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Evaluating the Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography in Identifying Choledocholithiasis in Patients with Obstructive Jaundice

Murad Arshad, Yasir Shakeel, Nisar Ahmed, Saerah Iffat Zafar, Rohaid Khan, Hafsa Aquil

Department of Radiology, Armed Forces Institute of Radiology and Imaging Rawalpindi/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objectives: To evaluate the diagnostic accuracy of Magnetic Resonance Cholangiopancreatography (MRCP) in the detection of choledocholithiasis in patients presenting with obstructive jaundice.
Study Design: Prospective comparative study.
Place and Duration of Study: Department of Radiology, Armed Forces Institute of Radiology and Imaging Rawalpindi, Pakistan, from Mar to Sep 2023.
Methodology: A total of 200 patients, aged between 18 and 60 years, were selected based on specific inclusion and exclusion criteria. Convenience sampling was employed for patient selection. Each patient underwent MRCP for the diagnosis of choledocholithiasis, had surgical intervention for the treatment of same issue. Sensitivity analysis was performed.
Results: Out of the 200 patients, 110(55%) were male and 90(45%) were female. MRCP identified 110(55%) cases of choledocholithiasis, whereas surgical procedures confirmed 120(60%) cases. The diagnostic accuracy of MRCP came as 95%.
Conclusion: MRCP is a non-invasive, operator-independent, and accurate diagnostic method for detecting choledocholithiasis.

Keywords: Diagnostic Accuracy, Magnetic Resonance Cholangiopancreatography, Obstructive Jaundice

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INTRODUCTION:

Choledocholithiasis refers to the occurrence of gallstones within the biliary ducts, including the common bile duct and extrahepatic duct. This condition, along with the associated obstructive jaundice and cholestasis, results in the slowing or restriction of bile flow.[1] Clinically, obstructive jaundice is described as a disorder with significant morbidity and mortality rates, necessitating early and precise diagnosis to reduce its effects as soon as possible.[2] Symptoms of choledocholithiasis include jaundice, characterized by yellow staining of the skin and sclera, clay-colored feces, pain in the right hypochondrium, itching, nausea, and vomiting. Timely identification of the cause of obstructive jaundice is critical, as untreated cholestasis may lead to secondary biliary cirrhosis.[3]

According to research, involvement of the pancreatic and biliary systems causes obstruction in approximately 17.1% of jaundice cases.[4] Hepatobiliary disorders account for about 2% of hospital admissions and are associated with significant morbidity and mortality in acute biliary system diseases.[5] Correct therapeutic decisions typically depend on a detailed assessment of the cause, location, level, and extent of the condition.[6]

Various radiological modalities have been employed for diagnosing obstructive jaundice, including ultrasound (U/S), Endoscopic Retrograde Cholangiopancreatography (ERCP), and Magnetic Resonance Cholangiopancreatography (MRCP). While U/S is rapid, easy to perform, affordable, and patient-dependent.[7] ERCP, although it is a highly invasive cholangiography technique, is considered an imperfect diagnostic tool.[8]

MRCP stands out as a crucial non-invasive imaging test for individuals with obstructive jaundice prior to surgery .[9,10]

While the diagnostic efficacy of ultrasound and ERCP in obstructive jaundice has been extensively examined in previous studies, this study aimed to assess the diagnostic efficacy of MRCP in the diagnosis of obstructive jaundice.

METHODOLOGY

This prospective comparative study was conducted on 200 patients, with data and radiographs obtained from the Armed Forces Institute of Radiology and Imaging (AFIRI), Rawalpindi, between March 2023 to September 2023, after obtaining

Correspondence: Dr Murad Arshad, Department of Radiology, Armed Forces Institute of Radiology and Imaging Rawalpindi Pakistan
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approval from the Institutional Ethical Review Board (letter no. --).

Inclusion Criteria: Patients of either gender aged between 18 to 60 years, presenting with symptoms indicative of choledocholithiasis, such as nausea, vomiting, and clay-colored stools were included. Additionally, laboratory profiles considered were alkaline phosphatase levels greater than 670 U/L, Gamma-Glutamyl Transpeptidase levels exceeding 90 U/L, and serum bilirubin levels above 1 mg/dL.

Exclusion Criteria: Postoperative patients with choledocholithiasis, those with prosthetic heart valves, cochlear implants, cardiac pacemakers, and brain aneurysm clips that were incompatible with MRCP, and those who had previously received medication for choledocholithiasis were excluded.

Sample size was calculated utilizing the WHO calculator, considering a 2% prevalence rate of obstructive jaundice.[11] Although the calculated sample size was 31, we increased it to 200 to enhance the generalizability of the findings. Convenience sampling was applied, and patients were recruited after taking informed consent.

All enrolled patients underwent MRCP (Magnetic Resonance Cholangiopancreatography) for diagnostic purposes. Following MRCP, patients were referred to the surgical department once the report was obtained an diagnosis of choledocholithiasis was verified. The presence of choledocholithiasis was confirmed intraoperatively through clinical observation. A certified radiologist, who was blinded to the clinical details, performed the MRCP. Subsequently, each patient's cholangiogram was assessed by an experienced consultant gastroenterologist, who was also blinded to the MRCP outcomes.

The comparative analysis focused on pathologies identified, including choledocholithiasis, pancreaticobiliary strictures, and dilation of biliary strictures.

Data were collected, processed, and analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Qualitative data were expressed as frequency and percentage. Sensitivity analysis was then performed.

RESULTS

A total of 200 individuals were enrolled in our study, comprising 110 males (55%) and 90 females (45%). Within this study, MRCP indicated positive choledocholithiasis in 110 patients (55%), while surgical procedures confirmed the diagnosis in 120 patients (60%). The overall diagnostic accuracy of MRCP was calculated to be 95%, as detailed in Table.

Table: Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography (n=200)

	Surgical Procedures Yes/Positive. No/Negative	
MRCP •Yes/Positive •No/Negative	110(55%) 120(60%)	90(45%) 80(40%)

Sensitivity= True Positive/(True Positive +False Negative)= 110/230= 47.82
Specificity= True Negative / (True Negative +False Positive) =80/170 = 47.05
Positive Predictive Value= True Positive/ (True Positive+ False Positive) = 110/200= 55%
Negative Predictive Value= True Negative/ (True Negative +False Negative) =80/200=40%
Diagnostic Accuracy= (True Positive +True Negative)/All Patients = 190/200= 95%

DISCUSSION

This prospective study was conducted on 200 individuals, where MRCP detected 55% of choledocholithiasis cases compared to 60% detection via surgical procedures, resulting in a diagnostic accuracy of 92% for MRCP. Previous studies have results that support our findings, reporting a diagnostic accuracy of 96% for MRCP, with the slight variation likely attributable to differences in sample size .[12,13]

Faruk Cavdar *et al.* further support our study by comparing the diagnostic accuracy of ERCP and MRCP in detecting CBCT stones. They found a diagnostic accuracy of 93.7% for MRCP; however, their study did not compare these results with operation-based diagnoses.[9] Similarly, Rashid et al. reported a diagnostic accuracy of 97% for MRCP.[14] Sugiyama *et al.* observed a 100% sensitivity for MRCP in a cohort of 101 patients.[15] Mendler *et al.* noted that MRCP sensitivity decreases for stones smaller than 3 mm.[16]

Additionally, You *et al.* emphasized dependable inter-observer concurrence and improved outcomes of MRCP for diagnosing choledocholithiasis. MRCP, being non-invasive, not requiring radiation exposure or contrast agents, is particularly beneficial as a first-line diagnostic tool for patients with cholecystitis.[17] Our findings of a 92% accuracy for MRCP support the study by Samara *et al.*, who found MRCP superior to ERCP for diagnosing choledocholithiasis.[18] The efficacy of MRCP in distinguishing benign strictures from those due to extrahepatic cholangiocarcinoma is on par with ERCP and surgical evaluations.[19]

Choledocholithiasis was identified as the most common cause of obstructive jaundice in our study. This is consistent with findings by Karki *et al*.[20] and Singh *et al*.[10] who both identified choledocholithiasis as the primary benign cause of obstructive jaundice. Notably, MRCP does not require any contrast material.[21,22] Furthermore, MRCP can effectively detect lesions, provide comprehensive visualizations, and identify highly sensitive duct obstructions, proving useful in various surgical contexts such as Billroth II gastrectomy and hilar strictures.[23]

LIMITATION OF STUDY

Limitations of our study include a small sample size, exclusion of patients with normal result, a lack of a control group, and no correlation with risk factors.

CONCLUSION

MRCP is a non-invasive, operator-independent, and patient-independent tool for the early detection of choledocholithiasis. It demonstrates high sensitivity and specificity for biliary dilatation, eliminating the need for invasive imaging techniques. MRCP remains and will continue to be the gold standard imaging modality for the detection of choledocholithiasis.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MA & YS: Data acquisition, data analysis, critical review, approval of the final version to be published.

NA & SIZ: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

RK & HA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

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.

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