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Original Article

Surgery Section

Diagnostic Accuracy of EUS versus MRCP for Extrahepatic Biliary Tract Disorders: A Prospective Observational Study

DIVIJ AGARWAL[1], VARUN S SHETTY[2], IQBAL ALI[3]

ABSTRACT

Introduction: Accurate diagnosis of Extrahepatic Biliary Tract Disorders (EHBTDs) is essential for guiding appropriate management. Magnetic Resonance Cholangiopancreatography (MRCP) is a widely used non-invasive modality but may miss small calculi or early lesions. Endoscopic Ultrasound (EUS), with its superior spatial resolution and ability for tissue sampling, may provide enhanced diagnostic yield.

Aim: To compare MRCP and EUS in EHBTDs, with special focus on obscure Common Bile Duct (CBD) dilatation.

Materials and Methods: The present prospective observational study was carried in the Department of General Surgery at Dr DY Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India, from January 2024 to March 2025. It included 100 adults with suspected EHBTDs who underwent MRCP followed by EUS within one week. Final diagnoses were confirmed using Endoscopic Retrograde Cholangiopancreatography (ERCP), operative findings, histopathology, and structured follow-up. Diagnostic performance was assessed by sensitivity, specificity, predictive values, and area under the ROC curve (AUC). Subgroup analysis was performed for obscure CBD dilatation (n=9).

Results: The EUS consistently outperformed MRCP across diagnostic categories. For choledocholithiasis, EUS achieved sensitivity and specificity of 97.2% and 95.4% (AUC 0.96), compared with 91.8% and 90.1% for MRCP (AUC 0.91). In benign biliary strictures, EUS reached 98.3% sensitivity and 96.2% specificity, surpassing MRCP (91.7% and 89.6%). For neoplastic lesions, EUS showed sensitivity of 96.8% and specificity of 95.0%, slightly higher than MRCP (95.0% each). The most striking difference was observed in obscure CBD dilatation: MRCP failed to reveal any aetiology, whereas EUS correctly identified the underlying pathology in six of nine patients. The remaining three cases required ERCP for definitive confirmation.

Conclusion: These results reinforce the higher diagnostic accuracy of EUS in EHBTDs and emphasise its role when MRCP is inconclusive. In obscure CBD dilatation, EUS not only clarified the diagnosis in most patients but also reduced unnecessary reliance on diagnostic ERCP.

Keywords: Common bile duct dilatation, Diagnostic yield, Endoscopic ultrasound, Magnetic resonance cholangiopancreatography Obstructive jaundice

INTRODUCTION

The EHBTD encompass a diverse array of benign and malignant conditions, including obstructive, congenital, and inflammatory pathologies, all of which demand accurate diagnosis to guide timely and appropriate management. Gallstone disease, which accounts for the majority of benign EHBTDs, affects roughly 10–15% of adults in Western populations and about 3–10% of adults in Asian cohorts, with consistently higher prevalence observed in women than in men [1]. In India, the prevalence is highly variable, ranging from as low as 4.87% in southern states to as high as 20-30% in the Gangetic belt as highlighted by Nayak SB [2]. Malignant extrahepatic biliary lesions, though less common, contribute disproportionately to morbidity and mortality. The incidence of bile duct cancers is estimated at one to two cases per one hundred thousand population annually, and recent epidemiological analyses by Florio AA and Miranda-Filho A et al., have demonstrated a rising trend in cholangiocarcinoma in Western Europe and North America, underscoring the dynamic epidemiology of EHBTDs [3,4].

A wide range of investigations is available for the evaluation of EHBTDs, and in practice these are usually pursued in a stepwise sequence. Transabdominal ultrasound serves as the most common initial investigation because of its availability and safety [5]. When further clarification is required, MRCP is typically performed to provide non-invasive, contrast free delineation of the biliary tract. EUS, with its superior spatial resolution and proximity to the bile duct, is increasingly used when additional diagnostic precision is needed. MRCP is widely regarded as a reliable first-line modality for mapping anatomy and excluding gross pathology, while EUS adds value through higher sensitivity for small stones, early strictures, and the capacity for real-time tissue acquisition [6]. Comparative studies have supported this complementary role. In a prospective cohort of patients with partial biliary obstruction and inconclusive initial imaging, Khan R S et al. showed that EUS achieved 100% sensitivity and 100% specificity for detecting common bile duct stones or sludge, whereas MRCP reached only 37.5% sensitivity despite 100% specificity, thereby strongly reinforcing the superiority of EUS over MRCP in biliary pathology [7].

Among the most diagnostically challenging presentations is obscure CBD dilatation, which is defined as enlargement of the CBD on imaging in the absence of a clearly identifiable cause. Hakim S and Sethi A reported that EUS was able to establish an aetiology in more than half of patients with unexplained CBD dilatation after MRCP and other cross-sectional imaging had failed to provide a diagnosis, reinforcing its role as a decisive second line investigation in this challenging context [8]. In light of these considerations, the present study was designed to compare the diagnostic performance of MRCP and EUS in patients with suspected EHBTDs, with a particular emphasis on those presenting with obscure CBD dilatation.

MATERIALS AND METHODS

The present prospective observational study was carried in the Department of General Surgery at Dr DY Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India,

from January 2024 to March 2025. Ethical clearance was obtained from the Institutional Ethics Committee (Ref. No.: I.E.S.C./271/2023), and written informed consent was obtained from all participating patients prior to enrolment.

Sample size calculation: The sample size was determined using Cochran's formula for proportions, a standard approach for estimating the required number of participants when a single proportion is the parameter of interest. Since the true value of overall diagnostic accuracy in The study population was not known in advance, They adopted the most conservative assumption of p=0.50, which maximises variance and therefore yields the largest required sample size. This "worst-case" approach ensures adequate power irrespective of the eventual observed proportion, as emphasised by Akoglu H, who described its use as a reference standard in planning diagnostic accuracy studies [9]. Thus, the required minimum sample size was 96 participants. Allowing for a small margin of attrition (~10%), the final sample size was rounded to 100 participants. Patients were selected using a non-probability, convenience sampling method.

Inclusion and Exclusion criteria: All adults aged 18 years and above presenting with clinical or biochemical suspicion of EHBTD were included in the study if they demonstrated either a dilated CBD on transabdominal ultrasonography, defined as a diameter greater than 7 mm in non-cholecystectomised adults measured in the extrahepatic supra duodenal segment, or unexplained cholestatic liver enzyme derangement characterised by alkaline phosphatase more than 1.5 times the upper limit of normal, gamma-glutamyl transferase more than twice the upper limit of normal, or conjugated bilirubin exceeding 1.5 times the upper limit of normal after exclusion of intrahepatic causes. A previous study reaffirmed the 7 mm cut-off, demonstrating that a diameter beyond this value reliably correlates with pathological obstruction [10]. Although CBD calibre may vary with advancing age and following cholecystectomy, applying variable thresholds would have reduced uniformity in the cohort. Therefore, a single cut-off was maintained to ensure consistency across the study population. Patients were excluded if they had a history of biliary surgery, such as hepaticojejunostomy or choledochoduodenostomy, a previously established malignant biliary or periampullary diagnosis, any contraindications to Magnetic Resonance Imaging (MRI) or endoscopy, including non MRI-compatible implants, severe claustrophobia that was not relieved by sedation, pregnancy, or an inability to provide informed consent.

Study Procedure

Each enrolled patient underwent MRCP using a 1.5 Tesla scanner equipped with dedicated cholangiographic sequences. Within one week of MRCP, EUS was performed using a radial echoendoscope under conscious sedation. To minimise interobserver variability, all ultrasonographic examinations were performed by experienced radiologists using a standardised protocol, with CBD diameters measured from inner-to-inner wall at end-expiration. In cases of borderline or equivocal findings, a second senior radiologist performed an independent blinded review, and any discrepancies were resolved by consensus, thereby reducing interobserver variability.

Final diagnoses were established through a composite reference standard, including findings from ERCP, surgical exploration, histopathological confirmation where relevant, and structured clinical follow-up for a minimum of six months. In cases that did not undergo intervention, resolution or progression of symptoms and biochemical markers was used to validate the presumed diagnosis. Within the broader cohort of patients, a distinct subgroup was identified comprising individuals with obscure CBD dilatation, defined as cases in which MRCP demonstrated dilated CBD without any apparent aetiology. This subgroup was isolated to assess the comparative diagnostic efficacy of MRCP and EUS, specifically in cases of diagnostic ambiguity.

The primary endpoint of the present study was to determine the diagnostic accuracy of MRCP and EUS in EHBTDs using a composite reference standard of findings on ERCP, surgery and histopathology with performance assessed by sensitivity, specificity, predictive values, and area under the ROC curve across choledocholithiasis, benign strictures, neoplastic lesions, and the diagnostically challenging subgroup of obscure CBD dilatation.

STATISTICAL ANALYSIS

All data were analysed using IBM Statistical Package for Social Sciences (SPSS) Statistics version 25.0. Continuous variables were summarised as mean±standard deviation (SD) and categorical variables as counts and percentages. Normality was assessed using the Shapiro-Wilk test. Diagnostic performance metrics {sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), and overall accuracy} were calculated for MRCP and EUS. A two-sided p-value <0.05 was considered statistically significant.

RESULTS

The mean age of the study population was 43.99±9.23 years. Age-wise distribution revealed that patients diagnosed with choledocholithiasis (n=67) were predominantly within the 40-49 year age group (40.30%) [Table/Fig-1]. Clinically, the most frequently reported symptoms were right upper quadrant pain (60%), followed by nausea and vomiting (55%), fever (29%), and pruritus (16%), aligning with the typical presentations of biliary tract pathology.

Characteristic	Sub-category	Choledocholithiasis {n (%)}	Benign stricture {n (%)}	Neoplastic lesions {n (%)}
Age (years)	<30	5 (7.46)	3 (17.65)	0 (0.0)
	30-39	20 (29.85)	3 (17.65)	3 (18.75)
	40-49	27 (40.30)	8 (47.06)	8 (50.0)
	50-59	10 (14.93)	3 (17.65)	5 (31.25)
	60-69	5 (7.46)	0 (0.0)	0 (0.0)
Gender	Male	39 (58.21)	10 (58.82)	9 (56.25)
	Female	28 (41.79)	7 (41.18)	7 (43.75)
Total		67 (100.0)	17 (100.0)	16 (100.0)

[Table/Fig-1]: Demographic distribution of EHBTD cases according to diagnosis.

On MRCP the most frequently detected pathology was choledocholithiasis (n=59), followed by neoplastic lesions (n=13) and benign biliary strictures (n=9) [Table/Fig-2]. MRCP identified choledocholithiasis with a sensitivity of 91.8% and specificity of 90.1% [Table/Fig-3,4].

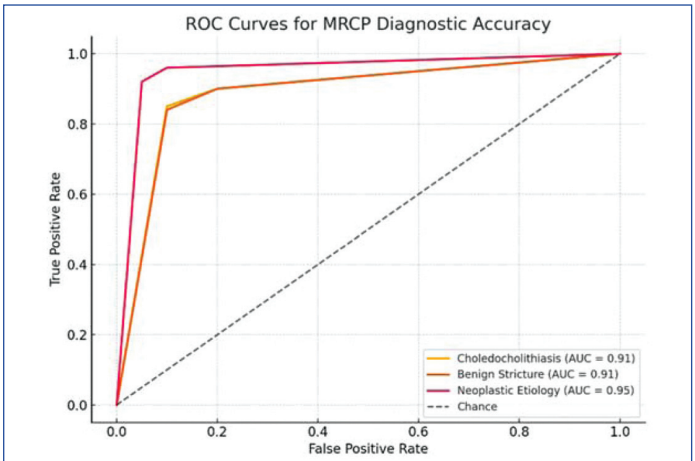
Final diagnosis	n	%
Choledocholithiasis	59	59.00
Neoplastic	13	13.00
Benign stricture	9	9.00
Choledochal cyst	6	6.00
Benign stricture with passed stone	1	1.00
Polyps	1	1.00
Malignant stricture	1	1.00
Periampullary cancer	1	1.00
Obscure CBD dilatation	9	9.00

[Table/Fig-2]: Final diagnosis of patients with EHBTD on MRCP (n = 100).

On EUS evaluation, choledocholithiasis was the most frequently detected pathology (n=60; 60%). Neoplastic lesions accounted for 12 (12%), while benign biliary strictures and choledochal cysts were identified in 7 (7%) of cases each [Table/Fig-5]. A comparative analysis of EHBTD diagnosis on MRCP and EUS has been provided

Diagnosis	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	AUC
Choledocholithiasis	91.8 (82.0-96.9)	90.1 (78.2-96.7)	90.2 (80.1-96.0)	91.8 (81.9-96.9)	0.91
Benign stricture	91.7 (59.8-99.6)	89.6 (79.0-95.9)	90.2 (60.0-98.9)	91.8 (80.4-97.7)	0.91
Neoplastic aetiology	95.0 (71.0-99.9)	95.0 (86.0-98.9)	95.0 (70.5-99.7)	95.0 (86.0-98.9)	0.95

[Table/Fig-3]: Diagnostic characteristics of MRCP in diagnosing EHBTD in our study cohort.



[Table/Fig-4]: ROC curves for MRCP in the diagnostic evaluation of EHBTD.

Final diagnosis	n	%
Choledocholithiasis	60	60.00
Neoplastic	12	12.00
Benign stricture	7	7.00
Choledochal cyst	7	7.00
Benign stricture with passed stone	3	3.00
Polyps	2	2.00
Malignant stricture	3	3.00
Cholelithiasis with passed stones	3	3.00
Obscure CBD dilatation	3	3.00

[Table/Fig-5]: Final diagnosis of patients with EHBTD on EUS (n = 100).

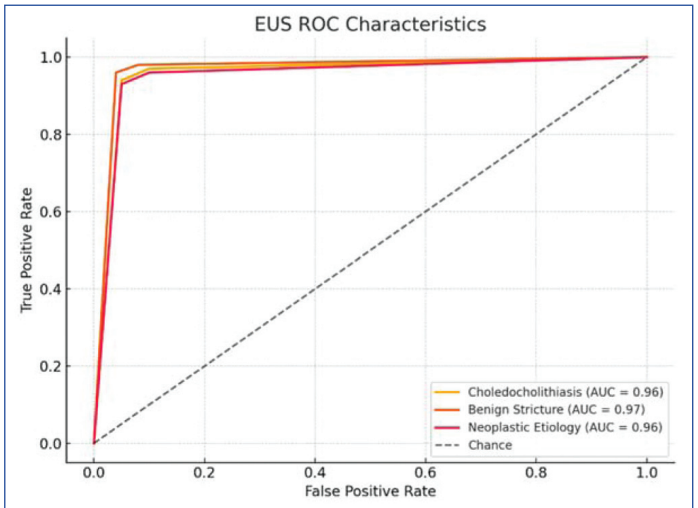
in [Table/Fig-6]. For choledocholithiasis, EUS achieved a sensitivity of 97.2% and specificity of 95.4%. For neoplastic aetiologies, including periampullary carcinoma and distal cholangiocarcinoma, EUS demonstrated similarly robust accuracy, with a sensitivity of 96.8% and a specificity of 95.0% [Table/Fig-7,8]. It is important to note that these diagnostic values reflect cases in which the cause of biliary obstruction was definitively identified on imaging and do not include patients with obscure CBD dilatation. A tabular representation of discordant diagnosis in cases with EHBTD between MCRP and EUS has been summarised in [Table/Fig-9].

Diagnosis	MRCP (n)	MRCP (%)	EUS (n)	EUS (%)
Benign Stricture	9	9.00	7	7.00
Benign stricture with passed stone	1	1.00	3	3.00
Choledochal cyst	6	6.00	7	7.00
Choledocholithiasis	59	59.00	60	60.00
Cholelithiasis with passed stones	0	0.00	3	3.00
Malignant stricture	1	1.00	3	3.00
Neoplastic	13	13.00	12	12.00
Obscure CBD dilatation	9	9.00	3	3.00
Periampullary cancer	1	1.00	0	0.00
Polyps	1	1.00	2	2.00

[Table/Fig-6]: Comparative distribution of diagnoses on MRCP and EUS in patients with suspected EHBTD (n=100).

Diagnosis	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	AUC
Choledocholithiasis	97.2 (88.7-99.9)	95.4 (84.2-99.4)	96.1 (87.1-99.4)	96.6 (86.6-99.5)	0.96
Benign stricture	98.3 (66.6-99.9)	96.2 (86.8-99.5)	97.4 (65.8-99.9)	97.3 (87.0-99.6)	0.97
Neoplastic aetiology	96.8 (71.5-99.9)	95.0 (86.0-98.9)	96.5 (71.0-99.7)	96.5 (87.0-99.6)	0.96

[Table/Fig-7]: Diagnostic characteristics of EUS in diagnosing EHBTD.



[Table/Fig-8]: ROC curves for EUS in diagnosing EHBTD.

MRCP finding	EUS finding	Final diagnosis
Normal CBD	Small stone in distal CBD - Choledocholithiasis	Choledocholithiasis confirmed on ERCP
Benign stricture	CBD dilatation with passed stone	CBD dilatation with passed stone confirmed on ERCP
Benign stricture	CBD dilatation with passed stone	CBD dilatation with passed stone confirmed on ERCP
Periampullary carcinoma	Benign stricture with passed stone	Benign stricture with passed stone confirmed on ERCP and Histopathology
Neoplastic lesion in distal CBD	CBD dilatation with passed stone	CBD dilatation with passed stone confirmed on ERCP
Benign stricture with CBD dilatation	Choledochal cyst	Choledochal cyst
Choledocholithiasis	Malignant stricture	Malignant stricture - distal Cholangiocarcinoma on Histopathology.
Benign stricture with passed stone	Malignant stricture	Malignant stricture - distal Cholangiocarcinoma on Histopathology
Choledochal cyst	Benign stricture with passed stone with CBD dilatation	Benign stricture with passed stone confirmed on ERCP and histopathology
Cholelithiasis with CBD dilatation	GB polyp	GB polyp confirmed post cholecystectomy and Histopathology

[Table/Fig-9]: Discordant MRCP-EUS interpretations associated with final diagnosis in patients with suspected EHBTD.

A key focus of this study was the evaluation of patients presenting with obscure CBD dilatation (n=9), defined as ductal dilatation without a discernible cause on MRCP. This subgroup represented a diagnostically complex cohort. EUS successfully established the underlying pathology in six patients, identifying choledocholithiasis (n=3), benign biliary strictures (n=2), and a neoplastic lesion (n=1). In the remaining three cases, EUS failed to detect a definitive aetiology; however, all were later confirmed to have choledocholithiasis on ERCP, thereby exposing diagnostic limitations even within high-resolution modalities [Table/Fig-10]. The resulting sensitivity of EUS in this subgroup was calculated at 66.7% (95% CI 29.9-92.5%), while specificity, PPV, and NPV could not be computed due to the absence

Aetiology	MRCP n (%)	EUS n (%)	Final reference standard (ERCP/surgery) n (%)
Choledocholithiasis	0 (0.0%)	3 (33.3%)	6 (66.7%)
Benign biliary stricture	0 (0.0%)	2 (22.2%)	2 (22.2%)
Neoplastic lesion	0 (0.0%)	1 (11.1%)	1 (11.1%)
No aetiology detected	9 (100.0%)	3 (33.3%)	0 (0.0%)
Total	9 (100.0%)	9 (100.0%)	9 (100.0%)

[Table/Fig-10]: Distribution of cases with obscure CBD dilatation based on diagnosis identified on comparison with EUS/ERCP/surgical findings.

of true negative cases. The wide interval reflects the limited precision inherent in such a small cohort. Post-hoc calculations indicate that with n=9, the study had less than 30% power to distinguish a sensitivity of 70% from a null value of 50% at α=0.05, underscoring that the analysis is underpowered and should be interpreted as exploratory. Nevertheless, the descriptive yield supports the role of EUS as a second-line test when MRCP is inconclusive, aligning with prior evidence that EUS frequently uncovers clinically relevant lesions in this scenario. The final diagnosis in cases with EHBTD, as determined by ERCP/surgery and histopathological examination, is summarised in [Table/Fig-11].

Diagnosis	Final diagnosis on ERCP/histopathology/ surgery (n) (%)
Benign stricture	7 (7%)
Benign stricture with passed stone	3 (3%)
Choledochal cyst	7 (7%)
Choledocholithiasis	63 (63%)
Cholelithiasis with passed stones	3 (3%)
Malignant stricture	3 (3%)
Neoplastic	12 (12%)
Polyps	2 (2%)

[Table/Fig-11]: Distribution of cases based on final diagnosis identified on ERCP/ Histopathology/Surgical findings (n=100).

DISCUSSION

EHBTDs represent a heterogeneous spectrum, encompassing gallstone disease and choledocholithiasis, benign and postoperative strictures, congenital anomalies with cystic dilatations, and premalignant and malignant neoplasms of the biliary tree. A recent systematic review of 115 studies including more than 32 million participants estimated a pooled global gallstone prevalence of 6.1% (95% CI 5.6–6.5), with higher rates in females than males (7.6% vs 5.4%) and marked geographic variation, reaching about 11% in South America compared with 5% in Asia [11]. Along similar lines, in a recent Yemeni series, post hepatic obstructive jaundice was most common in middle aged and older adults, with a predominance of women and choledocholithiasis as the leading cause [12]. An Indian tertiary care series by Sahu SK et al. demonstrated that benign causes, particularly choledocholithiasis, account for over half of obstructive jaundice cases, with pancreatic head and biliary tract malignancies comprising most of the malignant subset [13]. Similarly, hospital based South Asian data from Chalya PL et al. showed that benign obstruction, led by choledocholithiasis, remains more frequent than malignant obstruction, although pancreatic and biliary cancers still contribute substantially to the overall burden [14].

In the present study, MRCP demonstrated sensitivity and specificity values of 91.8% and 90.1%, respectively, for the detection of choledocholithiasis, which is in line with recent literature. Meta analytic data from Iram J et al. indicated that MRCP achieves sensitivities around 90% and specificities above 85% for choledocholithiasis when ERCP is used as the reference standard, although small stones may still be missed [15]. The authors attributed the lower specificity to false positives arising from overlapping fluid signals and the limited ability of MRCP to differentiate small intraductal air or sludge from true stones.

Similarly, Kumar A et al., in a series of 60 patients with distal biliary strictures, found MRCP accuracy to be approximately 70% when used alone but noted a significant improvement to nearly 89% when combined with CT, reasoning that cross sectional anatomical detail from CT complemented the ductal visualisation of MRCP and thereby reduced misclassification of benign versus malignant lesions [16]. Udaykumar J et al. reported MRCP sensitivities around 85–95% and specificities near 90% for choledocholithiasis, with most false negatives occurring in patients harbouring small distal stones, particularly attributing this strong performance to improved scanner resolution and meticulous correlation with ERCP, while emphasising that MRCP still risks missing stones smaller than 3 mm [17]. In a prospective comparison of 50 patients with biliary strictures, MRCP achieved a sensitivity of 85% and specificity of 71% for diagnosing malignancy, whereas CT reached 77% and 63%, respectively, highlighting that cross sectional imaging alone has limited specificity and often requires complementary modalities for definitive characterisation [18]. The authors attributed this accuracy to careful histopathological correlation and the use of adjunctive multiplanar reconstructions to distinguish inflammatory from malignant narrowing.

The shortcomings of MRCP in evaluating EHBTDs largely stem from its inherent technical and physiological limitations. As a static imaging modality, MRCP relies on fluid filled ductal structures for contrast and therefore has reduced sensitivity for detecting small stones (less than 3-5 mm), sludge, or early mucosal lesions that may not yet produce significant ductal dilatation. Wee D et al. demonstrated that MRCP yielded false negatives in nearly 14% of intermediate risk patients, particularly when stones were smaller than 5 mm or impacted distally [19]. Similarly, Eissa M et al. showed that MRCP detected only 41.1% of stones, with a sensitivity of 55.2%, compared with EUS, which detected 83.3% of stones and achieved a sensitivity of 93.9%, underscoring the poor performance of MRCP for small or distal calculi [20]. Most recently, a Cochrane meta analysis of patients with suspected common bile duct stones reported that EUS achieved a pooled sensitivity of 95% and specificity of 97%, compared with 93% and 96% for MRCP, respectively, resulting in an overall diagnostic accuracy of about 94% for EUS versus 89% for MRCP and confirming the superior performance of EUS, particularly for small or distal stones [21].

In the present cohort, EUS demonstrated superior diagnostic performance across all evaluated domains. In choledocholithiasis, Prachayakul V and Aswakul P reported an EUS sensitivity of 96.3%, specificity of 100%, and overall accuracy of 97.5% in patients with an intermediate or high likelihood of CBD stones, highlighting its excellent ability to rule out choledocholithiasis [22]. Collectively, these data confirm EUS as a highly accurate, versatile modality for diagnosing both benign and neoplastic EHBTDs [Table/Fig-12] [22-25].

Author and year	Sample size	Pathology assessed	EUS sensitivity (%)	EUS specificity (%)	Key takeaway
Prachayakul V et al. [22]	165	Choledocholithiasis (intermediate-high probability)	93-97	88-95	EUS demonstrated high diagnostic accuracy and reliably avoided unnecessary diagnostic ERCP in patients with suspected CBD stones.
Amouyal P et al.[23]	422	Choledocholithiasis	94	95	Landmark study establishing EUS as a highly accurate modality for detecting bile duct stones, particularly small or distal calculi.
Heinzow HS et al.[24]	215	Malignant vs benign biliary strictures	92-95	85-90	EUS outperformed CT and was complementary to ERCP in differentiating malignant from benign biliary strictures.

Sakamoto H et al.[25]	71	Malignant pancreatic and biliary lesions	96	~100	EUS showed excellent sensitivity for small pancreatic and biliary malignancies, supporting its role in early diagnosis and staging.

[Table/Fig-12]: Diagnostic performance of EUS in choledocholithiasis, benign strictures, and malignant lesions according to worldwide literature [22-25].

These findings highlight the inherent limitations of MRCP in identifying radiologically subtle or anatomically inconspicuous lesions and demonstrate that EUS, despite its superior resolution, may also underperform in very early phase or atypical presentations. The diagnostic yield in this subgroup affirms the indispensable role of EUS as a second line modality when MRCP findings are inconclusive, while reinforcing the continued relevance of ERCP as the diagnostic gold standard in unresolved cases. This subset analysis not only underscores the real world complexity of evaluating obscure CBD dilatation but also supports a tiered, algorithm driven diagnostic strategy to optimise clinical decision making in challenging biliary pathologies.

In the present series (n=9), EUS established the aetiology in 66.7% of cases, consistent with contemporary evidence. In a cohort of 199 patients with dilated CBD but normal liver function tests, Kaspy MS et al. found that EUS detected clinically significant pathology in only a small minority of cases, mostly in older patients or those with gallstones, suggesting that EUS may reasonably be deferred when these risk features are absent [26]. By contrast, in patients with unexplained ductal dilatation despite non diagnostic cross sectional imaging, Pausawasdi N et al. reported a diagnostic yield of 67% (88/131), with malignancy (31%), choledocholithiasis (18.3%), and benign strictures (17.6%) being common; diagnostic yield increased in men, in those with intrahepatic ductal dilatation, and in patients with cholestatic enzymes greater than three times the upper limit of normal [27]. Following a negative MRCP, Suzuki M et al. found that EUS established a definite diagnosis in roughly half of patients with unexplained biliary dilatation, most commonly detecting previously unrecognised choledocholithiasis, benign biliary strictures, or malignant obstruction, thereby reinforcing its value as a problem solving modality in this setting [28]. Similarly, in a cohort of patients with unexplained CBD dilatation, Ding H et al. showed that combining EUS with tumour markers yielded excellent diagnostic accuracy for malignant causes and identified elevated CA 19 9, weight loss, and pancreatic duct dilatation as strong independent predictors of malignancy [29]. Most recently, Mahajan A et al. (n = 121) documented a diagnostic yield of 55.4% in patients with non diagnostic CT or MRCP, most commonly identifying ampullary neoplasms, pancreatic masses, and small stones or worms, thereby underscoring the ability of EUS to detect subtle periampullary or pancreatic lesions that are often missed by cross sectional imaging [30].

Limitation(s)

The modest sample size, particularly within the obscure CBD dilatation subgroup, constrained statistical power and limited the generalisability of subgroup analyses. The single-centre design, set within a tertiary referral hospital, introduced the possibility of referral bias and might not have reflected outcomes in primary or secondary care settings. Furthermore, the relatively short follow up period also raised the possibility of missed late-presenting or indolent pathologies, especially small neoplastic lesions.

CONCLUSION(S)

The MRCP remains the first-line investigation for most intermediate-risk patients; however, EUS assumes a decisive role when suspicion persists despite negative imaging results. Rather than being viewed as competing modalities, MRCP and EUS should be regarded as complementary, with MRCP providing a non-invasive overview and EUS offering superior resolution, dynamic assessment, and the ability to acquire tissue.

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PARTICULARS OF CONTRIBUTORS:
1. Resident, Department of General Surgery, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pune, Maharashtra, India.
2. Assistant Professor, Department of General Surgery, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pune, Maharashtra, India.
3. Professor, Department of General Surgery, Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pune, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Iqbal Ali,
Dr. D. Y. Patil Medical College, Hospital and Research Centre, Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune-18, Maharashtra, India.
E-mail: shettyvarun03@gmail.com

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