

ROLE OF ULTRASOUND AND MRCP IN DETERMINING THE LEVEL AND CAUSE OF BILIARY OBSTRUCTION IN PATIENTS WITH OBSTRUCTIVE JAUNDICE

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Abstract

Background: Biliary obstruction is a common clinical condition that can result from both benign and malignant causes, including choledocholithiasis, strictures and tumors of the pancreas or perampullary region. Early and accurate identification of the level and cause of obstruction is essential to guide appropriate management and prevent complications such as cholangitis, biliary cirrhosis and hepatic failure. Imaging plays a crucial role in diagnosis, with ultrasound being widely available and cost-effective, while magnetic resonance cholangiopancreatography (MRCP) provides detailed non-invasive evaluation of the biliary and pancreatic ducts.

Objective: To assess and compare the diagnostic accuracy of ultrasound and MRCP in identifying the level and cause of biliary obstruction in patients with obstructive jaundice.

Methodology: A cross-sectional study was conducted at Muhammad Islam Teaching Hospital, Gujrawala, including 60 adult patients with suspected obstructive jaundice. All participants underwent abdominal ultrasonography and MRCP using a TOSHIBA Vantage Elan 1.5T MRI system to determine the level and cause of biliary obstruction. Patients with metal implants, pacemakers, cochlear devices or severe claustrophobia were excluded. Data were analyzed using SPSS version 26. Diagnostic performance of MRCP and ultrasound was assessed through sensitivity, specificity, positive predictive value and negative predictive value. McNemar's test was applied to compare the detection rates of both modalities, with < 0.05 considered statistically significant.

Results: This cross-sectional study included 60 patients with obstructive jaundice, of whom 61.7% were females and 38.3% were males, with the majority aged between 42 and 76 years. MRCP detected obstruction in 59 of 60 patients (98.3%) with positive predictive value of 100%, identifying distal CBD involvement more

frequently (32 cases). Ultrasound detected obstruction in 34 of 60 patients (56.7% missing 26 cases and showed variable sensitivity depending on the cause and level of obstruction. The most common causes were cholelithiasis with choledocholithiasis (22), choledocholithiasis alone (16), pancreatic head tumors (5) and CBD stricture (5). Cross-tabulation revealed that 33 patients were positive on both MRCP and USG, 26 were positive only on MRCP and one patient was positive only on USG. McNemar testing confirmed a statistically significant difference between the two modalities ($p < 0.001$), demonstrating the superior diagnostic performance of MRCP.

Conclusion: MRCP is a highly sensitive and reliable modality for determining both the level and cause of biliary obstruction, outperforming ultrasound in detecting distal CBD lesions and pancreatic pathologies. Ultrasound, while valuable as a first-line screening tool, shows limited sensitivity in certain obstructions and should be complemented by MRCP for accurate diagnosis.

INTRODUCTION

Obstructive jaundice (OJ) is a condition in which there is critical disruption of the bile flow from the liver or the gallbladder into the duodenum. It signals an underlying pathological blockage in the biliary tree. The obstruction may arise from benign or malignant conditions as gallstones, biliary stricture and tumors. [1] The causes of obstructive jaundice are branched into intra hepatic and extra hepatic types. Most prevalent intrahepatic factors include hepatitis, cirrhosis and hepato-cellular carcinoma. Extra hepatic causes are classified as intraductal and extraductal. The leading causes of intraductal causes include tumors, choledocholithiasis and biliary strictures. Extraductal factors include compression of biliary channels by tumors, pancreatitis, and cystic duct stones. [2] The most common cause of obstructive jaundice is stone. The incidence of occurrence of CBD calculus is 10-15%. In which 80% of the calculus is seen in CBD.[3] These stones originate from the gallbladder and have comparable appearance and chemical makeup to those found elsewhere in the biliary tree.[4] As reported in recent epidemiological studies biliary obstruction frequently occur in the 5th and 6th decade of life. Evidence from literature indicates the female predominance with the ratio of 1:1.5. Gallstone disease is more prevalent in the biliary obstruction. When the obstruction occurs, the proximal biliary system dilated because of the elevated pressure in the bile ducts. It disrupts the normal function and arrangement of the microvilli (small surface projections that enhance transport

efficiency) in the biliary canaliculi (tiny ducts between the liver cell that collect bile).[5]The obstruction of the bile flow with the hepatobiliary system build-up of bile is the systemic circulation of body and causes the symptoms.[6]Clinically, patients may present with jaundice either with pain or without any discomfort, along with dark urine, pale stools, pruritus, weight loss and loss of appetite. If it is not promptly managed, complications such as ascending cholangitis, malabsorption, hepatorenal syndrome and coagulopathy may develop. [7]

The central role of the liver is the production of the bile (800-2000 ml). Bile helps in the emulsification of the fat, absorption of fats soluble vitamins and excrete some waste substances. Hepatocytes secrete the bile that flows into the intrahepatic ducts (bile capillaries, cholangioles and interlobular bile ducts). [8] Bile ducts must stay open in order for the normal liver function. If the bile ducts are blocked due to any reason the waste substances like bilirubin and the bile salt start to accumulate into the blood. When these chemicals accumulate into the body, they become toxic and cause various health problems. Patients are at high risk to develop Malnutrition, Infection, kidney failure and various cardiovascular problems in these patients. Even after the surgery the patients with obstructive jaundice can experience different health problems in 20-30% cases.[9]

Recent technological progress in medical imaging and clinical practice have enhanced our acquaintance

of pathophysiology and management of Obstructive jaundice. The effectiveness of therapeutic intervention mainly depend on definitive information prior to procedure about precise location level and cause of obstruction. It will give the clinician to opt the best treatment option. An ill-defined planning could increase complications and greater morbidity.[10] With the help of the invasive techniques like endoscopic retrograde cholangiopancreatography (ERCP), percutaneous Transhepatic cholangiography (PTC) and recent advancement in imaging technology, have improve diagnosis of biliary tract disease. Computed tomography, ultrasonography (USG) and Magnetic resonance cholangiopancreatography (MRCP) are the noninvasive procedures that have very significant importance in diagnosing the blockage of biliary obstructions. [11]

The inability of Ultrasonography and CT scan is that they may not precisely pin point the location and degree of obstruction while the PTC and ERCP are the interventional procedure that invasive and use contrast. MRCP provides a diagnostic accuracy of >90%.[12] Numbers of complications that are associated with Endoscopic Retrograde Cholangiopancreatography (ERCP), including bleeding, sepsis, pancreatitis and leakage of the bile. It has mortality rate of 1%. [13] Over 5% of patients may experience these complications. [14] The ERCP procedure has a morbidity rate up to 7%. Moreover, the procedure is based on the skills of the operator. 3-9% of cases reported the failure of cannulation of the common bile duct. The diagnostic utility of ERCP is further limited in case of complete or partial obstruction because of the incomplete opacification of the proximal ducts occurs. The ERCP procedure also needs routine sedation or anesthesia which also adds procedural risk.[15] The first line of investigation is used to diagnose biliary obstruction is USG due to its wide accessibility, cost-effectiveness, and non-invasive. It has a limitation some structure may not be visible such as distal common bile duct and pancreas due to shadows from the bowel gases. [16] Many studies have shown its effectiveness in distinguishing the hepatocellular causes of jaundice from biliary obstructive causes. US is typically considered as a initial diagnostic step, serving as a basis before employing more advanced imaging

techniques like magnetic MRCP and ERCP.[17] In distinguishing obstructive from non-obstructive jaundice, ultrasound demonstrates a high diagnostic accuracy of about 90%. However, magnetic resonance cholangiopancreatography (MRCP) surpasses ultrasonography, with sensitivity and specificity rates of approximately 98% each and as compared with Ultrasound 88% each. Studies indicate that jaundice cases are due to obstruction mostly commonly involving the pancreatobiliary system. Although ultrasound is first-line, MRCP provides superior visualization and improves detection of level and cause. [18]

MRCP is an advanced application of Magnetic resonance imaging that can provide detailed cross-sectional images of ductal structures along with coronal projection images of the biliary and pancreatic ducts. [19] The Magnetic resonance cholangiopancreatography (MRCP) was first introduced by the Wallner et al in 1991. The most recent MRCP imaging techniques are Rapid Acquisition with relaxation Enhancement (RARE) and Half-Fourier Acquisition Single Shot Turbo-Spin-Echo (HASTE). By utilizing the fast spin echo sequence, multiplanar thick and thin sections acquisitions are obtained. These sequences provide high resolution and rapid imaging in a few seconds in a single breath-hold and reducing the motion artifact. [20]

AIMS AND OBJECTIVES

To evaluate the role of Ultrasound and MRCP in Determining the Level and Cause of Biliary Obstruction in Patients with Obstructive Jaundice.

METHODOLOGY

This cross-sectional study will be conducted at Muhammad Islam Teaching Hospital over a period of four months. A sample size of 60 participants will be selected using convenient sampling, based on a 95% confidence interval and a 5% margin of error, calculated using the formula $n = \frac{Z^2 P(1-P)}{d^2}$, where the expected prevalence is 4%[21]. The study will include adults (≥ 18 years) with suspected obstructive jaundice who present with clinical and laboratory evidence of biliary obstruction, are referred for MRCP, provide written informed consent, and have complete

medical records. Patients with metal implants, cardiac pacemakers, cochlear devices, severe claustrophobia, or those who are uncooperative will be excluded from the study. The study will utilize the TOSHIBA Vantage Elan 1.5T MRI system, a 1.5-Tesla Magnetic Resonance Imaging unit. All MRCP examinations will be performed using a standardized protocol with heavily T2-weighted sequences. Techniques such as HASTE (Half-Fourier Acquisition Single-Shot Turbo Spin Echo) and RARE (Rapid Acquisition with Relaxation Enhancement) will be applied to obtain high-signal-intensity images of static fluid within the biliary and

pancreatic ducts. Data were analyzed using SPSS version 25. Descriptive statistics summarized categorical variables including gender, ultrasound findings, MRCP results, and obstruction characteristics using frequencies and percentages. Cross-tabulations compared ultrasound and MRCP in detecting obstruction, its level, and its cause. Diagnostic accuracy, including true positives, was calculated for both modalities. The McNemar test assessed differences between ultrasound and MRCP performance, with $p < 0.05$ considered significant.

RESULTS

Table No 4.1: Frequency Distribution of Gender

Gender			
		Frequency	Percent
Valid	Female	37	61.7
	Male	23	38.3
	Total	60	100.0

A total of 60 participants were included in the study. The majority were females, comprising

61.7% ($n = 37$), while males represented 38.3% ($n = 23$).

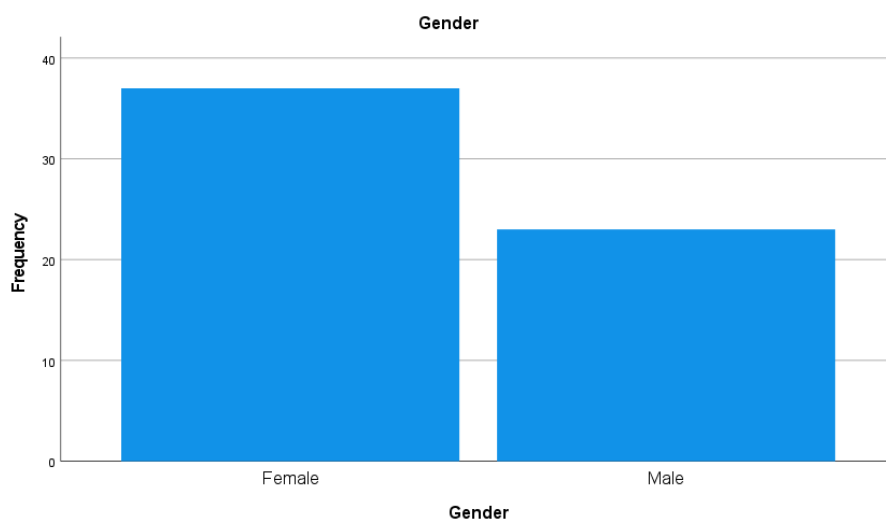


Table No 4.2: Frequency Distribution of Age

Age			
		Frequency	Percent
Valid	18-29 years	5	8.3
	30-41 years	9	15.0
	42-53 years	14	23.3

	54-65 years	20	33.3
	66-76 years	12	20.0
	Total	60	100.0

Most individuals belonged to the older age groups. The largest proportion was seen in those aged 54–65 years, accounting for 33.3 percent, followed by the 42–53 year range with 23.3 percent and the 66–76 year group with 20 percent. Younger participants were

fewer in number, with 15 percent falling in the 30–41 year range and only 8.3 percent in the 18–29 year category. Overall, the distribution shows that biliary obstruction occurred more frequently among middle-aged and elderly patients.

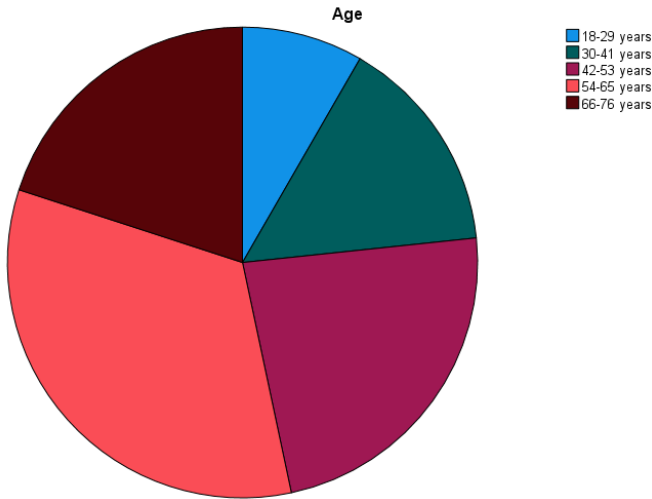


Table No 4.3: Frequency Distribution of MRCP Findings

MRCP findings		Frequency	Percent
Valid	negative	1	3.3
	positive	59	96.7
	Total	60	100.0

MRCP detected abnormalities in the vast majority of patients. A total of 59 showed positive findings on MRCP, while only 1 had no detectable abnormality. This indicates that

MRCP was highly effective in identifying features of biliary obstruction in the study population.

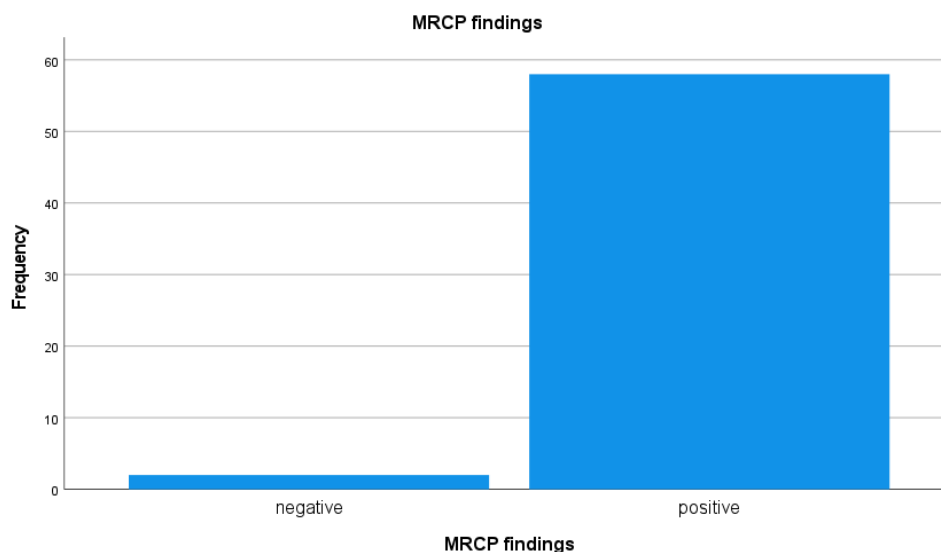


Table No 4.4: Frequency Distribution of Level of Obstruction

Level of obstruction		Frequency	Percent
Valid	CHD	1	1.7
	Cystic duct	1	1.7
	Distal CBD	32	53.3
	Mid CBD	7	11.7
	Periampullary region	2	3.3
	Porta hepatis	1	1.7
	Proximal and Distal CBD	1	1.7
	Proximal CBD	14	23.3
	Right and left hepatic duct	1	1.7
	Total	60	100.0

In 60 patients with obstructive jaundice, obstruction most commonly involved the distal CBD 32, followed by the proximal 14 and mid CBD 7, with other sites being less frequent. The main causes were choledocholithiasis, cholelithiasis with choledocholithiasis, strictures, masses and

tumors. MRCP was more sensitive (94.1%) in detecting both the level and cause of obstruction, while USG had a higher positive predictive value (94.1%) but lower sensitivity (55.2%), indicating MRCP as the more reliable imaging modality.

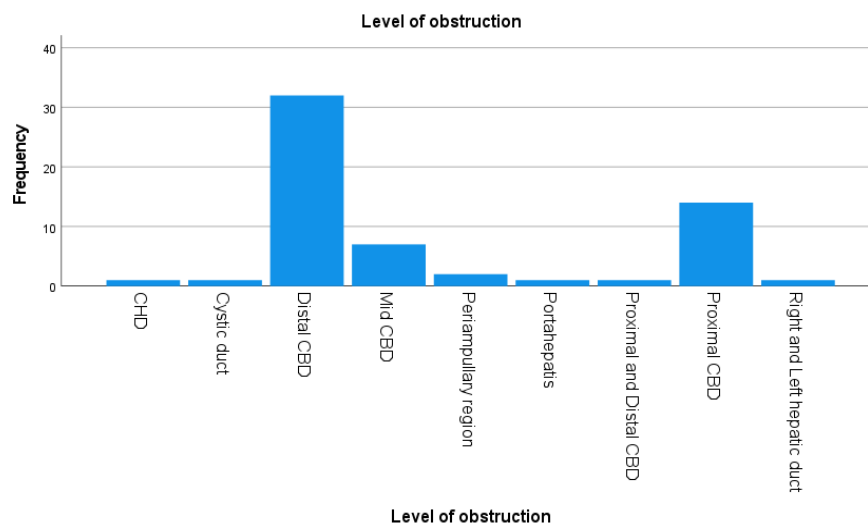


Table No 4.5: Frequency Distribution of Cause of Obstruction

Cause of obstruction		Frequency	Percent
Valid	cholelithiasis with choledocholithiasis	22	36.7
	periapillary tumor	2	3.3
	pancreatic head tumor	5	8.3
	choledochal cyst	2	3.3
	choledocholithiasis	16	26.7
	mass	7	11.7
	stones	1	1.7
	stricture of CBD	5	8.3
	Total	60	100.0

Among 60 patients with obstructive jaundice, the most common cause of obstruction was cholelithiasis with choledocholithiasis 22, followed by choledocholithiasis alone 16 and pancreatic head

tumors 5. Other causes included masses 7, strictures of the CBD 5, choledochal cysts 2, periapillary tumors 2 and stones 1.

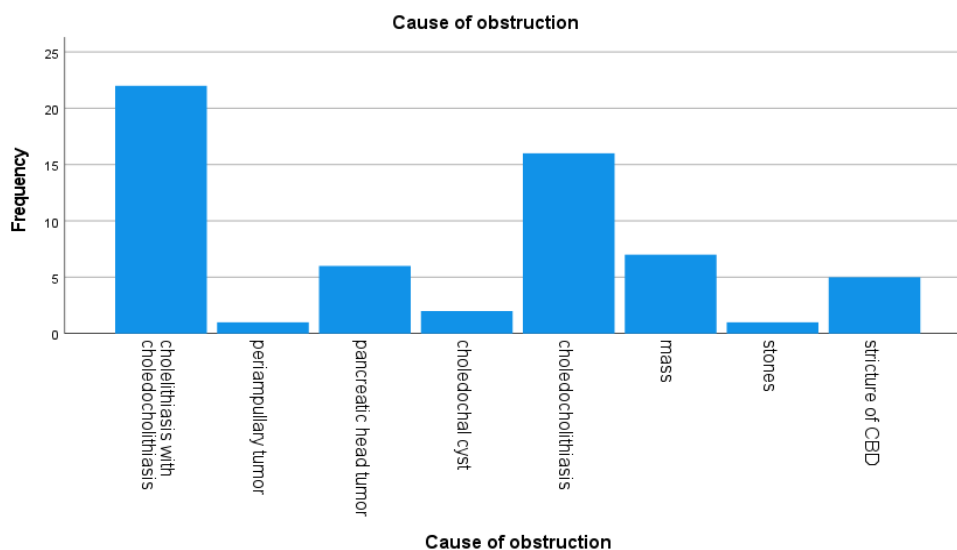


Table No 4.6: Frequency Distribution of USG Finding

USG finding			
		Frequency	Percent
Valid	negative	26	43.3
	positive	34	56.7
	Total	60	100.0

Among the 60 patients, USG findings were positive detected, while 26 patients had negative findings, in 34 patients, indicating that obstruction was indicating that obstruction was not detected.

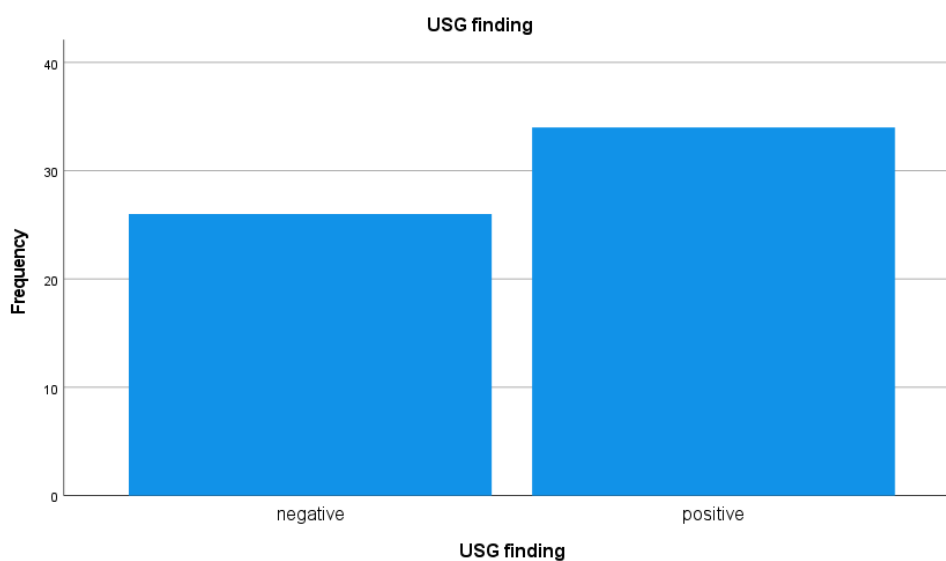


Table No 4.7: Crosstab of MRCP Findings * USG Finding

MRCP findings * USG finding Crosstabulation				
Count				
		USG finding		Total
		negative	positive	
MRCP findings	negative	0	1	1
	positive	26	33	59
Total		26	34	60

Crosstabulation of MRCP and USG findings showed that out of 60 patients, 33 patients were positive on both MRCP and USG, while 26 patients were positive on MRCP but negative on USG. Only 1

patient were negative on MRCP but positive on USG and no patient was negative on both modalities. This indicates that MRCP detected more cases of obstruction compared to USG.

Table No 4.8: McNemar Test for Comparing MRCP and USG Findings

Chi-Square Tests		
	Value	Exact Sig. (2-sided)
McNemar Test		.000 ^a
N of Valid Cases	60	

a. Binomial distribution used.

The McNemar test was applied to compare the detection rates of MRCP and USG in the same patients (n = 60). The test showed a significant

difference between the two modalities ($p < 0.001$), indicating that MRCP detected significantly more cases of obstruction than USG.

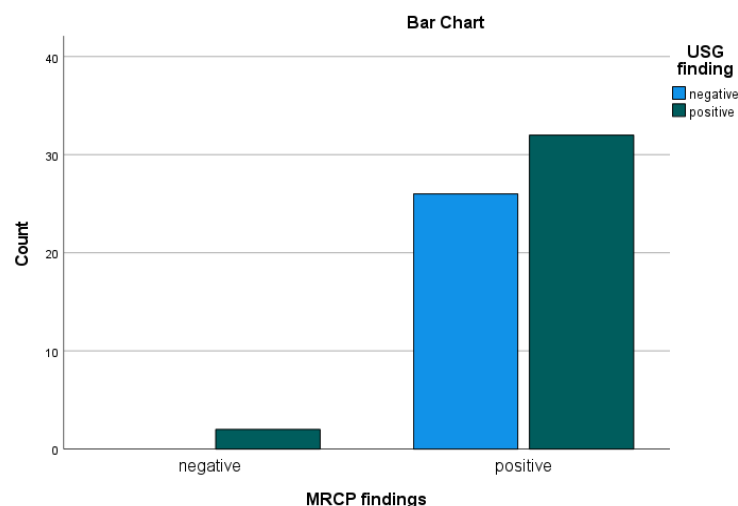


Table No 4.9: Crosstab of Level of Obstruction * USG Finding

Level of obstruction * USG finding Crosstabulation			
Count			
	USG finding		Total
	negative	positive	

Level of obstruction	CHD	0	1	1
	Cystic duct	1	0	1
	Distal CBD	19	13	32
	Mid CBD	2	5	7
	Periampullary region	1	1	2
	Porta hepatis	0	1	1
	Proximal and Distal CBD	0	1	1
	Proximal CBD	3	11	14
	Right and left hepatic duct	0	1	1
Total		26	34	60

Crosstabulation of the level of obstruction and USG findings showed that the distal CBD was the most frequently detected site, with 19 patients having negative USG findings and 13 patients positive. Among the proximal CBD, 11 patients were detected as positive and 3 as negative on USG. Single cases of obstruction in the CHD, cystic duct, porta hepatis,

proximal and distal CBD combined and right and left hepatic ducts were mostly detected on USG, while mid CBD and periampullary region showed mixed detection. Overall, USG detected obstruction in 34 patients and missed it in 26 patients, highlighting variable detection rates depending on the level of obstruction.

Table No 4.10: Crosstab of Cause of Obstruction * USG Finding

Cause of obstruction * USG finding Crosstabulation					
Count					
			USG finding		Total
			negative	positive	
Cause of obstruction	of	cholelithiasis with choledocholithiasis	9	13	22
		periampullary tumor	1	1	2
		pancreatic head tumor	3	2	5
		choledochal cyst	1	1	2
		choledocholithiasis	8	8	16
		mass	1	6	7
		stones	1	0	1
		stricture of CBD	2	3	5
Total			26	34	60

Crosstabulation of cause of obstruction and USG findings showed that among 22 patients with cholelithiasis with choledocholithiasis, obstruction was detected in 13 patients and not detected in 9. In 16 patients with choledocholithiasis alone, 8 were detected and 8 were not detected. Detection was equal for pancreatic head tumors (2 detected, 3 not detected) and masses were detected in 6 of 7 patients. For strictures of CBD, obstruction was detected in 3

and not detected in 2. For periampullary tumor, obstruction was detected in 1 and not detected in 1. Single cases of choledochal cyst and stones showed variable detection. Overall, USG identified obstruction in 34 of 60 patients and missed it in 26 patients, showing variable sensitivity depending on the underlying cause.

Table No 4.11: Crosstab of Level of Obstruction * MRCP Findings

Level of obstruction * MRCP findings Crosstabulation				
Count				
		MRCP findings		Total
		negative	positive	
Level of obstruction	Mid CBD	0	1	1
	CHD	0	1	1
	Cystic duct	0	1	1
	Distal CBD	0	32	32
	Mid CBD	0	6	6
	Periampullary region	0	2	2
	Porta hepatis	0	1	1
	Proximal and Distal CBD	0	1	1
	Proximal CBD	1	13	14
	Right and left hepatic duct	0	1	1
Total		1	59	60

Crosstabulation of MRCP findings and level of obstruction showed that obstruction was detected in all 32 patients with distal CBD involvement. Among 14 patients with proximal CBD obstruction, 13 were detected and 1 were not detected. Single cases of obstruction in the CHD, cystic duct, porta hepatis,

proximal and distal CBD combined, mid CBD (1 case), periampullary region and right and left hepatic ducts were all detected. Overall, MRCP identified obstruction in 59 of 60 patients and missed it in 1 patient, demonstrating consistently high detection across different obstruction levels.

Table No 4.12: Crosstab of Cause of Obstruction * MRCP Findings

Cause of obstruction * MRCP findings Crosstabulation				
Count				
		MRCP findings		Total
		negative	positive	
Cause of obstruction	cholelithiasis with choledocholithiasis	0	22	22
	periampullary tumor	0	2	2
	pancreatic head tumor	0	5	5
	choledochal cyst	0	2	2
	choledocholithiasis	0	16	16
	mass	0	7	7
	stones	0	1	1
	stricture of CBD	1	4	5
Total		1	59	60

Crosstabulation of MRCP findings and cause of obstruction showed that obstruction was detected in all 22 patients with cholelithiasis with choledocholithiasis, all 5 patients with pancreatic head tumor, all 7 patients with masses, all 2 patients with choledochal cyst, all 2 patients with

periampullary tumor and the single patient with stones. Among patients with choledocholithiasis alone, obstruction was detected in 16. For strictures of CBD, 4 were detected and 1 missed. Overall, MRCP identified obstruction in 59 of 60 patients and missed it in 1 patient, demonstrating

consistently high detection across different causes of obstruction.

Table No 4.13: Diagnostic Accuracy of MRCP and USG in Detecting Different Causes of Biliary Obstruction

Cause	Modality	TP	FP	FN	TN	Sensitivity %	Specificity %	PPV %	NPV %
Choledochal cyst	MRCP	2	0	0	0	100	0	100	0
	USG	1	0	1	0	50	0	100	0
Choledocholithiasis	MRCP	16	0	0	0	100	0	100	0
	USG	8	0	8	0	50	0	100	0
Cholelithiasis with choledocholithiasis	MRCP	22	0	0	0	100	0	100	0
	USG	13	0	9	0	59.1	0	100	0
Mass	MRCP	7	0	0	0	100	0	100	0
	USG	6	0	1	0	85.7	0	100	0
Pancreatic head tumor	MRCP	5	0	0	0	100	0	100	0
	USG	2	0	3	0	50	0	100	0
CBD stricture	MRCP	4	0	1	0	80	0	100	0
	USG	3	0	2	0	60	0	100	0
Periampullary tumor	MRCP	2	0	0	0	100	0	100	0
	USG	0	0	1	0	0	0	0	0

The cause-wise analysis of obstruction detection showed that MRCP identified obstruction in nearly all patients, detecting 59 of 60 cases. It demonstrated 100% sensitivity for choledochal cysts, cholelithiasis with choledocholithiasis, masses, pancreatic head tumors, choledocholithiasis and periampullary tumors, while the sensitivity for CBD stricture was at 80%. The positive predictive value (PPV) for MRCP was 100% across all causes, whereas specificity and negative predictive value (NPV) were 0%, reflecting

the very small number of negative cases. In contrast, USG detected obstruction in 34 out of 60 patients, with sensitivity varying widely by cause, from 0% for periampullary tumors to 85.7% for masses. PPV for USG remained high at 100%, while specificity and NPV were 0%. Overall, MRCP consistently outperformed USG in detecting biliary and pancreatic obstructions across all causes.

Table No 4.14: Diagnostic Accuracy of MRCP and USG

Modality	TP	FP	FN	TN	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
MRCP	59	0	1	0	98.3	0	100	0
USG	34	0	26	0	56.7	0	100	0

The overall diagnostic performance of MRCP and USG in detecting biliary and pancreatic obstruction was compared in 60 patients. MRCP identified obstruction in 59 cases, missing only one, resulting in a sensitivity of 98.3% and a positive predictive value of 100%. The single negative case was not correctly identified, so specificity and negative predictive value were 0%. In contrast, USG detected obstruction in 34 patients, missing 26 cases, yielding

a sensitivity of 56.7% and a PPV of 100%, while specificity and NPV were 0%. These findings demonstrate that MRCP detected a substantially higher number of obstructions than USG, highlighting its superior diagnostic performance.

DISCUSSION

In this study, a total of 60 patients with obstructive jaundice were evaluated, of whom 61.7% were

females and 38.3% were males. Most participants were middle-aged or elderly, with the largest proportion aged 54–65 years (33.3%), followed by 42–53 years (23.3%) and 66–76 years (20%). MRCP detected abnormalities in 59 of 60 patients, demonstrating a sensitivity of 98.3% and a positive predictive value of 100%, while the single negative case resulted in a specificity and negative predictive value of 0%. Obstruction most commonly involved the distal CBD (32 patients), followed by the proximal CBD (14) and mid CBD (7), with other sites being less frequent. The main causes included cholelithiasis with choledocholithiasis (22), choledocholithiasis alone (16), pancreatic head tumors (5), masses (7), CBD strictures (5), choledochal cysts (2), perampullary tumor (2), and stones (1). USG detected obstruction in 34 patients, missing 26 cases, with sensitivity varying from 0% for perampullary tumors to 85.7% for masses, and a PPV of 100%. Crosstabulation showed that 33 patients were positive on both MRCP and USG, 26 were positive on MRCP but negative on USG, and only one patient was negative on MRCP but positive on USG. McNemar testing indicated a statistically significant difference between the two modalities ($p < 0.001$). Overall, MRCP proved to be the more reliable modality for evaluating both the level and cause of biliary obstruction in this patient cohort. Chhetri et al. (2020) evaluated 185 individuals presenting with obstructive jaundice and compared the performance of ultrasound with MRCP in determining both the level and underlying cause of biliary obstruction. They reported choledocholithiasis as the leading etiology and found MRCP to have very high diagnostic accuracy, with sensitivity ranging from 91% to 100% and specificity between 90% and 98% for detecting stones, strictures, pancreatic tumors, and post-operative ductal abnormalities. Ultrasound, however, showed reduced effectiveness, particularly for distal CBD involvement and perampullary lesions. The pattern observed in our study mirrors these findings. MRCP identified obstruction in 59 of 60 cases (98.3%) and reliably demonstrated both benign and malignant causes across multiple anatomical levels, with the distal CBD being the most frequently involved site. In contrast, ultrasound detected obstruction in only 34 of 60 patients (56.7%) and frequently failed to

identify distal CBD lesions and pancreatic head tumors. Unlike Chhetri et al., our analysis additionally incorporated the McNemar test, which confirmed a statistically significant difference between the two imaging modalities ($p < 0.001$), reinforcing the superior diagnostic capability of MRCP within the same patient cohort. Overall, similar to Chhetri et al., our results highlight MRCP as a highly dependable, non-invasive tool for pinpointing the level and cause of biliary obstruction, particularly in challenging or distal bile duct pathologies.[22] Basak et al. (2024) conducted a cross-sectional analysis of patients with suspected obstructive jaundice and found that benign causes, particularly choledocholithiasis, accounted for nearly half of all obstructions. Their study also showed that MRCP reliably detected both level and cause of obstruction, although a few malignant lesions were missed compared with ERCP findings. Similarly, our study identified cholelithiasis-related causes as the predominant reason for obstruction and confirmed high MRCP detection rates at multiple levels including distal, proximal, and mid CBD segments. In contrast to Basak et al., MRCP in our study detected nearly all malignant and benign cases with minimal misses, suggesting comparatively higher sensitivity. Furthermore, our analysis incorporated detailed cross-tabulations with both level and cause, allowing clearer assessment of modality performance across different anatomical regions, thereby strengthening and extending Basak et al.'s observations.[23] Jiwani et al. (2016) evaluated 100 patients with obstructive jaundice and reported that MRCP accurately detected the level and cause of obstruction in the majority of cases, with stones being the most frequent benign pathology and pancreatic head lesions forming the major malignant component. Their study highlighted the limitations of ultrasound, which often identified ductal dilatation but failed to accurately define distal CBD stones and subtle malignant causes. Similarly, our study demonstrated a high diagnostic performance of MRCP, identifying obstruction in 59 of 60 patients (98.3%), with the distal CBD being the most frequently involved segment. Like Jiwani et al., we found CBD stones to be the leading cause of obstruction. Additionally, our study offered a more detailed comparison between modalities by applying

McNemar's test ($p < 0.001$), which confirmed the statistically significant superiority of MRCP over ultrasound for detection accuracy, an analytical depth not emphasized in Jiwani et al.'s report.[24]

CONCLUSION

MRCP is a highly sensitive and reliable modality for determining both the level and cause of biliary obstruction, outperforming ultrasound in detecting distal CBD lesions and pancreatic pathologies. Ultrasound, while valuable as a first-line screening tool, shows limited sensitivity in certain obstructions and should be complemented by MRCP for accurate diagnosis.

RECOMMENDATION

MRCP should be considered the preferred imaging modality in patients with suspected biliary obstruction, particularly when ultrasound findings are inconclusive or when distal CBD or pancreatic head involvement is suspected. Early use of MRCP can guide timely management, reduce invasive procedures and improve patient outcomes.

LIMITATIONS

The study was conducted at a single center with a relatively small sample size ($n = 60$), which may limit generalizability. Additionally, no direct comparison with ERCP or surgical findings was performed for all patients, which could provide further validation of MRCP findings.

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