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A comparative study of Accuracy, Sensitivity, and Specificity of MR Cholangiopancreatography versus Ultrasonography for diagnosis of hepatobiliary and pancreatic pathologies

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ABSTRACT

Background: The diagnosis of abdominal pathologies is a challenge and radiology is a very important tool in diagnosis. Various methods are often used for the diagnosis of such conditions. We in the present study tried to compare the efficacy of magnetic resonance cholangiopancreatography and ultrasonography in evaluating biliary duct diseases.

Methods: The present study was conducted in the Department of Radiodiagnosis, Prathima Institute of Medical Sciences, Naganur, Karimnagar. All patients presenting with recurrent pancreatitis, hypochondriac pain, jaundice presenting to the radiology department are included in the present study. Patients with metallic implants, claustrophobia are excluded from the present study. Ultrasonography was performed using a Philips HD 15 and Philips affinity 70 machine. Both curvilinear and linear probes were used in the study. Images of the biliary tree were recorded for later review. MRI-MRCP was performed on Philips ACHIEVA 1.5 Tesla MRI Scanner.

Results : In this study, n=13 subjects were clinically suspected to have cholelithiasis (n=7), choledocholithiasis (n=2), and both Cholelithiasis with choledocholithiasis (n=4). Ultrasonography was able to diagnose Cholelithiasis correctly in n=5 cases, choledocholithiasis in n=1 case, Cholelithiasis with choledocholithiasis in n=4 cases and rule out Cholelithiasis in n=2 cases, but failed to identify distal CBD calculus in n=1 case (choledocholithiasis) hence having a diagnostic accuracy of 92.31% for the cholelithiasis-choledocholithiasis group.

Conclusion: MR Cholangiopancreatography is very accurate in demonstrating calculi at the distal end of CBD as an area of the signal void, also in demonstrating strictures as the cause of dilatation of biliary radicals. It showed the length of the stricture segment very well and differentiated stricture as malignant and benign.

Keywords: MR Cholangiopancreatography, Ultrasonography, hepatobiliary and pancreatic pathologies

Introduction

Abdominal pathologies often require imaging modalities for diagnosis. Obstructive jaundice has been documented as one of the leading causes of abdominal pain and produces significant morbidity. In such cases, the goals of any imaging procedure in Obstructive Jaundice are to confirm the presence of obstruction, its location, extent, probable cause, and to obtain amap of the biliary tree that will help the surgeon to determine the best approach to each individual case. Among this Ultrasonography (USG) and Helical Computed Tomography (CT) are initial modalities of investigations. Recently Magnetic Resonance Imaging with Magnetic Resonance

Cholangiopancreatography (MRI with MRCP) is emerging as an exciting tool for non-invasive evaluation of patients with obstructive biliopathy. Magnetic Resonance Cholangiopan creatography is a relatively new MR imaging technique that has revolutionized the imaging of biliary and pancreatic ducts and has emerged as an accurate, non-invasive means of visualization of the biliary tree and pancreatic duct without injection of contrast material. [1] Since its introduction by Wallner et al; in 1991 [2], MR Cholangiopancreatography has undergone a wide range of changes. With the development of higher magnetic field strength and newer pulse sequences like HASTE (Half Fourier Acquisition Single Shot Turbo Spin Echo) and RARE (Rapid Acquisition and Relaxation Enhancement), Magnetic Resonance Cholangiopancreatography with its inherent high contrast resolution, rapidity, multiplanar capability and virtually artifact-free display of anatomy and pathology, is proving to be imaging of choice in these patients. MRCP shows the entire biliary tract and pancreatic duct without any

intervention and use of oral or IV contrast. The quality of images obtained is comparable with those of direct cholangiography procedures like ERCP, which is considered as the standard of reference in ductal pathologies. The diagnostic accuracy of MRCP suggests that it has the potential to replace the more invasive procedures like diagnostic ERCP, which should be used only in cases where intervention is being contemplated. It has proved effective in demonstrating bile duct dilatation, stricture, and choledocholithiasis. In patients with malignant obstruction or stenosis of biliary enteric anastomosis, this non-invasive imaging technique demonstrates the site and extent of the stenosis, the degree of proximal dilatation, the presence and size of biliary stones

and associated findings. [3, 4] In this present study, we have prospectively studied patients by MR with MRCP and ultrasonography who were suffering from various diseases of the biliary tract and/or pancreas and tried to evaluate the efficacy of ultrasound in comparison with MR/MRCP.

Material and Methods

The present study was conducted in the Department of Radiodiagnosis, Prathima Institute of Medical Sciences, Naganur, Karimnagar. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study after explaining the nature of the study in their local language.

Patient preparation for Ultrasonography:

• All the patients were instructed to come with an empty stomach on the day of the procedure

• All patients are made to drink water just before the examination to have a better visualization of the pancreas and biliary tree.

Patient preparation for MRI with MRCP

• All the patients were instructed to fast for 6 hours prior to examination.

• All the metallic belongings removed prior to the examination.
• In a few uncooperative and critically ill patients, respiratory triggering was used.

All patients presenting with recurrent pancreatitis, hypochondriac pain, jaundice presenting to the radiology department are included in the present study. Patients with metallic implants, claustrophobia are excluded from the present study. Ultrasonography was performed using a Philips HD 15 and Philips affinity 70 machine. Both curvilinear and linear probes were used in the study. Images of the biliary tree were recorded for later review. MRI-MRCP was performed on Philips ACHIEVA 1.5 Tesla MRI Scanner. The patient was given concentrated pineapple juice or oral iron oxide prior to the scan. All images were obtained with breath-holding and parameters were individualized to optimize each for a suspended breath-hold of about 15s. All conventional sequences were acquired in the axial plane. Secretin is an endogenous hormone normally produced by the duodenum, which stimulates the exocrine secretion of the pancreas. When given as a synthetic agent intravenously (1 ml/10 kg body weight), it improves the visualization of the pancreatic duct by increasing its caliber. Pancreatic juice flows out of the major duodenal papilla to progressively fill the duodenum. We perform a thick slab MRCP in the coronal oblique plane at baseline and then at 1, 3, 5, 7, and 9 min following injection. Its effect starts almost immediately and peaks between 2 to 5 mins. By 10 min, the caliber of the main pancreatic duct should return to baseline with persistent dilatation of >3 mm considered abnormal. All the data was recorded in the MS Excel spreadsheet and analyzed by SPSS version 19 on the Windows platform.

Results

The youngest patient in our study was 7 yrs old and the oldest was 80 years. The mean age of patients with benign lesions was 33.72 years and that with malignant lesions was 54 years. Out of n=47 suspected benign lesions, n=7 cases were ruled out as normal on final tests/diagnosis. It is observed that majority i.e. 51.92 % of the patients with pancreaticobiliary pathologies were male. It is evident that there is male preponderance in hepatobiliary and pancreatic pathologies

Table 1: Table showing the age-wise distribution of hepatobiliary pathologies among the study population

Age	No of cases	Percentage %
<20	17	32.69
21-40	18	34.62
41-60	14	26.92
>60	3	5.77
Total	**52**	**100**

In this study, it is observed that the majority i.e. 34.62 % of the patients with pancreaticobiliary pathologies were between 21-40 years of age. The youngest patient was 7 years old with choledocholithiasis and the oldest is 80 yrs of age with benign CBD stricture. In this study, it is observed that the most common symptom of the presentation was epigastric pain. In the study, it was observed that the most common type of lesions is benign i.e. 76.92% of cases. Out of normal n=7 cases n=5 clinically suspected pancreatic divisum cases and n=2 clinically suspected Cholelithiasis cases were Normal based on final diagnosis and hence categorized under Normal (negative result).

Table 2: showing Nature of lesions (n=52) among study subjects

Diagnosis	No of cases	Percentage %
Benign	40	76.92
Normal (negative result)	7*	13.46
Malignant	5	9.62
Total	**52**	**100**

In the study, it was observed that the most common benign cause for obstructive biliopathy was Cholelithiasis–choledocholithiasis group (n=11, excluding 2 cases –ve for Cholelithiasis on final diagnosis) i.e. 23.403%. Most common among congenital anomalies are pancreatic divisum (n=6, excluding 5 cases –ve for pancreatic divisum on ERCP) corresponding to 12.77 % of total benign cases. It was observed that the most common cause among malignant pathologies was periampullary carcinoma (n=3) i.e. 60%.

Table 3: Distribution of benign pathologies and normal result cases among the study population (with respect to clinical suspicion and final diagnosis)

Pathologies		No of cases	Percentage %	
Congenital anomalies				
Choledochal cyst		2	4.255	
Pancreatic divisum	Positive result	6	12.77	23.408
	Negative result*	5	10.638	
Gb duplication		1	2.127	
Cholelithiasis-choledocholithiasis group				
Cholelithiasis	Positive result	5	10.638	18.493
	Negative result*	2	4.255	
Choledocholithiasis		2	4.255	
Cholelithiasis with choledocholithiasis		4	8.51	
Ductal Calculus				
Cystic duct calculus		2	4.255	
Pancreatic duct calculus		3	6.382	
Benign stricture		5	10.638	
Hydatid cyst with biliary compression		4	8.51	
Chronic pancreatitis		6	12.77	
Total		**47 (40+7)**	**100**	

The malignant lesions were common after 40 years of age i.e. in (n=4 out of n=5 cases) 80% of total malignant cases, 23.53% of cases in the age group. Benign lesions were most common in the age group 1-40 years i.e. n=27 cases, corresponding to 67.5% of total benign cases & 77.14% of cases in the age group.

Table 4: Table showing diagnostic indices of USG and MRCP in identifying suspected abnormalities compared to final diagnosis among study population (n=52) [Abnormal (positive) vs Normal (negative)]

		Final Diagnosis			P values
USG		Positive	Negative	Total	<0.034*
	Positive	36	3	39	
	Negative	9	4	13	
	Total	45	7	52	
		Final Diagnosis			**P values**
MRCP		Positive	Negative	Total	<0.001*
	Positive	45	0	45	
	Negative	0	7	7	
	Total	45	7	52	

In this study, n=13 subjects were clinically suspected to have cholelithiasis (n=7), choledocholithiasis (n=2), and both Cholelithiasis with choledocholithiasis (n=4). Ultrasonography was able to diagnose Cholelithiasis correctly in n=5 cases, choledocholithiasis in n=1 case, Cholelithiasis with choledocholithiasis in n=4 cases and rule out Cholelithiasis in n=2 cases, but failed to identify distal CBD calculus in n=1 case (choledocholithiasis) hence having a diagnostic accuracy of 92.31% for the cholelithiasis-choledocholithiasis group. In this study, n=13 subjects were suspected to have Cholelithiasis (n=7), choledocholithiasis (n=2) and Cholelithiasis with choledocholithiasis (n=4). MRCP was able to diagnose Cholelithiasis, choledocholithiasis, Cholelithiasis with choledocholithiasis cases correctly in n=11 cases, and rule out Cholelithiasis in n=2 cases. Hence having a diagnostic accuracy of 100 % for cholelithiasis and choledocholithiasis group n this study, n=11 subjects were suspected to have pancreatic divisum. Ultrasonography was able to diagnose acute pancreatitis due to pancreatic divisum in n=1 case correctly and rule out pathology in n=2 cases hence showing a sensitivity of 16.67% and diagnostic accuracy of 27.27 percent whereas MRCP was able to diagnose pancreatic divisum in n=6 cases and rule out pathology in n=5 cases with a diagnostic accuracy of 100%.

Discussion

Diagnosing patients with suspected hepatobiliary or pancreatic pathologies in their early stages is most important in patient care and management. Knowledge of the advantages and disadvantages of each technique are needed to determine the appropriate workup of patients with these pathologies. With the introduction of MR Cholangiopancreatography in addition toconventional MRI, diagnosing biliary and pancreatic ductal pathologies invasive procedures like ERCP can be avoided solely for the purpose of diagnosis. In our study, we have studied n=52 patients suffering from various causes of obstructive biliopathy. The mean age of patients with benign lesions in the present study was 33.72 years and for malignant lesions was 54 years which is similar to study by Attri et al; [5] for malignant lesions, in which the mean age for benign and malignant lesions were 50 years and 56.6 years. In the present study, it was observed that the most common type of lesions is benign i.e. 76.92% of cases. In other similar studies such as by Siddique et al; [6] Sharma et al; [7] Jiwani MS et al; [8] malignant lesions were more common than benign. Our study included n=5 Cholelithiasis cases, n=4 cholelithiasis with choledocholithiasis cases, n=2 choledocholithiasis cases, n=2 clinically suspected cholelithiasis cases which were ruled out as normal based on final diagnosis by ERCP/ preoperative findings (total n=13 suspected cases). USG was able to diagnose Cholelithiasis in all 9 cases and rule out Cholelithiasis in n=2 cases. It was able to identify choledocholithiasis in n=5 cases but failed to identify choledocholithiasis in n=1 case. MRCP was able to diagnose Cholelithiasis in all 9 cases and rule out Cholelithiasis in n=2 cases. It was also able to diagnose choledocholithiasis in all n=6 cases. USG was able to detect gall bladder calculi (Cholelithiasis) (n=9 cases; n=5 isolated Cholelithiasis cases, n=4 Cholelithiasis along with choledocholithiasis cases) in all of the cases with 100% accuracy. Our study is in concordance with DM Macintosh et al;[9] found that the overall accuracy of USG in detecting Cholelithiasis was 98.9%. Amandeep Singh et al; [10] found that sensitivity and diagnostic accuracy of USG in diagnosing choledocholithiasis was 93.3% and 96%. Varghese JC et al; [4] in their study Ultrasound showed sensitivity, specificity, and diagnostic accuracy of 38%, 100%, and 89%, respectively, in the diagnosis of choledocholithiasis. Hazem ZA et al; [11] on acute biliary pancreatitis and found that MRCP had 81 to 100%

sensitivity, 94% negative predictive value and 94% positive predictive value for detecting common bile duct stones and found MR cholangiopancreatography to be as accurate as contrast-enhanced CT in predicting the severity of pancreatitis and identifying pancreatic necrosis. This is in concordance with the present study, in which MRCP shows sensitivity and specificity of 100% each in detecting common bile duct stones. Thus MRCP can be recommended for the final diagnosis of the common bile duct and pancreatic duct stones in patients with positive B-mode ultrasonography results. Our study included n=9 positive pancreatic divisum cases, 2 clinically suspected cases of pancreatic divisum but ruled out as normal on ERCP, n=1 positive case of gallbladder duplication and n=2 positive cases of Choledochal cyst. USG was able to recognize a case of recurrent acute pancreatitis due to pancreatic divisum in one case, but it falsely identified the causes of n=3 cases of acute pancreatitis due to pancreatic divisum, which turned out to be normal on final diagnosis. It failed to diagnose pancreatic divisum in about n= 5 cases of recurrent pancreatitis.USG showed a sensitivity of 16.67% in diagnosing pancreatic divisum which is higher when compared to previous smaller studies which showed transabdominal ultrasound not significant when compared to endoscopic ultrasound. MRCP showed a sensitivity of 100 % for pancreatic divisum which is in concordance with Bhatt et al; [12] found 100% accuracy for MRCP in diagnosing anatomical variants. This study has limitations has as this study was not blinded; the clinical history and previous imaging findings of all patients were known. The reported data are relevant to the studied population, wherein some abnormalities were not represented.

Conclusion

Within the constraints of the present study, it was found that MR Cholangiopancreatography is very accurate in demonstrating calculi at the distal end of CBD as an area of the signal void, also in demonstrating strictures as the cause of dilatation of biliary radicals. It showed the length

of the stricture segment very well and differentiated stricture as malignant and benign. The benign strictures were smooth tapered margins, whereas in malignant strictures there was an abrupt and irregular character of the narrowed segment with or without shouldering. MRCP is superior to USG in this regard.

REFERENCES

1. Patrice M Bret et al. Pancreas divisum: Evaluation with MR Cholangiopancreatography. Radiology 1996;199:99-103.
2. Wallner BK, Schumacher K.A. Weidenmaier W. Fariedrich JM. Dilated biliary tract: evaluation with MR Cholangiography with a T2 weighted contrast-enhanced fast sequence. Radiology 1991; 181:805-808.
3. V David, C Reinhold, M Hochman, R Chuttani, J McKee et al. Pitfalls in the interpretation of MRCholangiopancreatography. AJR 1998;170:1055-59.
4. J.C. Varghese, RP Liddell, MA Farrell, FE Murray. H Osborne, MJ Lee. The Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography and Ultrasound compared with direct Cholangiography in the detection of Choledocholithiasis. Clinical Radiology 1999;54:604-614.
5. Attri A, Galhotra RD, Ahluwalia A, Saggar K. Obstructive jaundice: Its etiological spectrum and radiological evaluation by magnetic resonance cholangiopancreatography. Med J DY Patil Univ 2016;9:443-50.
6. Siddique K, Ali Q, Mirza S, Jamil A, Ehsan A, Latif S, et al. Evaluation of the aetiological spectrum of obstructive jaundice. J Ayub Med Coll Abbottabad 2008;20:62-66.
7. Sharma MP, Ahuja V. Aetiological spectrum of Obstructive jaundice and diagnostic ability of ultrasonography: a clinician's perspective. Trop Gastroenterol 1999 Oct-Dec;20(4):167-169.
8. Jiwani MS, Banode PJ, Kharche AD, Jiwani A A, Vaidhya SV. Role of Magnetic Resonance Cholangiopancreatographyin Cases of Obstructive Jaundice in Correlation with Ultrasonography. Int J Recent Surg Med Sci 2016;2(2):70-84.
9. McIntosh DM, Penney HF. Gray-scale ultrasonography as a screening procedure in the detection of gallbladder disease. Radiology 1980; 136:725-727.
10. 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. 2014;8(3):103-07.
11. Hazem ZA. Acute Biliary Pancreatitis: Diagnosis and Treatment. Saudi J Gastroenterol. 2009;15:147–155.
12. Bhatt C, Shah P.S, Prajapati H.J, et al. Comparison of Diagnostic Accuracy between USG and MRCP in Biliary and Pancreatic Pathology. Ind J Radiol Imag 2005;5:2:177-181.

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