

# Suspected choledocholithiasis: endoscopic ultrasound or magnetic resonance cholangio-pancreatography? A systematic review

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There is a lack of consensus on the optimal noninvasive strategy for patients with suspected choledocholithiasis after a negative transabdominal ultrasound and/or computed tomography. A meta-analysis was conducted to compare the diagnostic ability of endoscopic ultrasound (EUS) and magnetic resonance cholangio-pancreatography (MRCP) in patients with suspected common bile duct (CBD) stones. A search, using the following terms 'MRCP', 'EUS' and 'Choledocholithiasis' in Pubmed and Cochrane Controlled Trials Register, was performed. Abstract books and reference list of review articles, as well as relevant studies, were also searched to complete our EUS versus MRCP for choledocholithiasis comparison studies database. The analysis demonstrated that, with respect to sensitivity, specificity and accuracy, there was no statistically significant difference between EUS and MRCP for the detection of choledocholithiasis. Our meta-analysis of

prospective comparison of MRCP and EUS for the detection of choledocholithiasis yielded statistically similar diagnostic values for both techniques. *Eur J Gastroenterol Hepatol* 19:1007–1011 © 2007 Wolters Kluwer Health | Lippincott Williams & Wilkins.

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## Background

Common bile duct (CBD) stones are classified into primary and secondary stones based on the location of formation. Although the incidence of primary CBD stones vary geographically, secondary CBD stones are not uncommon worldwide, formed in 15–20% of patients with gallbladder stones [1]. Whether primary or secondary, CBD stones can cause cholangitis. Its severe form, acute obstructive suppurative cholangitis (AOSC), is accompanied by septic shock, showing a very high mortality rate. Thus, it is recommended that CBD stones be removed once they are diagnosed.

Endoscopic retrograde cholangio-pancreatography (ERCP) is considered to be the most accurate procedure for CBD stones, especially when wire-guided intraductal ultrasonography is simultaneously performed [2]. Furthermore, ERCP can remove CBD stones subsequently after management of Vater's papilla by either endoscopic papillary balloon dilatation [3] or endoscopic sphincterotomy.

ERCP, however, carries a small but not negligible risk of complications such as pancreatitis and cholangitis. Thus, it would be preferable to use less invasive modalities for the confirmation of CBD stones in indefinite cases. Reported sensitivity of ultrasonography for CBD stones ranges from 18 to 74% [4,5] and that of computed

tomography (CT) ranges from 50 to 90% [6,7]. Thus, ERCP has been performed in patients with unconfirmed CBD stones, showing negative results in 38–80% of such cases [8,9].

Recently developed imaging modalities, endoscopic ultrasound (EUS) and magnetic resonance cholangio-pancreatography (MRCP), are presumed to have better sensitivity to CBD stones than ultrasound or conventional CT, whereas the remaining are less invasive than ERCP. The principal limitations of EUS are that it is an invasive procedure; its results are highly operator-dependent and the procedure is not widely available in clinical practice. In highly experienced hands, EUS has been found to be more sensitive than ERCP for choledocholithiasis [10]. MRCP has emerged as a potential noninvasive alternative approach to evaluate the pancreatobiliary system [11]. Although the equipment is costly and is still under development, the lack of need for routine sedation, intravenous contrast, radiation exposure and greater availability than EUS render MRCP an important alternative to diagnostic ERCP. Claustrophobia remains the major barrier to completion of the study. A comparison between MRCP and ERCP for the detection of CBD stones yielded variable results. These variable results suggest that, as with EUS, the accuracy of MRCP is dependent on experience in image interpretation as well as on MR imaging techniques [11,12].

A few reports have compared the diagnostic ability of CBD stones between EUS and MRCP. In such studies, the number of patients included is small, but extensive comparison between the two modalities has been reported in a single meta-analysis [13] that included five studies [14–18] and 301 patients but missed two current studies accounting for 104 patients [19,20]. One of these former studies included a new MRCP technique consisting in thick-slab single-shot projection to allow the entire visualization of CBD [20].

There is a lack of consensus on the optimal noninvasive strategy for patients with suspected choledocholithiasis after a negative transabdominal US and/or CT.

We conducted this meta-analysis to compare the diagnostic ability of EUS and MRCP in patients with suspected CBD stones.

### Objectives

The aim of this study was to compare the performance of these two noninvasive techniques with regard to the detection of choledocholithiasis when using the data from published comparative trials.

### Search strategy

We performed a search using the following terms ‘MRCP’, ‘EUS’ and ‘Choledocholithiasis’ in Pubmed and Cochrane Controlled Trials Register.

Abstract books and reference list of review articles, as well as relevant studies, were also searched to complete our EUS versus MRCP for choledocholithiasis comparison studies database.

### Selection criteria

We only accepted meta-analysis as well as prospective blinded and randomized studies, indexed in PubMed and written in the English language.

Both EUS and MRCP were performed in the same patients to rule out choledocholithiasis, and a confirmatory criterion standard test (ERCP or intraoperative cholangiography) or reasonable clinical follow-up was done.

Also, all studies had a similar design and patient population characteristics in terms of age, sex, distribution and clinical indication for the test.

In studies that included patients with diagnosis other than biliary stones, we limited our analysis to biliary stones and treated these other patients as negative cases for biliary stones, because they did not show any stones with criterion-standard evaluation.

The important characteristics of these studies are shown in Table 1.

The design, the conduct and the outcomes analysis of these studies were similar. The main objective of these studies was to compare EUS and MRCP diagnostic accuracy for choledocholithiasis. These procedures were carried out independently, and the individual operators were blinded to the outcome of the results of the other investigation. This analysis was limited to seven studies. We included all relevant studies irrespective of favouring one or the other technique.

### Data collection and analysis

An electronic search was used by means of PubMed. A manual search was also made for relevant reviews, original articles and abstract books. The data were extracted only from included studies.

A total of 405 patients comprised the pooled data set. We only included patients with CBD stones diagnosis. By using these values, we calculated sensitivity, specificity and accuracy of EUS and MRCP for choledocholithiasis. These values were extracted through a careful reading of included papers.

To compare the performance of these two techniques, a test for homogeneity of the proportions across the seven studies was performed. This test was not significant.

The choice of methodology for estimating aggregate outcome measures, all expressed in proportions, was the random effects model. By using this methodology, we calculated individual and aggregated sensitivity, specificity and accuracy for EUS and MRCP for choledocholithiasis.

Review Manager 4.2.9 from Nordic Cochrane Group was used for this meta-analysis.

### Results

Table 2 shows reported accuracies, sensitivities and specificities in included studies.

**Table 1 Study population characteristics**

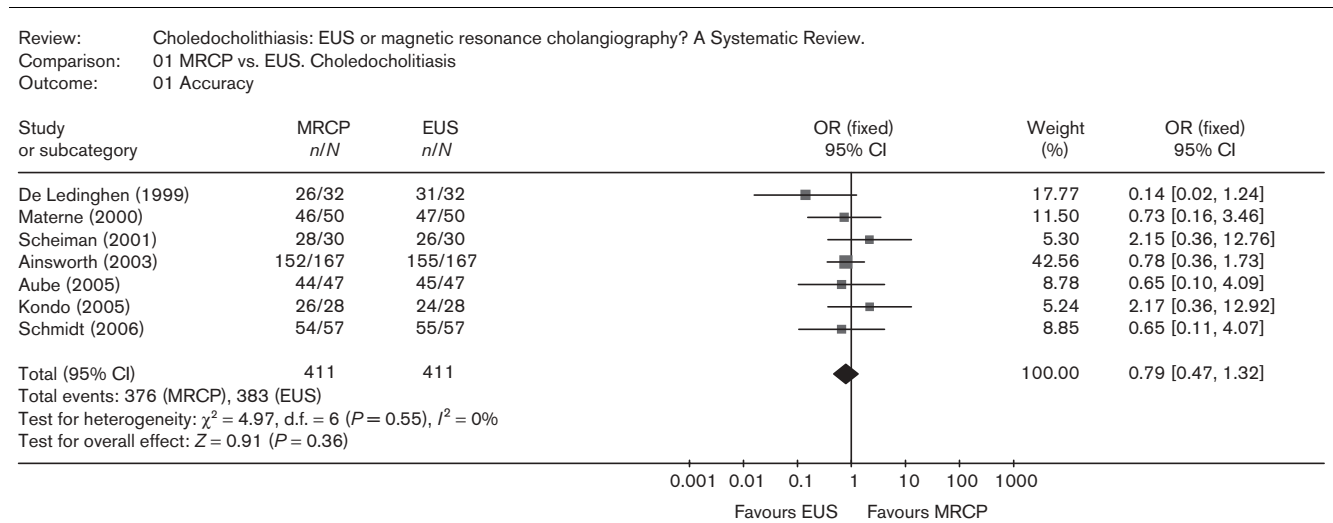
Study	Ainsworth	De Ledinghen	Materne	Scheiman	Kondo	Aube	Schmidt
Age (mean)	64	60.9	59	46.5	64	59	61
Female	104	25	27	14	12	25	36
No. of patients	163	32	50	28	28	47	57
Dx stones	60	10	9	5	24	16	18

Dx, diagnosed.

**Table 2 Performance of endoscopic ultrasound (EUS) and magnetic resonance cholangio-pancreatography (MRCP) for evaluation of choledocholithiasis**

Study	Ainsworth	De Ledinghen	Materne	Scheiman	Kondo	Aube	Schmidt
Accuracy							
EUS	0.93	0.96	0.94	0.93	0.93	0.95	0.96
MRCP	0.91	0.82	0.92	0.86	0.86	0.93	0.94
Sensitivity							
EUS	0.90	1	0.97	0.8	1.0	0.93	0.97
MRCP	0.87	1	0.91	0.4	0.88	0.87	0.94
Specificity							
EUS	0.99	0.95	0.88	0.95	0.5	0.96	0.94
MRCP	0.97	0.72	0.94	0.96	0.75	0.96	0.94

**Fig. 1**



Comparison between endoscopic ultrasound (EUS) and magnetic resonance cholangio-pancreatography (MRCP): accuracy. CI, confidence interval; OR, odds ratio.

For the detection of choledocholithiasis, the aggregated sensitivities of EUS were slightly superior to MRCP with an odds ratio of 0.34, 95% confidence interval (CI) (0.17, 0.70) (Fig. 1). The aggregated specificities of EUS were slightly superior to MRCP with an odds ratio of 0.78, 95% CI (0.35, 1.73) (Fig. 2). Finally, the aggregated accuracies of EUS were slightly superior to MRCP with an odds ratio of 0.79 95% CI (0.47, 1.32) (Fig. 3).

The analysis demonstrated that, with respect to sensitivity, specificity and accuracy, there was no statistically significant difference between EUS and MRCP for the detection of choledocholithiasis. Hence, they can suitably be used as a screening modality for choledocholithiasis.

**Discussion**

The results from this study are consistent with a recent meta-analysis performed by Verma *et al.* [13]

Most of the diagnostic results of EUS are slightly better than those of MRCP. The differences, however, are mostly not statistically significant.

In MRCP exams, the number of image repetitions necessary to obtain an adequate visualization of the sphincter complex in a relaxed state differs among the patients and thick-slab determines its accuracy [16,20].

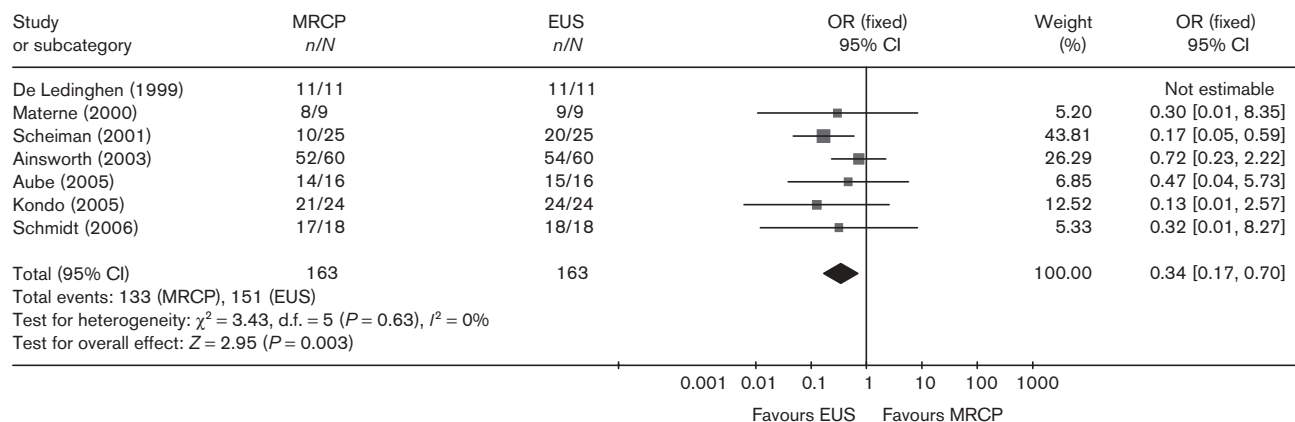
The gold standard used in a variety of studies [19,20] was ERCP, although its accuracy is not 100% [21] Another limitation could be patients with sphincter dysfunction or passage of stones between MRCP or EUS and gold standard [19,20].

None of these studies assesses the patient’s preferences.

In one study, the impact of EUS or MRCP on the ERCP workload was very dependent on the presumed probability of the need for endoscopic therapy, and it was possible to use clinical findings, liver function test values and ultrasound findings to categorize patients in different groups where the potential clinical impact of EUS and MRCP was very variable [17]. Some studies excluded patients with acute cholangitis because ERCP, was needed urgently and EUS, being an invasive procedure,

**Fig. 2**

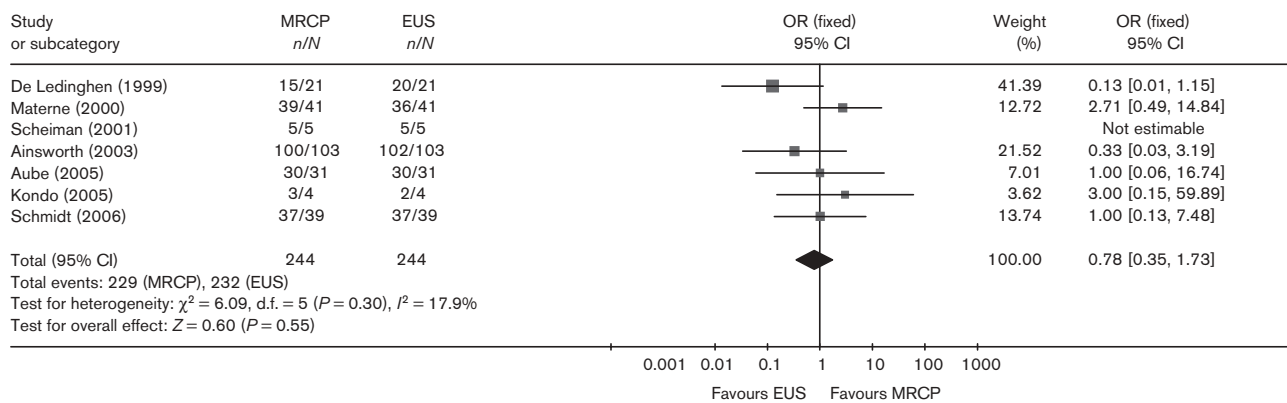
Review: Choledocholithiasis: EUS or magnetic resonance cholangiography? A Systematic Review.  
 Comparison: 01 MRCP vs. EUS. Choledocholithiasis  
 Outcome: 03 Sensitivity



Comparison between endoscopic ultrasound (EUS) and magnetic resonance cholangio-pancreatography (MRCP): sensitivity. CI, confidence interval; OR, odds ratio.

**Fig. 3**

Review: Choledocholithiasis: EUS or magnetic resonance cholangiography? A Systematic Review.  
 Comparison: 01 MRCP vs. EUS. Choledocholithiasis  
 Outcome: 04 Specificity



Comparison between endoscopic ultrasound (EUS) and magnetic resonance cholangio-pancreatography (MRCP): specificity. CI, confidence interval; OR, odds ratio.

was only carried out in patients with high suspicion of choledocholithiasis; thus, the sensitivity study was not powerful enough [18].

In one of the studies, EUS correctly diagnosed sludge whereas MRCP failed to do so [15].

A cost-effective analysis was made in one of the studies showing that EUS was the most cost-effective initial imaging modality for patients with extrahepatic disease and also suggesting that a marked improvement in MRCP

technique could change these results [16] and bring out the possibility that new EUS technologies, such as the transverse linear array technology, hold the potential to develop a single endoscope that can provide biliary images and allow the operator to proceed with ERCP, if necessary.

**Conclusion**

This meta-analysis of prospective comparison of MRCP and EUS for the detection of choledocholithiasis yielded statistically similar diagnostic values for both techniques.

One can use one of them in case of contraindication for the other.

As we observed no statistically significant difference between techniques, considerations other than diagnostic efficacy might be important when deciding which imaging method to use in addition to transabdominal ultrasound. These factors include cost, availability, lack of invasiveness and local expertise.

### Implications for practice and research

Economic analysis should be included for each option. Consider patient's opinion to undergo EUS or MRCP. Cost-effectiveness studies should be performed to address different factors.

### What is already known on this topic?

EUS and MRCP are emerging as reliable, low-risk substitutes for diagnostic ERCP, a procedure with possible complications.

A systematic review of five randomized and prospective trials comparing EUS and MRCP showed no significant difference between these modalities in terms of sensitivity, specificity and diagnostic accuracy.

### What does this study add to our knowledge?

In spite of new technologies being applied to MRCP and new entry data, the sensitivity, specificity and diagnostic accuracy of MRCP and EUS remain similar.

MRCP is a noninvasive procedure and so the initial step to evaluate patients with suspected choledocholithiasis should be MRCP. When MRCP is negative, the next step should be EUS.

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