

Magnetic Resonance Cholangiopancreatography Evaluation of Biliary Tract, Gall Bladder, and Pancreas

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ABSTRACT

BACKGROUND

Magnetic resonance cholangiopancreatography (MRCP) is a noninvasive imaging method of demonstration of hepatic, cholangio- and pancreatic-systems and their duct system and depends on heavy T2-weighted (T2-W) images. The present study was undertaken to study and evaluate patients with clinical suspicion of the biliary tract, gall bladder and pancreatic pathology, with conventional magnetic resonance imaging (MRI) and MRCP and to assess the pitfalls in MRCP for the evaluation of the biliary tract, gall bladder, and pancreas.

METHODS

The study included sixty patients with clinical signs and symptoms of obstructive jaundice referred for MRCP to the Department of Radiodiagnosis at Katuri Medical College and Hospital and patients who were referred to the department with clinical suspicion of pancreas, gallbladder and biliary tract disease. Pregnant patients, claustrophobic patients and patients with MRI contraindications such as cardiac pacemakers, aneurysm clips and metallic implants were excluded from the study.

RESULTS

Most of the patients in our study were of 30 - 70 years age group. Of the sixty cases included in our study, 58 % were males and 42 % were females. In most of the patients, in our study, benign pathology was observed which included cholelithiasis and choledocholithiasis and acute pancreatitis being next common. Case of choledochal cyst were also encountered. Most of common bile duct strictures were of benign aetiology. Of the malignant pathology detected, cholangiocarcinoma followed by periampullary carcinoma and gallbladder carcinoma were commonly encountered.

CONCLUSIONS

Magnetic resonance pancreatic cholangiography is an imaging modality for evaluation of pancreaticobiliary disorders. MRCP detected the exact location and cause of biliary tract obstruction and aetiology was well demonstrated. Pure cholesterol stones are difficult to detect on CT because they are iso attenuating or slightly hypoattenuating to bile. Sub centimetric calculi are well demonstrated by MRCP. Malignant strictures and benign strictures are well demonstrated. MRCP being non-invasive and radiation hazard free with inherent high resolution with multiplanar imaging capability could be considered as gold standard in imaging of few gall bladder and biliary system disorders.

KEYWORDS

Magnetic Resonance Cholangiopancreatography, Cholelithiasis, Pancreatitis, Periampullary Carcinoma, Gall Bladder Carcinoma, Cholangiocarcinoma

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BACKGROUND

The technique of MRCP is based on heavily T2-weighted pulse sequences, which result in an increase in contrast between background tissue (e.g., hepatic, pancreatic parenchyma and peritoneal fat) and stationary fluid (bile).^{1,2} The biliary tract and pancreas are subjected to a wide variety of pathological abnormalities. Hence, investigation of such a wide range of pathological abnormalities requires a multimodality approach.³ The Various imaging modalities that are used to diagnose biliary tract diseases include gray scale ultrasonography (USG), colour or power Doppler ultrasound and computed tomography (CT) as diagnostic tools for the assessment the biliary tract and surrounding structures.^{4,5}

Though endoscopic retrograde pancreato-cholangiography (ERCP) is considered as gold standard in the evaluation of biliary tract disease owing to its invasiveness, complications and operator dependency, it is being replaced by MRCP in the diagnostic evaluation of hepatic, gallbladder bile duct and pancreatic diseases. Advantages of MRCP include it is a non-invasive technique, does not require contrast administration and has multiplanar capability with images acquired in different anatomical planes and is relatively non-operator dependent as compared to ERCP. However, MRCP also has its pitfalls where artifacts could mimic a hepatic and extrahepatic disease. Improved diagnosis can be achieved with the knowledge of the benefits and limitations of MRCP techniques.⁶

METHODS

60 patients referred to the Department of Radiodiagnosis with clinical signs and symptoms of obstructive jaundice were included in the study. This study was conducted from November 2017 to October 2019, for a period of 24 months. This was a prospective descriptive study.

Method of Collection of Data

- The source of data for the study were the patients with clinical signs and symptoms of obstructive jaundice and advised an MRCP examination in the Department of Radiodiagnosis at Katuri Medical College and Hospital, Chinakondrupadu, Guntur.
- Clinical history of each patient was recorded and MRI evaluation was done.
- A detailed proforma was filled up.
- All the patients underwent MRCP and the data was collected and evaluated.

Inclusion Criteria

1. Patients who were referred to radio diagnosis department with symptoms of pancreas, gallbladder and biliary tract disease.
2. Patients detected with biliary tract, gall bladder and pancreatic disease on ultrasonography.

Exclusion Criteria

1. Pregnant women.
2. Any person with renal insufficiency.
3. Refusal of the study protocol.
4. Claustrophobic patients.

MRI AND MRCP

Equipment used was a 1.5 tesla Philips Achieva – 16 channel MRI scanner. The study was performed on a 1.5 T MR imaging unit (Achieva, Philips Medical Systems) cantered below the xiphisternum with a 16-element body phased array coil. Patient underwent imaging with conventional T2-W turbo spin echo (TSE), T1W turbo field echo (TFE), T2W balanced turbo field echo (BTFE), MRCP sequences which included axial thick slab imaging for all and coronal MR imaging for the BTFE sequences followed by a navigator triggered coronal 3D MRCP sequence. Maximum-intensity-projection (MIP) sequences were further reconstructed from the coronal navigator triggered 3D MRCP sequence. An initial clinical and radiological correlation was done and confirmation of the diagnosis was done with either surgical findings correlation, ERCP and biopsy which ever was possible given the clinical condition.

Statistical Analysis

A descriptive analysis of the data was done and tabulation was done to study the imaging characteristics of various benign and malignant conditions. Bar charts and graphs were constructed to determine these different conditions and occurrence of these conditions based on age and sex predilections and other demographic characteristics. Diagnostic variables such as sensitivity, specificity and predictive values were calculated with clinical correlation and based on ERCP, surgical and biopsy correlation.

RESULTS

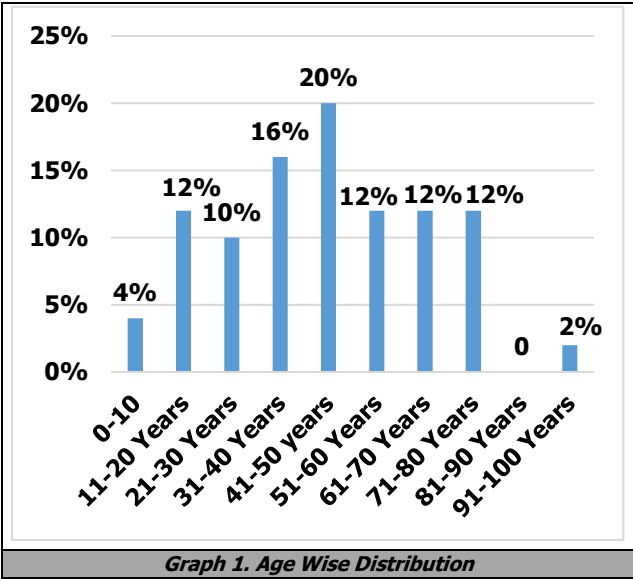
A total of (60) patients who were clinically diagnosed as having pancreatic & biliary diseases referred for MRCP were included in our present study. Of the total 60 patients included in the study, maximum 13 (20 %) were in the age group of 41 - 50 years and followed by 31 - 40 years age group which included 10 (16 %) cases and the mean age of the study population was between 3 - 80 years.

Sex	No. of Cases	%
Males	35	58 %
Females	25	42 %
Total	60	100 %

Table 1. Sex Wise Distribution in the Pancreatic & Biliary Diseases

Of the total 60 cases included in the study, 46 (76 %) patients had benign disorders, while 14 (24 %) patients had malignant disorders. Few patients with benign pathologies had combination of pathologies. Of the 60 cases included in

the study, most common 12 (20 %) patients had cholelithiasis with choledocholithiasis. Second most common was strictures seen in 8 (14 %) patients.



Type	No. of Patients	Percentage (%)
Benign	46	76 %
Malignant	14	24 %
Total	60	100 %

Table 2. Distribution of Pancreatic & Biliary Diseases Based on Type of Aetiological Characteristics as Observed on MRCP

Type of Disease	Cases	Percentage (%)
Acute pancreatitis	7	12 %
Chronic pancreatitis	4	6 %
Cholelithiasis	5	8 %
Choledocholithiasis	6	10 %
Cholelithiasis with choledocholithiasis	12	20 %
Choledochal cyst	4	6 %
Stricture	8	14 %
Cholangiocarcinoma	7	12 %
Gall bladder carcinoma	4	6 %
Peri ampullary carcinoma	4	6 %
Total	60	100 %

Table 3. Number of Patients Showing Various Diseases as Observed on MRCP

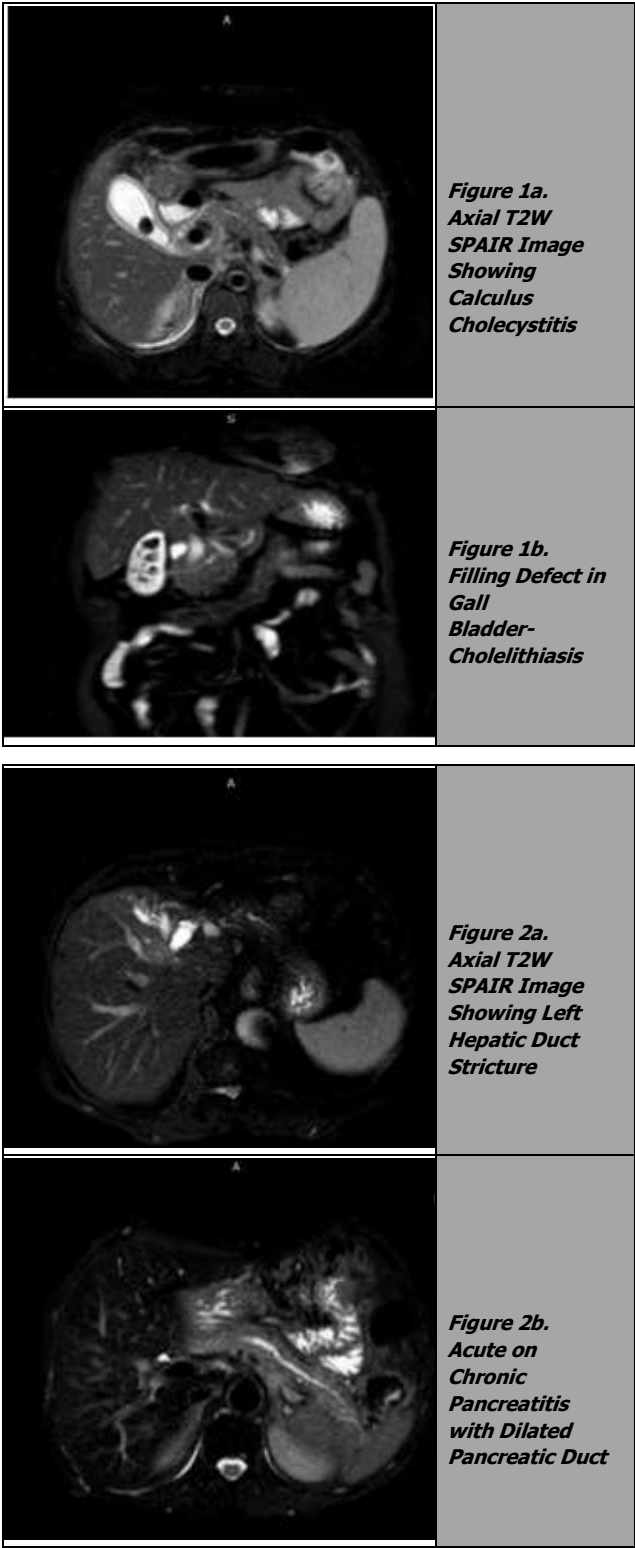
Type of Disease	Males	Males (%)	Females	Females (%)
Acute pancreatitis	6	10 %	1	2 %
Chronic pancreatitis	2	4 %	1	2 %
Cholelithiasis	2	4 %	2	4 %
Choledocholithiasis	4	6 %	2	4 %
Cholelithiasis with Choledocholithiasis	8	14 %	4	6 %
Choledochal cyst	1	2 %	2	4 %
Carcinoma gall bladder	2	4 %	1	2 %
Cholangio-carcinoma	4	6 %	4	6 %
Periampullary carcinoma	2	4 %	1	2 %
Stricture	2	4 %	6	10 %
Total	35	58 %	25	42 %

Table 4. Gender Wise Observation of Various Pathologies

Of the total 60 cases included in the study, the most common disorder observed was cholelithiasis with choledocholithiasis seen in 8 (14 %) patients with male preponderance. Second most common benign disorder was strictures seen in 6 (10 %) patients with female preponderance. Out of 7 patients with benign strictures detected, in our study, 5 were in distal CBD, 1 was in CHD and proximal CBD. Out of the 11 patients with malignant strictures detected in our study most common was relativistic magnetohydrodynamics (RMHD) stricture seen in 4 (6 %) cases followed by LMHD & distal common bile duct (CBD) stricture. Least common was MHD and proximal

CND stricture. Out of 10 patients with CBD strictures detected in our study, 6 were benign and 4 were malignant.

Illustrative Cases



DISCUSSION

MRCP is non-invasive modality that provides good visualisation of hepato-biliary and pancreatic ductal system.

Over the decades, MRCP has emerged as the modality of choice in the visualization of the biliary tree with a diagnostic accuracy on par with endoscopic retrograde cholangiopancreatography. Advantages of MRCP include it is non-invasive technique, does not require contrast administration and has multiplanar capability with images acquired in different anatomical planes and is relatively non-operator dependent as compared to ERCP.

Upadhaya et al.⁷ studied 100 patients, out of which 46 % were males and 54 % were females. Ferrari et al. studied 131 patients. Male were 47 % and females were 53 %. Soto et al.⁸ studied 43 patients out of which 47 % were males and 53 % were female. Miyazaki et al.⁹ studied total of 56 patients of which 66 % were male patients and 34 % were female patients. In the present study of total 50 cases, 35 cases included males and 25 females. In our study the percentage distribution of male to female was more.

Isolated choledocholithiasis was seen in 6 cases, cholelithiasis in 5 and combination of cholelithiasis with choledocholithiasis was seen in 12 patients in our study. MRCP clearly demonstrates caliber of CBD, intrahepatic biliary radicals (IHBR) dilatation, exact location and size of calculus. The ability to detect bile duct stones on CT depends on a number of factors. Shadan et al.¹⁰ reported choledocholithiasis with cholelithiasis in 20 % cases.

Macaulay et al.¹¹ reported choledocholithiasis in 14.2 % cases. Upadhaya et al. reported choledocholithiasis in 32 % cases. In Reinhold et al. study choledocholithiasis was seen in 25 % cases. Total no of choledocholithiasis in our study was 18 (30 %) which resembles the study of Upadhaya et al. The difference in study was due to difference in sample size

CBD strictures were detected in 19 cases out of which 7 were benign, 11 were malignant. Shadan et al. reported benign strictures in 4 % cases and postoperative anastomotic stricture in 2 % cases. Bhatt et al.¹² reported benign strictures in 4 % cases, malignant in 8 % and postoperative anastomotic stricture in 4 % cases. Upadhaya et al. reported benign CBD stricture in 6 %, malignant in 9 % and postoperative stricture in 6 % cases. Hurter et al.¹³ reported benign stricture in 9.6 % cases and malignant strictures in 5.7 % of cases. CBD strictures in our study resembles with Upadhaya et al.

MRCP can demonstrate the exact location, length and type of stricture. In our study, 4 cases of choledochal cyst were seen. MRCP provided diagnostic information by showing exact anatomical map for pre-surgical evaluation. Upadhaya et al. reported choledochal cyst in 3 % of cases in his study. All the cases were of type I choledochal cyst.

In our study pancreatitis was seen in 11 patients. Of the 11 cases, 8 were males showing male predilection. This was because of alcoholism as one of the risk factors for pancreatitis. Ultrasound did not show much change in cases of acute pancreatitis. Pseudocyst and necrotic changes were detected rarely in acute pancreatitis. Cholelithiasis was noted in 5 cases, out of which 3 were female and 2 were male. Out of 8 patients of cholangiocarcinoma evaluated, 4 were males while 4 were female showing equal prevalence. The most common type of cholangiocarcinoma seen is Hilar (Klatskin's) tumour seen in 5 cases.

In the study by Shadan et al. cholangiocarcinoma was seen in 4 % cases. In the study by Bhatt et al. Klatskin's tumour was seen in 12 % cases. In the study by Reinhold et al. cholangiocarcinoma was seen in 2.3 % cases. MRI helped in showing the level of obstruction, extent of the tumour and in staging.

Shadan et al. in his study of 50 cases reported cholangiocarcinoma in 4 % cases, carcinoma of pancreas in 8 % cases, carcinoma of GB in 4 % cases and periampullary carcinoma in 4 % cases. Schwartz et al. in his study of 32 cases reported cholangiocarcinoma in 21.8 % cases, carcinoma of pancreas in 37.5 % cases, carcinoma of GB in 28.1 % cases and periampullary carcinoma in 6.2 % cases. Soto et al. in his study of 43 cases reported cholangiocarcinoma in 13.9 % cases, carcinoma of pancreas in 18.6 % cases, carcinoma of GB in 4.6 % cases and Periampullary carcinoma in 9.3 % cases.

Upadhaya et al. in his study of 100 cases reported cholangiocarcinoma in 9 % cases, carcinoma of pancreas in 9 % cases, carcinoma of GB in 19 % cases and periampullary carcinoma in 10 % cases. In the present study which included 50 cases, cholangiocarcinoma was noted in 6 cases, periampullary region carcinoma in 3 cases and gall bladder carcinoma in 3 cases.

From above table, percentage distribution of cholangiocarcinoma in our study matched with Bhatt et al. and Soto et al. Percentage distribution of carcinoma of pancreas in our study matched with Bhatt et al. as he also didn't report any case of carcinoma of pancreas.

This may be due to less sample size of Bhatt et al. Percentage distribution of carcinoma of GB in our study matched with Soto et al. and Shadan et al. Percentage distribution of periampullary carcinoma in our study matched with Schwartz et al. Larger percentage of cases was reported in Schwartz et al. and Soto et al. because of inclusion criteria of only patients with pancreatobiliary malignancies. Overall percentage distribution of malignant pathologies in our study closely matched with Bhatt et al. and Shadan et al. Larger percentage in Upadhaya et al. may be due to slightly larger sample size (100 patients).

Accuracy of MRCP in our study was 82 % lesser than conventional MRI that is 90 % because on 3D MRCP filling defects can be easily go undetected.

CONCLUSIONS

MRCP, with its 3-dimensional reconstruction and multiplanar imaging capability, and inherent high resolution is an effective investigation for the detection of pancreaticobiliary pathologies. MRCP could detect the cause and location of bile tract obstruction. Useful particularly in the patients who are to undergo surgery to determine the level and extent of strictures.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jebmh.com.

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