

DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY (MRCP) IN THE DIAGNOSIS OF CHOLEDOCHOLITHIASIS TAKING ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY (ERCP) AS GOLD STANDARD

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ABSTRACT

Objective: To determine how accurately MRCP identifies choledocholithiasis when compared with Endoscopic Retrograde Cholangiopancreatography (ERCP), which serves as the reference standard.

Material & Methods: A cross-sectional study was conducted in the Department of Radiology at the Combined Military Hospital in Peshawar, Pakistan, from April 3, 2022, to October 3, 2022, including patients with choledocholithiasis who had been symptomatic for at least 3 months. Diagnostic accuracy was assessed using sensitivity, specificity, positive predictive value, and negative predictive value.

Results: A total of 100 patients, aged 18-60 years and of both genders, with suspected choledocholithiasis for at least 3 months, were included. The diagnostic accuracy of MRCP was evaluated. When compared with ERCP as the reference method, MRCP showed a sensitivity of 91.07%, a specificity of 81.82%, a positive predictive value of 86.44%, and a negative predictive value of 87.80%.

Conclusion: The results of this study show that MRCP is a reliable and effective noninvasive method for detecting choledocholithiasis, with a sensitivity of 91.07% and a specificity of 81.82%.

Keywords: Magnetic Resonance Cholangiopancreatography (MRCP), Choledocholithiasis, Endoscopic Retrograde Cholangiopancreatography (ERCP), Diagnostic Accuracy

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INTRODUCTION

In Western countries, gallbladder stones are common, and laparoscopic cholecystectomy (LC) remains the standard surgical treatment for symptomatic cholelithiasis. As people age, the likelihood of developing common bile duct (CBD) stones alongside gallstones increases, occurring in about 8–15% of affected individuals.¹ It is crucial to identify biliary and pancreatic duct anomalies in patients with obstructive jaundice, as this helps surgeons and endoscopists plan and optimize management strategies.²

Biliary obstruction can result from choledocholithiasis, tumors, or trauma, with choledocholithiasis being the

most common cause. Although ERCP remains the standard method for diagnosing and treating hepatobiliary disorders, it is an invasive procedure that requires sedation, ductal cannulation, and exposes patients to ionizing radiation. Additionally, the procedure demands a skilled multidisciplinary team, including gastroenterologists and support staff, and carries potential complications such as bleeding, infection, bile leakage, pancreatitis, and a mortality risk approaching 1%.^{3,4}

MRCP, a noninvasive imaging technique, offers a safer alternative for evaluating the biliary system and detecting obstructions.⁵ The technique uses MRI sequences that are highly sensitive to fluid signals, enabling clear visualization of the hepatobiliary and pancreatic ductal systems. Since its introduction in the 1900s, MRCP has become an essential diagnostic tool for pancreaticobiliary disorders. One limitation of MRCP is its purely diagnostic role, unlike ERCP, which allows both diagnosis and therapeutic intervention.⁶ Nonetheless, MRCP avoids many complications associated with ERCP, such as infection, sepsis, and post-procedural pancreatitis.⁷

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MRCP is especially useful when ERCP is difficult, unsafe, or fails. Imaging methods like abdominal ultrasound and liver function tests are usually the first tests performed. For patients with a moderate risk of CBD stones, additional evaluation with imaging techniques such as MRCP or endoscopic ultrasound (EUS) is recommended, as both have high diagnostic accuracy, with sensitivities of 93–95% and specificities of 96–97%. EUS is preferred in certain situations, such as when patients have pacemakers, metal implants, severe obesity, or claustrophobia.⁹⁻¹⁰

Compared to ERCP, MRCP is more accessible, noninvasive, and doesn't require sedation. It provides clear visualization of intrahepatic ducts, allows image storage for later review, and is cost-effective.¹¹ Prior studies report MRCP's sensitivity and specificity for diagnosing choledocholithiasis at 87% and 80%, respectively.¹² Other research shows MRCP sensitivity ranges from 85% to 97%, and specificity from 75% to 98%.¹³

Given the inconsistencies in prior literature concerning the diagnostic reliability of MRCP for choledocholithiasis, this study was designed to provide an objective assessment of its accuracy. If proven to be highly effective, MRCP can be recommended for routine clinical use.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Radiology at the Combined Military Hospital in Peshawar, Pakistan, from April 3, 2022, to October 3, 2022, using a Non-probability consecutive sampling, and including patients with choledocholithiasis who had been symptomatic for at least 3 months. Diagnostic accuracy was assessed using sensitivity, specificity, positive predictive value, and negative predictive value.

Based on an expected sensitivity of 87%, specificity of 80%, and a choledocholithiasis prevalence of 50%, the calculated sample size was 125 patients. However, due to limitations in case availability, only 100 patients meeting the criteria were ultimately enrolled. Patients aged 18-60 years, of both genders, with suspected choledocholithiasis for at least 3 months were included in the study. Patients with cardiac pacemakers, claustrophobia, or degenerative or ankylotic spine conditions were excluded. Approval for the study was obtained from the institutional ethics review committee.

Eligible participants were selected consecutively from both inpatient and outpatient departments. Informed consent was obtained after explaining the study's purpose, procedures, risks, and benefits. Demographic details, including age, gender, occupation, residence, and education, were recorded. Two consultant radiologists interpreted the MRCP findings, while ERCP was performed by a consultant with over two years of experience. Data, including MRCP and ERCP results, were documented using a structured form.

The collected data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 23. Categorical variables, such as gender, occupation, area of residence, education level, clinical features, and imaging results, were summarized as frequencies and percentages. In contrast, continuous variables, including age and symptom duration, were expressed as mean \pm SD or median (IQR) where appropriate. The normality of continuous variables was assessed with the Shapiro–Wilk test. Key diagnostic parameters, such as sensitivity, specificity, positive and negative predictive values, and overall diagnostic accuracy, were calculated. Data were further stratified to evaluate the potential impact of demographic factors on diagnostic outcomes, with post-stratification comparisons performed using a 2 \times 2 contingency table.

RESULTS

A total of 100 subjects participated in the study, with an average age of 40.48 \pm 12.69 years. The mean duration of symptoms was 4.81 \pm 1.39 months. There were more male patients (56%) than female patients (44%). In our study on MRCP, 59 (59%) patients were positive for choledocholithiasis, while 41 (41%) were negative; for ERCP, 56 (56%) were positive, and 44 (44%) were negative (see Table 1 for details). When ERCP was used as the reference method, MRCP showed an overall diagnostic accuracy of 87%, with sensitivity and specificity of 91.07% and 81.82%, respectively, and predictive values of 86.44% (PPV) and 87.80% (NPV).

Table No 1: baseline characteristics of participants and findings of MRCP and ERCP

Variable	n (%)	Mean \pm SD
Age (Years)	---	40.48 \pm 12.695
Age distribution in years		
18 to 35	34 (34.0%)	
36 to 50	39 (39.0%)	
51 to 60	27 (27.0%)	
Gender		
Male	56 (56.0%)	
Female	44 (44.0%)	
Duration of Symptoms (Months)		4.81 \pm 1.398
MRCP Findings		
Positive for Choledocholithiasis	59 (59.0%)	
Negative for Choledocholithiasis	41 (41.0%)	
ERCP Findings		
Positive for Choledocholithiasis	56 (56.0%)	
Negative for Choledocholithiasis	44 (44.0%)	

Table No 2: 2x2 table for the diagnostic accuracy of magnetic resonance cholangiopancreatography (MRCP)

		Choledocholithiasis on ERCP		Total
		Positive	Negative	
Choledocholithiasis on MRCP	Positive	(TP) 51 91.1%	(FP) 8 18.2%	59 59.0%
	Negative	(FN) 5 8.9%	(TN) 36 81.8%	41 41.0%
Total		56 100.0%	44 100.0%	100 100.0%

TP= True Positive, FP= False Positive, FN= False Negative, TN= True Negative

Table No 3: Final results of diagnostic accuracy

Diagnostic accuracy measures	Percentage
Sensitivity:	91.07%
Specificity:	81.82%
Positive Predictive Value:	86.44%
Negative Predictive Value:	87.80%

DISCUSSION

The current study aimed to evaluate the diagnostic accuracy of MRCP in detecting choledocholithiasis, using ERCP as the reference standard. The results showed that MRCP had an overall accuracy of 87%, with a sensitivity of 91.07% and a specificity of 81.82%. These findings align with previously published data, in which Ali M et al reported MRCP having a sensitivity of 97%, a specificity of 75%, and an accuracy of 80%. In comparison, Gondal M et al reported a sensitivity of 87% and a specificity of 80%.¹¹⁻¹²

MRCP has become a valuable noninvasive imaging technique for evaluating biliary disease. Compared to ERCP, which serves both diagnostic and therapeutic purposes but involves procedural risks, MRCP is much safer.⁷⁻¹⁰ Its high sensitivity allows MRCP to accurately identify choledocholithiasis, helping clinical decision-making and reducing unnecessary ERCP procedures. This is particularly beneficial when ERCP is technically challenging or contraindicated.⁸

Compared with other imaging modalities, such as abdominal ultrasound, which has variable sensitivity depending on operator experience and patient factors, MRCP offers a more comprehensive evaluation of the biliary system. Endoscopic ultrasound (EUS) has slightly higher sensitivity and specificity in some cases, but its limited availability and dependence on the operator restrict its widespread use. MRCP, however, is noninvasive, does not require sedation, and is readily accessible, making it the first choice in most clinical environments.¹¹

Though advantageous, MRCP has its limitations. It cannot provide therapeutic interventions, requiring ERCP for stent placement or stone removal when needed.⁶

MRCP results can also be affected by motion artifacts and patient-related factors such as metallic implants and obesity.⁹ But technological advancements in MRI continue to enhance image resolution and diagnostic capability.

The study’s findings support MRCP as a valuable first-line diagnostic tool for suspected choledocholithiasis. With its high sensitivity and specificity, MRCP can help identify patients who should undergo ERCP, optimizing resource use and minimizing unnecessary invasive procedures. Further validation of these results and refinement of diagnostic protocols can be achieved through larger, multicenter studies. While MRCP is limited to imaging, ERCP offers therapeutic benefits by enabling the removal of biliary stones and other interventional procedures.

CONCLUSION

MRCP is a dependable and accurate noninvasive method for diagnosing choledocholithiasis, with 91.07% sensitivity and 81.82% specificity.

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Yadain SH	✓	✓	✗	✗	✓	✗
Nisar U	✓	✗	✓	✓	✓	✗
Hussain S	✓	✓	✗	✗	✗	✓
Tahir F	✓	✗	✓	✓	✓	✗
Sultana SM,	✓	✓	✗	✗	✗	✓
Ihsan HR	✓	✗	✓	✓	✓	✗

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This Manuscript was approved by the Ethical Review Committee of Combined Military Hospital, Peshawar.



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