

Role of magnetic resonance cholangiopancreatography in patients with pancreatico-biliary diseases with importance of diffusion weighted sequence in characterisation of the lesions

Veeresh S Aland¹, Dhaval^{2*}, Vikram Gowda N R³

¹Assistant Professor, Department of Radio diagnosis, Khaja Banda Nawaz Institute of Medical Sciences Kalaburgi, Karnataka, INDIA.

²Consultant Radiologist, Radnest Radiology Services Bengaluru, INDIA.

³Associate Professor, Department of Physiology, Pushpagiri Institute of Medical Sciences and Research Centre Thiruvalla, Kerala, INDIA.

Email: vikramgowda2@gmail.com

Abstract

Background: Magnetic resonance imaging is useful for evaluating pancreaticobiliary disease after preliminary screening by ultrasonography, instead of undergoing repeated ionizing radiation exposure or invasive procedures such as endoscopic retrograde cholangiopancreatography (ERCP) or transhepatic biliary procedures. MRCP is more sensitive on comparing to ERCP in identifying lesions of cystadenomas and cystadenocarcinomas of biliary tree. The present study was to evaluate the role of Magnetic resonance Cholangiopancreatography (MRCP) in Pancreatico-biliary diseases **Methodology:** MRCP was performed in 52 patients with Pancreatico-biliary diseases attending PIMS and RC Tiruvalla with 1.5 TESLA SUPERCONDUCTING MAGNET GE SIGNA HDXT MRI. Pancreatic biliary diseases were evaluated on all the sequences and images of MRCP by experienced radiologist. The findings were confirmed by follow up surgery or ERCP or histopathology. The sensitivity and positive predictive value was used to assess the relationship between the diagnostic accuracy of MRCP with that of histopathological diagnosis and other investigation as appropriate. Statistical analysis was performed using SPSS software version 19.0. **Results:** Of the 52 patients, 32 were male and the mean age was 48.2 years. Out of 52 patients who underwent MRCP, 16 had chronic pancreatitis (Males-12 and Females-04), 10 patients had cholangiocarcinoma (Males-06 and Females-04), 08 had Choledocholithiasis, 07 had Periapillary carcinoma, 04 patients had Carcinoma pancreas and others had Carcinoma Gall bladder, post-operative stricture and choledochal cyst. Biliary strictures were seen in 12 patients, out of which 7 had malignant strictures and 5 were benign. **Conclusion:** MRCP is a sensitive, very reliable non-invasive imaging modality that helps in diagnosing hepatobiliary disorders, predominantly in patients undergoing biliary enteric anastomosis for knowing the level and extent of strictures. Diffusion weighted sequence was helpful in characterising the pancreatic neoplasms, mainly to differentiate between focal mass forming pancreatitis and pancreatic carcinoma, and helping in therapeutic and prognostic significance.

Key Words: biliary stricture, pancreatitis, choledocholithiasis, periapillary mass.

*Address for Correspondence:

Dr Dhaval, Consultant Radiologist, Radnest Radiology Services INDIA.

Email: vikramgowda2@gmail.com

Received Date: 02/11/2019 Revised Date: 10/12/2019 Accepted Date: 18/01/2020

DOI: <https://doi.org/10.26611/10131338>

Access this article online

Quick Response Code:



Website:

www.medpulse.in

Accessed Date:
02 March 2020

INTRODUCTION

Magnetic Resonance Imaging (MRI) plays a pivotal role in areas of involvement obscured by endoscopic retrograde cholangiopancreatography (ERCP), for instance mass in the uncinate process / head of the pancreas causing extrinsic indentation over the common bile duct. To identify and characterise the pathologies distal to the stricture, which is a limitation of ERCP. Abundance availability of various sequences in magnetic resonance imaging spectrum further helps in characterising the

How to cite this article: Veeresh S Aland, Dhaval, Vikram Gowda N R. Role of magnetic resonance cholangiopancreatography in patients with pancreatico-biliary diseases with importance of diffusion weighted sequence in characterisation of the lesions. *MedPulse International Journal of Radiology*. March 2020; 13(3): 130-134. <http://www.medpulse.in/Radio%20Diagnosis/>

lesions, predominantly the cystic lesions. Uncomplicated cystic lesions on MRI show low signal intensity relative to normal pancreatic parenchyma on unenhanced T1-weighted sequences and high signal intensity on T2-weighted images, although this also can vary if there are hemorrhagic, proteinaceous, or mucinous components within these lesions. On contrast-enhanced MRI, the enhancement characteristics also vary depending on the type of lesion¹. Magnetic Resonance Imaging (MRI) plays a vital role in diagnosing many conditions of the pancreatobiliary tract like primary sclerosing cholangitis, acute pancreatitis, chronic pancreatitis and its complications such as haemorrhage or pseudocyst formation. It is also helpful to distinguish focal enlargement due to chronic pancreatitis from that due to pancreatic carcinoma². It can also depict the extent of gall bladder carcinomas and can contribute to the staging of the disease³. Magnetic resonance Cholangiopancreatography (MRCP) with its ability to generate images of high contrast in multiple plane which has reduced artefact and increased assistance in identifying variations is becoming choice of investigation in patients with Pancreatobiliary diseases⁴. MRCP is a radiation free imaging technique, which can be planned in short time notice which does not require any contrast medium. MRCP helps in demonstration of various pathologies varying from choledocholithiasis, malignant lesions and presence of stricture in pancreatobiliary tree. The nature of information provided will help the treating Clinician his mode of approach in terms of surgical or conservative in nature. One of the disadvantages of MRCP is its diagnostic value is highly dependent on the choledochal diameter and the diameter is narrowed the predictive value of MRCP decreases. The purpose of this study was to prospectively assess the accuracy of Magnetic Resonance imaging and assessing the importance of DWI sequence in indeterminate lesions.

METHODOLOGY

The study population were the patients suspected clinically with pancreatobiliary disease and referred for MRCP in tertiary care hospital of central Travancore in Kerala (Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla). It was an analytical study in which patients were subjected to MRCP using a GE 1.5 TESLA SUPERCONDUCTING MAGNET GE SIGNA HDXT MRI scanner and were followed up clinically with

diagnostic support as required. The radiologist was blinded from the ERCP as well as histological findings, the findings were confirmed by at least two expert radiologist available at the time of reporting. The presence of calculus, thickness of wall, biliary dilatation, stricture and hydatid cyst communicating with the biliary system were evaluated. The radiological diagnosis was correlated with ERCP, surgical findings and histopathology correlation. Excluding those having cardiac pacemakers, prosthetic heart valves, cochlear implants or any metallic orthopaedic implants, 52 patients were conveniently selected as the study sample after considering the anatomical site, presence of stricture and nature of presentation in pancreatobiliary diseases. The study protocol was approved by institutional human ethics committee (No. PIMS and RC/E1/388A/27/13) and all participants had provided their consent for participation in the study. The study was carried during the period of 2013 December to 2015 February. All cases were in state of fasting for a minimum of 6 hours prior to the procedure and examined in supine position with breath holding in inspiration. In few cases of critically ill and non-cooperative patients respiratory triggering was used. Heavy T2-weighted images were obtained using a gradient-echo balanced steady-state free precession technique. Non-breath-hold techniques (with respiratory triggering) were used, with images obtained either as a two-dimensional or three-dimensional. The following scan parameters were used for developing three dimensional image technique which helps in having higher signal to noise ratio. Thinner slices with repetition time of 2500ms, long echo time of 681ms, thickness of 1mm and field view of 380mm were developed. This helped in fast processing and manipulation of images in different planes for better understanding of anatomical and physiological functioning.

Statistical analysis

Data was expressed in frequency tables for distribution of nominal variables. Percentage and ratios were used for presenting numeric variables. To compare means between genders unpaired t test was done, the significance limit was taken as $p < 0.05$ and two-sided. Sensitivity, specificity, PPV, NPV were calculated. Positive on histopathology was considered as a gold standard. Statistical analysis was performed using Statistical Package for Social Sciences software version 19.0

RESULTS

Fifty two cases were referred for MRI with suspicion of pancreaticobiliary disorders were subjected to MRCP and included in the study. Male preponderance was noted with 60.4% (32) and females were 39.6 % (20). Table 1

Table 1: Age wise distribution of Pancreaticobiliary diseases

Age	No. of Cases	Percentage (%)
≤20 yrs	2	3.8
21-40yrs	13	25
>40yrs	37	71.2
Total	52	100

Table 2: Results of patients showing diagnoses of Pancreaticobiliary diseases on MRCP in comparison to Histopathological (HP) or ERCP findings confirmed

Diagnosis	No. of cases	MRCP (Positive findings)	MRCP (Negative)	Sensitivity
Cholangiocarcinoma	10 (19.2%)	8	2	80%
Chronic Pancreatitis	16 (30.7%)	14	2	87.5%
Periampullary Carcinoma	7(13.5%)	6	1	85%
Carcinoma Pancreas	4(7.7%)	4	0	100%
Carcinoma Gall bladder	2(3.8%)	2	0	100%
Choledocholithiasis	8(15.4%)	7	1	87.5%
Post-operative Stricture	3(5.7%)	2	0	100%
Choledochal cyst	2(3.8%)	2	0	100%
Total	52			

As shown in table no.2 the maximum cases diagnosed on MRCP were chronic pancreatitis (30.7%) followed by cholangiocarcinoma (19.2%) and choledocholithiasis (15.4%), the sensitivity with respect to MRCP on comparison to diagnosis made by gold standard of histopathologically or subsequently by ERCP in different cases varied from 80% to 100%. Though specificity was 100% as there were no case which cannot be diagnosed. Similarly, Positive predictive value is 100% and negative predictive value varying around 70%. As observed in Table No.2 Carcinoma pancreas, carcinoma gall bladder and choledochal cyst with MRCP had highest sensitivity of 100%, Choledocholithiasis and chronic pancreatitis with sensitivity of 87.5%, Periampullary carcinoma and cholangiocarcinoma with MRCP reporting sensitivity of 85% and 80% respectively

Table 3: Sex wise distribution of various diseases as observed on MRCP

Diagnosis	No. of cases (Male)	No. of Cases (Female)	P value
Cholangiocarcinoma	6 (18.75%)	4(20%)	(P=0.17)
Chronic Pancreatitis*	12 (37.5%)	4(20%)	(P=0.001)
Periampullary Carcinoma	4 (12.5%)	3(15%)	(P=0.48)
Carcinoma Pancreas	2(6.25%)	2(10%)	(P=1)
Carcinoma Gall bladder	1(3.12%)	1(5%)	(P=1)
Choledocholithiasis	3(9.37%)	5(25%)	(P=0.17)
Post-operative Stricture*	3(9.37%)	0	(P=0.04)
Choledochal cyst	1(3.12%)	1(5%)	(P=1)
Total	32	20	

*- statistically significant

Our study showed a significant difference in cases of chronic pancreatitis ($p=0.001$), reporting being affecting male on comparison to female population similar difference were noted in cases of post-operative stricture ($p=0.04$). In case of cholangiocarcinoma we found more common being reported in males but in contrast we found increased cases of choledocholithiasis in females, though not statistically significant as shown in table no.4

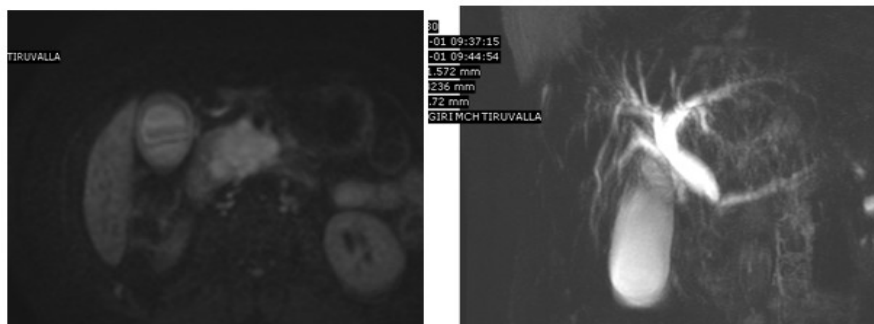


Figure: 1A

Figure: 1B

CARCINOMA PANCREAS (Figure 1A and 1B)

Figure 1A: AX DWI shows mass lesion measuring 5 x 3.2 x 5.2 cms in the head and uncinate process of the pancreas. **Figure 1B:** 3D-MRCP Respiratory triggered image showing IHBRD and dilated CBD and pancreatic duct with smooth abrupt tapering of the distal CBD and Pancreatic duct due to mass lesion in the head of pancreas.

DISCUSSION

This study results indicated a good diagnostic accuracy of MRCP in predicting pancreaticobiliary diseases. Based on the observations we can conclude that the ability of MRCP to diagnose true positive patients with stricture association with malignancy was almost similar to that of histopathological results but however negative predictive value was 70% on comparison to gold standard diagnosis by histopathology. In 10 cases of cholangiocarcinoma observed in our study based on radiological features suggested sensitivity of 80% are similar to studies by Guibaud *et al.*⁵, Barish M A and Soto⁶ and Pavone *et al.*⁷. Who in their studies established sensitivities ranging from 80 to 86%. Similarly specificity of our study was 100% to 98% as mentioned by above authors. In one case of cholangiocarcinoma diagnosed by MRI in our study there was infiltration into the gallbladder with minimal local spread. This was confirmed by per operative findings of carcinoma of gallbladder. This is a known limiting factor on imaging when both, the gall bladder and bile duct are involved. MRI was helpful in defining the level, extent and staging of the disease in the pre surgical evaluation. In 7 cases of periampullary carcinoma, MRI was able to delineate the extent, level and local infiltration and helped in staging of the lesion. The lesion characterisation with relatively T2 hypointense signal favoured malignancy. The precise identification of the encasement of Superior mesenteric artery and vein by some of the lesions helped in identifying as non resectable. Tiny discrete nodes at the porta hepatis in 2 of the patients were identified with diffusion weighted sequence and helped in staging of the lesions, thus proving superior sensitivity to computerised tomography in staging. The assessment of the periampullary lesions was difficult on ultrasound in obese patients and bowel gas shadows was also a limiting factor. Sugita *et al.*⁸ in his study of 25 cases of periampullary tumours reported a sensitivity 88%, specificity 100% and

diagnostic accuracy of 96% which are similar to our study results. 4 cases of carcinoma of pancreas (Figure 5A and 5B) studied 2 cases were involving the head and body region, 2 cases involved the distal part of body and tail. MRI could clearly differentiate carcinoma pancreas from pancreatitis in all 2 cases except, in 2 case there was difficulty in differentiating neoplasm from chronic pancreatitis. However partial restricted diffusion in the above cases were favouring the diagnosis of neoplasm, but appearance in other sequences were inconclusive. Ultrasound is unable to detect the loco regional spread accurately. Eric Tam *et al.*⁹ who reported sensitivity of 80% and specificity of 95 % and that concluded by Enrique Lopez Haminem *et. al*¹⁰ in a study of 66 cases of suspected pancreatic cancers reported a diagnostic accuracy, sensitivity and specificity of 91%, 95% and 96%. In our study of 2 cases of carcinoma of gall bladder, MRI was used as investigative tool and the staging was very accurate. MRI detected all 2 cases and detecting subtle lesions in liver and local spread and helped in pre-surgical staging. In our study on comparison to histopathology reports sensitivity in determination of MRCP was found to be 100 % and specificity of 100%. It was also evident that all cases based in radiological findings to be malignant correlated with that of histopathological diagnosis. It was always not evident and hence negative predictive value of 71%. Ultrasound can be used as a primary investigative tool but cannot be used for staging purpose of carcinoma gall bladder. The diagnostic accuracy for staging will be very low. A total of 16 cases of pancreatitis were evaluated MRI showed diffuse homogeneous enhancement of the entire gland in cases of acute pancreatitis in early stages where ultrasound features were normal. Main pancreatic duct was better seen on MRI in cases of chronic pancreatitis where surgical intervention was required. In one case differentiation between chronic pancreatitis and neoplastic change was difficult on MRI, a known

limitation of MR imaging. Ultrasound will not show much significant changes in cases of pancreatitis. Pseudocyst and necrotic changes were detected rarely. Exact extent was not appreciated due to bowel gas and probe tenderness. In cases of chronic pancreatitis the altered morphology of the gland can be seen but the caliber of main pancreatic duct was difficult to visualize. In 8 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. Hence to confirm the results similar observations were reported by Nilsson P *et al.*¹¹, suggesting higher utility of MRCP in cases of choledocholithiasis. In 2 cases of choledochal cysts our study results were similar to Kim *et al.*¹² who concluded MRCP has been able to provide better diagnostic information in form of providing minute anatomic details prior to surgical intervention. In a recently published study of Vaynshtein *et al.*¹³ has suggested endoscopic ultrasound as an excellent screening tool for choledocholithiasis before performing ERCP. But being invasive procedure MRCP can be weighted and still be useful in predicting pathologies of gallbladder as the positive predictive value of endoscopic ultrasound was determined to be 88%, which is lesser than our study results which suggests 100%.

CONCLUSION

The introduction of MRCP now readily permits the study of anatomy and pathology of the biliary tree including pancreatic duct very easily. Based on our study observations we have highlighted the importance of diffusion weighted sequence in diagnosing indeterminate lesions especially differentiating focal pancreatitis from neoplastic mass. Diffusion weighted images also helped in identifying small metastatic nodes in peripancreatic region and celiac region. It also proved the added advantage of T1 sequence in characterising the cystic lesions, mainly the content of the lesions predominantly protein/ mucin containing lesions. Presence of debris in pseudocyst and thin septations within the cyst helps in characterising the lesions. Soft tissue plane resolution is better with MRI, hence it helps in identifying the encasement of superior mesenteric artery and vein and helps in deciding the criteria of surgical intervention.

REFERENCES

1. Atif Khan, Faisal Khosa and Ronald L. Eisenberg. Cystic lesions of Pancreas. American Journal of Roentgenology. 2011; 196: W668-W677.
2. Richard S, Susan M. MRI of the Pancreas. Radiology 1993; 188; 593-602
3. Sagoh T1, Itoh K, Togashi K, Shibata T, Minami S, Noma S, Gallbladder carcinoma: evaluation with MR imaging. Radiology. 1990 Jan; 174(1):131-6.
4. David, Reinhold C, Wang L, Kaplan R *et al.* Pitfalls in the interpretation of MR Cholangiopancreatography. AJR 1998; 170; 1055-1059
5. Guibaud L, Bret PM, Reinhold C, Atri M, Barkun AN. Bile duct obstruction and choledocholithiasis: Diagnosis with MR cholangiography. Radiology 1995; 197:109-115.
6. M A Barish, J Soto. MRCP Techniques and Clinical applications. AJR 1997; 169: 1295-1303.
7. Pavone P, Laghi A, Catalano C, *et al.* MR Cholangiopancreatography (MRCP): technique optimization and preliminary results. European Radiology 1996; 6:147-52.
8. Sugita R, Furuta A, Ito K, Fujita N, Ichinohasama R, Takahashi S. Periampullary tumors: High Spatial MR Imaging and Histopathologic Findings in Ampullary Region Specimens. Radiology 2004; 231:767-774.
9. Eric T, Paul MS, Chusilp C, Douglas E. Imaging in Oncology from The University of Texas M.D Anderson Cancer Center. Diagnosis, Staging and Surveillance of Pancreatic Cancer. AJR 2003; 180:1311-1323.
10. Enrique Lopez Hänninen, Holger Amthauer, Norbert Hosten *et al.* Prospective Evaluation of Pancreatic Tumors: Accuracy of MR Imaging with MRCP and MR Angiography. Radiology 2002; 224:34-41.
11. Nilsson P, Ekberg O, Aspelin P, Sigurjonsson SV, Genell S. Ultrasonography in the diagnosis of Gallbladder carcinoma. Fortschr Rontgenstr 1989; 150:171-175.
12. Kim, Seok Joo Han, Choon Sik Yoon *et al.* Using MR Cholangiopancreatography to Reveal Anomalous Pancreaticobiliary Ductal Union in Infants and Children with Choledochal Cysts. AJR 2002; 179: 209-214.
13. Vaynshtein J, Sabbag G, Pinsk I, Rahmani I, Reshef A. Predictors for choledocholithiasis in patients undergoing endoscopic ultrasound. Scand J Gastroenterol 2018; 53:335-9.

Source of Support: None Declared
Conflict of Interest: None Declared