



ORIGINAL ARTICLE

Relative Efficacy of Magnetic Resonance Cholangiopancreatography (MRCP) versus Ultrasound (USG) in detection of obstructive jaundice.

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ABSTRACT... Objective: To compare the relative efficacy of Magnetic Resonance Cholangiopancreatography (MRCP) versus ultrasound (USG) in detection of obstructive jaundice. **Study Design:** Prospective Cohort study. **Setting:** Department of Radiology, Pakistan Air Force Hospital, Islamabad. **Period:** September 2023 to March 2024. **Methods:** A total of 144 consecutive patients, irrespective of age and gender, with clinical and laboratory features of obstructive jaundice that were referred to the radiology department for further evaluation were included. All patients underwent USG followed by MRCP, and their findings were compared using surgery/histopathology/ERCP as the gold standard for the final diagnosis. **Results:** This study enrolled 144 patients with obstructive jaundice, split into two age groups: 18-50 years (47.22%) and 51-89 years (52.77%). The gender distribution includes 78 males (54.16%) and 66 females (45.83%). Common symptoms were jaundice (27.08%), weight loss (26.38%), abdominal pain (23.61%), and fever (22.91%). Among the patients, 65.28% were diagnosed with positive obstructive jaundice. Diagnostic comparison between ultrasound (USG) and magnetic resonance cholangiopancreatography (MRCP) showed MRCP's superior sensitivity (100%), specificity (90.91%), positive predictive value (96.67%), negative predictive value (100%), and diagnostic accuracy (97.50%) compared to USG. **Conclusion:** Obstructive jaundice slightly affects older adults more than younger individuals and shows a slight male predominance. The symptoms vary, necessitating comprehensive diagnostic approaches. MRCP outperforms USG in all diagnostic metrics, establishing it as a more reliable tool for accurately detecting obstructive jaundice. This underscores the need for accurate diagnostic and therapeutic strategies to manage this condition effectively.

Key words: Diagnostic Accuracy, MRCP, Obstructive Jaundice, Sensitivity, USG.

INTRODUCTION

Obstructive jaundice is a commonly encountered problem in gastroenterology and hepatobiliary practice that poses diagnostic as well as therapeutic challenges to the physician. It is one of the most frequent and grave presentations of hepatobiliary disease and is considered to be associated with increased morbidity and mortality predominantly in patients undergoing surgical intervention.^{1,2}

Obstructive jaundice is usually caused by extrahepatic or intrahepatic organic obstructive pathology interrupting the biliary channel, like gall stones, strictures, choledochal cyst, malignancies such as carcinoma of the head of the pancreas, cholangiocarcinoma, carcinoma

of the gall bladder and peri-ampullary cancer. Some of the rare obstructive causes reported are Castle-Mann's disease, Caroli's syndrome, and liver metastases.^{3,4} Clinical anticipation is often associated with a better diagnostic outcome. Most of the patients present with jaundice with or without pain, pale stools, dark urine, pruritis, malaise, and weight loss, with raised serum alkaline phosphatase being characteristic of obstructive jaundice.⁵

The recent advancement has led to a better understanding of pathophysiology and management options for obstructive jaundice. The therapeutic outcome of treatment options relies on pre-procedural knowledge of precise location,

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level, extent and etiology of the disease. This information will allow the interventionist or surgeon to better decide therapeutic option because an ill-defined approach can cause increased morbidity. There are myriads of radiological modalities including both invasive and non-invasive being used for the evaluation of obstructive jaundice. Ultrasonography (USG), computed tomography (CT), Endoscopic Retrograde Cholangiopancreatography (ERCP) and Magnetic Resonance Cholangiopancreatography (MRCP) are commonly used investigations.⁶

USG is usually the primary modality for the evaluation of obstructive jaundice in our clinical set-ups. It is simple, easy, cost effective, readily available and radiation free. Its ability to differentiate obstructive from non-obstructive causes has been reported to about 90%.⁷ However, USG is solely operator dependent and overlying gas shadows and physique can limit pancreatobiliary anatomy visualization. MRCP has now emerged as new diagnostic modality of choice for evaluation of biliary obstruction because of its characteristics like; high resolution, complete of visualization of biliary tree, non-invasiveness, contrast free, short exam time and artifact free display of ductal system.⁸ The estimated sensitivity of MRCP in diagnosing ductal pathologies as demonstrated by MRCP is 81-100%.⁹

Biliary obstruction leading to jaundice is common clinical entity which requires prompt diagnosis and management. Although a lot of work has been done that evaluated the diagnostic efficacy of different diagnostic modalities. Still there is limited data in our clinical set-up especially the role of USG and MRCP in evaluation of obstructive jaundice. Keeping this perspective, we conducted this study that will compare the role of both modalities in evaluation of obstructive pathology.

METHODS

This prospective comparative study was conducted at the Department of Radiology, Pakistan Air Force (PAF) Hospital Islamabad over a period of 6 months. The study protocols were approved by the hospital ethical committee

(10/8/23) prior to the start of the study. Informed consent was taken from all patients who were willing to be part of this study. The sample size was calculated using the prevalence of obstructive jaundice: 242 per 1000 cases, a confidence interval of 95%, and a margin of error of 7%. The final sample size was 144.

All consecutive patients, irrespective of age and gender, with clinical and laboratory features suggestive of obstructive jaundice who were referred to the Department of Radiology for USG and MRCP for further evaluation were included in our study. Patients who were claustrophobic, had electromagnetic implants, were pregnant women, and those who didn't give consent for the study were excluded.

All patients underwent USG abdomen followed by MRCP on the same day or the next day. On USG, obstructive jaundice was considered present with intrahepatic duct and extrahepatic duct dilatation of 2 mm or 4 mm or more, respectively, while on MRCP, intrahepatic duct dilatation of 2 mm or more and extrahepatic duct dilatation of 6 mm or more were considered positive for obstructive jaundice. Choledocholithiasis appeared as echogenic foci with posterior acoustic shadow on USG and hypointense filling defect on MRCP. Stricture appeared as focal segment narrowing of the lumen of the bile duct on both USG and MRCP.

On USG, carcinoma of the head of the pancreas and periampullary carcinoma were defined as hypoechoic lesions of any size in the head of the pancreas and periampullary region, while on MRCP, heterogeneous intensity lesions of any size were considered positive. Cholangiocarcinoma and carcinoma of the gall bladder were defined as heterogeneous echotexture lesions of any size in their respective locations on USG, while on MRCP, they were defined as heterogeneous signal intensity lesions of any size in the biliary system or gall bladder. MRCP and USG scans were separately studied and analyzed by classified radiologists in a blinded fashion without knowing the findings of the other investigation. The final diagnosis was made using surgery or

histopathological findings as the gold standard. All data, including patients' demographic data, were recorded on pre-designed proformas.

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS IBM version 21). Quantitative variables, including age, were expressed as means with standard deviations. Qualitative variables such as gender, symptoms, and outcomes were expressed as frequencies and percentages. Sensitivity, specificity, and diagnostic accuracy of USG and MRCP were calculated using cross tables, taking surgical or histopathological outcomes as the gold standard.

RESULTS

The study encompasses a total of 144 patients with obstructive jaundice, divided into two age groups. The first group, comprising individuals aged 18-50 years, includes 68 patients, accounting for 47.22% of the study population. The second group, consisting of individuals aged 51-89 years, includes 76 patients, making up 52.77% of the total. This distribution indicates that obstructive jaundice slightly affects older adults more than younger to middle-aged adults within this cohort. In terms of gender distribution, the study population consists of 78 male patients (54.16%) and 66 female patients (45.83%). This slight predominance of males suggests a potentially higher prevalence or increased likelihood of males seeking medical evaluation for symptoms of obstructive jaundice. The symptoms presented by the patients vary, with jaundice being the most common, affecting 39 patients (27.08%). This is followed by weight loss, reported by 38 patients (26.38%). Abdominal pain is experienced by 34 patients (23.61%), while fever is noted in 33 patients (22.91%). These findings highlight the diverse symptomatology of obstructive jaundice, underscoring the necessity for comprehensive diagnostic approaches to effectively identify and manage the condition across a varied patient population. (Table-I)

Out of the total 144 patients, 94 (65.28%) were diagnosed with positive obstructive jaundice, while 50 (34.72%) were diagnosed as negative.

This distribution shows that a significant majority of the patients in the study were found to have obstructive jaundice, which underscores the importance of accurate diagnostic tools such as USG and MRCP in identifying this condition. The higher percentage of positive cases highlights the prevalence of obstructive jaundice among patients presenting with related symptoms, reinforcing the need for effective diagnostic and therapeutic strategies to manage this condition.

Variables		No. of Patients (%)
Age	18-50	68 (47.22%)
	51-89	76 (52.77%)
Gender	Male	78 (54.16%)
	Female	66 (45.83%)
Symptoms	Abdominal Pain	34 (23.61%)
	Fever	33 (22.91%)
	Jaundice	39 (27.08%)
	Weight Loss	38 (26.38%)

Table-I. Demographics of patients (n=144)

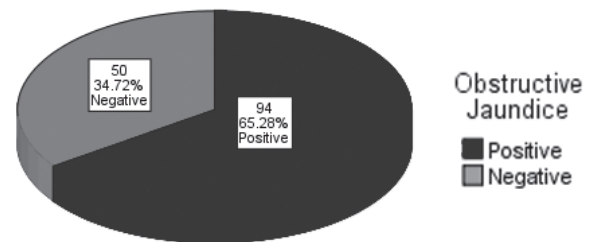


Figure-1: Showing the frequency of pts with obstructive jaundice among all the patients enrolled

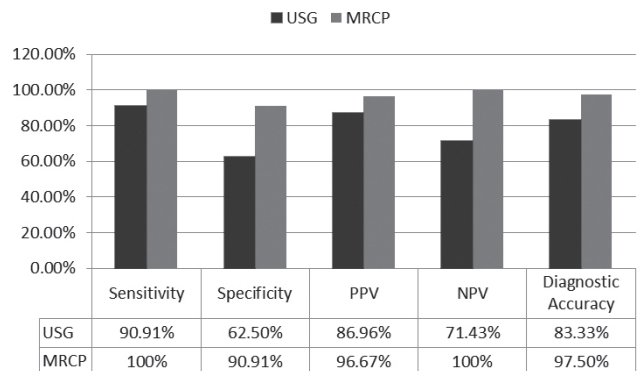


Figure-2: Showing the diagnostic accuracy, sensitivity and specificity of USG

The bar chart provides a comparative analysis of the diagnostic performance between ultrasound (USG) and magnetic resonance cholangiopancreatography (MRCP) in detecting

obstructive jaundice. The metrics evaluated include sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy. MRCP demonstrated superior performance across all metrics compared to USG. It achieved a perfect sensitivity of 100%, meaning it correctly identified all patients with obstructive jaundice, whereas USG had a slightly lower sensitivity of 90.91%. MRCP also excelled in specificity, with a rate of 90.91% compared to USG's 62.50%, indicating MRCP's better ability to correctly identify patients without the disease and minimize false positives. In terms of PPV, MRCP achieved 96.67%, suggesting a higher likelihood that patients with a positive test result actually had the disease, compared to USG's 86.96%. Additionally, MRCP's NPV was 100%, indicating that all patients with a negative test result were accurately identified as disease-free, while USG's NPV was 71.43%, showing some false negatives. Overall, MRCP's diagnostic accuracy was significantly higher at 97.50%, compared to USG's 83.33%. This comprehensive superiority in diagnostic performance underscores MRCP as a more reliable tool for accurately detecting obstructive jaundice in clinical settings.

DISCUSSION

Our study at the Department of Radiology, Pakistan Air Force Hospital, Islamabad, aimed to compare the diagnostic effectiveness of Magnetic Resonance Cholangiopancreatography (MRCP) and ultrasound (USG) for evaluation of detecting obstructive jaundice. Our results indicated that MRCP surpassed USG across various diagnostic criteria. We compare our results with other studies to provide a thorough understanding of MRCP and USG's relative effectiveness.

Satyanarayana Goud and colleagues²² investigated 37 patients with obstructive jaundice, finding that MRCP had a diagnostic accuracy of 97.2% and USG had an accuracy of 86.4% in diagnosing the cause of obstructive jaundice. In terms of sensitivity, MRCP was better than USG. Furthermore, MRCP had a perfect accuracy of 100% in diagnosing the level of obstruction, compared to 81% for USG. Our study mirrors these findings, with MRCP showing a diagnostic

accuracy of 97.50% compared to USG's 83.33%, and MRCP's sensitivity and specificity also being notably higher.

Sunny Swaraj and colleagues²³ in 2023 conducted a study on 120 patients, showing that MRCP accurately predicted the cause of obstruction in 113 patients (94.8% accuracy), while USG did so in only 40 patients (48.9% accuracy). The sensitivity and specificity of MRCP were 94.1% and 91.9%, respectively, significantly higher than USG's 33.3% sensitivity and 84% specificity. Additionally, MRCP had a high diagnostic accuracy of 98.33% in predicting the site of obstruction, compared to USG's 64.3%. These results are in line with our findings, supporting the superior diagnostic performance of MRCP over USG.

In 2014, Amandeep Singh and colleagues²⁴ compared MRCP, CT, and USG in diagnosing benign and malignant diseases in patients with obstructive jaundice. They found that MRCP had a high diagnostic accuracy of 98% for both benign and malignant conditions, significantly higher than USG's accuracy of 88% for both conditions. MRCP was 100% sensitive in diagnosing benign diseases, compared to USG's 80.77%, and also more sensitive in diagnosing malignant diseases (95.83%) compared to USG (79.17%). Our study similarly found MRCP to have higher diagnostic accuracy and sensitivity compared to USG.

Muhammad Usaid Baig and colleagues²⁵ studied 50 patients with obstructive jaundice and reported that 17 patients who tested negative on USG were positive on MRCP, while 3 patients were positive on USG but negative on MRCP. This emphasizes the inconsistencies in USG's diagnostic capability, which were observed in our study also where MRCP showed superior diagnostic performance.

Biplab Debbarma and colleagues²⁶ found that the most common cause of obstructive jaundice was common bile duct stones (55%), followed by tumors (22%). Their study showed that USG had a sensitivity of 97% and specificity of 67% for benign cases, and sensitivity of 86% and specificity of 100% for malignant cases, taking MRCP findings as the gold standard. Our study confirms the

high sensitivity of MRCP and the relatively lower performance of USG in diagnosing the causes of obstructive jaundice.

Purnima Irom and colleagues²⁷ included 36 patients and observed that MRCP had a higher diagnostic accuracy (94.4%) than CT (91.6%) and USG (30.56%). This study underscores MRCP's reliability and non-invasiveness in pre-operative evaluations, aligning with our findings that MRCP is a more accurate diagnostic tool compared to USG.

Our study reinforces the superiority of MRCP over USG in the diagnostic evaluation of obstructive jaundice. MRCP demonstrated higher sensitivity, specificity, and overall diagnostic accuracy compared to USG. These findings are consistent in line with the results of other studies, highlighting MRCP's reliability as a diagnostic tool for obstructive jaundice. Consequently, while USG remains a valuable initial screening modality, MRCP should be considered the definitive diagnostic tool for accurate assessment and treatment planning in patients with obstructive jaundice.

CONCLUSION

Obstructive jaundice slightly affects older adults more than younger individuals and shows a slight male predominance. The symptoms vary, necessitating comprehensive diagnostic approaches. MRCP outperforms USG in all diagnostic metrics, establishing it as a more reliable tool for accurately detecting obstructive jaundice. This underscores the need for accurate diagnostic and therapeutic strategies to manage this condition effectively.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.







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2	Shaista Nayyar	Review of paper.	
3	Salman Azhar	Data analysis, Discussion contents.	
4	Aiman Iqbal	Review of manuscript & Discuss contents.	
5	Huma Khaliq	Data Collection, Data analysis.	
6	Marryum Mukhtar	Data analysis, Review of paper.	
7	Muhammad Ahsan	Data Analysis, Manuscript.	