

## Retrospective analysis of biliary tract pathologies detected on magnetic resonance cholangiopancreatography (MRCP)

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### Abstract

**Background:** Biliary tract diseases encompass a wide range of conditions, including cholelithiasis, choledocholithiasis, biliary strictures, malignancies, and other hepatopancreatic abnormalities. Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive magnetic resonance imaging technique that provides detailed visualization of the biliary and pancreatic ductal systems without the use of ionizing radiation. Retrospective evaluation of MRCP findings can help determine the distribution of biliary pathologies and their association with biliary obstruction.

**Aim:** To retrospectively evaluate the spectrum and frequency of biliary tract pathologies detected on MRCP and their association with biliary obstruction.

**Materials and Methods:** A retrospective observational study was conducted at Max Super Speciality Hospital, Noida, Uttar Pradesh, including 40 patients who underwent MRCP between January 2026 and June 2026. Demographic, clinical, and imaging findings were obtained from available medical records and MRCP reports and images. Patients were categorized into obstructive and non-obstructive groups for exploratory analysis. The Mann-Whitney U test was used to compare CBD diameter, while associations between obstruction and intrahepatic biliary radical (IHBR) dilatation and jaundice were assessed using the Chi-square and Fisher's exact tests, respectively. A p-value <0.05 was considered statistically significant. Institutional Ethics Committee approval was obtained.

**Results:** The mean age was  $51.93 \pm 17.02$  years, with females comprising 65% of the study population. Stone-related pathology was the most common finding (55%). Biliary obstruction was identified in 27.5% of patients. Mean CBD diameter was significantly higher in obstructive cases ( $11.23 \pm 5.34$  mm) than in non-obstructive cases ( $6.06 \pm 3.80$  mm;  $p=0.002$ ). IHBR dilatation was also significantly associated with obstruction (81.8% vs. 37.9%;  $p=0.013$ ).

**Conclusion:** MRCP effectively demonstrated a wide spectrum of biliary tract abnormalities. CBD and IHBR dilatation were significantly associated with biliary obstruction, supporting the role of MRCP in the evaluation of biliary diseases.

**Keywords:** MRCP, biliary tract, biliary obstruction, cholelithiasis, choledocholithiasis, common bile duct, intrahepatic biliary dilatation

### Introduction

Biliary tract diseases are an important group of conditions affecting the hepatobiliary system. These disorders may cause symptoms such as abdominal pain, jaundice, reduced or blocked bile flow, fever, cholangitis, and sometimes pancreatitis [1]. The biliary system includes the intrahepatic and extrahepatic bile ducts and other related structures involved in the transport of bile. Various conditions can affect this system, including bile duct stones, benign and malignant strictures, cholangiocarcinoma, inflammatory diseases, congenital abnormalities, and postoperative changes. Accurate identification of the type and location of these abnormalities is important for establishing the diagnosis and planning appropriate treatment [2-4].

Ultrasonography is commonly used as the initial imaging modality in patients with suspected biliary disease because it can identify gallstones and biliary dilatation [5]. Computed tomography also provides useful information regarding masses, surrounding structures, and complications [6]. However, detailed assessment of the biliary ductal system

may require additional imaging. Current appropriateness criteria recognize MRI with MRCP as an appropriate imaging option in patients with jaundice and suspected mechanical biliary obstruction [7].

Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive MRI technique used to obtain detailed images of the biliary and pancreatic ducts. It mainly uses heavily T2-weighted sequences, in which bile and pancreatic fluid appear bright, allowing clear visualization of the ductal system. MRCP does not involve ionizing radiation and can provide a non-invasive alternative to diagnostic ERCP, while ERCP is mainly used when therapeutic intervention is required [8, 9].

In addition, MRCP can also detect congenital abnormalities and anatomical variations of the biliary tract. Identifying these variations is important because they may increase the risk of complications during surgery or other biliary procedures. Therefore, MRCP is useful for diagnosis as well as preoperative and treatment planning [10, 12].

The growing use of MRCP has improved the detection of various biliary tract abnormalities. The pattern of these findings may differ according to age, sex, clinical symptoms, and referral reasons. Therefore, retrospective analysis of MRCP examinations can help determine the frequency and distribution of biliary pathologies in a specific patient population [13, 15].

Therefore, the present study, entitled “Retrospective Analysis of Biliary Tract Pathologies Detected on Magnetic Resonance Cholangiopancreatography (MRCP),” aims to evaluate the spectrum and distribution of biliary tract abnormalities detected on MRCP. The study will assess the demographic distribution of patients, common pathological findings, the site and possible causes of biliary obstruction, and associated hepatobiliary or pancreatic abnormalities. Such an analysis may contribute to a better understanding of the diagnostic role of MRCP as a non-invasive modality in the evaluation of biliary tract diseases.

### Aim

To retrospectively evaluate the spectrum and frequency of biliary tract pathologies detected on MRCP and their association with biliary obstruction.

### Objective

To identify the common biliary tract pathologies detected on MRCP.

To evaluate the distribution of biliary pathologies according to age and sex.

To assess the location and nature of biliary obstruction.

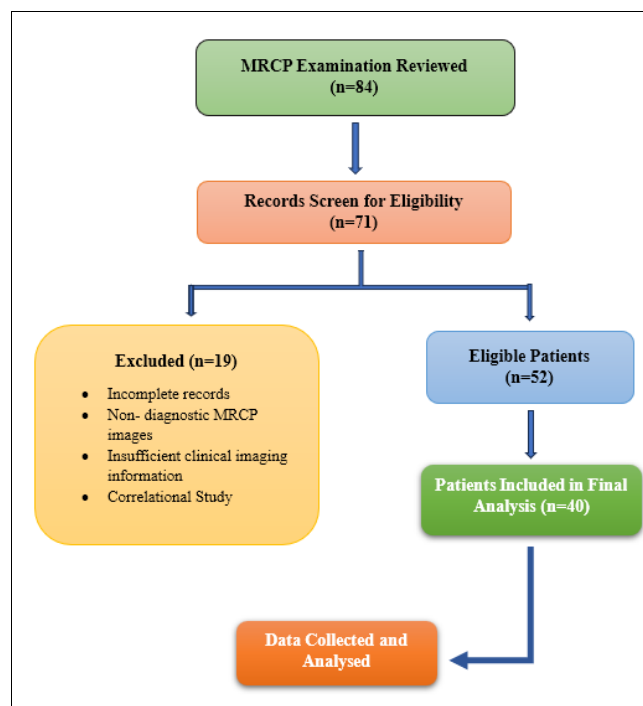
To describe associated pancreatic and hepatobiliary findings detected during MRCP.

To assess the association of biliary obstruction with CBD dilatation, IHBR dilatation, and jaundice.

### Material & Methods

This retrospective observational study was conducted to evaluate the spectrum and frequency of biliary tract pathologies detected on magnetic resonance cholangiopancreatography (MRCP). The study included patients who underwent MRCP examination at Max Super speciality Hospital, Noida, U.P during the study period from January, 2026 to June, 2026.

A total of 40 patients who underwent MRCP and fulfilled the study criteria were included in the retrospective analysis. The demographic and imaging data of the patients were collected from available medical records and MRCP examination reports & images. For exploratory analysis, patients were divided into obstructive and non-obstructive groups. CBD diameter was compared between the two groups using the Mann-Whitney U test. The association of obstruction with IHBR dilatation was assessed using the Chi-square test, while the association between jaundice and obstruction was evaluated using Fisher's exact test. A p-value of less than 0.05 was considered statistically significant. Institutional Ethics Committee approval was obtained before conducting the study. Patient confidentiality was maintained, and no personally identifiable information was included in the analysis.



**Fig 1:** Flow chart of the inclusion of the patients

### Results

A total of 40 patients who underwent MRCP and met the study criteria were included in the retrospective analysis.

### Demographic Characteristics

The age of the patients ranged from 19 to 89 years, with a mean age of  $51.93 \pm 17.02$  years. The median age was 47.5 years. Females constituted the majority of the study population, with 26 patients (65.0%), while 14 patients (35.0%) were male.

The highest proportion of patients belonged to the 41–50 years age group (22.5%), followed by the 31–40 years age group (20.0%).

**Table 1:** Demographic characteristics of the study population (n = 40)

| Characteristic    | n                   | %    |
|-------------------|---------------------|------|
| Sex               |                     |      |
| Male              | 14                  | 35.0 |
| Female            | 26                  | 65.0 |
| Age group (years) |                     |      |
| ≤30               | 4                   | 10.0 |
| 31–40             | 8                   | 20.0 |
| 41–50             | 9                   | 22.5 |
| 51–60             | 6                   | 15.0 |
| 61–70             | 6                   | 15.0 |
| >70               | 7                   | 17.5 |
| Age, mean ± SD    | 51.93 ± 17.02 years | -    |
| Age range         | 19–89 years         | -    |

### Clinical and associated MRCP findings

Jaundice was present in 19 patients (47.5%). IHBR dilatation was observed in 20 patients (50.0%). Hepatomegaly and splenomegaly were identified in 13 (32.5%) and 6 (15.0%) patients, respectively.

**Table 2:** Clinical and associated imaging findings

| Finding         | Present, n (%) |
|-----------------|----------------|
| Jaundice        | 19 (47.5)      |
| IHBR dilatation | 20 (50.0)      |
| Hepatomegaly    | 13 (32.5)      |
| Splenomegaly    | 6 (15.0)       |

**Common Bile Duct Diameter**

The CBD diameter ranged from 3.0 mm to 20.0 mm. The mean CBD diameter was  $7.48 \pm 4.81$  mm, while the median CBD diameter was 5.2 mm.

**Table 3:** Descriptive statistics of CBD diameter

| CBD Diameter Group (mm) | n (%)     |
|-------------------------|-----------|
| $\leq 6.99$             | 21 (52.5) |
| 7-10                    | 7 (17.5)  |
| 11-15                   | 10 (25.0) |
| $>15$                   | 2 (5.0)   |

**Spectrum of MRCP-detected pathologies**

For descriptive purposes, the individual MRCP diagnoses were grouped into broad pathological categories. Stone-related pathology was the most common category, identified in 22 patients (55%). Only dilated CBD was the second most frequent category, occurring in 5 patients (12.5%).

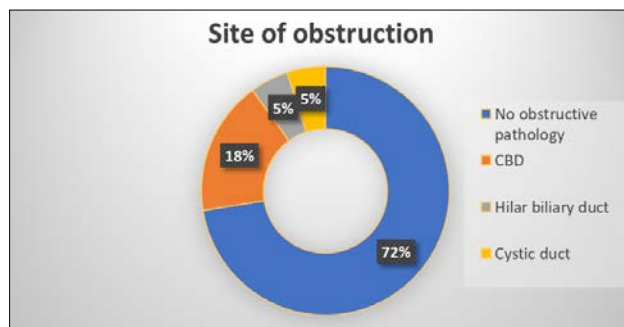
**Table 5:** Major individual MRCP diagnoses

| MRCP diagnosis                         | n  | %    |
|----------------------------------------|----|------|
| Cholelithiasis                         | 12 | 25.0 |
| Choledocholithiasis                    | 4  | 10.0 |
| Cholelithiasis with cholecystitis      | 3  | 7.5  |
| Choledocholithiasis with cholecystitis | 3  | 5.0  |
| Only Dilated CBD                       | 5  | 5.0  |
| Gallbladder carcinoma                  | 3  | 2.5  |
| Extrahepatic cholangiocarcinoma        | 1  | 2.5  |
| Acute pancreatitis                     | 2  | 2.5  |
| Biliary stricture                      | 2  | 2.5  |
| Atrophic pancreas                      | 2  | 5.0  |
| Other findings                         | 10 | 25.0 |

Other findings included chronic liver disease, Liver abscess, hemosiderosis, pericholecystic oedema, mesenteric lymphadenopathy, and duodenal diverticulum.

**Site of obstruction**

No obstructive pathology was identified in 29 patients (72.5%). Among the 11 patients (27.5%) with an obstructive pathology, the CBD was the most common site, accounting for 7 patients (17.5% of the total study population).

**Fig 2:** Distribution of the site of obstruction

Malignancies were identified in 4 patients (10%) including Gallbladder carcinoma and Extrahepatic cholangiocarcinoma.

**Table 4:** Broad distribution of pathological categories detected on MRCP

| Pathological category   | n  | %     |
|-------------------------|----|-------|
| Stone-related pathology | 22 | 55.0  |
| Only Dilated CBD        | 5  | 12.5  |
| Malignancy              | 4  | 10.0  |
| Pancreatic pathology    | 3  | 7.5   |
| Hepatic pathology       | 2  | 5.0   |
| Biliary stricture       | 2  | 5.0   |
| Total                   | 40 | 100.0 |

**Individual pathological findings**

The most frequently observed individual diagnosis was isolated cholelithiasis, identified in 10 patients (25.0%). Choledocholithiasis alone was identified in 4 patients (10.0%), while cholelithiasis associated with cholecystitis was observed in 3 patients (7.5%). Other patients demonstrated combined or associated abnormalities, including cholelithiasis with choledocholithiasis, acute pancreatitis, gallbladder carcinoma, biliary strictures, chronic liver disease, and pancreatic abnormalities.

**Statistical Analysis**

An exploratory statistical analysis was performed to compare patients with obstructive pathology and those with no obstruction. The relationship of obstruction with CBD diameter, IHBR dilatation, and jaundice was assessed. A p-value of less than 0.05 was considered statistically significant.

**CBD Diameter and Obstruction**

Patients with obstructive pathology had a higher mean CBD diameter ( $11.23 \pm 5.34$  mm) compared with patients without obstruction ( $6.06 \pm 3.80$  mm). The difference was statistically significant ( $p = 0.002$ ), indicating that patients with biliary obstruction generally had a significantly more dilated CBD.

**IHBR Dilatation and Obstruction**

IHBR dilatation was observed in 9 out of 11 patients (81.8%) with obstructive pathology, compared with 11 out of 29 patients (37.9%) without obstruction. This association was statistically significant ( $p = 0.013$ ), indicating that IHBR dilatation was significantly more common in patients with biliary obstruction.

**Jaundice and Obstruction**

Jaundice was present in 8 out of 11 patients (72.7%) with obstructive pathology, compared with 11 out of 29 patients (37.9%) without obstruction. Although jaundice was more common in patients with obstruction, the Fisher's exact test

showed that the association was not statistically significant ( $p = 0.078$ ). Therefore, based on the present sample, jaundice alone could not be considered significantly associated with biliary obstruction.

**Table 6:** Comparison of obstructive and non-obstructive pathology

| Variable                | Obstructive pathology (n = 11) | No obstruction (n = 29) | Statistical test    | p-value |
|-------------------------|--------------------------------|-------------------------|---------------------|---------|
| Mean CBD diameter (mm)  | 11.23 ± 5.34                   | 6.06 ± 3.80             | Mann-Whitney U test | 0.002   |
| IHBR dilatation present | 9 (81.8%)                      | 11 (37.9%)              | Chi-square test     | 0.013   |
| Jaundice present        | 8 (72.7%)                      | 11 (37.9%)              | Fisher's exact test | 0.078   |

**Discussion**

The present retrospective study evaluated the spectrum of biliary tract pathologies detected on MRCP in 40 patients. MRCP identified a variety of abnormalities, including stone-related disease, biliary dilatation, obstruction, strictures, malignancies, and associated pancreatic and hepatic findings. These findings support the role of MRCP as a useful non-invasive technique for evaluating the biliary system [8, 10].

The mean age of the patients was 51.93 ± 17.02 years, and females constituted 65% of the study population. The highest number of patients belonged to the 41–50-year age group. This pattern may be related to the high frequency of gallstone-related disease observed in the present study.

Stone-related pathology was the most common finding, accounting for 55% of cases. Cholelithiasis was the most frequent individual diagnosis, followed by choledocholithiasis and other combined stone-related conditions. This finding shows the usefulness of MRCP in identifying biliary stones and assessing possible involvement of the bile ducts. Previous studies have also reported the diagnostic value of MRCP in patients with suspected choledocholithiasis [9, 16].

The mean CBD diameter in the study population was 7.48 ± 4.81 mm. Patients with biliary obstruction had a significantly greater CBD diameter (11.23 ± 5.34 mm) than patients without obstruction (6.06 ± 3.80 mm;  $p = 0.002$ ). This suggests that CBD dilatation is an important imaging finding associated with biliary obstruction. However, duct size should be assessed along with other MRCP findings to determine the exact cause of obstruction [13, 14].

IHBR dilatation was also significantly associated with obstruction. It was observed in 81.8% of patients with obstruction, compared with 37.9% of patients without obstruction ( $p = 0.013$ ). Therefore, the presence of intrahepatic biliary dilatation may provide an additional indication of biliary obstruction [2].

Jaundice was more common in patients with obstruction (72.7%) than in those without obstruction (37.9%); however, this association was not statistically significant ( $p = 0.078$ ). This may be due to the small sample size. The result indicates that jaundice alone may not reliably predict biliary obstruction and should be assessed together with imaging and other clinical findings [7].

Malignant lesions were identified in 10% of patients, including gallbladder carcinoma and extrahepatic cholangiocarcinoma. Although the number of cases was small, their identification is clinically important. MRCP can help demonstrate biliary involvement and provide useful anatomical information for further management [2, 4].

Associated pancreatic and hepatic abnormalities were also identified. These included acute pancreatitis, pancreatic

atrophy, chronic liver disease, and liver abscess. This shows that MRCP can provide additional information about structures surrounding the biliary system and contribute to a more comprehensive evaluation [15].

In conclusion, the present study shows that stone-related pathology was the most common abnormality detected on MRCP. CBD dilatation and IHBR dilatation were significantly associated with biliary obstruction. The findings support MRCP as a valuable non-invasive imaging modality for identifying biliary diseases, determining the site of obstruction, and detecting associated hepatopancreatic abnormalities.

**Conclusion**

The present retrospective study evaluated the spectrum of biliary tract pathologies detected on MRCP in 40 patients. The findings showed that MRCP was useful in identifying various biliary and associated hepatopancreatic abnormalities. Stone-related pathology was the most common finding, accounting for 55% of cases, with cholelithiasis being the most frequent individual diagnosis. Other findings included choledocholithiasis, CBD dilatation, biliary strictures, malignant lesions, pancreatic abnormalities, and hepatic pathologies.

Biliary obstruction was identified in 27.5% of patients, with the common bile duct being the most frequent site of obstruction. Patients with obstruction had a significantly larger CBD diameter than those without obstruction. Similarly, IHBR dilatation was significantly more common in patients with obstruction. Although jaundice was more frequently observed in obstructive cases, its association with obstruction was not statistically significant.

Overall, the study highlights the value of MRCP as a non-invasive imaging modality for evaluating biliary tract diseases. It helps in detecting stones, assessing ductal dilatation, identifying the site of obstruction, and demonstrating associated abnormalities. Therefore, MRCP plays an important role in the diagnosis and evaluation of patients with suspected biliary pathology.

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