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Original Research Article

Role of Combined CT and MRCP in the Pre-Operative Assessment of Obstructive Biliopathy: An Observational Study, in a Tertiary Care Hospital

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Abstract:

Obstructive jaundice is a prevalent hepatobiliary disease causing high morbidity and mortality. Despite advancements in diagnosis, management, and treatment, it remains a significant issue. Radiologists must assess the disease's etiology, location, and extent before deciding on treatment. Ultrasound (US) is the primary technique for studying biliary obstructive diseases due to its accessibility, speed, and low cost. Traditional Computed Tomography (CT) is considered more accurate for determining obstruction causes. Magnetic Resonance Imaging with Magnetic Resonance Cholangiopancreatography (MRI with MRCP) is emerging as an exciting tool for noninvasive evaluation of patients with obstructive jaundice. This study investigates the use of MRI with MRCP for evaluating biliary duct systems, specifically in cases of cholangiocarcinoma or distal common duct obstruction.

Methods: The study investigates the use of combined CT and MRCP in preoperative assessment of obstructive biliopathy, aiming to diagnose the condition using CT and MRCP and confirm their diagnostic accuracy with intraoperative findings. The observational study was conducted in collaboration with the Department of Surgery at AGMC and GBP Hospital, spanning one and a half years from January 2018 to June 2019. The sample size was 25 patients with obstructive jaundice, including those with clinical features, biochemical features, dilatation of the biliary system, clinically documented cause, and surgical or obstructive lesion. Patients under 12 years, those with prehepatic/hepatic jaundice, patients who refused to give consent, and those with contraindications for MRCP were excluded. The study was conducted with prior approval from the Ethical Committee of AGMC & GBPH Agartala, Tripura.

Discussion: The study by Kushwah A et al (2015) found that obstructive biliary disease (OBD) is a common issue, with jaundice being the most common symptom. USG was the first choice for diagnosing obstructive biliary disease, with a sensitivity of 81.2%. The study also found that choledocholithiasis was the most common benign cause. MRCP was found to be more accurate and invasive than USG in diagnosing both benign and malignant diseases. MRCP has a high diagnostic accuracy of 98%, making it a new gold standard for diagnosing CBD and pancreatic ductal pathologies. It is recommended for preoperative diagnosis of gallstones, as it can rule out possible concomitant CBD stones. MRCP can also detect residual or iterative choledocholithiasis in patients post-cholecystectomy, potentially replacing endoscopic retrograde cholangiopancreatography (ERCP) and reducing unnecessary invasive procedures. The study highlights the importance of identifying obstructive and non-obstructive causes in diagnosing biliary disorders.

Conclusion: Radiologists play a crucial role in selecting appropriate imaging for patient management, with ultrasound being useful for diagnosing biliary obstruction but not for obstructive jaundice. Non-invasive MRCP, with higher diagnostic accuracy, is essential for preoperative evaluation and treatment planning.

Keywords: OBD, MRCP, CBD, ERCP, Obstructive jaundice.

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Introduction

Obstructive jaundice is a prevalent hepatobiliary disease, causing significant morbidity and mortality. Despite technical advancements, management methods have been associated with high morbidity. Over the past decade, understanding the disease's pathogenesis, diagnosis, staging, and management has improved.

Radiologists now need to assess the disease's etiology, location, and extent. [1, 2]

Pre-operatively determining obstruction is crucial for effective treatment. Ultrasound (US) is the primary technique for studying biliary obstructive diseases due to its accessibility, speed, and low cost. Traditional Computed Tomography (CT) is considered more accurate for determining obstruction causes. Both ultrasound and CT are safe, non-invasive procedures for evaluating biliary tract status. [3,4] Obstructive jaundice is a common and severe hepatobiliary disease, causing high morbidity and mortality. Despite advancements in diagnosis, management, and treatment, it remains a significant issue. Radiologists must assess the etiology, location, level, and extent of the disease before deciding on a treatment, as an ill-chosen approach can be dangerous. [5,6,7]

Ultrasound (US) is the primary technique for studying biliary obstructive diseases due to its accessibility, speed, and low cost. Traditional CT scans are considered more accurate, but both are safe and noninvasive. Ultrasound confirms or excludes duct obstruction with 90% accuracy. MRCP techniques offer high-resolution images. [8,9,10] Obstructive jaundice is a leading cause of increased morbidity and is diagnosed using imaging modalities like Ultrasonography (USG) and helical computed tomography (CT). Magnetic Resonance Imaging with Magnetic Resonance Cholangiopancreatography (MRI with MRCP) is emerging as an exciting tool for noninvasive evaluation of patients with obstructive jaundice. Ultrasonography is a routine, accurate, safe, and sensitive diagnostic tool for biliary tract diseases.

Magnetic resonance cholangiopancreatography (MRCP) is a noninvasive, safe method for imaging the biliary tree and investigating biliary obstruction. It uses selective fluid-sensitive MRI to evaluate the biliary ductal system without ionizing radiation. Despite various diagnostic methods, detecting bile duct obstructions remains a major challenge in gastroenterology. MRCP is effective in demonstrating bile duct dilatation, strictures, and choledocholithiasis. The study investigates the use of noninvasive MRI with MRCP for evaluating biliary duct systems, specifically in cases of cholangiocarcinoma or distal common duct obstruction, by producing detailed images.

This study aims to combine CT and MRCP to visualize the specific cause, level, nature, and extent of obstruction in the bile duct, and to determine if this combination improves diagnostic and preoperative assessment accuracy.

Aim and Objectives

The study investigates the use of combined CT and MRCP in preoperative assessment of obstructive biliopathy, aiming to diagnose the condition using CT and MRCP, and to confirm their diagnostic accuracy with intraoperative findings.

Material and Methods

Study Design: Observational study

Study Set Up: In the Dept. of Surgery collaboration with Dept. of radio diagnosis, AGMC and GBP Hospital

Study Duration: The procedure was carried out for one and half year's w.e.f the month of January 2018 to June 2019

Study Population: All the patients who were admitted with obstructive jaundice in the department of surgery at AGMC & GBP Hospital during the study period.

Sample Size: As per IPD record yearly about 15 obstructive jaundice patients was admitted in surgery department in last three years, so in my one and half years study duration minimum sample size was 25**.**

Sampling Method: All the patients to be taken as sample after fulfilling the inclusion and exclusion criterias. No sampling technique is required.

1. Informed consent of each patient will be taken according to vide Annexure I.

2. Socio-demographic data of each patient enrolled will be recorded in a proforma vide Annexure II.

Inclusion Criteria:

1. Patients with clinical features of obstructed jaundice.
2. Those with biochemical features of obstructed jaundice such as elevated serum bilirubin.
3. Those in whom USG investigation showed dilatation of biliary system with jaundice.
4. Those with a clinically documented cause of jaundice.
5. Those with surgical and/or obstructive lesion were included in the study.

Exclusion Criteria:

1. Patients less than 12 years
2. Patients with Prehepatic/Hepatic Jaundice.
3. Patients who refused to give consent.
4. Those with contraindication for MRCP such as patients with ferromagnetic implant, aneurysm clips, pacemaker, and those with claustro-phobia were excluded from the study.

Working Definitions:

Subject Selection: Patients with obstructive jaundice admitted in GBPH Surgery ward during study period of two years irrespective of sex, area, religion was included in this study**.**

Study Tools: Data was collected in a pretested semi structured interview schedule, according to the Annexure II.

Ethical Consideration: Protocol to be placed before institutional ethics committee of AGMC for approval. The study was conducted with prior approval from Ethical committee of AGMC & GBPH Agartala, Tripura

Methods of Data Collection: Informed consent was sort from the eligible subject, according to the Annexure I, consenting subject was subjected to blood sample collection, USG, doing CT scan and MRCP etc. for study.

Analysis of Data: Descriptic statistics was expressed in frequency and percentage and chi squire test statistics was applied to assess significant association p value<0.05 was taken as significant.

Result and Analysis

Table 1: Distribution of Age in Years

Age in Years	Frequency	Percent
≤20	3	12.0%
21 to 30	5	20.0%
31 to 40	5	20.0%
41 to 50	5	20.0%
51 to 60	5	20.0%
61 to 70	2	8.0%
Total	25	100.0%

The study found that 12.0% of patients were under 20, 20% were between 21-30 years old, 20% were between 31-40 years old, 20% were between 41-50 years old, 20% were between 51-60 years old, and 8% were between 61-70 years old.

Table 2: Distribution of Gender

Gender	Frequency	Percent
FENALE	11	44.0%
MALE	14	56.0%
Total	25	100.0%

The study found that 44.0% of the patients were female, while 56.0% were male.

Table 3: Distribution of Religion

Religion	Frequency	Percent
HINDU	25	100.0%
Total	25	100.0%

The majority of the 25 patients (100.0%) were Hindu.

Table 4: Distribution of occupation

Occupation	Frequency	Percent
Farmer	13	52.0%
HW	9	36.0%
Student	3	12.0%
Total	25	100.0%

The majority of the patients (52.0%) were farmers, while 36.0% were house wives and 12.0% were students.

Table 5: Distribution of Address

Address	Frequency	Percent
Rural	10	40.0%
Urban	15	60.0%
Total	25	100.0%

The majority of patients (40.0%) were from rural areas, while 60.0% were from urban areas.

Table 6: Distribution of socio economic status

Socio eco	Frequency	Percent
APL	13	52.0%
BPL	12	48.0%
Total	25	100.0%

The study found that 52.0% of patients had APL, while 48.0% had BPL.

Table 7: Distribution of Diet habit

Diet habit	Frequency	Percent
Non veg	25	100.0%
Total	25	100.0%

The study revealed that 25 out of 25 patients had a non-veg diet habit.

Table 8: Distribution of jaundice

Jaundice	Frequency	Percent
Present	25	100.0%
Total	25	100.0%

In this Study, Out of the total 25 patients, 100% had jaundice.

Table 9: Distribution of USG

USG	Frequency	Percent
Done	25	100.0%
Total	25	100.0%

The majority of the 25 patients (100%) underwent a USG.

Table 10: Distribution of CECT

CECT	Frequency	Percent
Done	25	100.0%
Total	25	100.0%

The total number of patients who have undergone CECT is 25 (100.0%).

Table 11: Distribution of MRCP

MRCP	Frequency	Percent
Done	25	100.0%
Total	25	100.0%

The majority of the 25 patients (100%) underwent MRCP.

Table 12: Distribution of Diagnosis

Diagnosis	Frequency	Percent
Ca GB	4	16.0%
Ca HOP	4	16.0%
Cbd cyst	4	16.0%
Cbd stone	10	40.0%
Cholan ca	1	4.0%
Stricture	2	8.0%
Total	25	100.0%

The study revealed that 16.0% of patients had Ca gb, 16.0% had Ca HOP, 16.0% had Cbd cyst, 40.0% had Cbd stone, 4.0% had Cholan ca, and 8.0% had Stricture.

Table 13: Distribution of intra op

Intra op#	Frequency	Percent
Ca gb	4	16.0%
Ca HOP	4	16.0%
Cbd stone	1	4.0%
Cbd cyst	4	16.0%
Cbd stone	9	36.0%
Cholan ca	1	4.0%
Stricture cbd	2	8.0%
Total	25	100.0%

The study revealed that 16.0% of patients had Ca gb, 16.0% had Ca HOP, 4.0% had Cbd stone, 16.0% had Cbd cyst, 36.0% had Cbd stone, 4.0% had Cholan ca, and 8.0% had Stricture Cbd.

Table 14: Distribution of mean Age

	Number	Mean	SD	Minimum	Maximum	Median
Age	25	49.2000	16.2839	15.0000	78.0000	50.0000

The patients' mean age was 49.2000 ± 16.2839 years.

Table 15: Distribution of mean weight

	number	Mean	SD	Minimum	Maximum	Median
Weight	25	55.7800	7.0682	39.0000	67.0000	57.0000

The patients' mean weight was 55.7800 ± 7.0682 kg.

Table 16: Distribution of mean height

	number	Mean	SD	Minimum	Maximum	Median
Height	25	1.5048	0.0692	1.4000	1.6400	1.5000

The mean height of patients was 1.5048 ±.0692.

Table 17: Distribution of mean BMI

	number	Mean	SD	Minimum	Maximum	Median
BMI	25	26.1820	0.7804	24.8800	27.8000	26.4000

The patients' mean BMI was 26.1820 ±.7804 kg/m2.

Table 18: Distribution of mean bilirubin

	number	Mean	SD	Minimum	Maximum	Median
Bilirubin	25	9.6800	2.5948	7.6000	18.5600	9.0000

The mean bilirubin level in patients was 9.6800 ± 2.5948.

Table 19: Distribution of mean direct bil

	number	Mean	SD	Minimum	Maximum	Median
Direct bil	25	5.4604	1.9349	3.9000	12.2300	4.9000

The mean direct bilirubin level in patients was 5.4604 ± 1.9349.

Table 20: Distribution of mean SGOT

	number	Mean	SD	Minimum	Maximum	Median
SGOT	25	54.1200	17.3645	31.0000	112.0000	54.0000

The mean SGOT (mean ± standard deviation) of patients was 54.1200 ± 17.3645.

Table 21: Distribution of mean SGPT

	number	Mean	SD	Minimum	Maximum	Median
SGPT	25	51.2000	14.1627	23.0000	87.0000	49.0000

The mean SGPT of patients was 51.2000 ± 14.1627.

Table 22: Distribution of mean GGT

	number	Mean	SD	Minimum	Maximum	Median
GGT	25	67.1200	25.8591	23.0000	132.0000	58.0000

The mean GGT (mean ± standard deviation) of patients was 67.1200 ± 25.8591.

Table 23: Distribution of mean ALP

	number	Mean	SD	Minimum	Maximum	Median
ALP	25	280.0400	84.4864	187.0000	569.0000	256.0000

The average length of life (ALP) of patients was 280.0400 ± 84.4864.

Table 24: Distribution of mean PT

	number	Mean	SD	Minimum	Maximum	Median
PT	25	11.5280	0.4800	10.6000	12.5000	11.5000

The mean PT of patients was 11.5280 ±.4800.

Table 25: Distribution of mean INR

	number	Mean	SD	Minimum	Maximum	Median
INR	25	1.3252	0.1195	1.2000	1.6000	1.3000

The mean intravascular resistance (INR) of patients was 1.3252 ±.1195.

Table 26: Distribution of mean Na+

	number	Mean	SD	Minimum	Maximum	Median
Na+	25	138.9600	4.0258	130.0000	148.0000	139.0000

The mean Na+ level in patients was 138.9600 ± 4.0258.

Table 27: Distribution of mean K+

	number	Mean	SD	Minimum	Maximum	Median
K+	25	4.4920	0.6048	3.5000	5.5000	4.5000

The mean K+ (mean± standard deviation) of patients was 4.4920 ±.6048.

Table 28: Distribution of mean urea

	number	Mean	SD	Minimum	Maximum	Median
Urea	25	37.3200	3.5440	30.0000	43.0000	39.0000

The mean urea of patients was 37.3200 ± 3.5440.

Table 29: Distribution of mean Creatinine

	number	Mean	SD	Minimum	Maximum	Median
Creatinine	25	1.1116	0.2762	0.6000	2.0000	1.1000

The mean creatinine level in patients was 1.1116 ±.2762.

Table 30: Association of USG vs. Operative Finding

	Operative Finding		
USG	**Detected**	**Not Detected**	**TOTAL**
Detected	14	1	15
Row%	93.3	6.7	100.0
Col %	60.9	50.0	60.0
Not Detected	9	1	10
Row%	90.0	10.0	100.0
Col %	39.1	50.0	40.0
TOTAL	23	2	25
Row%	92.0	8.0	100.0
Col %	100.0	100.0	100.0

Chi-square value: 0.0906; p-value: 0.7634. The study found that 60.9% of patients with a USG had an operative finding detected, while 39.1% had an operative finding not detected, and the association between USG and operative findings was not statistically significant. Sensitivity: 60.9, Specificity: 50.0, Positive Predictive Value: 93.3, Negative Predictive Value: 10.0, Accuracy: 60.0% (TP+TN/Total) X100

Table 31: Association of CECT vs. Operative Finding

	Operative Finding		
CECT	**Detected**	**Not Detected**	**Total**
Detected	19	1	20
Row %	95.0	5.0	100.0
Col %	82.6	50.0	80.0
Not Detected	4	1	5
Row %	80.0	20.0	100.0
Col %	17.4	50.0	20.0
Total	23	2	25
Row %	92.0	8.0	100.0
Col %	100.0	100.0	100.0

Chi-square value: 1.2228; p-value: 0.2688. The study found that 82.6% of patients with CECT-detected operations had an operation, while 17.4% had an operation, and the association between CECT and operation findings was not statistically significant (p=0.2688). Sensitivity: 82.6, Specificity: 50.0, Positive Predictive Value: 95.0, Negative Predictive Value: 20.0, Accuracy: 80.0% (TP+TN/Total) X100

Table 32: Association of MRCP vs. Operative Finding

	Operative Finding		
MRCP	**Detected**	**Not Detected**	**Total**
Detected	21	1	22
Row%	95.5	4.5	100.0
Col %	91.3	50.0	88.0
Not Detected	2	1	3
Row%	66.7	33.3	100.0
Col %	8.7	50.0	12.0
Total	23	2	25
Row%	92.0	8.0	100.0
Col %	100.0	100.0	100.0

Chi-square value: 4.9727; p-value: 0.0468. The study found a statistically significant association between MRCP and operation findings in 21 patients (91.3%), and 2 patients (8.7%), with a 50.0% and 91.3% detection rate of operation respectively. Sensitivity: 91.3, Specificity: 50.0,

Positive Predictive Value: 95.5, Negative Predictive Value: 33.3, Accuracy: 88.0% (TP+TN/Total) X100

Discussion

Kushwah A et al [11] (2015) studied 50 patients with obstructive biliary disease, primarily aged 51-60. Jaundice was the most common symptom, with malignant obstruction being more common. USG was sensitive in 81.2% of cases, while MRCP was sensitive in 93.7%. Intra-hepatic biliary radicals were dilated in all patients except one. USG is considered the first choice for diagnosing obstructive biliary disease.

The study revealed that 12.0% of patients were under 20, 20% were between 21-30, 31-40, 41-50, 51-60, and 61-70, with 44.0% being female and 56.0% male, and a total of 61-70 patients.

The study revealed that 25 patients were Hindu, with 52.0% being farmers, 36.0% housewives, and 12.0% students. 40.0% were rural, 60.0% urban, and 52.0% had APL and 48.0% BPL.

Agrawal et al.'s 2018 study revealed that 62% of patients had malignant CBD strictures, with longer segments, larger diameters, thicker walls, and more enhancement during the delayed phase. [12]

Jiwani MS et al [13] (2016) found that jaundice is a common problem, and it's crucial to differentiate between obstructive and non-obstructive causes. They studied 100 patients, 58 females and 42 males, and found 56 malignant and 44 benign causes. The study found that malignancy increases with age, with choledocholithiasis being the most common benign cause. They concluded that MRCP is more accurate and invasive than USG.

The study revealed that 25 patients had jaundice, underwent USG, CECT, and MRCP. 16 patients had Ca Gb, 16 had Ca HOP, 16 had Cbd cyst, 40 had Cbd stone, 1 had Cholan Ca, and 2 had Stricture Cbd. The remaining patients had varying degrees of Cbd.

The study analyzed the demographics of patients with a variety of medical conditions. The mean age was 49.2000 ± 16.2839 years, with a mean weight of 55.7800 ± 7.0682 kg. The mean height was 1.5048 ±.0692, and the mean BMI was 26.1820 ±.7804 kg/m2. The mean bilirubin levels were 9.6800 ± 2.5948, with direct bilirubin levels of 5.4604 ± 1.9349. The mean SGOT, SGPT, GGT, ALP, PT, INR, Na+, K+, urea, and creatinine levels were also recorded.

Singh et al [14] found that MRCP has a high diagnostic accuracy of 98% in diagnosing benign and malignant diseases, with 100% sensitivity in benign cases and 95.33% in malignant cases. Ultrasound screening is useful for confirming or excluding biliary dilatation and MRCP is crucial for preoperative evaluation of obstructive jaundice patients.

Biliary disorders are common clinical issues, with ultrasound being the initial investigation. Magnetic resonance cholangiopancreatography (MRCP) has gained popularity due to its excellent diagnostic capabilities, with sensitivity, specificity, positive predictive value, and diagnostic accuracy of 98%. [15]

Judy Mary Kurian et al [16] (2017) found that ultrasonography has a higher sensitivity and specificity for detecting lesions, with a positive predictive value of 89.40% and a negative predictive value of 75%, while MRCP has a higher accuracy of 97.14% and 81.8%, making it a new gold standard for CBD and pancreatic ductal pathologies.

The study by SiNgh SN et al [17] (2016) found that MRCP was the most effective method for detecting gallstones and CBD stones, with a sensitivity of 91.3 and specificity of 50.0, and a positive predictive value of 95.5, indicating a high accuracy rate.

MRCP is recommended for preoperative diagnosis of gallstones, as it can rule out possible concomitant CBD stones, despite low accuracy of preoperative ultrasonography, influenced by factors like elevated alanine aminotransferase.

MRCP, or magnetic resonance cholangiopancreatography, is a diagnostic tool that can detect residual or iterative choledocholithiasis in patients post-cholecystectomy, offering valuable anatomic details of the biliary tree and potentially replacing endoscopic retrograde cholangio pancreatography (ERCP), thereby reducing unnecessary invasive procedures. [18]

Conclusion

In the modern era of imaging, radiologists play a crucial role in selecting the right imaging modality for patient management. Ultrasound is a screening modality for diagnosing biliary obstruction, but it cannot accurately determine the extent and cause of obstructive jaundice. MRCP, a non-invasive imaging investigation, scores higher in diagnostic accuracy compared to USG and CECT. Ultrasound is useful for confirming or excluding biliary dilatation and choosing patients for MRCP examination. MRCP is an important non-invasive imaging investigation in preoperative evaluation of patients with obstructive jaundice, providing a more accurate diagnosis and treatment plan.

Limitations of the Study

The study has several shortcomings, including a small sample size of 25 cases, being conducted in a single center, and being conducted in a tertiary care hospital, which may lead to hospital bias.

Summary

The study analyzed the demographics of patients with obstructive jaundice, focusing on age, gender, and diet habits. The majority of patients were aged 21 to 30, with a significant percentage aged 31 to 40, 41 to 50, 51 to 60, and 61 to 70. The majority were female, with 44.0% being female and 56.0% male.

The majority were farmers, with 52.0% having a farmer, 36.0% having a housewife, and 12.0% having a student. The majority were rural, with 40.0% being rural and 60.0% being urban. The majority had a non-veg diet.

The study found that 25 patients had jaundice, with 16.0% having Ca gb, 16.0% having Ca HOP, 16.0% having Cbd cyst, 40.0% having Cbd stone, 4.0% having Cholan ca, and 8.0% having Stricture cbd.

The results showed high sensitivity and specificity for ultrasound in detecting biliary disorders, making it a valuable tool for preoperative evaluation.

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