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

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How to cite this article

Safdar A, Iqbal S, Khan S. Diagnostic Accuracy Of Magnetic Resonance Cholangiopancreatography (Mrcp) in The Diagnosis Of Choledocholithiasis Taking Endoscopic Retrograde Cholangiopancreatography (Ercp) as Gold Standard. J Gandhara Med Dent Sci. 2025;12(4):44-47. https://doi.org/10.37762/jgmds.12-4.725

Date of Submission: 03-05-2025
Date Revised: 29-08-2025
Date Acceptance: 19-09-2025

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ABSTRACT

OBJECTIVES

This study aimed to determine the diagnostic accuracy of magnetic resonance cholangiopancreatography (MRCP) in choledocholithiasis, using endoscopic retrograde cholangiopancreatography (ERCP) as the gold standard.

METHODOLOGY

This retrospective, descriptive, cross-sectional study, based on data retrieved from the hospital information management system, was performed in the Radiology Department of Northwest General Hospital and Research Centre, Peshawar. Data from October 15, 2022, to October 15, 2024, was retrieved. A total of 224 patients fulfilling the inclusion criteria were included in the sample through non-probability consecutive sampling.

RESULTS

The mean age of the sample was 46.8 ± 7.8 years. The sample consisted of 59.4% males and 40.6% females. The mean BMI of the sample was 28.4 ± 2.9kg/m². On MRCP, choledocholithiasis was recorded in 65.6% of patients, and on subsequent ERCP, it was confirmed in 58.5% of patients. The sensitivity of MRCP was found to be 90.8%, and the specificity was 69.9%. The positive predictive value of the MRCP was 81% and the negative predictive value was 84.4%. The overall accuracy was 82.1%.

CONCLUSION

MRCP is a highly sensitive and specific tool for choledocholithiasis, with the additional advantage of being non-invasive. Effect modifiers, such as diabetes and hypertension, as well as the expertise of the performing physician, should be included in further studies to determine their effect on the accuracy of MRCP.

KEYWORDS: *Choledocholithiasis, Magnetic Resonance Cholangiopancreatography, Endoscopic Retrograde Cholangiopancreatography, Body Mass Index*

INTRODUCTION

Choledocholithiasis refers to the presence of gallstones in the bile ducts, including the common hepatic duct and the common bile duct. Its prevalence ranges from 3% to 22%, and the incidence increases with age in patients with gallstones.[1] Investigations needed for the diagnosis & management of choledocholithiasis include abdominal ultrasound, Computed Tomography (CT), magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP). The sensitivity and specificity of ultrasound for choledocholithiasis are 55% and 90%, respectively, but its diagnostic capabilities are operator-dependent. Furthermore, body habitus, bowel gas, and other artefacts sometimes prevent proper visualisation of the biliary tract. MDCT was found to have a sensitivity of 44.5%, specificity of 52.2%, and an accuracy of 46.9% for the detection of bile duct stones. However, CT scans expose patients to ionising radiation.[2] ERCP is both diagnostic and may be therapeutic in some cases. It is performed under anaesthesia or sedation. The limitations of ERCP are technical, as the efficacy depends on the expertise of the gastroenterologist.[3,4] In addition, sometimes the anatomy of the biliary tract poses difficulty in the safe removal of the biliary stones. This leads to retained stones or other complications, which ultimately result in surgical management.[5] MRCP is a non-invasive means for diagnosing biliary stones. In addition, it allows visualisation of the biliary channels for the detection of any anatomical variations in the biliary tree, thus guiding both the gastroenterologist performing the ERCP and the surgeon performing biliary tract surgery for the removal of stones.[6] Makmun D et al reported sensitivity, specificity, accuracy, positive predictive value and negative predictive value of MRCP as 81%, 40%, 68%, 74%, and 50%, respectively.[7] In another study, sensitivity, specificity, PPV, NPV and accuracy of MRCP were found to be 94.6%, 93.8%, 97.8%, 85.7%

and 94.4% respectively.[8] These findings suggest that MRCP is a valuable tool in the diagnosis and management of biliary stones, with high sensitivity and accuracy in detecting anatomical variations in the biliary tree. The results of these studies provide important information for both gastroenterologists and surgeons, helping them make informed decisions regarding the treatment of patients with biliary stones. Overall, MRCP plays a crucial role in guiding medical professionals in the successful removal of biliary stones through both ERCP and surgical procedures.[9,10] Most of these studies are conducted in the Western population. Further research is warranted to determine the diagnostic performance of MRCP in detecting choledocholithiasis within our local population. Should MRCP exhibit diagnostic performance equivalent to ERCP, it could be recommended as the first-line imaging modality for diagnosing choledocholithiasis. This would be a step forward in facilitating diagnosis and improving patient care.

METHODOLOGY

A retrospective, descriptive, cross-sectional study was conducted using data retrieved from the hospital information management system in the Department of Radiology at Northwest General Hospital and Research Centre, Peshawar. After obtaining ethical approval from the hospital's ethics committee (IRB&EC/2025-GH/0238), data from October 15, 2022, to October 15, 2024, were retrieved. A total of 224 patients with suspected choledocholithiasis were included in the study through non-probability consecutive sampling. Excluded from the study were patients having contraindication to either of the diagnostic techniques (MRCP, ERCP). Informed written consent was taken. The MRCP images were interpreted by two consultant radiologists using a standardised reporting template. In cases where there was disagreement, a third radiologist was consulted to provide an additional opinion and resolve the discrepancy. Data, including name, age, gender, body mass index (Kg/m²), height, weight, and occupation, were entered into a proforma for analysis. Each entry was double-checked for accuracy and completeness. Any missing or incomplete data was addressed as follows: If the missing data was minimal or non-critical, the record was included. Patients with significant missing data were excluded from the analysis if their presence would compromise the study's integrity. The data was evaluated with SPSS version 25.0. The descriptive analysis was performed, and the data were presented in the form of frequencies and percentages.

RESULTS

The study was conducted on 224 patients who presented with epigastric pain and were referred for MRCP with suspected choledocholithiasis. The mean age of the sample was 46.8 + 7.8 years. The minimum age was 30 years, and the maximum age was 60 years. The mean BMI of the sample was 28.4± 2.9kg/m².

Table 1: Demographics of the Sample (n=224)

		Frequency	%age
Age Group(Year)	30-40	30-40	24.6
	40-50	40-50	46.4
	50-60	50-60	29.0
Gender	Male	133	59.4
	Female	91	40.6
BMI (kg/m$^{2)}$	23-25.5	47	21.0
	25.5-29.9	89	39.7
	29.9-33.5	88	39.3

Table 2: Frequency of Choledocholithiasis on Mrcp (N=224)

Choledocholithiasis on MRCP	Frequency	%age
Yes	147	65.6
No	77	34.4

Table 3: Frequency of Choledocholithiasis on Ercp (n=224)

Choledocholithiasis on MRCP	Frequency	%age
Yes	131	58.5
No	93	41.5

Table 4: Mrcp and Ercp 2 X 2 Table (n = 224)

Choledocholithiasis on MRCP	Choledocholithiasis on ERCP	
Yes	119	28
No	12	65

Sensitivity of MRCP: TP/TP + FN = 90.8% Specificity of MRCP: TN/TN + FP = 69.9% Positive Predictive Value MRCP: TP/TP + FP = 81% Negative Predictive Value MRCP: TN/TN + FN = 84.4% Accuracy of MRCP: TP + TN / n = 82.1%

DISCUSSION

Obstructive jaundice is a common clinical problem diagnosed based on clinical and laboratory findings, but to identify the cause of obstruction, different imaging modalities are available.[11] There are several causes of obstruction at both intrahepatic and extrahepatic levels.[8] The most common intraductal cause of obstruction is calculi; other causes are benign and malignant biliary strictures, neoplasms like cholangiocarcinoma, parasites and primary sclerosing cholangitis. Extraductal causes include compression of biliary channels by periampullary masses, pancreatitis, pseudo-pancreatic cysts, and mucoceles.[11,12] Ultrasound is the initial

imaging investigation in patients with obstructive jaundice. The sensitivity of ultrasound in detecting choledocholithiasis varies between 20-80%.13 Distal CBD stones are often missed on ultrasound due to overlying duodenal gas.[13] Moreover, the diagnostic value of ultrasound in biliary stones is inconsistent, as it depends on the operator's experience and the patient's body habits. The gold standard for examining the hepatobiliary and pancreatic channels is Endoscopic retrograde cholangiopancreatography (ERCP).[14,15] This is widely used for both diagnostic and therapeutic purposes. ERCP is an invasive technique and thus carries the risks of biliary infection and other complications.[14] It is associated with 1-7% morbidity.[15,16] Magnetic Resonance Cholangiopancreatography (MRCP) has high accuracy in detecting biliary duct calculi. Furthermore, it is a multiplanar and non-invasive imaging modality with no ionising radiation.[1] MRCP is a heavy T2-weighted MR imaging method that requires no contrast administration. It has 88.9% sensitivity and 100% specificity for diagnosing biliary stones. Its positive predictive value (PPV), negative predictive value (NPV) and accuracy rates are 100%, 99.2% and 99.2%, respectively.[15] Sensitivity, specificity, PPV, NPV and diagnostic accuracy of MRCP were recorded as 83.33%, 93.88%, 90.91%, 88.46%, and 89.41% respectively, taking operation as the gold standard.[16] The diagnostic attributes of MRCP included 95% sensitivity, 73.33% specificity, 93.44% positive predictive value (PPV), 78.5% negative predictive value and 90.66% diagnostic accuracy.[17] The evidence on patient satisfaction shows that patients prefer MRCP over diagnostic ERCP. The diagnostic accuracy, sensitivity and specificity of MRCP in our study were comparable to those reported in the literature.[16,17,18] The purpose of this research was to determine the diagnostic accuracy of MRCP in the diagnosis of choledocholithiasis, using ERCP as the gold standard. We evaluated diagnostic accuracy based on sensitivity, specificity, positive predictive value, and negative predictive value, which were comparable to those in other studies in the literature. MRCP could thus be proposed as the examination of choice for bile duct abnormalities, and ERCP could be reserved for therapeutic intervention.

LIMITATIONS

It is a single-centre study conducted on an urban population; therefore, the results might not be generalised to larger populations. We recommend that more studies, using larger patient samples and spanning more extended time periods, are required. There is still more to be done to assist and guide physicians on the high diagnostic accuracy of MRCP in patients with suspected choledocholithiasis, to help them reassure patients and refer them for imaging. Moreover, effect modifiers such as diabetes, hypertension, and the expertise of the performing technician should be included in further studies to determine their impact on the accuracy of MRCP.

CONCLUSIONS

MRCP is a valuable diagnostic tool for choledocholithiasis, offering high sensitivity and specificity. It may be proposed as the diagnostic modality of choice since it is multiplanar and non-invasive with no ionising radiation and requires no contrast administration.

CONFLICT OF INTEREST: None

FUNDING SOURCES: None

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AUTHORS CONTRIBUTION

Anam Safdar - *Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval*

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Shandana Khan - *Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval*

The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.