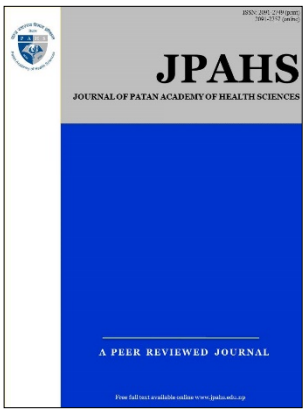

ISSN: 2091-2749 (Print)
2091-2757 (Online)

Accuracy of magnetic resonance cholangiopancreatography in the diagnosis of benign and malignant cause of obstructive jaundice

Ngawang Temba Sherpa[1], Sagun Manandhar[2], Anil Karki[1], Prabhat Karki[1]

[1]Lecturer, [2]Resident, Dept. of Radiology and Imaging, Patan Hospital, Patan Academy of Health Sciences, Lalitpur, Kathmandu, Nepal

Abstract

Introduction: Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive technique for overall assessment of obstructive jaundice. This study aims to compare the accuracy of MRCP in benign and malignant obstructive jaundice with the gold standard, the invasive procedure of endoscopic retrograde cholangiopancreatography (ERCP), and histopathology.

Method: This was a retrospective study reviewing MRCP findings of clinically diagnosed obstructive jaundice from 2018 to 2021 at Patan Hospital, Kathmandu, Nepal. The study was conducted after ethical clearance from the institutional review committee. Sensitivity, Specificity, PPV, NPV, and overall accuracy of MRCP were compared with ERCP and histopathology. A Chi square test was used for analysis, with a p 0.05 considered significant.

Result: Among 66 patients, the Sensitivity, Specificity, PPV, and NPV of MRCP for biliary obstruction due to malignant pathology were 89.50%, 93.60%, 85.00%, and 95.70%, respectively. Similarly, for benign etiology, it was 93.60%, 89.50%, 95.70%, and 85.00% respectively. The overall diagnostic accuracy was 92.40%. Choledocholithiasis was 31(46.97%) among benign causes and periampullary carcinoma 8(12.12%) among malignant.

Conclusion: MRCP is a highly sensitive and specific test in the evaluation of benign and malignant biliary pathology. It is noninvasive and can have good diagnostic value despite the use of contrast. So, the minimally invasive procedure ERCP can be reserved for therapeutic or diagnostic biopsy purposes only.

Keywords: Magnetic resonance cholangiopancreatography (MRCP), endoscopic retrograde cholangiopancreatography (ERCP), histopathological examination (HPE), obstructive jaundice

Correspondence
Ngawang Temba Sherpa
Dept. of Radiology and Imaging, Patan Hospital, Patan Academy of Health Sciences, Lalitpur, Nepal
Email: nawang77writeme@gmail.com

Peer Reviewers
Assit. Prof. Dr. Ashis Shrestha, Patan Academy of Health Sciences, Nepal

Dr. Akanand Singh, Consultant, Hepatobiliary & Liver Transplant Surgeon, Grande International Hospital, Nepal

Submitted
26 Dec 2021

Accepted
27 Mar 2022

How to cite this article
Ngawang Temba Sherpa, Sagun Manandhar, Anil Karki, Prabhat Karki. Accuracy of magnetic resonance cholangiopancreatography in the diagnosis of benign and malignant cause of obstructive jaundice Journal of Patan Academy of Health Sciences. 2022Apr;9(1):65-71.

https://doi.org/10.3126/jpahs.v9i1.43896

Introduction

Obstructive jaundice is one of the most common and serious forms of hepatobiliary disease. It can pose problems in diagnosis and management, particularly in intrahepatic cholestasis.[1] Endoscopic Retrograde Cholangio-Pancreatography (ERCP) has high diagnostic accuracy in detecting suspected stones and can be applied both as a diagnostic and a therapeutic tool. However, it is an invasive procedure with mortality and morbidity of 1% and 7%, respectively.[2]

The Magnetic resonance cholangiopancreatography (MRCP) is safe and can be obtained without administration of any contrast agent or radiation exposure.[3] The limitations of available imaging modalities have led to the increasing use of MRCP, which is a non-invasive and highly accurate technique in evaluating biliary obstruction.[4] It has a high diagnostic specificity for determining the location and extent of obstruction.[5] It makes use of heavily T2-weighted pulse sequences, thus exploiting the inherent differences in the T2-weighted contrast between stationary fluid-filled structures in the abdomen and adjacent soft tissue.[6] The MRCP has an overall diagnostic accuracy, sensitivity, and specificity of 94.1%, 93.5%, and 100% respectively in detecting the etiology of hepatopancreati biliary disease. Its positive predictive value is 100% and negative predictive value of 60%.[7] With the help of MRCP many benign cases can be diagnosed so it can reduce unnecessary intervention and also help surgeon with clear surgical roadmap. Hence, the current study is planned to see the accuracy of MRCP to diagnose the benign and malignant cause of obstructive jaundice comparing with gold standard i.e., ERCP and histopathology examination (HPE).

Method

This was a cross-sectional study of retrospective findings of MRCP in the Department of Radiology and Imaging from July 2018 to June 2021 at Patan Hospital, Patan Academy of Health Sciences (PAHS), Kathmandu, Nepal. The study was conducted after ethical clearance of the institutional review committee of the PAHS, (Reference number- drs2110221573).

All the patients with obstructive jaundice on clinical evaluation who underwent MRCP and either ERCP or HPE (i.e., Diagnostic biopsy, post-surgery HPE, or post-ERCP Biopsy) were included in the study. The magnetic resonance imaging (MRI) was performed in the Philips Ingenia MRI system with a field strength of 1.5 Tesla.

For an operational definition, a benign stricture was differentiated from a malignant one if it showed regular, symmetric, and short segment narrowing. Irregular, asymmetric, and long segment narrowing was considered a feature of malignant stricture. The presence of mass was considered highly specific for malignant strictures but the absence of mass did not rule out the possibility of malignancy.[8]

Result

The total number of patients with obstructive jaundice who underwent MRCP were 230 and 66 had ERCP or histopathology report available. Data on these 66 patients were analyzed in this study. Males were 37(56.06%) and females 29(43.94%) and median age of 47.50 y, Table 1.

Luminal pathologies were present in 35(53.03%), extraluminal pathologies in 22(33.33%), and mural pathologies in nine(13.64%). Causes of biliary obstructions were choledocholithiasis in 31(46.97%), periampullary carcinomas including pancreatic head carcinomas in 8(12.12%), carcinoma of gall bladder 5(7.58%), cholangiocarcinoma 4(6.06%), biliary sludge 4(6.06%), choledochal cysts 3(4.55%), benign biliary strictures 3(4.55%), malignant biliary strictures 2(3.03%) and solitary case each of autoimmune pancreatitis, duodenal diverticulum, hydatid cyst of liver, Mirizzi syndrome, serous

cystadenoma of the pancreas and xanthogranulomatous cholecystitis.

The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of MRCP for biliary obstruction due to malignant pathology were 89.50%, 93.60%, 85.00%, and 95.70% respectively. Similarly, for benign etiology, sensitivity, specificity, PPV and NPV accounted for 93.60%, 89.50%, 95.70% and 85.00% respectively. The overall diagnostic accuracy was 92.40%. Stratification was done with respect to the four most prevalent causes of obstruction, Table 2. About one-fourth of the cases were histologically proven to be of malignant etiology. A statistically significant association was found between MRCP and ERCP/ histopathological diagnosis for malignant biliary obstruction, p<0.001, Table 3. Three cases with choledochal cyst were correctly diagnosed in MRCP. According to Todani classification,[9] two cases were extrahepatic fusiform (Type I) and one case was both intra- and extrahepatic biliary dilatation. Ten cases in our study were intrahepatic causing biliary obstruction and 56 cases were extrahepatic.

In one case, MRCP misdiagnosed cystic duct calculus as common hepatic duct (CHD) calculus. This was proven to be due to the mass effect of Mirizzi syndrome which is a complication of chronic symptomatic gallstone disease[10] causing compression on CHD mimicking CHD calculus.

Table 1. Demography of patients with obstructive jaundice who had magnetic resonance cholangiopancreatography (MRCP), N=66

Age (in y)	Male/female	N(%)
20-39	12/8	20(30.30)
40-59	13/25	38(57.58)
60-79	4/4	8(12.12)

Table 2. Accuracy of MRCP findings for the cause of biliary obstruction, N=66

	N(%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Etiology (N=66)						
Benign	47 (71.21)	93.60	89.50	95.70	85.00	92.40
Malignant	19 (28.79)	89.50	93.60	85.00	95.70	92.40
Cause of obstruction*						
Top four causes (N=48)						
Choledocholithiasis	31 (46.96)	96.80	88.60	88.22	96.91	92.46
Periampullary carcinoma	8 (12.12)	87.50	98.33	87.55	98.37	97.00
Carcinoma of gall bladder	5 (7.57)	100	98.47	83.34	100	98.50
Cholangiocarcinoma	4 (6.06)	75.09	100	100	98.43	98.50
Others[#] (N=18)	18 (27.27)	NA	NA	NA	NA	NA

*Only top four causes were analyzed; [#]Others: Biliary Sludge, mirizzi syndrome, autoimmune pancreatitis, choledochal cysts, benign biliary strictures, malignant biliary strictures, duodenal diverticulum, hydatid cyst of liver, serous cystadenoma of the pancreas and xanthogranulomatous cholecystitis; PPV: Positive Predictive Value, NPV: Negative Predictive Value

Table 3. Association between MRCP and histopathology for malignant biliary obstruction, N=66

MRCP	ERCP/ Histopathology		Fischer's exact
	Malignant	Benign	
Malignant	17	3	p<0.001
Benign	2	44	

Discussion

In the present study of 66 patients with obstructive jaundice, MRCP showed a sensitivity, specificity, PPV, and NPV of 89.50%, 93.60%, 85.00%, and 95.70% respectively. Choledocholithiasis (46.97%) was the most common cause of obstructive jaundice. Only two patients with positive MRCP were found to be negative in ERCP, (Table 3). Among the two patients, one had sludge only and in another patient, a 2 mm distal common bile duct (CBD) calculus diagnosed on MRI was not present on ERCP. It may be either due to the low sensitivity of MRCP in the detection of smaller stones or may be due to spontaneous passage of the stone.[13] Bile flow-related artifact might also have contributed to the false-positive result. A similar finding of two false-positive MRCP among 63 patients with gallstone pancreatitis was reported in a randomized study comparing two groups one with MRCP and one without MRCP with intraoperative cholangiography (IOC) /ERCP.[14] In a retrospective study of 117 patients of gallstone pancreatitis who underwent MRCP and subsequent ERCP/IOC, the MRCP detected 95 choledocholithiasis with a positive likelihood ratio of 6.5 and the negative likelihood ratio of 0.1.[15]

In another study among 30 patients with MRCP findings when compared to postsurgical diagnosis; MRCP failed to detect a CBD calculus in a minimally dilated ductal system and misdiagnosed a case of focal chronic pancreatitis as carcinoma head of the pancreas, and a small pancreatic head mass as cholangiocarcinoma. The MRCP had a sensitivity of 94.44%, specificity of 81.81%, PPV 89.47%, and NPV 90% for the detection of malignant causes. The overall diagnostic accuracy for detection of level and cause of obstruction was 96.3% and 89.65%, respectively in that study.[4] In the present study there were no false-negative findings of calculus.

In another study of 129 patients who underwent ERCP/MRCP, the sensitivity, specificity, positive, and negative predictive values for MRCP in the diagnosis of choledocholithiasis were 97.9%, 89.0%, 83.6%, and 98.6%, respectively. All 12 strictures were diagnosed by MRCP (sensitivity 100%, specificity 99.1%).[16] Similarly, in our current study five CBD strictures were correctly diagnosed, three benign and two malignant.

In a study of 28 patients with infiltrative cholangiocarcinoma and 23 patients with benign CBD strictures reviewed retrospectively, the final diagnosis (based on surgical or biopsy records) reported that infiltrative cholangiocarcinoma and benign CBD strictures could be effectively differentiated using DCE-MRI and MRCP based on hyperenhancement during the equilibrium phase and bile wall thickness of the involved segment.[17]

A study done in the Nepalese population taking patients showed choledocholithiasis as the main biliary duct pathology(25.7%)[18] similar to the present study. Another study published in 2019 done on 20 patients showed tumors (45%) to be the most common cause of obstructive jaundice followed by choledocholithiasis(35%).[19] This variation may be due to smaller sample size (29) or variation in the presentation of the patient at the study time in that center.

Periampullary carcinoma 8(12.12%), carcinoma of gall bladder 5(7.58%), cholangiocarcinoma 4(6.06%) were the leading cause of malignant pathology causing obstructive jaundice. In a study by Suthar Meena et al. among 21 cases of malignant obstruction, cholangiocarcinoma was the most common cause with 13(62%) cases. Other causes of malignant obstruction were periampullary carcinoma 4(19%), carcinoma gall bladder, and carcinoma head of pancreas each 2(9.5%).[20]

The ERCP may have some limitations in the identification of distal bile duct stenosis in cases of critical stenosis. The non-invasive nature and panoramic capabilities of MRCP and the fact that no contrast material is needed make MRCP the examination of

reference in the diagnosis of malignant stenosis of the distal bile duct, also it has a better ability to visualize the entire biliary tree in the presence of critical strictures of the common bile duct. The rationale for the use of ERCP lies in the possibility of taking histological samples and performing minimally invasive surgical interventions.

Similarly, in a study of 21 patients with clinically distal biliary stricture comparing the MRCP and ERCP, the MRCP correctly identified the presence and site of the distal biliary stenosis in 21(100%) cases, as well as allowing evaluation of the upper abdomen by associating it with conventional MRI. ERCP, instead, allowed detection of the presence and site of biliary stenosis in 20(95%) cases.[21]

A comparative study of MRI and MRCP as well as a comparison between MRCP- and pathology-based diagnoses revealed there was a 100% positive rate of anatomical diagnosis and the detection rate of bile ducts on the proximal side of an obstruction, and diagnostic accuracy of 82.9% for malignant obstruction.[22] This finding is consistent with our results which show that MRCP has a high diagnostic specificity for determining the location and extent of obstruction.

This is one of the few studies from Nepal that have looked into the sensitivity and specificity of MRCP in diagnosing benign and malignant pathology causing obstructive jaundice in hospital patients. Though the data cannot be generalized as this is a single hospital study but the hospital caters to a large number of patients from around Nepal and hence our present findings could be representative of the country.

Though 230 patients with clinical obstructive jaundice had undergone MRCP examination at our center during the study period, only 66 patients fulfilled our study design. Many patients were lost to follow up and others were under conservative management without undergoing histopathology. Also, the overall patient flow and MRCP procedures were affected by the COVID-19 pandemic.

Differentiation of benign from malignant biliary obstruction has been one of the challenges for the radiologist by imaging alone. The reported accuracy in the differentiation of benign from the malignant cause of obstruction has varied from 30 to 80%.[8]

Although ultrasound is a good first-line diagnostic tool in obstructive jaundice and provides information about the presence and level of biliary obstruction, it does not suggest the possible cause in many cases. The site of measurement may differ as ultrasound may not visualize the most distal part of CBD due to overlying gas while MRCP defines the whole ductal system. Also, US is operator dependent so operators differ in measuring the outer or inner outline of CBD while MRCP is not operator dependent So Ultrasound is regarded as the initial examination, which provides a guide to choose patients for MRI examination.[11]

Though CT scan is readily available and is a good modality in the evaluation of the cause of obstructive jaundice CT scans do not depict biliary stones <3 mm because of their limited resolution. The contrast-enhanced CT (CECT) scan differentiates between native hyperattenuating lithiasic lesions and enhancing tumoral disease. Because of the axial image acquisition (coronal planes are only reformatted reconstructions), CT can hardly point to the location of the obstruction relating to the duodenal papilla.[12]

Present retrospective study findings of diagnostic accuracy of MRCP and its ability to differentiate the benign and malignant cause of obstructive jaundice when compared to the gold standard ERCP and histopathology, we observed that MRCP is a good imaging modality with high sensitivity and specificity. Since it is noninvasive and without the need for contrast material, it can be recommended diagnostic test and ERCP can be reserved for therapeutic and diagnostic biopsy purposes. Our results also revealed that MRCP has false-positive findings for very small calculus <2 mm in size. Similarly, biliary sludge, flow-related

artifact, and respiratory artifact in CBD also compromised the quality of MRCP and its overall accuracy.

Conclusion

The MRCP is a highly sensitive and specific test for the evaluation of obstructive jaundice, and detection of benign and malignant biliary pathology. The additional advantages include it is a noninvasive test and doesn't use contrast.

Acknowledgment
None

Conflict of Interest
None

Funding
None

Author Contribution
Concept, design, planning: NTS, SM, AK, PK; Literature review: NTS, AK; Data collection: NTS, PK; Data analysis: NTS, SM, AK, PK; Draft manuscript: NTS, SM; Revision of draft: NTS, SM, AK, PK; Final manuscript: NTS, SM, AK, PK; Accountability of the work: NTS, SM, AK, PK.

Reference

1. Singh A, Mann HS, Thukral CL, Singh NR. Diagnostic Accuracy of MRCP as Compared to Ultrasound/CT in Patients with Obstructive Jaundice. J Clin Diagn Res JCDR. 2014 Mar;8(3):103–7. | DOI | PubMed | Google Scholar | Full Text | Weblink |
2. Mandelia A, Gupta AK, Verma DK, Sharma S. The Value of Magnetic Resonance Cholangio-Pancreatography (MRCP) in the Detection of Choledocholithiasis. J Clin Diagn Res JCDR. 2013 Sep;7(9):1941–5. | DOI | PubMed | Google Scholar | Full Text | Weblink |
3. Basile L, Pezzoto C, Roubicek D, Tempra A, LabordaMolteni J. [Magnetic resonance cholangiopancreatography: comparative study with direct cholangiography]. Acta Gastroenterol Latinoam. 2000;30(5):487–90. | DOI | PubMed| Google Scholar | Full Text | Weblink |
4. Vaishali MD, Agarwal AK, Upadhyaya DN, Chauhan VS, Sharma OP, Shukla VK. Magnetic resonance cholangiopancreatography in obstructive jaundice. J Clin Gastroenterol. 2004 Dec;38(10):887–90. | DOI | PubMed | Google Scholar | Full Text | Weblink |
5. Changhua L, Huajie M, Qinghua W, Dongming H, Yuxia L, Junyan Y, et al. Diagnostic Performance of Magnetic Resonance Cholangiopancreatography in Malignant Obstructive Jaundice. Cell BiochemBiophys. 2011 Nov 1;61(2):383–8. | DOI | PubMed | Google Scholar | Full Text | Weblink |
6. Griffin N, Charles-Edwards G, Grant LA. Magnetic resonance cholangiopancreatography: the ABC of MRCP. Insights Imaging. 2011 Sep 28;3(1):11–21. | DOI | PubMed | Google Scholar | Full Text | Web Link |
7. Osman NM, Mohammad SA, Khalil RM. Diagnostic benefit of MRCP in hepatopancreaticobiliary diseases in children. Egypt J RadiolNucl Med. 2016 Mar 1;47(1):291–5. | DOI | PubMed | Google Scholar | Full Text | Web Link |
8. Suthar M, Purohit S, Bhargav V, Goyal P. Role of MRCP in Differentiation of Benign and Malignant Causes of Biliary Obstruction. J Clin Diagn Res JCDR. 2015 Nov;9(11):TC08-TC12. | DOI | PubMed | Google Scholar | Full Text | Web Link |
9. Lee HK, Park SJ, Yi BH, Lee AL, Moon JH, Chang YW. Imaging Features of Adult Choledochal Cysts: a Pictorial Review. Korean J Radiol. 2009 Feb 5;10(1):71–80. | DOI | PubMed | Google Scholar | Full Text | Web Link |
10. Beltrán MA. Mirizzi syndrome: History, current knowledge and proposal of a simplified classification. World J Gastroenterol WJG. 2012 Sep 14;18(34):4639–50. | DOI | PubMed | Google Scholar | Full Text | Web Link |
11. Al-Obaidi S, Al-Hilli MRA, Fadhel AA. The Role of Ultrasound and Magnetic Resonance Imaging in the Diagnosis of Obstructive Jaundice. 2007;11. | Full Text |
12. Petrescu I, Bratu A, Petrescu S, Popa B, Cristian D, Burcos T. CT vs. MRCP in choledocholithiasis jaundice. J Med Life. 2015;8(2):226–31. | PubMed | Full Text |
13. DeWaele E, Op de Beeck B, DeWaele B, Delvaux G. Magnetic Resonance Cholangiopancreatography in the Preoperative Assessment of Patients with Biliary Pancreatitis. Pancreatology. 2007 Sep;7(4):347–51. | DOI | PubMed | Google Scholar | Full Text | Web Link |

14. Hallal AH, Amortegui JD, Jeroukhimov IM, Casillas J, Schulman CI, Manning RJ, et al. Magnetic resonance cholangiopancreatography accurately detects common bile duct stones in resolving gallstone pancreatitis. J Am Coll Surg. 2005 Jun 1;200(6):869-75. | DOI | PubMed | Google Scholar | Full Text | Weblink |
15. Srinivasa S, Sammour T, McEntee B, Davis N, Hill AG. Selective use of magnetic resonance cholangiopancreatography in clinical practice may miss choledocholithiasis in gallstone pancreatitis. Can J Surg. 2010 Dec;53(6):403-7. | PubMed | Google Scholar | Full Text | Weblink |
16. 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 Jan 1;55(1):17-22. | DOI | PubMed | Google Scholar | Full Text | Weblink |
17. Yu XR, Huang WY, Zhang BY, Li HQ, Geng DY. Differentiation of infiltrative cholangiocarcinoma from benign common bile duct stricture using three-dimensional dynamic contrast-enhanced MRI with MRCP. Clin Radiol. 2014 Jun 1;69(6):567-73. | DOI | PubMed | Weblink |
18. Gurung GS, Subedi K, Karki DB. Spectrum of MRCP findings: An initial experience with 3.0 tesla magnetic resonance imaging system in Nepal. Journal of Institute of Medicine. 2015 Aug;37(2):3-9. | Google Scholar | Weblink |
19. Kalode RR. Role of MRCP in obstructive jaundice. Int J Med Sci Diagn Res. 2019 Jul 30;3(7):154-6. | Google Scholar | Full Text | Weblink |
20. Suthar M, Purohit S, Bhargav V, Goyal P. Role of MRCP in differentiation of benign and malignant causes of biliary obstruction. J Clin Diagn Res JCDR. 2015 Nov;9(11):TC08-TC12. | DOI | PubMed | Google Scholar | Full Text | Weblink |
21. Di Cesare E, Puglielli E, Michelini O, Pistoi MA, Lombardi L, Rossi M, et al. Malignant obstructive jaundice: comparison of MRCP and ERCP in the evaluation of distal lesions. Radiol Med (Torino). 2003 May 1;105(5-6):445-53. | PubMed | Google Scholar |
22. Changhua L, Huajie M, Qinghua W, Dongming H, Yuxia L, Junyan Y, et al. Diagnostic performance of magnetic resonance cholangiopancreatography in malignant obstructive jaundice. Cell Biochem Biophys. 2011 Nov 1;61(2):383-8. | DOI | PubMed | Weblink |