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Diagnostic Performance of Ultrasonography and MRCP in Differentiating Benign and Malignant Hepatobiliary Lesions

Akashdeep Kaur[1], Arvinder Singh[2], Kunwarpal Singh[3]

[1]Resident, Department of Radiodiagnosis and Imaging, Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India.
[2]Professor & Head, Department of Radiodiagnosis and Imaging, Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India.
[3]Professor, Department of Radiodiagnosis and Imaging, Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India.

Corresponding Author: Dr Akashdeep Kaur

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ABSTRACT

Background: Hepatobiliary disorders frequently present with obstructive jaundice and pose a diagnostic challenge due to overlapping clinical features between benign and malignant etiologies. Accurate differentiation is essential for appropriate therapeutic decision-making and prognostication. Ultrasonography (USG) is commonly employed as the initial imaging modality because of its accessibility, cost-effectiveness, and ability to detect biliary dilatation and gallbladder pathology. However, its diagnostic performance may be limited in evaluating distal bile ducts and periampullary regions. Magnetic Resonance Cholangiopancreatography (MRCP), a non-invasive imaging technique, provides detailed visualization of the biliary tree and pancreatic ducts, thereby improving lesion characterization.
Materials and Methods: This cross-sectional observational study included 52 patients presenting with clinical suspicion of biliary obstruction. All patients underwent transabdominal ultrasonography followed by MRCP. Findings from both imaging techniques were evaluated against the definitive diagnosis, which was established using histopathological results, endoscopic assessment, or follow-up clinical outcomes. Measures of diagnostic efficacy—including sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy—were then determined and interpreted.
Results: Ultrasonography demonstrated a sensitivity of 85.7%, specificity of 25.0%, and overall diagnostic accuracy of 47.3% in differentiating benign from malignant lesions. In comparison, MRCP showed higher sensitivity (90.0%), improved specificity (60.0%), and greater overall accuracy (72.0%). MRCP was particularly superior in identifying the level and cause of biliary obstruction, as well as in delineating malignant strictures and masses.
Conclusion: While USG remains an effective first-line first-line imaging approach for evaluation of hepatobiliary disorders, MRCP provides superior diagnostic accuracy and better lesion characterization. MRCP should be considered especially in cases where malignancy is suspected or when USG findings are inconclusive.

Keywords: Ultrasonography, MRCP, hepatobiliary lesions, obstructive jaundice, biliary obstruction.

INTRODUCTION

The hepatobiliary system, which includes the liver, gallbladder, and intrahepatic & extrahepatic biliary ducts, forms a vital anatomical and functional unit responsible for digestion, metabolism, and bile secretion. A diverse range of pathological conditions—from inflammatory, obstructive to neoplastic disorder can involve this system and account for a substantial proportion of abdominal diseases.

Differentiation between benign and malignant hepatobiliary lesions can be challenging because they frequently share overlapping clinical features, including jaundice, abdominal pain, fever, anorexia, and weight loss. Despite similar presentations, their therapeutic approaches and prognostic outcomes differ significantly, underscoring the importance of timely and accurate diagnosis.

Imaging plays a pivotal role in evaluation, with non-invasive modalities being increasingly preferred. Ultrasonography (USG) remains the initial imaging technique of choice owing to its wide availability and cost-effectiveness; however, it is limited by operator dependency and reduced sensitivity in assessing distal biliary segments.[1] In contrast, Magnetic Resonance Cholangiopancreatography (MRCP) has emerged as a robust and reliable imaging modality, providing high-resolution visualization of the biliary tree and superior characterization of pathological lesions.[2]

Multiple studies have highlighted the enhanced diagnostic performance of MRCP over USG in accurately identifying the level and etiology of biliary obstruction and in differentiating benign from malignant conditions. [3-5]

MATERIALS & METHODS

Study Design and Setting:

This observational cross-sectional study was conducted in the Department of Radiodiagnosis and Imaging at Sri Guru Ram Das Institute of Medical Sciences and Research (SGRDIMSAR), Amritsar. The study was carried out over a period of 18 months, from July 2024 to December 2025. Approval was obtained from the Institutional Research and Ethics Committee of Sri Guru Ram Das University of Health Sciences, Vallah, Amritsar, prior to the commencement of the study.

Study Population:

The study included patients presenting with clinical features suggestive of obstructive jaundice who attended the outpatient department (OPD) or were admitted to the inpatient department (IPD) at SGRDIMSAR, Amritsar. All the patients fulfilling the selection criteria were referred to the Department of Radiodiagnosis and Imaging for further evaluation. Written informed consent was obtained from all participants before inclusion in the study.

Inclusion Criteria:

Patients presenting with clinical features suggestive of obstructive jaundice with total serum bilirubin levels greater than 1.2 mg/dL.

Radiological Examination Protocol:

Ultrasonography (USG): Ultrasound of the whole abdomen was performed using Samsung V8, Philips Affinity 30, Wipro Logic P6, and Wipro G Venue Go machines with a 2.5–5 MHz curvilinear probe and 4–12 MHz linear probe. Imaging was obtained in sagittal, transverse, and subcostal oblique planes. The hepatobiliary system was evaluated for biliary dilatation, calculi, masses, and level of obstruction, and images were documented.

Magnetic Resonance Cholangiopancreatography (MRCP):

MRI was performed on a Philips Gyroscan Achieva D-STREAM 1.5 Tesla system. The protocol included T1-weighted, T2-weighted (axial, coronal, and oblique), diffusion-weighted imaging, HASTE sequences, and heavily T2-weighted single-shot and 3D MRCP sequences for detailed biliary evaluation.

Statistical Analysis

Data were recorded in a pre-designed proforma. Qualitative variables were expressed as frequencies and percentages, while quantitative variables were presented as mean ± standard deviation. Statistical significance of diagnostic association was assessed using the Fisher's exact test wherever appropriate. A p-value of less than 0.05 was considered statistically significant. Statistical analysis was performed using SPSS version 26.0, and graphical representations were generated using Microsoft Excel 2021.

RESULT

A total of 52 patients with clinically suspected obstructive jaundice were evaluated. The majority of patients were in the 51–60 years age group (30.8%) shown in table 1, followed by those older than 70 years (25.0%), with a mean age of 58.1 ± 15.3 years. There was a female predominance, with females accounting for 61.5% of cases and males 38.5%.

Table 1. Distribution of study groups as per age

Age Group (yrs)	N	%
<20	0	0%
21–30	2	3.8%
31–40	4	7.7%
41–50	10	19.2%
51–60	16	30.8%
61–70	7	13.5%
>70	13	25.0%
Total	52	100.0%
Mean age - 58.1 +/- 15.3 years		

Table 1 shows the largest proportion of patients belonged to the 51–60 years age group (30.8%), with a mean age of 58.1 +/- 15.3 years.

Clinically, all patients presented with jaundice (100%). Pain abdomen was the most common associated symptom (94.2%), followed by fever (42.3%) and pruritus (38.5%).

On ultrasonography (USG), intrahepatic biliary radical (IHBR) dilatation was observed in 59.6% of patients, while proximal and distal common bile duct (CBD) dilatation were seen in 57.7% and 48.1% of cases, respectively. Cholelithiasis was identified in 46.2% and choledocholithiasis in 23.1% of patients. Based on USG findings, cholelithiasis was the most frequent diagnosis (46.2%), followed by choledocholithiasis (23.1%) and cholecystitis (15.4%) and gall bladder mass (5.8%) (Figure 1). However, USG failed to establish a definitive diagnosis in 19.2% of cases. (Table 2) Overall, USG categorized 71.2% of cases as benign and 9.6% as malignant, while 19.2% remained indeterminate.

Table 2. Distribution of study groups as per USG Diagnosis

USG Diagnosis	N	%
Cholelithiasis	24	46.2%
Choledocholithiasis	12	23.1%
Cholecystitis	8	15.4%
Gallbladder mass	3	5.8%
Cholangiocarcinoma	1	1.9%
Liver metastasis	4	7.7%
Not able to Diagnose	10	19.2%

Table 2 shows based on ultrasonography, the commonest detected condition was cholelithiasis (46.2%), followed by choledocholithiasis (23.1%) and cholecystitis (15.4%). In 19.2% cases, a definitive USG diagnosis could not be established.

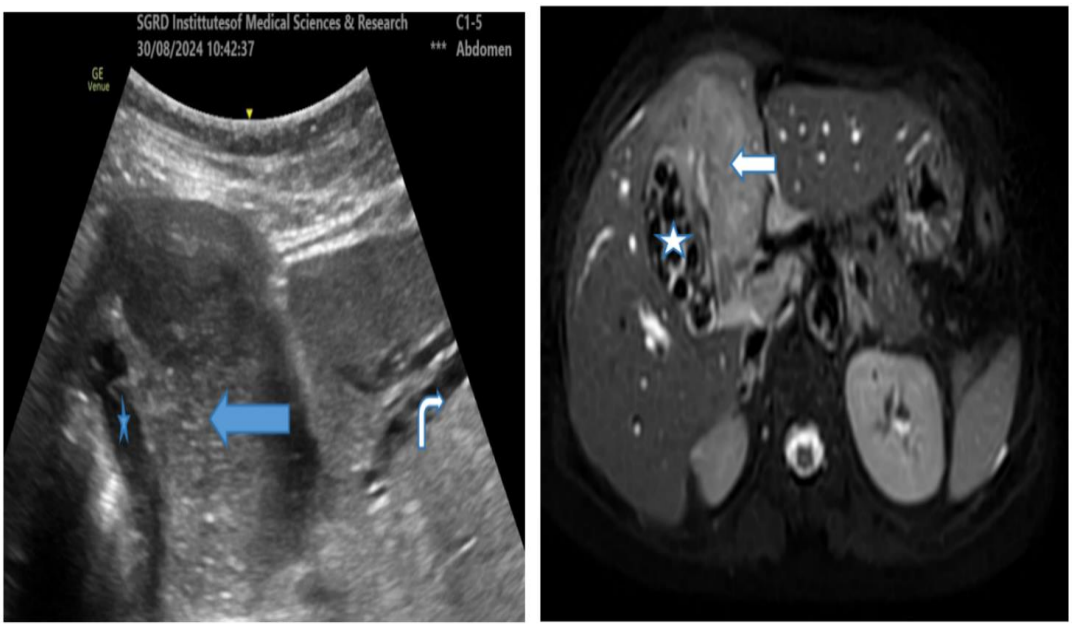

Figure 1: USG & MRCP images of a 56-year-old female presented with pain abdomen (A) Transabdominal ultrasonography axial image showing asymmetrical thickening of the posterior wall of the gallbladder (arrow), with minimally distended gallbladder lumen (star). (curved arrow) depicts prominent IHBRs. (B) Axial T2-weighted MR image of same above USG patient demonstrating a hyperintense mass lesion in the GB fossa region (arrow). The gallbladder (star) shows multiple intraluminal hypointense calculi.

Magnetic Resonance Cholangiopancreatography (MRCP) demonstrated improved diagnostic yield. IHBR dilatation was detected in 92.3% of patients, and proximal CBD dilatation in 71.2%. Cholelithiasis (57.7%) and choledocholithiasis (48.1%) were more frequently identified on MRCP. (Figure 2) Additionally, MRCP detected gallbladder masses in 23.1% and cholangiocarcinoma in 17.3% of cases represented in table 3. Overall, MRCP classified 63.5% of cases as benign and 36.5% as malignant. Notably, in all cases where USG was inconclusive (n=10), MRCP successfully established a diagnosis, most commonly identifying choledocholithiasis and malignant lesions.

Table 3. Distribution of study groups as per MRCP Diagnosis

MRCP Diagnosis	N	%
Cholelithiasis	30	57.7%
Choledocholithiasis	25	48.1%
Cholecystitis	15	28.8%
Gallbladder mass	12	23.1%
Cholangiocarcinoma	9	17.3%
Pancreatic Ca	3	5.8%
CBD stricture	6	11.5%

Table 3 shows the distribution of diagnostic impressions on MRCP. Cholelithiasis was the most frequent MRCP diagnosis (57.7%), followed by choledocholithiasis (48.1%) and cholecystitis (28.8%). MRCP identified gallbladder mass in 23.1% and cholangiocarcinoma in 17.3%. Pancreatic Ca and CBD stricture were each diagnosed in 5.8% and 11.5% respectively.

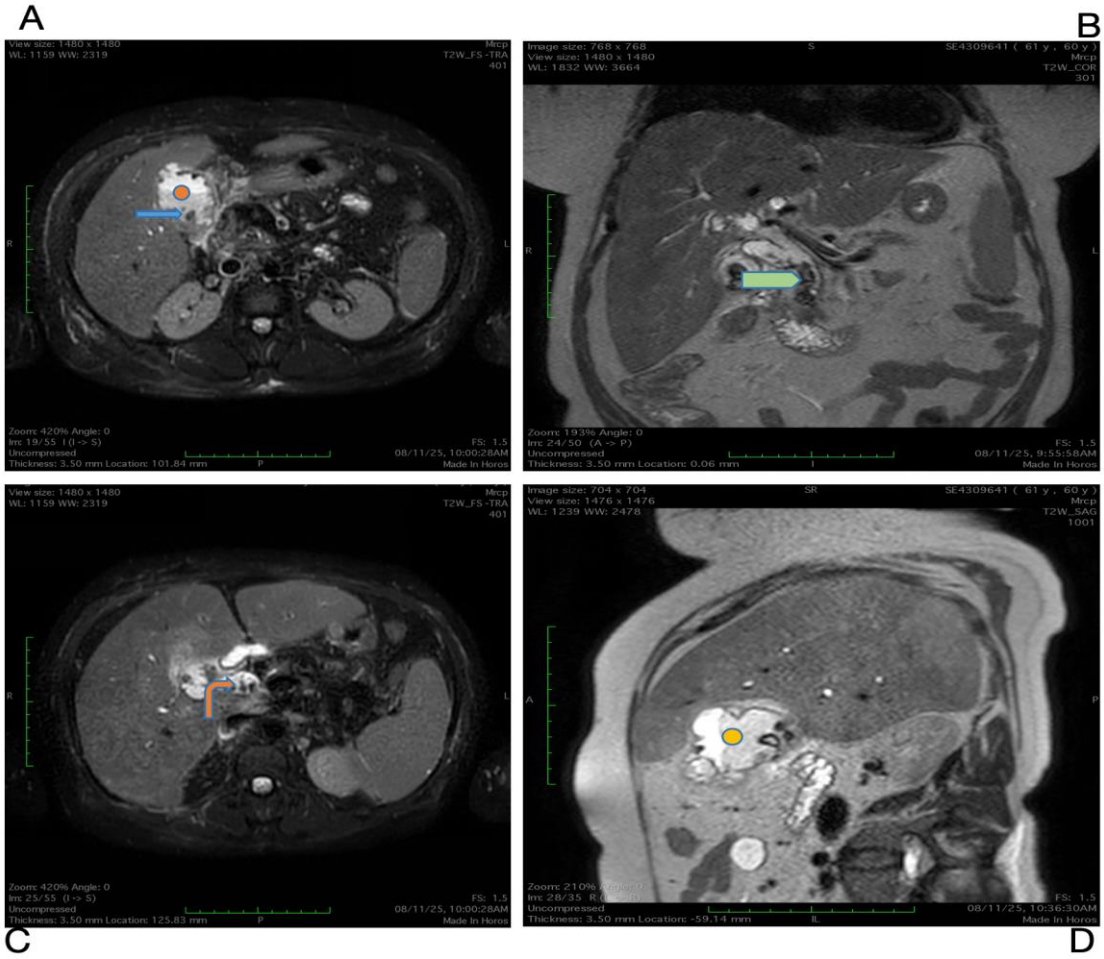

Figure 2: - T2-weighted MRCP (axial, coronal & sagittal) sections of a 60-year-old female presenting with jaundice and abdominal pain. (A) Orange circle depicts a partially distended gallbladder containing calculi (blue arrow) and sludge. (B) & (C) shows a dilated common bile duct (CBD) with multiple intraluminal calculi (curved arrow) & (green arrow). (D) Sagittal image demonstrating the gallbladder with intraluminal sludge (yellow circle).

Correlation with final diagnosis revealed that USG had a sensitivity of 85.7%, specificity of 25.0%, and overall accuracy of 47.3% for differentiating benign from malignant lesions (Table 5a & b). In contrast, MRCP demonstrated superior performance, with sensitivity of 90.0%, specificity of 60.0%, and accuracy of 72.0%. (Table 6a & b)

Table 5a. Correlation of USG Diagnosis with Final Diagnosis (Benign vs Malignant)

USG Diagnosis	Final Diagnosis		Total
	Benign	Malignant	
Benign	6	9	15
Malignant	1	3	4
Total	7	12	19

Table 5b. Diagnostic accuracy of USG in differentiation of benign and malignant lesions.

Parameters	%
Sensitivity	85.7%
Specificity	25.0%
PPV	40.0%
NPV	75.0%
Accuracy	47.3%

Table 5 (a, b) shows diagnostic accuracy of USG for benign-malignant differentiation was assessed against histopathology in 19 cases (excluding 6 indeterminate USG cases). USG showed sensitivity 85.7% and specificity 25%, with overall accuracy 47.3%.

Table 6a. Correlation of MRCP Diagnosis with Final Diagnosis (Benign vs Malignant)

MRCP Diagnosis	Final Diagnosis		Total
	Benign	Malignant	
Benign	9	6	15
Malignant	1	9	10
Total	10	15	25

Table 6b. Diagnostic accuracy of MRCP in differentiation of benign and malignant lesions.

Parameters	%
Sensitivity	90.0%
Specificity	60.0%
PPV	60.0%
NPV	90.0%
Accuracy	72.0%

Table 6 (a, b) shows against histopathology (n=25), MRCP demonstrated sensitivity 90% and specificity 60.0% for benign-malignant differentiation, with overall accuracy 72.0%.

For specific pathologies, USG showed high specificity for cholelithiasis (90.9%) and choledocholithiasis (96.3%), but relatively lower sensitivity, particularly for choledocholithiasis (44.0%). Sensitivity was markedly low for gallbladder carcinoma (14.3%) and cholangiocarcinoma (11.1%) (figure 3), despite high specificity.

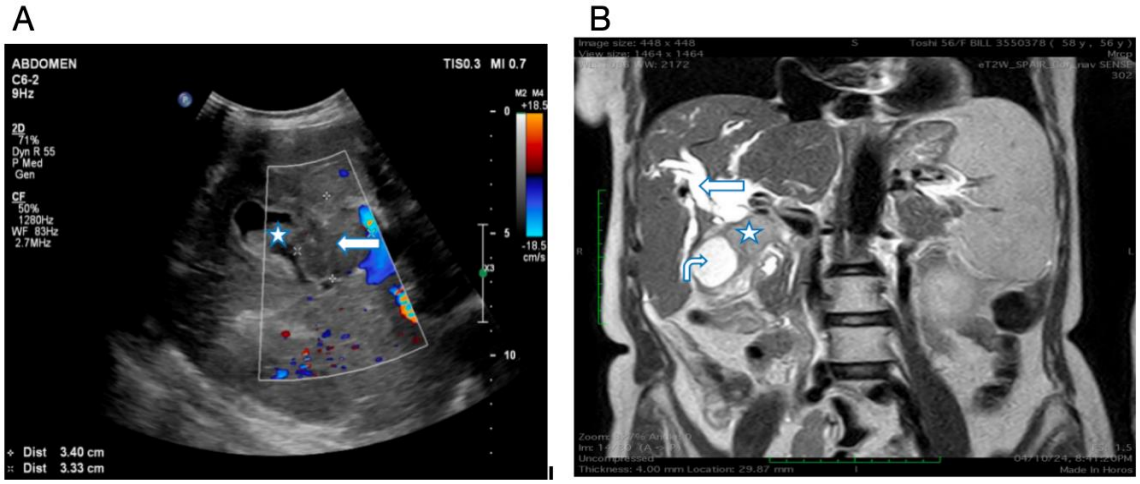

Figure 3: A 60-year-old male presented with complaints of pain abdomen, yellowish discoloration of skin and fever (A) USG abdomen axial image showing well defined hypoechoic mass lesion at the gall bladder neck region (arrow). Gall bladder lumen is partially distended and shows echogenic sludge within it (star). (B) Coronal MRCP showing dilated IHBR (solid arrow) with distended gallbladder (curved arrow), hyperintense lesion at confluence (star). Histopathology proven cholangiocarcinoma.

Overall, MRCP proved superior to USG in accurately identifying the level and etiology of biliary obstruction and in differentiating benign from malignant hepatobiliary lesions ($p < 0.05$).

DISCUSSION

Accurate differentiation between benign and malignant hepatobiliary lesions is essential for guiding appropriate management, as treatment strategies and prognosis differ significantly between these conditions. Ultrasonography (USG) is widely utilized as the initial imaging modality due to its accessibility and cost-effectiveness; however, its diagnostic limitations necessitate the use of advanced imaging techniques such as Magnetic Resonance Cholangiopancreatography (MRCP), which provides superior visualization of the biliary tree.

In the present study, the mean age of patients was 58.1 ± 15.3 years, with a predominance of cases in the fifth and sixth decades. Similar demographic patterns have been reported by Khan et al., who observed that biliary obstruction is more common in middle-aged and elderly populations. [1] A female predominance was noted in this study, which is consistent with findings from Swaraj et al. and Katariya et al.,

reflecting the higher incidence of gallstone disease among females. [5,6]

Clinically, jaundice was present in all patients, with abdominal pain being the most common associated symptom. This is in agreement with studies by Suthar et al. and Singh et al., who reported similar clinical presentations in patients with obstructive biliary pathology. [7-8]

A key finding of this study was the superior diagnostic yield of MRCP compared to USG. While USG failed to provide a definitive diagnosis in a proportion of cases, MRCP successfully established the diagnosis in all patients. Debbarma et al. and Shimu et al. similarly reported that MRCP significantly improves diagnostic confidence, particularly in cases where USG findings are inconclusive. [3-4] In addition, MRCP detected a higher proportion of malignant lesions compared to USG, highlighting its superior capability in lesion characterization.

In terms of diagnostic performance, USG demonstrated high sensitivity with comparatively low specificity in differentiating benign from malignant lesions, whereas MRCP showed higher sensitivity, specificity, and overall diagnostic accuracy. These findings are consistent with previous studies by Parashari et al., Suthar et al. and Shabanikia et al., which have established MRCP as a more reliable modality for evaluating biliary obstruction and differentiating malignant from benign etiologies. [2,8-9]

For specific conditions, USG showed high specificity but lower sensitivity, particularly for choledocholithiasis and malignant lesions. This limitation has also been described by Varghese et al., who reported difficulty in detecting distal common bile duct stones on ultrasound.[10] Similarly, studies by Huang et al. and Khanduri et al. have highlighted the variable sensitivity of USG in detecting cholecystitis and gallbladder carcinoma, respectively.[11-12] MRCP, on the other hand, offers improved delineation of biliary strictures and masses, with studies by Ke et al. demonstrating high diagnostic accuracy for cholangiocarcinoma. [13]

Overall, the findings of the present study are in concordance with existing literature and support the use of MRCP as a superior non-invasive imaging modality. While USG remains an effective first-line screening tool, MRCP should be employed in cases where USG is inconclusive or when detailed characterization of hepatobiliary pathology is required.

CONCLUSION

The present study highlights that both ultrasonography and MRCP play important roles in the evaluation of hepatobiliary lesions, with each modality contributing at different stages of diagnosis. Ultrasonography remains the preferred initial screening tool due to its accessibility, cost-effectiveness, and ability to detect common biliary abnormalities. However, its limitations in evaluating distal bile ducts and complex or malignant lesions reduce its overall diagnostic reliability. MRCP, with its superior ductal visualization and higher diagnostic accuracy, provides better characterization of the level and cause of obstruction. It is particularly valuable in cases where ultrasound findings are inconclusive or when malignancy is suspected. Thus, MRCP serves as an essential non-invasive modality for definitive evaluation and clinical decision-making.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Khan T, Alam SZ, Al Mamun M, Rahman MS, Islam MU, Bari S. Accuracy of Magnetic Resonance Cholangiopancreatography in Case of Biliary Obstruction Comparing Post-operative Findings: A Study of 50 Cases.

Mymensingh Med J. 2021 Oct;30(4):1079-1085.
2. Parashari UC, Khanduri S, Bhadury S, Upadhyay D, Kishore K. Diagnostic role of magnetic resonance cholangiopancreatography in evaluation of obstructive biliopathies and correlating it with final diagnosis and clinical profile of patients. J Nat Sci Biol Med. 2015 Jan-Jun;6(1):131-8. doi: 10.4103/0976-9668.149110.
3. Debbarma, Biplab & Reang, Chandini & Tripura, Kaushik. Diagnostic efficacy of ultrasonography against magnetic resonance cholangiopancreatography in obstructive biliopathy. European Journal of Molecular & Clinical Medicine. 2022;9(16):1232-36.
4. Shimu, F., Ahmed, A., Shahriar, S, Yasmin, T., Amin, M. B., Hasan, A. F. U. Comparison of the Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography (MRCP) with Ultrasound and Computed Tomography (CT) in Evaluation of Patients with Obstructive Jaundice. Journal of Shaheed Suhrawardy Medical College. 2023, 14(1), 32–36. https://doi.org/10.3329/jssmc.v14i1.70116.
5. Katariya P, Vaishnani B, Gamit H, Vaghela S, Jasani K. Comparative Diagnostic Accuracy of Ultrasonography and Magnetic Resonance Cholangiopancreatography (MRCP) in the Evaluation of Obstructive Jaundice: A Prospective Study in Western India. Cureus. 2025 Dec 29;17(12):e100312. doi: 10.7759/cureus.100312.
6. Swaraj S, Mohapatra M, Sathpathy G, Yalamanchi R, Sen K, Menon SM, Madhesia A, Kumaraswamy SM, Radha Krishna K, Bobde DV. Diagnostic Performance of Ultrasonography Versus Magnetic Resonance Cholangiopancreatography in Biliary Obstruction. Cureus. 2023 Jan 18;15(1):e33915. doi: 10.7759/cureus.33915.
7. Singh A, Basappa N, Singh J. Comparative Analysis of Hepatobiliary and Pancreatic Pathologies on Sonography and Magnetic Resonance Cholangiopancreatography. AMEI's Curr Trends Diagn Treat 2019;3(2):45–55.
8. Suthar M, Purohit S, Bhargav V, Goyal P. Role of MRCP in Differentiation of Benign and Malignant Causes of Biliary Obstruction. J Clin Diagn Res. 2015 Nov;9(11):TC08-12. doi: 10.7860/JCDR/2015/14174.6771.
9. Shabanikia N, Adibi A, Ebrahimian S. Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography to Detect Benign and Malignant Biliary Strictures. Adv Biomed Res. 2021 Nov 26; 10:38. doi: 10.4103/abr.abr_137_20.
10. Varghese, J.C., Lucey, B.C., Soto, J.A. 33 Imaging of Biliary Disorders: Cholecystitis, Bile Duct Obstruction, Stones, and Stricture. In: Medina, L., Blackmore, C., Applegate, K. (eds) Evidence-Based Imaging. Springer, New York, NY. (2011). https://doi.org/10.1007/978-1-4419-7777-9_33
11. Huang SS, Lin KW, Liu KL, Wu YM, Lien WC, Wang HP. Diagnostic performance of ultrasound in acute cholecystitis: a systematic review and meta-analysis. World J Emerg Surg. 2023 Nov 30;18(1):54. doi: 10.1186/s13017-023-00524-5.
12. Khanduri S, Goyal A, Usmani T, Jain S, Goyal A, Chaudhary M, et al. Role of ultrasonography in the diagnosis of gall-bladder carcinoma: A boon for low-resource settings. Asian J Oncol 2018; 4:1-5.
13. Ke C, Yang T, Huang G, Gu C. Investigation of the accuracy of magnetic resonance cholangiography and multi-slice spiral computed tomography in the diagnosis of cholangiocarcinoma. J Gastrointest Oncol. 2023 Jun 30;14(3):1496-1503. doi: 10.21037/jgo-22-1294.

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