FNA/FNB was done to confirm the diagnosis.

EUS Finding	Studied patients (N=80) N (%)
CBD stones	26 (32.5%)
Pancreatic mass	24 (30%)
CBD mass	15 (18.8%)
Ampullary mass	5 (6.3%)
Chronic pancreatitis	4 (5%)
Portal biliopathy	1 (1.6%)
No pathology	5 (6.3%)

Table 2: EUS findings in all studied patients.



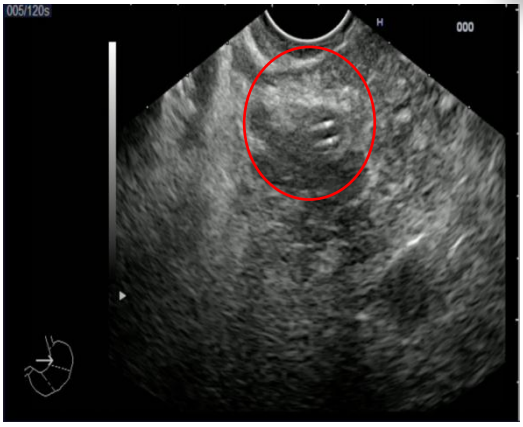


Figure 2: EUS showed distal CBD stone(5mm) and distal CBD mass(8mm).

The figure 2 showed distal CBD stone measuring 5mm in the left photo while in the right one showed distal CBD mass which confirmed cholangiocarcinoma by EUS FNA.

EUS mass size	**Mean ±SD**	**20 ± 3.7**	
	Min - Max	**13 - 26**	
EUS pancreatic mass site	**Head**	20	83.3%
	Body	4	16.6%
EUS stone size(mm)	**Mean ±SD**	5.57 ± 1.02	
	Min - Max	3 - 7	
EUS stone site	**Distal CBD**	22	84.6%
	Mid CBD	4	15.4%

Table 3: characteristics of masses and stones detected by EUS.

Table 3 showed the EUS characteristics of mases and stones detected in this study, the mean size of EUS mass was 20mm, while the site of pancreatic mass was seen most likely in the head (83.3%). On the hand, the mean size of stones discovered by EUS was 5.5mm and most of them were in distal CBS (84.6%).

The five patients diagnosed by EUS as normal findings, one of them confirmed by EUS FNA as a case of chronic pancreatitis.

Table 4 demonstrates the final diagnosis by tissue pathology in patients demonstrate mass in EUS. Pancreatic adenocarcinoma in 24 individuals, cholangiocarcinoma in 15 patients, ampullary cancer in 5 patients, and chronic pancreatitis in 5 patients.

		Studied patients (N=49) N	%
Tissue pathology	**Cholangiocarcinoma**	15	30.6%
	Pancreatic Adenocarcinoma	24	49%
	Ampullary adenocarcinoma	5	10.2%
	Chronic Pancreatitis	5	10.2%

Table 4: description of tissue pathology in patients having mass in EUS .

In patients with mass detected by EUS, EUS FNA was done to confirm the diagnosis, the sensitivity,

specificity, PPV, NPV, and accuracy of EUS were 95.1%, 100%, 100%, 80%, and 95.9%, respectively, according to Table 5.

EUS	%
Sensitivity	95.1%
Specificity	100%
PPV	100%
NPV	80%
Accuracy	95.9%

Table 5: diagnostic performance of EUS in relation to Histopathology results in the diagnosis of malignancy.

DISCUSSION

The purpose of a diagnostic evaluation of a patient with a common bile duct obstruction is to distinguish benign lesions such as gallstones from malignant biliary obstructions and identify the extent of tumor invasion and spread in cases of malignancy.[6]

Several imaging modalities are available for the evaluation of obstructive jaundice.

They are classified into noninvasive and invasive like TUS, CT, /MRIMRCP, EUS, ERCP.[7] Endoscopy and ultrasound are combined in EUS to provide incredibly detailed images of the pancreas and biliary tree. It uses higher-frequency ultrasonic waves (3.5 MHz vs. 20 MHz) than the regular US and permits diagnostic tissue samples using EUS-FNA.[8]

The goal of this study was to determine the value of EUS in determining the cause of CBD dilatation that TUS, CT, and MRCP had missed.

In the current study, forty-seven patients were females (58.7%), while thirty-three were males (41.3%). The median age is 52.5 years. Our results are consistent with Sotoudehmanesh et al. study, which including 152 patients (82 females (53.9%), 70 males (46.1%) with median age 60.4 years).[5] Similarly, in Maluf-Filfo et al. study, during which included 61 patients (35 females (54.1%), 28 males (45.9%) with median age 56.8 years).[8]

On the opposite hand, Heinzow et al. study, during which they enrolled 123 patients with a better percentage of male patients (88 males (71.5%), 35 females (28%), median age 61.3 years).[9] This is also in agreement with Heinzow et al. study, which enrolled 234 patients (127 males (54.2 %), 107 females (45.8%), median age 64).[9]

As regards the presenting symptoms, this study shows the bulk of patients were presented with abdominal pain (48.1%) followed by weight loss (26.2%) and jaundice (25%).

TUS, CT, MRCP, and EUS were performed on all patients in our study. All cases in the TUS, CT, MRCP and EUS groups had a mean CBD diameter of 10.7mm, 11mm, 11.5mm, and 12.4mm, respectively(P-value<0.001).

This was not in agreement with Sotoudehmanesh et al. study, in which all patients underwent TUS, EUS, the mean value of CBD diameter 11.7 mm, 10.1 mm consecutively.[5]

In this study, the total malignant obstruction was 44 patients who represented (55.1 %) of the study number, 26 cases with calcular obstruction, which represent (38.8 %) of the study patients, 4 cases with chronic pancreatitis, which represented (5 %) of the study patients, 1 case with portal biliopathy (1.3%) and 5 cases with no pathology detected which described (6.3%).

In agreement with the result of the current study, Sotoudehmanesh et al. study, who reported that the final diagnoses by EUS were as follows: choledocholithiasis in 32 cases (21.1%), passed CBD stone in 35 patients (23%), opium-induced CBD dilation in 14 patients (9.2%), post-cholecystectomy states in 20 patients (13.1%), ampullary neoplasia in 15 patients (15.8%), cholangiocarcinoma in 14 patients (9.2%), cholangiocarcinoma in (5.9%).[5]

This was not in agreement with Chen et al. study, in which total malignant obstruction was 41 patients, which represented (33.34%) of study patients, calcular obstruction was 28 patients, which represented (22.76 %) of study patients, benign obstruction was 43 patients, which represented (34.95%) of study patients.[10]

The sensitivity and specificity values for malignant blockage detected by EUS in our study were 95.1% and 100%, respectively, with a positive predictive value of 100%, a negative predictive value of 80%, and an overall accuracy of 95.9%. This was in close agreement with Makar et al. study. The sensitivity and specificity value for malignant obstruction detected by EUS was 97.5% and 97.6%, respectively, with PPV 95.1 % and NPV 98.8 %, and overall accuracy of 92.9%.[11]

Also, in close agreement with Maluf-Filho et al. study, the sensitivity and specificity value for malignant stricture detected by EUS is 96.6 % and 90.6 %, respectively, with PPV 90.3%, NPV 96.7, and accuracy 93.4%.[8]

CONCLUSION

Patients with obstructive jaundice should be evaluated initially by TUS then by other imaging modalities like CT or MRCP. If the cause is not clear, EUS is considered the next diagnostic modality for illustrating the cause of obstruction.

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