Journal of Surgical Radiology

Site: https://journalsurgrad.com/

ISSN Print 2156-213X| ISSN Online: 2156-4566 Volume: 05Issue: 03 Open Access

Research Article

MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY (MPRCP): A PROSPECTIVE STUDY TO EVALUATE BILIARY AND PANCREATIC ANOMALIES AND PATHOLOGIES ON 3T MR (MRCP).

Dr Sajjad Ali Hashmi Syed[1], Sadaf Tanveer Khan[2], Dr Huzaif shaikh [3],Jawwad Ali HashmiSyed[4]

[1]. Associate Professor, Department of Radiology, JIIUS IIMSR Warudi, Badnapur, Maharashtra, India
[2]. Associate Professor, Department of Anatomy, MGM medical college, Ch.Sambhaji Nagar
[3]. Associate Professor, Department of pharmacology, JIIUS IIMSR medical college
[4]. Professor, Department of Community Medicine, JIIUS IIMSR medical college

*Corresponding Author
Jawwad Ali Hashmi Syed E-MAIL:
dr.syed.jawwad@gmail.com

Article History
Received: 20.01.2026
Revised: 26.02.2026
Accepted: 19.03.2026
Published: 21.03.2026

Citations:
Hashmi Syed, S. A., Khan, S. T., Shaikh, H., & Hashmi Syed, J. A. Magnetic resonance cholangiopancreatography (MRCP): A prospective study to evaluate biliary and pancreatic anomalies and pathologies on 3T MR (MRCP).J Surg Radiol, V5(3) 41-47

Abstract: ***Introduction:*** Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive imaging modality that overcomes limitations of ultrasonography, CT, and invasive procedures like ERCP in evaluating pancreatico-biliary diseases. It provides excellent visualization of biliary and pancreatic ducts without ionizing radiation.**Aim and Objectives:** To evaluate normal anatomy, anatomical variations, and pathologies of the pancreatico-biliary tree using 3T MRCP.**Materials and Methods:** A prospective observational study was conducted on 100 patients (July–December 2023) with suspected biliary or pancreatic pathology. MRCP was performed using T2-weighted HASTE sequences with 2D and 3D imaging. Patients with MRI contraindications or unstable conditions were excluded.**Results:** Among 100 patients (51% males), majority (64%) were aged 31–70 years. Common findings included cholelithiasis (42%), choledocholithiasis (17%), and acute cholecystitis (20%). Pancreatic pathologies were seen in 17% cases, including acute pancreatitis (29.4%) and carcinoma pancreas (29.4%). Anatomical variations were observed in 20% patients, most commonly trifurcation. Malignant strictures were present in 12%, predominantly involving distal CBD (50%).**Conclusion:** MRCP is a highly accurate, non-invasive modality for evaluating pancreatico-biliary anatomy and pathology. It effectively differentiates benign and malignant conditions and aids in preoperative planning, though it lacks therapeutic capability.

Keywords: Magnetic Resonance Cholangiopancreatography (MRCP) , evaluation , pancreatico-biliary diseases.

INTRODUCTION

Evaluation of suspected biliary obstruction has traditionally involved a variety of imaging modalities including ultrasonography (US). Computed tomography (CT) and invasive cholangiography. These techniques have limitations because of poor visualisation of intraductal stones on US and CT and the need for invasive procedures like Endoscopic Retrograde Cholangio-Pancreatography and Percutaneous Transhepatic Cholangiography (PTC). Magnetic resonance Cholangio-pancreatography (MRCP) is a non invasive imaging modality that provides good visualization of hepatobiliary system (1).

Magnetic resonance cholangiopancreatography, which combines the advantages of projectional imaging with those of cross-sectional imaging, is an established diagnostic technique that can be substituted for endoscopic retrograde cholangiopancreatography (ERCP) in most clinical settings (2,3,4).

Technical advances over the past decade, including the refinement of 3.0-T imaging capabilities, have added to the usefulness of this noninvasive method. MR cholangiopancreatography is now considered the imaging test of choice after a failed or incomplete ERCP evaluation (3,4). It is also helpful for presurgical planning and postsurgical follow-up.

MRCP technique is based on heavily T2W images which result in remarkable increase in contrast between stationary fluid (bile) and background (abdominal fat, hepatic and pancreatic parenchyma). Firstly, MRCP can directly reveal extraductal tumor whereas ERCP depicts only the duct lumen. Second, MRCP lacks the major complication rate of approximately 3% associated with ERCP such sepsis, bleeding, bile leak and death(5). Overall the purpose of this study will be to prospectively assess the accuracy of MR imaging in pancreatico-biliary pathologies.

AIMS AND OBJECTIVES:

- To study the normal anatomy with identification of variation and anomalies of pancreaticobiliary tree.
- To study and establish diagnosis of pathologies of Biliary tree

- To study and establish the diagnosis of pathologies of pancreas and pancreatic duct.

MATERIALS AND METHODS

- This is a prospective observation study.
- Study is carried out in a private imaging centre at chatarpati sambhaji nagar
- Initial evaluation is done using T2W axial and coronal FSE and HASTE sequence.
- Fat suppression technique is used for suppression of background fat.
- 2D and 3D imaging of biliary tree was performed with T2 HASTE sequences and thick slab MIP images were obtained.

STUDY PROFORMA:
About 100 consecutive patients who were referred for MRCP between July 2023 to December 2023 were included in the study.

Inclusion criteria: All patients who presented with sign or symptoms of Biliary or pancreatic pathology after initial clinical evaluation by senior surgeon or physician and referred for evaluation of Biliary or pancreatic pathologies or to detect the anomaly preoperatively, were included in this study.

Exclusion criteria:
Hemodynamically unstable, unconscious and the patient on ventilator or other life support were excluded.
Patient having contraindication for MRI, as patient with cardiac pacemaker, recent history of non MRI compatible metallic implants, cochlear implants was excluded.

RESULTS

The total of 100 patients who were clinically diagnosed or suspected of having pancreaticobiliary pathology was included in the present study. The following parameters were studied for every patient with MRCP. Level of obstruction, Presence of bile duct calculi, Status of CBD, Degree of dilatation of intrahepatic biliary radicals, Gall bladder pathology including size, wall, stones, Dilatation of pancreatic duct , Oedema and swelling of pancreas, peri-pancreatic fluid, pancreatic atrophy, calcification and pseudo cyst , Presence of masses Invasion of viscera, facial planes, Presence of metastasis. Then depending on characteristic imaging findings lesions were divided into benign and malignant pathologies for biliary or pancreatic duct dilatation and presence or absence of associated mass lesion. Gall bladder pathologies were divided into cholelithiasis, and in presence of features of inflammation further divided into calculus or acalculus cholecystitis and gall bladder perforation.

Anatomical variants were identified with the use of 3D volume rendered images depending on the site of insertion of posterior division of right hepatic duct, the confluence, long low insertion of cystic duct and different variations in the opening of pancreatic duct into distal CBD, major papilla or minor papilla.

TABLE 1: Gender and age wise distribution of pateints presenting with pancreatico biliary diseases.

SEX	NO. OF CASES	PERCENTAGE%
MALES	51	51%
FEMALES	49	49%
Age in years	No of patients	Percentage %
<30	7	7%
31 to 50	33	33%
51 to 70	31	31%
71 TO 90	24	24%
>90	5	5%
TOTAL	100	100%

In the present study the peak incidence of pancreaticobiliary diseases was seen in 31 to 50 yrs age group, and the majority of patients with pancreatico- biliary pathologies were between 31 to 70 years of age ie approximately 64%.The number of patients in the less than 30 years age group were 7, of which only 2 patients were below 15 years of age.

TABLE 2: Number of patients showing various diseases as observed on MRCP.

Type Of Disease	No. Of Cases	Percentage%
Cholelithiasis	42	42%

Cystic Duct Calculi	5	5%
Choledocholithiasis	17	17%
Acute Cholecystitis	20	20%
Chronic Cholecystitis	2	2%
Primary Sclerosing Cholangitis	2	2%
Choledochal Cyst	3	3%
Duodenal Diverticulum	2	2%
Acute Pancreatitis	5	5%
Chronic Pancreatitis	2	2%
Carcinoma Pancreas	5	5%
Cystic Panceatic Masses	5	5%
Cholangiocarcinoma	8	8%

Among the benign pathologies the commonest pathology was choleliathisis which was seen in 42 patients and choledocholithisis in 17 patients.Out of 42 cases of cholelithisis, 28 patients were not showing any signs of inflammation of gall bladder and 14 had acute calculus cholecystitis, of which 6 were showing changes of gangrenous cholecystitis, in the form of gall bladder sloughing and perforation.

TABLE 3: ANATOMICAL VARIATIONS IN PANCREATICO BILIARY TREE:

Anatomical Variation	Number Of Cases
Trifurcation	6
Low Medial Insertion Of Cystic Duct	5
Choledochal Cyst	3
Phrygean Cap	1
Pancreatic Divisum	3
Posterior Rhd Inserting Into CBD	2
Total	20

The total number of patients included in present study was 100, out of which 20 patients were showing some anatomical variations in pancreatico-biliary tree. The commonest variation was “trifurcation” ie. posterior division of right hepatic duct opening either at the confluence or left hepatic duct instead of forming common right hepatic duct channel. The second commonest anatomical variation was low medial or posteromedial insertion of cystic duct, it was seen in 5 cases. Choledochal cyst was noted in 3 cases of which two were type 1 choledochal cyst and one was type 4A. In two patients the posterior division of right hepatic duct was opening in common bile duct. Pancreatic divisum was noted in cases**.**

TABLE 4 : DISTRIBUTION OF SITE OF MALIGNANT STRICTURE INVOLVING PANCREATICO-BILIARY SYSTEM AS OBSERVED ON MRCP

Site Of Malignant Stricture	No. Of Patients	Percentage
Right Main Hepatic Duct	0	0
Left Main Hepatic Duct	1	8.3
Confluence Of Right And Left Main Hepatic Duct	2	16.6
Proximal CBD	2	16.6
Mid CBD	1	8.3
Distal CBD/ PD	6	50%
Total	12	100%

Of the total 100 studied patients 12 patients were found to have malignant stricture, in which one had left main hepatic duct stricture due to intrahepatic cholangiocarcinoma. Two had stricture at the confluence due to klatskin tumor. One had mid CBD cholangio- carcinoma and 6 had stricture at the distal CBD of which 4 were due to carcinoma pancreas, 1 distal cholangiocarcinoma and one ampullary carcinoma.

TABLE 5 : DISTRIBUTION OF PANCREATIC PATHOLOGIES ON MRCP

Pathology	Males	Females	Total	Percentage

Acute Pancreatitis	3	2	5	29.4%
Chronic Pancreatitis	1	1	2	11.7%
Cystic Pancreatic Masses	2	3	5	29.4%
Carcinoma Pancreas	5	0	5	29.4%
Total	11	6	17	100%

In our study out of total 100 patients 17 had pancreatic pathologies, among which 5 (29.4 %) had acute pancreatitis, 2 (11.7%) had chronic pancreatitis, and 5 (29.4%) had benign cystic pancreatic masses of which one was pseudo cyst,3 Intra-pancreatic mucinous tumor and 1 was serous cystadenoma.

DISCUSSION

Evaluation of suspected biliary obstruction has traditionally involved a variety of imaging modalities including ultrasonography (US), computed tomography (CT) and invasive cholangiography. These techniques have limitations because of poor visualization of intraductal stones on US and CT and the need for invasive procedures like ERCP and PTC. MRCP is a non-invasive imaging modality that provides good visualization of the hepato biliary system (8). Magnetic resonance cholangio pancreatography is non invasive technique for direct visualization of biliary tree and pancreatic duct, and provides images similar to those obtained with invasive cholangiography viz. PTC and ERCP. MRCP does not require use of contrast medium or any biliary intervention. The total of 100 patient who were clinically diagnosed or suspected of having pancreaticobiliary pathology were included in the present study of which 51 were males and 49 were females and majority were in the age group of 31 to 70 years. In 17 cases of choledocholithiasis, MRCP clearly shows the IHBR dilatation, caliber of CBD and the site of the calculus, especially in the distal CBD which is difficult to visualize on ultrasound. In addition MRCP combined with T2 HASTE sequences helped to determine the associated pathologies like cholecystitis, cholangitis, cholangitic abscess, acute pancreatitis. Varghese et al (9) who reported 91% sensitivity, specificity of 98% and diagnostic accuracy of 97% on MRCP Sugiyama et al (10) reported 91% sensitivity, specificity of 100% and diagnostic accuracy of 97% on . Caroline Reinhold et al (11) showed a sensitivity of 90%, specificity of 100% and accuracy of 97 % on MRCP.

In our study a total of 22 patients had cholecystitis.

MRCP combined with T2HASTE and post contrast images with characteristic imaging findings of distended gall bladder with gall bladder wall thickening and peri-cholecystic fluid for acute choelcystitis (in 20 cases), and depending upon presence or absence of filling defect for differentiating calculus (14 cases) and acalculcu cholecystitis (6 cases) and rent in gall bladder wall or dirty looking wall for gangrenous cholecystitis (5 cases) and persistently contracted gall bladder with thickened wall for chronic cholecystitis (2cases), was able to identify and differentiate in above mentioned pathologies. MRCP was able to identify the impacted stone at the neck of gall bladder with secondary compression over the CBD resulting in Mirizzi syndrome. Abdulaziz A. Al-Quorain et al (12) in a study 42 patients reported that MRCP detects more gallbladder stones, combined gallbladder and total stones than ERCP and lower cases of common bile duct (CBD) stones. Both procedures were sensitive. They concluded that MRCP was more sensitive in diagnosing gallbladder stones and visualization of the gallbladder and the pancreatic ducts, while ERCP was more accurate in diagnosing CBD - stones; however, both procedures were generally sensitive and showed almost similar results.

About 20 cases of total study were showing some anatomical variation like insertion of posterior division of right hepatic duct, long cystic duct, choledochal cyst and pancreatic divisum. MRCP yielded diagnostic information by providing exact anatomic map in pre surgical evaluation. Kim et al (13) in his study of 20 patients concluded the same.

In our study 13 cases were of benign stricture of pancreatico-biliary tract, of which one was anastomotic site stricture at the site of previous hepaticojejunostomy, and one was in the body of pancreas in a case of chronic pancreatitis and 11 were distal CBD/ ampullary strictures. Mi-Suk Park, Tae Kyoung Kim et al (14) in the year 2004 performed a study to retrospectively evaluate criteria for differentiating extrahepatic bile duct cholangiocarcinoma from benign cause of stricture at magnetic resonance cholangiopancreatography (MRCP) and to compare diagnostic accuracy with this modality versus endoscopic retrograde cholangiopancreatography (ERCP). Sensitivity, specificity, and accuracy of the two methods for differentiation of malignant from benign causes of biliary stricture were 81% (22 of 27), 70% (16 of 23), and 76% (38 of 50), respectively, for MRCP and 74% (20 of 27), 70% (16 of 23), and 72% (36 of 50), respectively, for ERCP. Mean length (standard deviation) of cholangiocarcinomas was 30.0 mm ± 8.5, and that of benign strictures was 13.6 mm ± 9.1 ($P \leq 0.001$). concluding that, the accuracy of MRCP is comparable with that of ERCP.

8 cases of cholangiocarcinoma were evaluated. In one case of cholangiocarcinoma diagnosed by MRI there was extension into left hepatic duct up to secondary confluence. 2 were klatskin tumors involving the hilum. One mid CBD intraluminal mass and two were distal cholangio-carcinomas. One case was showing encasement and extension into the second part of duodenum and gall bladder fosaa, pre operatively on imaging it was thought to be carcinoma gall bladder, but per operative findings were those of cholangio carcinoma. This is a known limiting factor on imaging when both, the gall bladder and bile duct are involved. MRI helped in defining the level, extent and staging of the disease in the pre surgical evaluation. Guibaud et al (15) , Barish M A and Soto (16) and Pavone et al (17) who concluded their studies with sensitivities ranging from 80-86% and specificities of 96-98%and diagnostic accuracies of 91-100% for level of obstruction.

Figure 1,2 :NORMAL ANATOMY OF PANCREATICO BILIARY TREE,

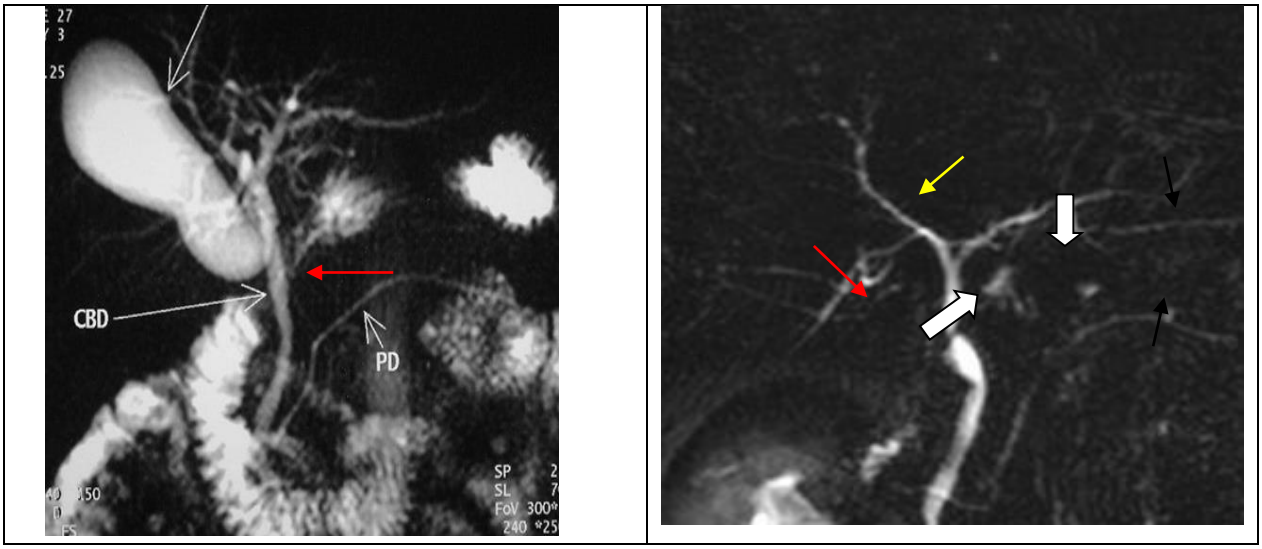

Fig 1,2 .MRCP MIP image showing the normal anatomy gall bladder, common bile duct (CBD) and pancreaticduct (PD) and cystic duct(red arrow). Fig 6B: showing the right and left main heatic ducs(thick arrows) and anterior and posterior divisions of right heaptic duct and superior and inferior divisions of left hepatic duct (thin arrows).

FIGURE3,4 : ANATOMICAL VARIANTS IN PBT

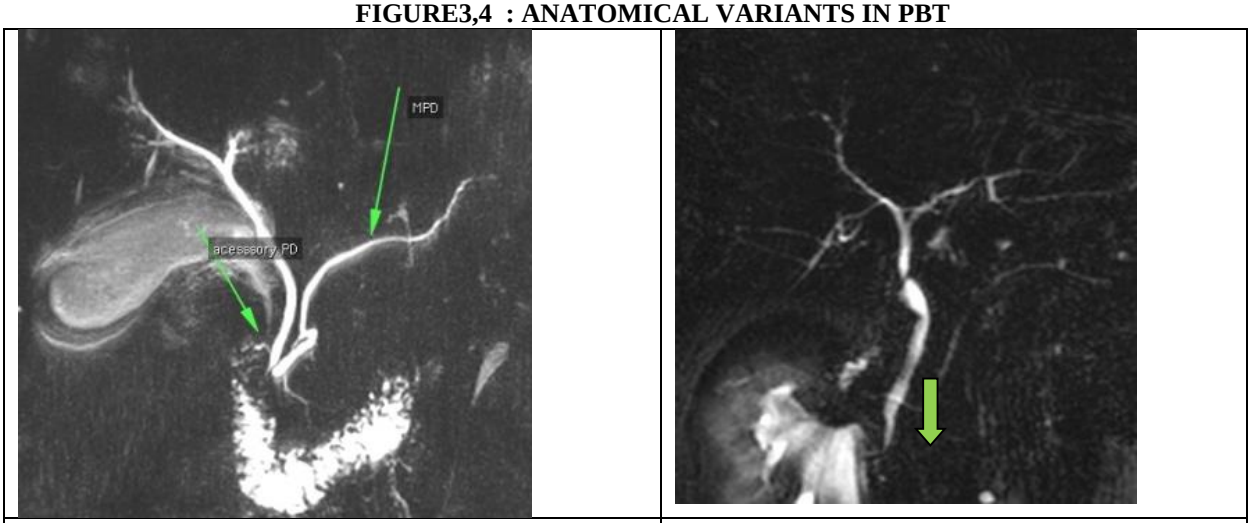

Fig 3 **Fig 4**

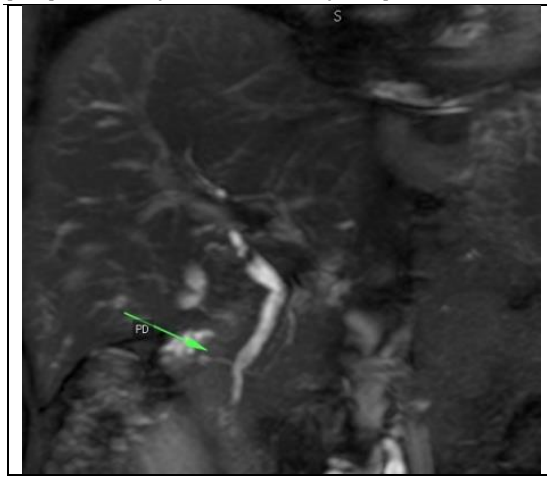

Fig 3: Patent duct of Sanatorini: short arrow showing the opening of accessory pancreatic duct (duct of santorini) opening at minor papilla.
Fig 4: MRCP MIP image and
Fig 5 :T2 HASTE FS Coronal: **Pancreatic divisum**, thick arrow in Fig B and thin arrow in Fig C showing the separate opening of dorsal (main) pancreatic duct at the minor papilla

CONCLUSION

Ultrasonography with Color Doppler is an indispensable With the introduction magnetic resonance cholangio-pancreatography now it is possible to accurately image the pancreatico biliary tree non invasively, very easily without the use of ionizing radiation and study the anatomy, to depict normal anatomic variations preoperatively and to study the pathologies of pancreatico- biliary tree. Hence based on our prospective observational study the following conclusions can be made.

- MRI with MRCP serves as an accurate and non invasive, non ionizing imaging method for evaluation of pancreatico-biliary anatomy and pathology.
- MRI with MRCP is very helpful in preoperative evaluation of pancreatico-biliary anatomy, and anatomical variations to avoid intra-operative complications especially during laparoscopic surgeries.
- MRI with MRCP allows better depiction of pathologies of pancreatico-biliary tree and found very sensitive and useful in differentiating benign and malignant strictures.

Drawbacks

a) Claustrophobia
b) No therapeutic and interventional procedures can be carried out
c) Breath holding is not possible in elderly, children and debilitated patients
d) Time consuming

REFERENCES

1. Wallner BK, Schumacher KA, Weidenmaier W, Friedrich JM. Dilated biliary tract: evaluation with MR cholangiography with a T2-weighted contrast-enhanced fast sequence. Radiology. 1991;181(3):805-808.
2. Fulcher AS, Turner MA. MR cholangiopancreatography. Radiology. 1999;215(2):331-349.
3. Barish MA, Yucel EK, Ferrucci JT. Magnetic resonance cholangiopancreatography. N Engl J Med. 1999;341(4):258-264.
4. Soto JA, Barish MA, Yucel EK, Siegenberg D, Ferrucci JT. Magnetic resonance cholangiography: comparison with endoscopic retrograde cholangiopancreatography. Gastroenterology. 1996;110(2):589-597.
5. Guibaud L, Bret PM, Reinhold C, Atri M, Barkun AN. Bile duct obstruction and choledocholithiasis: diagnosis with MR cholangiography. Radiology. 1995;197(1):109-115.
6. Taylor AC, Little AF, Hennessy OF, Banting SW, Smith PJ, Desmond PV. Prospective assessment of magnetic resonance cholangiopancreatography for noninvasive imaging of the biliary tree. Gastrointest Endosc. 2002;55(1):17-22.
7. Adamek HE, Albert J, Weitz M, Schilling D, Riemann JF. Magnetic resonance cholangiopancreatography versus endoscopic retrograde cholangiopancreatography for diagnosing biliary obstruction. Gut. 1998;43(5):680-683.
8. Reinhold C, Bret PM. Current status of MR cholangiopancreatography. AJR Am J Roentgenol. 1996;166(6):1285-1295.
9. Varghese JC, Liddell RP, Farrell MA, Murray FE, Osborne DH, Lee MJ. The diagnostic accuracy of magnetic resonance cholangiopancreatography and ultrasound compared with direct cholangiography in the detection of choledocholithiasis. Clin Radiol. 1999;54(9):604-614.
10. Sugiyama M, Atomi Y. Magnetic resonance cholangiopancreatography for diagnosing choledocholithiasis: a prospective comparative study with ERCP. Gastrointest Endosc. 1997;45(2):143-146.

11. Reinhold C, Taourel P, Bret PM, Cortas GA, Barkun AN. Choledocholithiasis: evaluation with MR cholangiography. Radiology. 1998;209(2):435-442.
12. Al-Quorain AA, Satti MB, Al-Gindan YM, Al-Humaidi MA, Al-Faleh FZ. Magnetic resonance cholangiopancreatography versus endoscopic retrograde cholangiopancreatography in biliary tract diseases. Saudi J Gastroenterol. 2001;7(2):59-63.
13. Kim TK, Kim AY, Kim PN, Ha HK, Lee MG. MR cholangiopancreatography in the evaluation of biliary tract anomalies and variants. Radiographics. 2002;22(4):e10.
14. Park MS, Kim TK, Kim KW, Park SW, Lee JK, Kim JS. Differentiation of extrahepatic bile duct cholangiocarcinoma from benign stricture: findings at MR cholangiography and MR imaging. Radiology. 2004;233(1):234-240.
15. Guibaud L, Bret PM, Reinhold C. Biliary obstruction: evaluation with MR cholangiography. Radiology. 1995;197(1):109-115.
16. Barish MA, Soto JA. MR cholangiopancreatography: techniques and clinical applications. AJR Am J Roentgenol. 1997;169(5):1295-1303.
17. Pavone P, Laghi A, Catalano C, et al. MR cholangiopancreatography in the evaluation of biliary obstruction. Eur Radiol. 1997;7(4):537-542.