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Original Research Article

Diagnostic Accuracy of MRCP in the Evaluation of Obstructive Jaundice

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Abstract: *Obstructive jaundice is a significant clinical condition that requires timely and accurate diagnosis to guide appropriate management. Endoscopic Retrograde Cholangiopancreatography (ERCP) is considered the gold standard but is invasive and associated with potential complications. Magnetic Resonance Cholangiopancreatography (MRCP) offers a non-invasive alternative, and its diagnostic accuracy warrants evaluation.* ***Objective:*** *To determine the diagnostic accuracy of MRCP in diagnosing obstructive jaundice using ERCP as the reference standard.* ***Methods:*** *This prospective observational study was conducted at the Jinnah Postgraduate Medical Centre (JPMC), Karachi, from September 1, 2024, to February 28, 2025, after obtaining ethical approval. A total of 109 patients aged 18 years or older, of either gender, presenting with clinical features of obstructive jaundice, including jaundice, pruritus, dark-colored urine, and pale stools, were enrolled through non-probability sampling. Patients with contraindications to MRCP or a history of prior biliary surgery were excluded. MRCP findings were compared with ERCP to evaluate diagnostic accuracy. Receiver Operating Characteristic (ROC) curve analysis was performed using SPSS Version 25.* ***Results:*** *MRCP demonstrated a sensitivity of 86.4% and specificity of 88% in diagnosing obstructive jaundice when compared with ERCP. ROC curve analysis revealed an area under the curve (AUC) of 0.864, with a statistically significant p-value (<0.001), indicating strong diagnostic performance.* ***Conclusion:*** *MRCP demonstrates high diagnostic accuracy in detecting obstructive jaundice and can serve as a reliable, non-invasive alternative to ERCP, particularly in the initial diagnostic evaluation or in patients where ERCP is contraindicated.*

Keywords: MRCP, ERCP, obstructive jaundice, accuracy

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Introduction

Obstructive jaundice is a condition in which bile is unable to reach the duodenum due to obstructions that can be benign or malignant, such as those caused by gallstones, tumors, or strictures (1). Differential diagnosis is essential to avoid life-threatening conditions like cholangitis, biliary cirrhosis, or hepatic failure. ERCP has been considered the gold standard for diagnosing and treating biliary strictures; however, it carries risks such as pancreatitis, infections, and perforation due to its invasive nature (2). Magnetic Resonance Cholangiopancreatography (MRCP) has been developed as a non-invasive method that offers high-quality images of the biliary and pancreatic ducts without the use of contrast agents or radiation (3). MRCP has the advantage of being a diagnostic tool that reduces patient morbidity compared to ERCP, especially when therapeutic interventions are not necessary at that particular time (4). Nevertheless, the yield of MRCP in diagnosing different etiologies of obstructive jaundice compared to ERCP remains under investigation. Current research also emphasizes that MRCP is being extended for the diagnosis of obstructive jaundice (5). In a 2020 study on the diagnostic performance of MRCP for biliary obstruction, Hanif et al. established that MRCP for biliary obstruction yielded a high sensitivity of 94% and specificity of 95%, making it especially useful for the diagnosis of choledocholithiasis and biliary strictures (6). Similarly, a 2022 review by Patel et al. has shown that MRCP can be used to diagnose malignant biliary obstruction effectively, but it may lack sensitivity in detecting smaller stones or subtle strictures (7). However, there have been some drawbacks that still leave MRCP with some shortcomings. The problem of false negatives, including the failure to detect small stones or tumors in their early stages, persists. Additionally, the interpretation of MRCP images is best performed by an experienced radiologist, which makes their implementation in specific clinical scenarios less feasible (8). However, with the development of technology, MRCP has gained recognition as the first-line imaging diagnostic study for obstructive jaundice, serving as a roadmap for ERCP when intervention is required. The present study aims to determine the diagnostic accuracy of MRCP in diagnosing obstructive jaundice.

Methodology

After obtaining ethical approval from the institutional review board, this prospective observational study was conducted at JPMC Hospital, Karachi, from September 1, 2024, to February 28, 2025. Through non-probability sampling, 109 patients aged 18 years and above of both genders, presenting with clinical features suggestive of obstructive jaundice, including yellowing of the skin and sclerae, pruritus, dark urine, and pale stools, were included in the present study. Patients with a history of MRCP or prior biliary surgery were excluded from the study. Written informed consent was obtained from all participants included in the study. Once the study participants had been assessed against the eligibility criteria mentioned above, they were subjected to a clinical review, including a history and physical examination, as well as laboratory investigations, to establish obstructive jaundice. In turn, patients were then referred for MRCP imaging based on the time intervals described in the departments' protocol. MRCP images were obtained using a specifically designed MRI scanner with coils designed for abdominal protocols. The imaging protocol involved sequences specific to the depiction of the biliary and pancreatic ducts, mainly without the use of contrast agents. Skilled technologists did image acquisition under the supervision of competent radiologists. After image acquisition, the MRCP images were reviewed by abdominal imaging subspecialty radiologists, who determined the presence, level, and etiology of biliary obstruction. Data collected from patients' records included demographic information, clinical presentation, laboratory investigations, and imaging findings from MRCP, which were documented in a standardized

electronic database. To characterize the demographic parameters of the study population, simple descriptive statistics were conducted on the attributes, including age, gender, and clinical profile. Subsequently, the diagnostic performance of CE-MRI was assessed and measured by sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy. MedCalc software was used to analyze the data.

Results

The study involved 109 participants with an average age of 53.35 ± 14.4 years. Of these participants, 63 were male (58%) and 46 were female (42%). The average level of alkaline phosphatase among the participants was 128.65 ± 66.2 IU/L, and the mean bilirubin level was 8.3 ± 3.92 mg/dL. In terms of diagnostic performance, MRCP demonstrated a sensitivity of 86.4% and a specificity of 88.0% when compared to ERCP, the gold standard for diagnosis. Out of 59 cases confirmed as positive by ERCP, MRCP correctly identified 51, resulting in a positive predictive value (PPV) of 89.4%. Additionally, MRCP correctly identified 44 out of 50 cases as unfavorable, resulting in a negative predictive value (NPV) of 88.0%. The overall accuracy of MRCP in diagnosing obstructive jaundice in this study was 87.16%, highlighting its effectiveness as a non-invasive diagnostic tool. Figure 1 shows the ROC curve analysis comparing MRCP and ERCP findings, with an area under the curve (AUC) of 0.864 and a p-value of <0.001.

Table 1: Demographic parameters of the study participants

Parameters	**N=109**
Age (years)	53.35±14.4
Gender	
Male	63 (58%)
Female	46 (42%)
Alkaline phosphates Level (IU/L)	128.65±66.2
Bilirubin Levels (mg/dL)	8.3±3.92

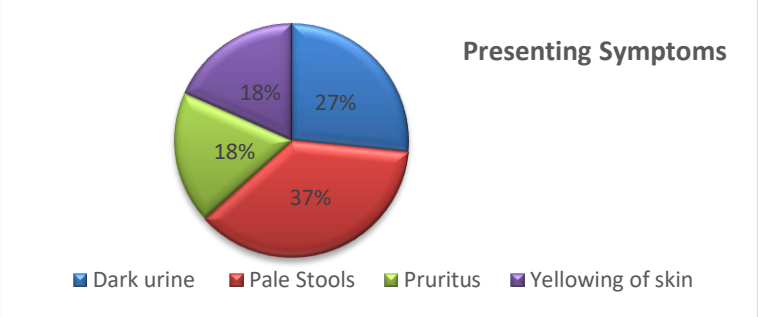

Figure 1: Presenting symptoms of the study participants

Table 2: Sensitivity and specificity analysis of MRCP in obstructive jaundice diagnosis

Analysis	**MRCP**		**Total**
ERCP	**Yes**	**No**	
Yes	51	8	59
No	6	44	50
Total	57	52	109
Sensitivity	86.40%		
Specificity	88%		
PPV	89.40%		
NPV	84.60%		
Accuracy	87.16%		

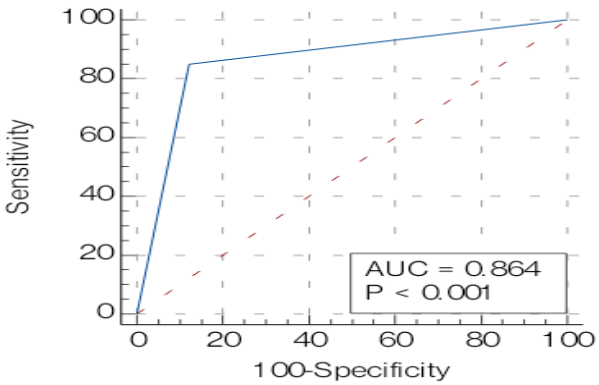

Figure 2: ROC curve analysis

Discussion

The present study demonstrates that MRCP is a reliable modality for diagnosing obstructive jaundice, particularly in terms of sensitivity and specificity, compared to the current gold standard, ERCP. With a sensitivity of 86.4% and a specificity of 88% for MRCP, this has demonstrated the effect of MRCP to be a non–invasive diagnostic tool that correlates with findings in the literature. Singh et al. (2014) conducted a meta-analysis, in which the sensitivity and specificity of MRCP were reported as 92% and 87%, respectively, confirming its reliability as a diagnostic tool for biliary obstruction (9). The positive predictive value (PPV) of 89.4% in this study implies that MRCP is particularly effective in eliminating false positives, especially in cases of biliary obstruction. This finding is consistent with the study by Dilip (2018), which showed that MRCP has a very high positive predictive value (PPV), particularly in the diagnosis of choledocholithiasis, and accurately pinpoints stones in the common bile duct (CBD) at a rate greater than 90 percent (10). Likewise, the negative predictive value (NPV) was estimated to be 84.6%. It can be concluded that MRCP has moderate specificity in excluding obstructive jaundice; however, it also has certain disadvantages, including an inability to accurately pinpoint small stones or early-stage tumors. Similar challenges were also highlighted by Kumar et al. (2023), who observed that MRCP may fail to detect small bile duct stones, especially in patients with mild symptoms (4). The overall accuracy achieved in this study, at 87.16%, stresses the effectiveness of using MRCP as the first-line diagnostic test for obstructive jaundice. This is supported by a survey by Alsaigh et al. (2020), which concluded that the accuracy of MRCP in diagnosing malignant biliary obstructions was 89%, thereby enhancing its applicability in clinical practice (11). In our study, ROC curve analysis was performed, yielding a value, i.e., the area under the curve (AUC), of 0.864, with a P value of <0.001, which strengthens the diagnostic accuracy of MRCP and its effectiveness. This finding is in agreement with the results of recent studies, which show that MRCP has high accuracy rates in diagnosing various pathologies of the pancreas and biliary tract and is especially effective in differentiating between benign and malignant causes of jaundice (12). However, like all techniques, MRCP has its limitations, as outlined below: The false negatives, especially in cases involving small stones or subtle strictures, remain a downside. A study by Lee et al. (2018) demonstrated that MRCP is highly effective in detecting significant obstructions; however, it may not detect minor abnormalities that could be clinically significant (Lee et al., 2018). Moreover, as with any imaging technique, the interpretation of MRCP images also requires specific expertise, and inter-center variability can cause variation in the diagnosis. As mentioned by Kwon et al. (2018), such differences in interpretation were observed among different readers, and the authors emphasized the crucial role of the senior radiologist in explaining MRCP readings (14).

Conclusion

In conclusion, the present study demonstrates that MRCP is highly accurate in diagnosing obstructive jaundice and can, therefore, be used as an alternative to ERCP, which is an invasive procedure. The high sensitivity and specificity, resulting in high positive predictive value (PPV) and negative predictive value (NPV), make it a handy additional diagnostic tool on the pathway. However, as suggested earlier, MRCP should be used in conjunction with other clinical examinations or imaging techniques, especially when results obtained from MRCP are ambiguous. Thus, future studies should focus on enhancing the sensitivity of MRCP, particularly in discerning more minor obstructions, as well as on standardizing the interpretation of MRCP studies.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-JPMC-883-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

V (Postgraduate trainee)
Manuscript drafting, Study Design,
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Study Design, manuscript review, critical input.
AS (Postgraduate Trainee)
Manuscript drafting, Study Design, Conception of Study, Development of Research Methodology Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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