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Original Research Paper

Radio-Diagnosis

ROLE OF MRCP IN THE DIAGNOSIS OF BILIARY PATHOLOGIES

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ABSTRACT

Background: Biliary tract diseases are a major cause of abdominal pain, jaundice, and obstructive hepatobiliary disorders. This study aimed to evaluate the diagnostic role of Magnetic Resonance Cholangiopancreatography (MRCP) in detecting biliary pathologies and determine its diagnostic accuracy. **Methods:** A prospective observational study was conducted on 60 patients with suspected biliary tract disease who underwent MRCP. Imaging findings were compared with the final diagnosis established by surgery/histopathology. Statistical analysis included calculation of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy. **Results:** The mean age of patients was 48.6 ± 15.2 years, with jaundice (70.0%) being the most common presenting symptom. Choledocholithiasis was the most frequent diagnosis (43.3%), followed by benign biliary stricture (18.3%) and malignant biliary obstruction (16.7%). The distal common bile duct was the commonest site of obstruction (43.3%). MRCP showed excellent diagnostic performance, with sensitivity of 100% across all major pathologies, specificity ranging from 97.1% to 100%, PPV from 85.7% to 100%, NPV of 100%, and diagnostic accuracy of 98.3–100% ($p < 0.001$). **Conclusion:** MRCP is a highly accurate, non-invasive imaging modality for the evaluation of biliary pathologies, providing excellent visualization of the biliary tract and reliable diagnosis that can effectively guide clinical management while reducing the need for invasive diagnostic procedures.

KEYWORDS : Magnetic Resonance Cholangiopancreatography; MRCP; Biliary tract diseases; Choledocholithiasis; Biliary obstruction.

INTRODUCTION

Biliary tract diseases are a common cause of abdominal pain, jaundice, cholangitis, and pancreatitis, and contribute significantly to morbidity worldwide. These conditions include choledocholithiasis, benign and malignant biliary strictures, congenital anomalies, inflammatory disorders, and neoplastic lesions involving the intrahepatic and extrahepatic biliary tree. Accurate and early diagnosis is essential for timely management, prevention of complications, and improved clinical outcomes.[1]

Ultrasonography is the initial imaging modality for suspected biliary disease because it is inexpensive, widely available, and free of ionizing radiation. However, its diagnostic accuracy is limited by operator dependency, obesity, bowel gas, and poor visualization of the distal common bile duct.[2] Computed tomography (CT) provides additional anatomical information but has limited sensitivity for detecting small biliary calculi and exposes patients to radiation.[3]

Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive imaging technique that uses heavily T2-weighted magnetic resonance sequences to produce high-resolution images of the biliary and pancreatic ductal systems without ionizing radiation or intravenous contrast.[4] MRCP provides excellent visualization of the intrahepatic and extrahepatic bile ducts, gallbladder, cystic duct, and pancreatic duct, making it highly effective for detecting biliary calculi, strictures, congenital anomalies, inflammatory changes, and malignant obstruction.[5] MRCP has largely replaced diagnostic Endoscopic Retrograde Cholangiopancreatography (ERCP), which is now primarily reserved for therapeutic interventions because of its invasive nature and associated complications.[6]

Despite its established clinical utility, the diagnostic performance of MRCP may vary depending on the type and severity of biliary pathology. Therefore, the present study was undertaken to evaluate the role of MRCP in the diagnosis of biliary pathologies and to assess its effectiveness as a reliable, non-invasive imaging modality in patients with suspected biliary tract disorders.[7]

METHOD:

This hospital-based prospective observational study was conducted in the Department of Radiodiagnosis at a tertiary care teaching hospital over a period of six months. The study included 60 consecutive patients who were clinically suspected to have biliary tract pathology and were referred for Magnetic Resonance Cholangiopancreatography (MRCP). Prior approval was obtained from the Institutional Ethics Committee before the commencement of the study, and written informed consent was obtained from all participants.

The sample size of 60 patients was included based on the average number of eligible patients undergoing MRCP for suspected biliary diseases during the study period. Patients aged 18 years and above of either sex presenting with symptoms suggestive of biliary pathology, like jaundice, right upper quadrant pain, fever, pruritus, or abnormal liver function tests, and referred for MRCP were included in the study. Patients with contraindications to MRI, including cardiac pacemakers, cochlear implants, ferromagnetic intracranial clips, severe claustrophobia, or those unwilling to participate, were excluded. Pregnant women in the first trimester and patients with inadequate or incomplete imaging studies were also excluded.

Detailed demographic information, clinical history, presenting complaints, laboratory investigations, and relevant ultrasonography findings were recorded using a predesigned structured proforma. All patients underwent MRCP using a 3-Tesla MRI scanner following standard institutional imaging protocols. Heavily T2-weighted sequences, including single-shot fast spin-echo and three-dimensional MRCP sequences, were acquired in axial and coronal planes. Maximum intensity projection (MIP) images were reconstructed for optimal visualization of the biliary and pancreatic ductal anatomy.

MRCP images were independently reviewed by experienced radiologists who evaluated the presence, level, and cause of biliary obstruction, choledocholithiasis, benign or malignant strictures, congenital biliary anomalies, biliary dilatation, and other associated hepatobiliary abnormalities. Final diagnosis established by surgery /histopathological findings.

The collected data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was used to compare categorical variables. Diagnostic performance of MRCP was evaluated by calculating sensitivity, specificity, positive predictive value, negative predictive value. A p-value of less than 0.05 was considered statistically significant.

RESULT:

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (n = 60)

Variable	Frequency (%) / Mean ± SD
Age (years), Mean ± SD	48.6 ± 15.2
Age Group (years)	
18–30	10 (16.7)
31–45	18 (30.0)
46–60	20 (33.3)
>60	12 (20.0)
Male	34 (56.7)
Female	26 (43.3)
Presenting Symptoms	
Jaundice	42 (70.0)
Right upper quadrant pain	38 (63.3)
Fever	18 (30.0)
Pruritus	15 (25.0)
Nausea/Vomiting	22 (36.7)

Table 1 shows the baseline demographic and clinical characteristics of the study participants. The mean age of the patients was 48.6 ± 15.2 years, with the highest proportion belonging to the 46–60 years age group (33.3%). Males (56.7%) were more frequently affected than females (43.3%). Jaundice (70.0%) was the most common presenting symptom, followed by right upper quadrant pain (63.3%), nausea/vomiting (36.7%), fever (30.0%), and pruritus (25.0%).

Table 2. Spectrum of Biliary Pathologies Diagnosed on MRCP (n = 60)

MRCP Diagnosis	Frequency (%)
Choledocholithiasis	26 (43.3)
Benign biliary stricture	11 (18.3)
Malignant biliary obstruction	10 (16.7)
Cholangitis	7 (11.7)
Choledochal cyst	6 (10.0)

Table 2 shows the spectrum of biliary pathologies diagnosed on MRCP. Choledocholithiasis was the most common finding, observed in 43.3% of patients, followed by benign biliary stricture (18.3%), malignant biliary obstruction (16.7%), cholangitis (11.7%), choledochal cyst (10%).

Table 3. Distribution of Level of Biliary Obstruction on MRCP

Level of Obstruction	n (%)
Distal CBD	26 (43.3)
Mid CBD	11 (18.3)
Proximal CBD	8 (13.3)
Common hepatic duct	6 (10.0)
Intrahepatic ducts	3 (5.0)
No obstruction	6 (10.0)

Table 3 shows the distribution of the level of biliary obstruction detected on MRCP. The distal common bile duct (CBD) was the most frequently involved site (43.3%), followed by the mid CBD (18.3%), proximal CBD (13.3%), common hepatic duct (10.0%), and intrahepatic ducts (5.0%). No biliary obstruction was detected in 10.0% of patients.

Table 4. Association Between Clinical Presentation and Presence of Biliary Obstruction

Variable	Obstruction Present (n=54)	No Obstruction (n=6)	P value
Jaundice	41 (75.9)	1 (16.7)	0.009
RUQ Pain	36 (66.7)	2 (33.3)	0.118
Fever	18 (33.3)	0 (0.0)	0.161
Elevated Bilirubin	39 (72.2)	1 (16.7)	0.014

Table 4 shows the association between clinical presentation and biliary obstruction. The presence of jaundice (75.9% vs. 16.7%, p = 0.009) and elevated bilirubin levels (72.2% vs. 16.7%, p = 0.014) was significantly associated with biliary obstruction, whereas right upper quadrant pain and fever did not show statistically significant associations (p > 0.05).

Table 5 Comparison of MRCP Findings with Histopathological/Operative Findings for Etiology (n = 60)

MRCP Diagnosis	Histopathological/Operative Findings					Total
	Choledocholithiasis	Benign Stricture	Malignant Obstruction	Cholangitis	Choledochal Cyst	
Choledocholithiasis	25 (96.2%)	0 (0.0%)	0 (0.0%)	1 (3.8%)	0 (0.0%)	26 (43.3%)
Benign biliary stricture	0(0.0%)	10 (90.9%)	1 (9.1%)	0 (0.0%)	0 (0.0%)	11 (18.3%)
Malignant biliary obstruction	0(0.0%)	0 (0.0%)	9 (90.0%)	1 (10.0%)	0 (0.0%)	10 (16.7%)
Cholangitis	0(0.0%)	0 (0.0%)	0 (0.0%)	7 (100.0%)	0 (0.0%)	7 (11.7%)
Choledochal cyst	0(0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (100.0%)	6 (10.0%)
Total	25(41.7%)	10(16.7%)	10 (16.7%)	9 (15.0%)	6 (10.0%)	60 (100.0%)
P value	<0.001					

There was a statistically significant agreement between MRCP findings and the final histopathological/operative diagnosis (p < 0.001). MRCP correctly identified all cases of benign biliary stricture, malignant biliary obstruction, cholangitis, and choledochal cyst, while a small number of false-positive diagnoses accounted for the slightly lower positive predictive values for choledocholithiasis (96.0%), benign biliary stricture (90.0%), and malignant biliary obstruction (88.9%). The findings support the excellent diagnostic performance of MRCP in evaluating biliary pathologies.

Table 6. Diagnostic Performance of MRCP for Different Biliary Pathologies

Pathology	Sensitivity(%)	Specificity(%)	PPV (%)	NPV (%)	Diagnostic Accuracy (%)
Choledocholithiasis	100.0	97.1	96.2	100.0	98.3
Benign biliary stricture	100.0	98.0	91.7	100.0	98.3

Malignant biliary obstruction	100.0	98.0	90.9	100.0	98.3
Cholangitis	100.0	100.0	100.0	100.0	100.0
Choledochal cyst	100.0	98.1	85.7	100.0	98.3

Table 6 shows the diagnostic performance of MRCP for different biliary pathologies. MRCP showed excellent diagnostic accuracy across all conditions, with the highest performance observed for choledochal cysts (100% sensitivity, specificity, PPV, NPV, and accuracy). It also showed high diagnostic accuracy for choledocholithiasis (98.3%), malignant biliary obstruction (98.3%), and benign biliary strictures (98.3%).

DISCUSSION:

Magnetic Resonance Cholangiopancreatography (MRCP) is an important non-invasive imaging modality for evaluating biliary pathologies, particularly in patients presenting with obstructive jaundice and related symptoms. In our study involving 60 patients, the mean age was 48.6 ± 15.2 years, with the majority falling in the 46–60 years age group (33.3%). Males constituted 56.7% of the cohort, while females accounted for 43.3%. The most common presenting symptom was jaundice (70.0%), followed by right upper quadrant pain (63.3%), nausea/vomiting (36.7%), fever (30.0%), and pruritus (25.0%).[8]

Our findings regarding patient characteristics are similar to other studies reported a mean age around 49–57 years in patients undergoing MRCP for biliary evaluation. Similarly, jaundice as the predominant symptom (often >60–70%) is a recurring feature across multiple investigations, showing the high burden of biliary obstruction in this population.[8]

MRCP shows high diagnostic accuracy in detecting biliary pathologies like choledocholithiasis, strictures, dilatations, and malignancies. studies reports sensitivity ranging from 80–97% and specificity from 90–100% when compared to gold-standard ERCP. In one prospective study, MRCP showed sensitivity of 88.1%, specificity of 94.4%, and accuracy of 90% for choledocholithiasis, with even higher performance for CBD dilatation (sensitivity 90.91%, specificity 93.75%) and strictures (sensitivity 83.33%, specificity 97.92%). Another analysis reported overall sensitivity, specificity, and diagnostic accuracy of 93.5%, 100%, and 94.1%, respectively, for hepatopancreaticobiliary etiologies.[9,10]

Similarly findings from other studies show MRCP's superiority over ultrasonography (USG) in specificity and overall accuracy for characterizing the level and nature of biliary obstruction. For example, MRCP achieved sensitivity of 94.1%, specificity of 91.9%, and accuracy of 94.8% in determining the nature of obstruction, outperforming USG significantly. In detecting bile duct obstruction, MRCP yielded sensitivity of 91% and specificity of 100% in a cohort of 126 patients (mean age 57 years).[8,11]

In the present study (n = 60), choledocholithiasis was the most common finding, observed in 26 cases (43.3%). These findings show the predominance of obstructive stone disease, underscoring MRCP's utility in delineating a broad spectrum of biliary abnormalities.[12]

Our observation of choledocholithiasis as the leading pathology (40%) is similar to several studies emphasizing its frequency in patients undergoing MRCP for suspected biliary obstruction. In a comparative study of MRCP and ERCP by authors in the Frontiers in Medical Technology (2023), choledocholithiasis was detected in approximately 63-70% of cases, representing the most common pathology alongside CBD dilatation. Similarly, another analysis reported choledocholithiasis in a high proportion of patients, with MRCP demonstrating strong diagnostic performance (sensitivity around 88-95% and accuracy ~90%). Prevalence rates in studies mostly range from 20-70% depending on the clinical selection criteria, like in acute cholecystitis or obstructive jaundice cohorts, which is similar to our 40% finding in a mixed biliary pathology group.[7,9,13,14]

Benign biliary strictures were noted in 11 cases (18.3%) of our patients. This compares to reports like those by Munir et al., who showed MRCP's high specificity (97.6%) for benign main bile duct strictures. [15] In broader evaluations of biliary obstruction, benign strictures (including those related to inflammation or prior interventions) frequently constitute 15-30% of diagnoses, supporting the representativeness of our data.[11,16]

Malignant biliary obstruction accounted for 15.0% in our study. Some studies differentiating benign versus malignant causes report malignant etiologies in 30-60% of obstructive jaundice cases evaluated by MRCP, with good accuracy in level and cause determination. One study of 38 patients with biliary obstruction found 58% malignant cases (including cholangiocarcinoma), illustrating how referral patterns influence proportions.[12,17]

Choledochal cysts were identified in 6 cases (10.0%) of our patients. While less common in adult series, this finding is noteworthy as MRCP is considered highly accurate (often 90–100% sensitivity) for classifying these congenital anomalies and detecting associated complications like anomalous pancreaticobiliary junction. Cholangitis (7 cases, 11.7%) and no obstruction (6 cases, 10.0%) further show the spectrum, with normal MRCP helping avoid unnecessary invasive procedures.[18,19]

Our finding of distal CBD as the predominant level of obstruction (43.3%) is similar to multiple studies on obstructive jaundice. In a study by Serinsöz and Aktürk (2023) evaluating MRCP in 38 patients with obstructive jaundice, the most common level of obstruction was the distal CBD, similar to our results; stones were the leading etiology overall. Similarly, in a prospective study from Western India on MRCP versus ultrasonography in obstructive jaundice, distal CBD was reported as the predominant site of obstruction.[20,21]

Many study shows distal predominance due to the higher incidence of choledocholithiasis and periampullary/ pancreatic head pathologies in this region. For example, comparative analyses of MRCP and ERCP often note distal or extrahepatic levels accounting for a significant majority, with proximal/hilar lesions being less common unless malignancy (e.g., cholangiocarcinoma) predominates. One study using ERCP as reference reported obstruction sites as proximal (38%), mid (34%), and distal (28%), showing some variation possibly due to differing patient populations or inclusion of more hilar malignancies.[22,23]

Table 7: Comparison of Study Findings with Literature on Diagnostic Performance of MRCP

Pathology	Study	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Choledocholithiasis	**Present study**	100.0	97.1	96.2	100.0	98.3
	Varghese et al. (2000) [24]	91	98	–	–	97
	Kumar et al. (2023) [9]	88.1	94.4	97.3	72.7	90
Benign Stricture	**Present study**	100.0	98.0	91.7	100.0	98.3
	Suthar et al. (2015) [12]	91.7	96.1	–	–	94.7
	Kumar et al.(2023) (CBDstricture) [9]	83.3	97.9	90.9	95.9	95
	Munir et al. (2004)[15]	83.3	97.6	–	–	–

Malignant Obstruction	**Present study**	100.0	98.0	90.9	100.0	98.3
	Suthar et al. (2015) [12]	85.7	96.3	–	–	93.3
	Shabanikia et al.[25]	95.7	96.3	–	–	–

Mid and proximal CBD obstructions in our cohort (11 cases, 18.3% and 8 cases, 13.3%, respectively) correspond to benign strictures, post-procedural changes, or extrinsic compressions, which MRCP accurately delineates along with associated upstream dilatation. Common hepatic duct involvement (6 cases, 10.0%) and purely intrahepatic patterns (3 cases, 5.0%) were less frequent, similar to the lower prevalence of primary intrahepatic or hilar-dominant diseases like primary sclerosing cholangitis or certain cholangiocarcinomas in general MRCP cohorts.[26]

MRCP's ability to accurately predict both proximal and distal levels of obstruction (with reported sensitivity approaching 100% in targeted evaluations) makes it superior for non-invasive localization compared to initial ultrasound, while providing additional anatomic detail. Our 10.0% rate of no obstruction on MRCP further supports its value in ruling out pathology and avoiding invasive procedures.[11]

In the present study, comparison wit histopathological/operative findings (Table 5) demonstrated excellent concordance ($p < 0.001$). Among 8 patients without disease, MRCP was negative in 7 (true negatives) and positive in 1 (false positive), resulting in a specificity of 87.5%. The positive predictive value (PPV) was 98.0%, negative predictive value (NPV) 77.8%, and overall diagnostic accuracy 95.0% ($p < 0.001$). These metrics affirm MRCP as a highly reliable non-invasive tool for detecting biliary pathologies, with excellent sensitivity and accuracy suitable for clinical decision-making.[11]

Our sensitivity of 100% across all major pathologies and diagnostic accuracy of 98.3–100% are comparable to or higher than other studies. In a study by Serinsöz and Aktürk (2023) on MRCP in obstructive jaundice, MRCP showed high sensitivity and specificity for key pathologies like choledocholithiasis and strictures, with overall excellent correlation to ERCP/surgical findings. Similarly, Munir et al. and others have reported MRCP sensitivity and specificity for benign biliary strictures around 83.3% and 97.6%, respectively,[16] while overall performance in mixed biliary obstruction cohorts often reaches 90–98%.[27]

In the evaluation of choledocholithiasis (the most common pathology), literature shows sensitivity of 88–95% and specificity of 90–99% across studies. A 2023 comparative study of MRCP versus ERCP reported diagnostic accuracy of 90% for choledocholithiasis, with sensitivity 88.1% and specificity 94.4%. Another analysis found MRCP sensitivity of 93% and specificity 69% in suspected choledocholithiasis using 3T imaging, though specificity can vary with stone size and reader experience. Meta-analyses and reviews generally cite composite sensitivity and specificity for biliary obstruction around 96% and high values, closely mirroring our 100% sensitivity and 98.3% accuracy.[9,28]

For broader biliary pathologies including strictures and malignancies, our specificity (97.1–100%) and PPV (85.7–100%) are similar to findings showing MRCP accuracy exceeding 90% in differentiating benign from malignant causes. In one prospective study from Western India, MRCP showed sensitivity of 95.6% and specificity of 78.9% for benign biliary pathologies, with overall high performance. The high NPV (100% across pathologies) in our study reflects the reliability of negative findings in this cohort.[14]

In the present study, jaundice was significantly more common in patients with obstruction (75.9% vs. 16.7%, $p = 0.009$). RUQ pain, seen in 66.7% of our obstructed cases, is similar to the typical colicky or constant pain associated with choledocholithiasis or other distal obstructions. Some studies report abdominal/RUQ pain in 50–80% of such patients, though statistical significance in smaller cohorts (as in our non-significant $p = 0.118$) can vary depending on the mix of stone-related versus malignant etiologies.[29]

Fever, indicative of associated cholangitis, was noted in one-third of obstructed patients in our study. This is comparable to reports where fever/cholangitis occurs in 20-40% of biliary obstruction cases, particularly with stones, and forms part of Charcot's triad (jaundice, fever, and RUQ pain) when present. The absence of fever in the small no-obstruction group is expected but limits statistical power ($p=0.161$).[30]

For choledocholithiasis, our study reported sensitivity of 100.0%, specificity of 97.1%, PPV of 96.2%, NPV of 100.0%, and accuracy of 98.3%. Similarly, Varghese et al. (2000) found MRCP sensitivity, specificity, and accuracy of 91%, 98%, and 97%, respectively, compared to direct cholangiography. In a more recent study, MRCP showed sensitivity of 88.1%, specificity of 94.4%, PPV of 97.3%, and accuracy of 90% versus ERCP. Other studies report sensitivities ranging from 81–100% and specificities from 85–100%, with some differences influenced by stone size, bile duct dilatation, or scanner strength.[9,24]

Regarding benign strictures, the present study showed sensitivity of 100.0%, specificity of 98.0%, PPV of 91.7%, NPV of 100.0%, and accuracy of 98.3%. Similarly, other studies show MRCP sensitivity for biliary obstruction (including benign causes) often falls between 81–100%, with specificity of 84–100% and overall accuracy of 90–96%. One study reported MRCP sensitivity and specificity for benign main bile duct stricture as 83.3% and 97.6%, respectively. Our results show MRCP's strength in ruling out benign pathologies with high specificity and NPV.[31]

For malignant obstruction, our metrics included sensitivity of 100.0%, specificity of 98.0%, PPV of 90.9%, NPV of 100.0%, and accuracy of 98.3%. Differentiation of benign versus malignant strictures remains challenging, with reported sensitivities for malignancy detection varying widely (e.g., 30–98%). However, several studies demonstrate strong performance: one reported sensitivity and specificity of 95.7% and 96.3% for detecting malignancy, with features like upstream dilation and abrupt tapering aiding characterization. Suthar et al. noted sensitivity of 85.7% and specificity of 96.3% for malignant strictures. Another analysis showed MRCP sensitivity/specificity/accuracy of 89.6%, 98.9%, and 96.7% for malignant lesions. Our high specificity and accuracy are similar to these, showing MRCP's utility in identifying malignant features, though integration with clinical context or additional modalities may enhance differentiation in equivocal cases. [11,12,16,31]

Choledochal cysts achieved perfect diagnostic performance in our study (100% across all metrics). This is similar to other study finding showing MRCP detection rates of 96–100% for choledochal cysts, with high accuracy in Todani classification (often 81–100% depending on type). MRCP is frequently regarded as the preferred non-invasive modality for delineating cyst anatomy, associated anomalies (e.g., anomalous pancreaticobiliary junction), and complications like stones or malignancy.[18,32]

CONCLUSION

MRCP is a highly accurate and reliable non-invasive imaging modality for the evaluation of biliary tract pathologies. It effectively detects the site and cause of biliary obstruction, particularly choledocholithiasis, biliary strictures, and malignant obstruction, with excellent diagnostic accuracy. Its high sensitivity and specificity make MRCP an effective alternative to diagnostic ERCP, reducing the need for invasive procedures. Therefore, MRCP should be considered the imaging modality of choice in patients with suspected biliary tract disorders.

Images

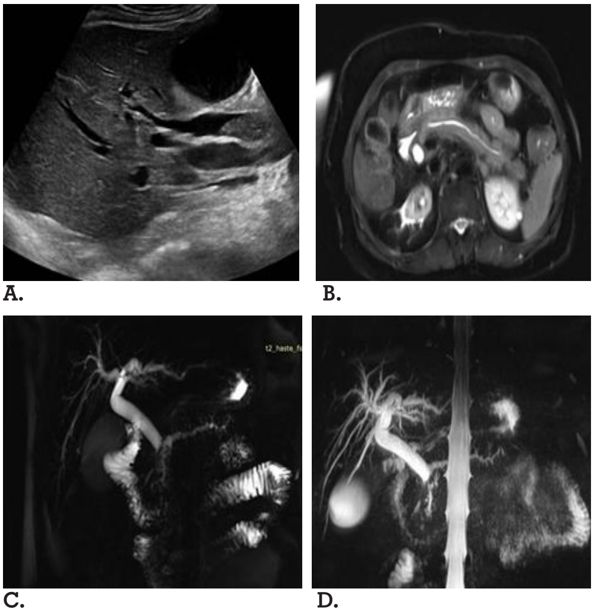

Figure 1 A: Ultrasound image shows IHBRD and dilated CBD with sludge and abrupt tapering in the distal segment of CBD.

Figure 1 B, C and D: MRCP images showing IHBRD with dilated CBD and MPD along with tapering in the distal segment....s/o DISTAL CBD STRICTURE.

On Histopathology: BENIGN STRICTURE OF DISTAL CBD

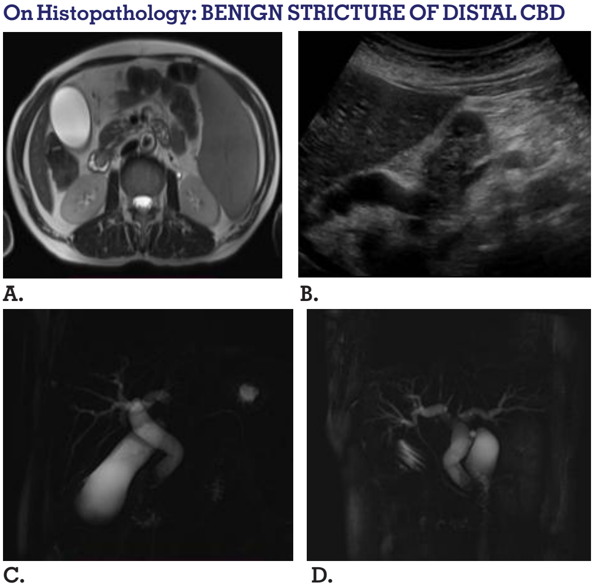

Figure 2A: Ultrasound image shows an ill-defined hypoechoic mass in the periampullary region causing upstream dilatation of CBD.

Figure 2B and C shows a relatively circumscribed, irregular soft tissue signal intensity epi-centred at the ampulla of Vater causing upstream dilatation of CBD...s/o CHOLANGIOCARCINOMA

ON Histopathology: CHOLANGIOCARCINOMA OF DISTAL CBD

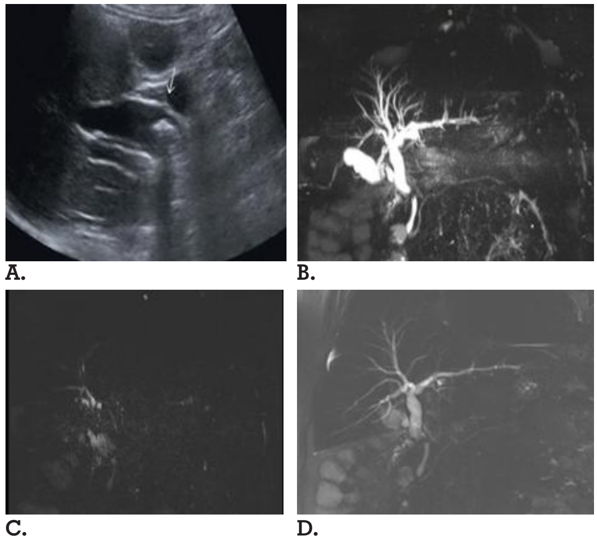

Figure 3A: shows a calculus casting posterior acoustic shadow in CBD causing upstream dilatation along with IHBRD.

Figure 3B, C and D shows a filling defect within CBD in the MRCP images...s/o CHOLEDOCHOLITHIASIS.

Intra-operative finding: CHOLEDOCHOLITHIASIS

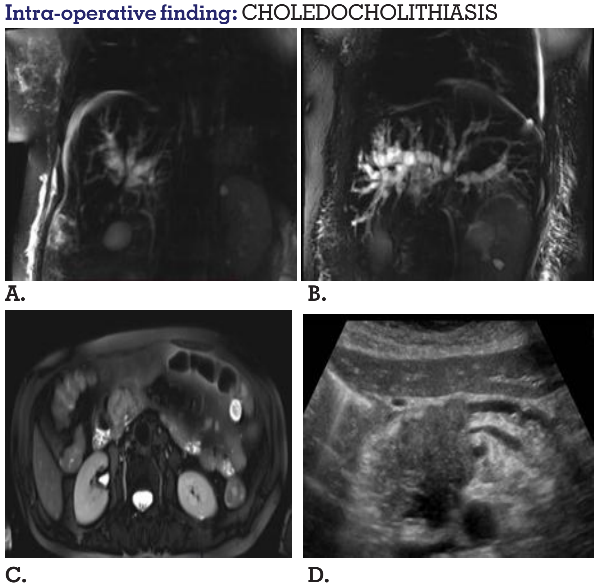

Figure 4A: Ill- defined hypoechoic area noted in pancreatic head with prominent pancreatic duct and dilated Proximal and mid CBD.

Figure 4B, C and D: Heterogenous signal intensity SOL in periampullary region causing displacement and mass effect over lower 3rd CBD and pancreatic duct... s/o CARCINOMA OF THE HEAD OF PANCREAS

Intra-operative Findings: CARCINOMA OF THE HEAD OF PANCREAS

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