ORIGINAL ARTICLE

Better non-invasive endoscopic procedure: endoscopic ultrasound or magnetic resonance cholangiopancreatography?

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ABSTRACT

Aim To present our experience with a diagnostic ability of endoscopic ultrasound (EUS) and magnetic retrograde cholangiopancreatography (MRCP) in cases of choledocholithiasis verified by endoscopic retrograde cholangiopancreatography (ERCP).

Methods This retrospective study was conducted after a collection of data involving 58 suspected choledocholithiasis patients who underwent ERCP from January 2013 to December 2015. Patients who were diagnosed with choledocholithiasis on the basis of clinical symptoms and radiological findings and who underwent ERCP were included in this study. The first group (29 patients) underwent EUS, and the second group (29 patients) underwent MRCP. The ERCP was performed in both groups. Sensitivity, specificity and diagnostic accuracy of EUS and MRCP were determined by comparing them with ERCP, which was considered to be a gold standard.

Results Gender representation was in favour of males, 58:42%. The mean age was 55.5 years. In the group 1 (EUS) 22 patients were found to have choledocholithiasis using ERCP. The EUS stone detection rate was 88%. Endoscopic ultrasound showed sensitivity (97%), specificity (67%) and accuracy (88%), positive predictive value (PPV) of 88%, negative predictive value (NPV) of 80%. In the group 2 (MRCP) 16 patients were found to have choledocholithiasis by ERCP. MRCP sensitivity was 81%, specificity 40%, PPV of 74%, NPV of 50%.

Conclusion The EUS was a superior non-invasive tool in comparison with MRCP for detecting choledocholithiasis, which was confirmed using ERCP.

Key words: choledocholithiasis, cholangiopancreatographies, endoscopic ultrasonography, magnetic resonance

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INTRODUCTION

Gallstone disease is a common clinical problem. In Europe, ultrasound studies have revealed prevalence of 9–21% and incidence of 0.63/100 persons/year (1,2). Choledocholithiasis or common bile duct (CBD) stones are a frequent complication of gallstone disease and are present in up to 20% of the patients (3,4). The approach used in these patients is most important because CBD stones are a common cause of hospitalization due to recurrent symptoms, cholangitis, and pancreatitis (4). Once the diagnosis of choledocholithiasis is made, stones should be removed by a therapeutic procedure, namely endoscopic retrograde cholangiopancreatography (ERCP), which is the gold standard for the treatment of CBD stones (5). However, although ERCP is highly effective for the extraction of CBD stones, it is associated with a reasonable rate of adverse events, some of them life-threatening, including acute pancreatitis, bleeding, perforation, sepsis (5,6).

For many clinicians, the initial evaluation of patients with suspected choledocholithiasis includes serum liver biochemical tests (aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, and total bilirubin) and transabdominal ultrasonography (US) (7-9) to select patients for other procedures, such as magnetic resonance cholangiopancreatography (MRCP) (10) or endoscopic ultrasound (EUS) (11), before they recommend ERCP to the patient; thus, they are trying to avoid the overuse of ERCP, which should not be a diagnostic procedure because it is associated with complications.

In 2010, the American Society for Gastrointestinal Endoscopy (ASGE) published guidelines for the prediction of risk stratification for patients being evaluated for CBD (4), which classifies patients into high risk (>50%), intermediate risk (10–50%), and low risk of choledocholithiasis. Patients at high risk were defined as having any of the very strong predictors of choledocholithiasis (i.e. CBD stones on transabdominal US, clinical ascending cholangitis, or serum bilirubin level >70 μmol/l) or both strong predictors (i.e. dilated CBD on US, namely >6 mm with gallbladder in situ, and bilirubin level 30-70 μmol/l). Patients at intermediate risk were those with the presence of 1 strong predictor or any moderate predictor (abnormal liver biochemical tests other than bilirubin, age older than 55 years, and clinical gallstone pancreatitis). Patients with low risk were those with no predictors present. Based on these guidelines, patients at high risk should directly receive ERCP, patients at intermediate risk should be submitted to less invasive evaluations, namely preoperative MRCP or EUS.

Additionally, there is spontaneous CBD emission in 73% clinical cases in patients with jaundice, biliary colic and cholecystitis (12)

However, in the clinical scenario, many authors advocate for the use of alternative diagnostic strategies for all patients with high and intermediate probability of choledocholithiasis, namely MRCP or EUS before ERCP (13-15).

The ASGE guidelines may lead to an unnecessarily large number of ERCPs, which can be associated with complications. It is clear that the ASGE guidelines should be re-opened for discussion. The optimal cost-effectiveness approach for patients with suspected CBD stones is unknown, but new modalities should be used.

Given the need to redefine the ASGE Guidelines, the focus of recent research is non-invasive techniques in choledolithiasis diagnostics, with the aim of assessing their usability, extending the criteria for their use, with the consequence of using ERCP only as a therapeutic procedure (4). There is a lack of consensus about the optimal non-invasive strategy for patients with suspected choledocholithiasis.

The aim of this study was to present our experience in the diagnostic ability of endoscopic ultrasound (EUS) and magnetic retrograde cholangiopancreatography (MRCP) in cases of choledocholithiasis, verified by ERCP.

PATIENTS AND METHODS

Patients and study design

This retrospective comparative observational study involved 58 patients, who attended the Department of Gastroenterology and Hepatology, Clinical Centre University of Sarajevo, Bosnia and Herzegovina, from January 2013 to December 2015. Patients aged 18–65 years were diagnosed with choledocholithiasis on the basis of clinical symptoms and radiological findings and underwent either EUS or MRCP followed by ERCP. The

diagnosis was based on symptoms (most patients complained of upper right abdomen or epigastric pain and jaundice), laboratory findings (elevated bilirubin level, elevated liver enzymes: alanine aminotranferase, asparta aminotransferase, alkaline phosphatase and gamma-glutamyl transferase), and abdominal ultrasonography examination (most patients were found to have dilated extrahepatic and intrahepatic bile ducts due to suspected choledocholithiasis). All patients were examined by experienced ultrasonographer. Patients with suspected sludge on ultrasonography (US) (presence *of* echogenic, mobile, nonshadowing debris), ultrasonically unspecified stones in the common bile duct were excluded.

Methods

The patients were divided into two groups: 29 patients underwent MRCP and 29 patients underwent EUS.

Laboratory findings and abdominal ultrasound were performed for all patients, then the patients were divided into the groups: group 1 included patients with endoscopic ultrasound examination, and group 2 patients with MRCP examination.

After EUS or MRCP were performed, the patients underwent ERCP. The data were obtained from case report forms completed during the procedure.

On the first group, EUS was performed using a radial scope with a frequency of 6–7.5 MHz (Olympus, Japan). On the second group, MRCP was performed using a 1.5 T magnetic resonance imaging (MRI) system (Siemens, Germany), in which no medication or contrast medium was administered.

The ERCP was performed with a standard duodenoscope.

Patients who refused to take part in this study and patients with contraindications for ERCP were excluded. The gold standard for the diagnosis of choledocholithiasis was ERCP. The sensitivity, specificity and diagnostic accuracy of EUS and MRCP were determined for the diagnosis of choledocholithiasis. All procedures were performed by experienced doctors.

Statistical analysis

The positive and negative predictive values (PPV and NPV, respectively) are the proportions of positive and negative results in statistics and diagnostic tests that are true positive and true negative results, respectively. The PPV and NPV described the performance of a diagnostic test or other statistical measure. The PPV and NPV are not intrinsic to the test; they depend also on the prevalence.

Sensitivity, specificity, PPV, NPV and accuracy were calculated. Positive choledocholithiasis on ERCP was considered as a gold standard.

RESULTS

Gender representation was 58% : 42%. The mean age was 56.26 years (SD 12.14) in the group 1 (performing EUS) and 54.8 years (SD 12.31) in the group 2 (performing MRCP).

In the group 1 (EUS) among 29 patients with choledocholithiasis on transabdominal ultrasound 22 (75.9%) patients were found to have choledocholithiasis using ERCP, e. g. the EUS stone detection rate was 88%. In the group 2 (MRCP) among 29 patients with choledocholithiasis on transabdominal ultrasound 16 (55.2 %) patients were found to have choledocholithiasis by ERCP, e. g. the MRCP stone detection rate was 74% (Table 1).

Table 1. Results of endoscopic retrograde cholangiopancreatography (ERCP) according to groups of patients

Patients' group (Diagnostic tool)			ERCP (Gold standard)	
			Finding	No (%) of patients
	Finding	No (%) of patients	Stone	No stone
Group 1 (EUS)	Stone	25 (86.2)	22 (75.9)	3 (10.3)
	No stone	4 (13.7)	1 (3.4)	3 (10.3)
Total		29	23 (79.3)	6 (20.7)
Group 2 (ERCP)	Stone	22 (75.9)	16 (55.2)	6 (20.7)
	No stone	7 (24.1)	4 (13.8)	3 (10.3)
Total		29	20 (69.0)	9 (31.0)

EUS, endoscopic ultrasonography; MRCP, magnetic resonance cholangiopancreatography.

After statistical analysis of false positive and false negative, true positive and true negative results, it was shown that EUS had sensitivity (97%), specificity (67%) and accuracy (88%).

The positive predictive value (PPV) and negative predictive value (NPV) of EUS were 88% and 80%, respectively. For MRCP sensitivity was 81%, specificity 40%. The PPV and NPV of MRCP was 74% and 50%, respectively, which was lower than that of the EUS (Table 2).

Table 2. Comparison of diagnostic values between endoscopic ultrasonography (EUS) and magnetic resonance cholangiopancreatography (MRCP)

Variables compared to ERCP	EUS	MRCP
True positive (No, %)	22 (75.9)	16 (55.2)
True negative (No, %)	4 (13.8)	4 (13.8)
False positive (No, %)	3 (10.3)	6 (20.7)
False negative (No, %)	1 (3.4)	4 (13.8)
Diagnostic test (%)		
Sensitivity	97	81
Specificity	67	40
Accuracy	88	68
PPV	88	74
NPV	80	50

ERCP, endoscopic retrograde cholangiopancreatography; PPV, positive predictive value; NPV, negative predictive value

DISSCUSION

This study demonstrated a high diagnostic accuracy of both non-invasive methods, endoscopic ultrasound and magnetic retrograde cholangiopancreatography. Based on the data, we can conclude that the ability of EUS to diagnose true positive patients with choledocholithiasis was higher than MRCP. EUS examination was also better for diagnosing true negative patients than MRCP. The PPV of EUS was 88%, which indicates 88% probability of a patient with choledocholithiasis having positive diagnostic test results; and in MRCP group it was 74%. Thus, in our study, EUS was superior to MRCP for detecting choledocholithiasis, which was confirmed using ERCP.

In a recently published study of Vaynshtein et al. EUS was an excellent screening tool for choledocholithiasis before performing ERCP. In most patients who undergo an early EUS, a subsequent diagnostic ERCP will not be needed. Additionally, alkaline phosphatase (ALP) serum levels higher than 300 IU/L are an independent predictor for the presence of CBD stones (16).

A systemic review from 2017 performed by Guillaca et al. included a total of 18 studies involving 2366 participants. Both EUS and MRCP have high diagnostic accuracy for detection of common bile duct stones. People with positive EUS or MRCP should undergo endoscopic or surgical extraction of common bile duct stones and those with negative EUS or MRCP do not need further invasive tests. The two tests were similar in terms of diagnostic accuracy and the choice of which test to use will be informed by availability and contra-indications to each test. Further studies that are of high methodological quality are necessary to determine the diagnostic accuracy of EUS and MRCP for the diagnosis of common bile duct stones (17).

In a study of Prachayakul et al. EUS had a sensitivity of 100% and specificity of 80% for detection of CBD stones, and authors concluded that EUS is an accurate diagnostic tool for the detection of CBD stones, and can prevent the unnecessary use of ERCP (18).

Currently there is a need to redefine the ASGE Guidelines, so the focus of recent research are non-invasive techniques in choledolithiasis diagnostics with the aim of assessing their usability. Further, in the scenario of acute cholecystitis, the ASGE guidelines have a low positive predictive value and specificity and leading to an excessive overuse of ERCP as described in the paper of Gouveia et al. concluding that ASGE choledocholithiasis score was not useful for diagnosing choledocholithiasis in patients presenting with acute cholecystitis. Therefore, in patients with acute cholecystitis and suspected choledocholithiasis, this score should not be used and another diagnostic method such as EUS or MRCP should be employed prior to ERCP (19).

The major advantage of MRCP is its completely noninvasive nature compared with EUS, perhaps making it a better test for high-risk patients such as the elderly or the severely ill (17). Nevertheless, a high level of technical expertise is crucial to ensure an accurate review of MRCP images and this method requires a high level of patient cooperation. The presence of air bubbles inside the bile duct is a contributing factor to EUS false negative results (17).

The EUS yields very high-resolution images because of the proximity of the endoscope probe to the internal structures. This high resolution, which exceeds that of MRCP, makes EUS extremely sensitive to small stones. If stones are demonstrated by EUS, therapeutic ERCP can potentially be performed immediately after the completion of EUS while the patient is still sedated (16). However, EUS brings risks of sedation, bleeding, and perforation (17).

There has been much recent interest in performing new guidelines in initial evaluation of patients with suspected choledocholithiasis with less invasive or noninvasive modalities such as EUS and MRCP (17-19).

Choledocholithiasis is often missed on US because it has a relatively low sensitivity (15%–40%), although, its sensitivity is better for detecting CBD dilatation (77%–87%) (20).

The MRCP and EUS are other reliable noninvasive procedures used to evaluate choledocholithiasis and have few risks and complications. The ERCP was still considered as a golden standard. The ideal algorithm for choledocholithiasis diagnostic protocol is still an interest of further research.

In conclusion, EUS is a superior noninvasive tool in comparison with MRCP for detecting choledocholithiasis, which was confirmed using ERCP.

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TRANSPARENCY DECLARATION

Competing interest: None to declare.

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