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Original Research Article

Comparative study of diagnostic accuracy between magnetic resonance cholangiopancreatography (MRCP) and ultrasonography (USG) in patients suspected with pancreaticobiliary pathologies.

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Abstract:

Background: The aetiology & diagnosis of the pancreato-biliary ductal system diseases that cause symptoms such as obstructive jaundice is crucial for the best treatment approach. In the current study, we prospectively examined patients with various biliary tract and/or pancreatic illnesses using MRI with MRCP and USG in order to assess the effectiveness of MRI with MRCP as a preferred imaging modality.

Material and Methods: Present study was single-center, prospective, observational study, conducted in patients 20-70 years age, either gender, clinical history and laboratory criteria suggestive of having cholelithiasis or choledocholithiasis & findings of cholelithiasis or choledocholithiasis or dilated common bile duct on other imaging modalities especially ultrasound underwent further evaluation with MRCP.

Results: Among 65 patients, the majority were from the 21-40 and 41-60 age groups (33.8% each), females (78.5%) and had abdominal pain (90.77%), jaundice (41.54%), nausea/ vomiting (36.92%). USG detected 29.2% dilated IHBR pathologies, whereas 58.5% detected dilated IHBR pathologies with the help of the MRCP technique. Among pancreatico biliary pathologies, USG detected in pathologies such as gall bladder calculus (32.3%), CBD calculus (35.4%) & pancreatitis (15.4%). Among pancreatico biliary pathologies, MRCP were detected following pathologies as gall bladder calculus (35.4%), CBD Calculus (49.2%) and non-calculus (63.2%), pancreatitis (18.5%) and neoplastic changes in the pancreas (1.5%). MRCP had the highest area under the curve (AUC) of 0.942, whereas USG had 0.923 accuracies in the diagnosis of hepatobiliary and pancreatic pathologies.

Conclusion: When comparing MRCP to USG, MRCP had the highest sensitivity, AUC with Dilated IHBR, calculus, non-calculus gall bladder pathologies, calculus, non-calculus common bile duct pathologies, and pancreatic pathologies.

Keywords: pancreatico biliary pathologies, MRCP, USG, Dilated IHBR, gall bladder calculus.

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1. INTRODUCTION

The aetiology & diagnosis of the pancreato-biliary ductal system diseases that cause symptoms such as obstructive jaundice, are crucial for the best treatment approach. Imaging frequently needs a multimodality strategy to explore such a wide range of disorders. Currently, computed tomography (CT) is used in conjunction with ultrasonography (USG) as the initial screening method of choice for instances of suspected pancreato-biliary ductal disorders (CT). However, due to intestinal gas, food bolus in the duodenum, or adipose tissue covering the distal portion of the common bile duct (CBD), these methods have limited sensitivity in detecting calculi within the CBD. [1]

Intra-Venous Cholangiography (IVC), Endoscopic Retrograde Cholangio-Pancreatography (ERCP) and Percutaneous Transhepatic Cholangiography (PTC) are necessary for certain situations. IVC only plays a little part since, in 30–40% of instances, it results in partial opacification of the biliary system[2,3]. With a 1-4% sepsis rate, ERCP and PTC call for biliary intervention and the use of contrast agents[4].

Magnetic Resonance Cholangio-Pancreatography (MRCP) is useful for assessing pancreato-biliary ductal disorders since it's fast, precise, painless, sedation-free, operator-independent, radiation-free, and unaffected by intestinal gas, resulting in high- resolution pictures with no need for contrast.[5,6] In the current study, we prospectively examined patients with various biliary tract and/or pancreatic illnesses using MRI with MRCP and USG in order to assess the effectiveness of MRI with MRCP as a preferred imaging modality.

2. MATERIAL & METHOD

This was a prospective, single-center, observational investigation conducted in the Department of Radio diagnosis at Gajraj Raja Medical College in Gwalior, India. The study lasted for two years. (January 2020 to December 2021). The institution's ethics committee approved the study.

Patients 20-70 years age, either gender, clinical history and laboratory criteria suggestive of having cholelithiasis or choledocholithiasis & findings of cholelithiasis or choledocholithiasis or dilated common bile duct on other imaging modalities especially ultrasound underwent further evaluation with MRI, willing to participate in present study were included. However, patient not giving consent, patients who did not cooperating with study, claustrophobia, patients with metallic implants, pacemakers, prosthesis etc. and pregnant patients were excluded from the study.

Patients were informed of the study in their native language, and written consent was obtained for participation. Patient's demographic details, clinical history, examination findings, laboratory/diagnostic tests, upper gastroduodenal endoscopy findings and other appropriate investigations were all recorded. After proper preparation, USG abdomen was performed, followed by MRCP.

USG PROTOCOL - After a 6-hour fast and while in a variety of settings, patients were scanned using an ESAOTE S.P.A system (supine, left lateral, upright). A 3.5-4 MHz probe was used to conduct the initial subcostal examinations while the patient held their breath or between the 10th and 11th ribs while the patient was not holding their breath. All of the investigations used colour doppler imaging to tell portal branches apart from enlarged bile ducts. Diagnostic imaging for pancreatic biliary illness included transverse, longitudinal, and oblique scans of the upper abdomen.

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MRCP protocol - After a 4-hour fast, a phased-array body coil with 1.5-T Philips MRI equipment, we conducted MRCP. In the beginning, HASTE sequence was performed, followed by two 3D FSE sequences that are initiated by respiratory cycles in the coronal oblique plane. The final imaging plane was determined by two acquisitions, one oriented toward the common bile duct (CBD) near the head of the pancreas and the other oriented toward the pancreatic duct at an angle of about 90 degrees to the first imaging plane. In order to initiate an MRI scan, respiratory motion is detected with the help of an MR pre-pulse and a navigation sequence. The finished product was a stack of 40 uniform slices, each 1.5 mm thick. T2-weighting highlights the pancreatico-biliary tree while displaying neighbouring structures at a lesser signal level. Eighteen distinct MIP shapes, spaced equally at 10-degree intervals around a 360-degree ring, were produced as part of our routine operating procedure. Before and after intravenous contrast injection, 3D fat-suppressed T1-weighted GRE sequences can be used to examine the duct walls and any focal parenchymal disease.
Microsoft Excel was used to acquire and compile data, while version 23.0 of SPSS was used to analyse the data. Descriptive statistics were used for statistical analysis.

3. RESULTS

Sixty-five patients having pancreatic biliary pathologies patients visiting OPD were evaluated in this study. Out of 65 patients, the majority were from the 21-40 and 41-60 age groups (33.8% each), whereas the least number of patients was observed in the >60 age group (15.4%). 51 (78.5%) Females and 14 (21.5%) Males were observed in our study. Among patient's common symptoms observed were abdominal pain (90.77%), jaundice (41.54%), nausea/ vomiting (36.92%), fever (23.08%) & abdominal swelling (3.08%).

Table 1- General characteristics

	No. of patients	Percentage
Age groups (in years)		
<20	11	16.9
21-40	22	33.8
41-60	22	33.8
>60	10	15.4
Mean age (mean±SD)	40.78 ± 19.31	
Gender		
Female	51	78.5
Male	14	21.5
Symptoms		
Abdominal Pain	59	90.77
Jaundice	27	41.54
Nausea/ Vomiting	24	36.92
Abdominal swelling	2	3.08
Fever	15	23.08

Common pancreatico biliary pathologies observed on radio-imaging were dilated IHBR, gall bladder pathologies, CBD pathologies and pancreatic pathologies. USG detected 29.2% dilated IHBR pathologies, whereas 58.5% detected dilated IHBR pathologies with the help of MRCP technique. Among pancreatico biliary pathologies, USG detected pathologies such as gall bladder calculus (32.3%), CBD calculus (35.4%) & pancreatitis (15.4%).

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Among pancreatico biliary pathologies, MRCP were detected following pathologies as gall bladder calculus (35.4%), CBD Calculus (49.2%) and non-calculus (63.2%), pancreatitis (18.5%) and neoplastic changes in pancreas (1.5%).

Table 2: Pancreaticobiliary pathologies

		USG		MRCP	
	Variable	Frequency	%	Frequency	%
	Dilated IHBR	19	29.2%	38	58.5%
Gall bladder pathologies	Calculus	21	32.3%	23	35.4%
	Non-calculus	11	16.9%	15	23.1%
CBD pathologies	Calculus	23	35.4%	32	49.2%
	Non-calculus	13	20%	41	63.1%
Pancreatic pathologies	Pancreatitis	10	15.4%	12	18.5%
	Neoplastic	0	0%	1	1.5%

In the present study, 27.69 % of patients correctly identified with Dilated IHBR with the help of USG and MRCP, both technique.

Table 3: Dilated IHBR (MRCP)

		Dilated IHBR(MRCP)		Total
		Negative	Positive	
Dilated IHBR(USG)	Negative	26	19	45
	Positive	1	19	20
Total		27	38	65

In the present study, 30.77 % of patients correctly identified Calculus (Gall bladder Pathologies with the help of USG and MRCP technique.

Table 4: Calculus (Gall bladder pathologies (MRCP))

		Calculus Gall bladder Pathologies (MRCP)		Total
		Negative	Positive	
Calculus (Gall bladder Pathologies (USG))	Negative	41	3	44
	Positive	1	20	21
Total		42	23	65

In present study, 15.38 % patients were correctly identified Non-calculus (Gall bladder Pathologies with the help of USG and MRCP both the technique.

Table 5: Non-Calculus (Gall bladder pathologies (MRCP))

		Non-Calculus (Gall bladder Pathologies (MRCP))		
		Negative	Positive	Total
Non-Calculus (Gall bladder pathologies (USG))	Negative	49	5	54
	Positive	1	10	11
Total		50	15	65

In the present study, 33.85 % of patients correctly identified Calculus (CBD Pathologies with the help of USG and MRCP technique.

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Table 6: Calculus(CBD pathologies(MRCP))

		Calculus (CBD Pathologies (MRCP))		Total
		Negative	Positive	
Calculus (CBD Pathologies (USG))	Negative	32	10	42
	Positive	1	22	23
Total		33	32	65

In the present study, 9.23 % of patients correctly identified Non-calculus (CBD pathologies) with the help of USG and MRCP technique.

Table 7: Non calculus (CBD pathologies(MRCP))

		Non-calculus (CBD Pathologies (MRCP))		Total
		Negative	Positive	
Non-calculus (CBD Pathologies (USG))	Negative	22	30	52
	Positive	2	11	13
Total		24	41	65

In the present study, 33.85 % of patients correctly identified Calculus (CBD Pathologies (MRCP)) with the help of USG and MRCP technique.

Table 8: Pancreatitis (Pancreatic pathologies (MRCP))

		Pancreatitis (Pancreatic Pathologies (MRCP))		
		Negative	Positive	Total
Pancreatitis (Pancreatic Pathologies (USG))	Negative	52	3	55
	Positive	1	9	10
Total		53	12	65

4. DISCUSSION

Accurately diagnosing neoplasms (such as cholangiocarcinoma) and inflammatory disorders (like primary sclerosing cholangitis) is the most challenging aspect of pancreato-biliary ductal imaging for radiologists. [5] Tracking the radiological development of cases suspected of having pancreatic and hepatobiliary illnesses typically involves the use of ultrasound, computed tomography (CT), and endoscopic retrograde pancreatography (ERP). Abdominal USG is the preferred initial bile duct assessment technique in individuals with jaundice. Ultrasonography has drawbacks, particularly when used to assess distal CBD, where intestinal gas, duodenal debris, and obesity can all impair the image quality.[7]

A limited role for CT is also played in detecting biliary strictures and calculi. According to reports, the sensitivity of CT in identifying biliary calculi is only 90%.[1] A radiologic procedure called magnetic resonance cholangiopancreatography (MRCP) creates images of the pancreaticobiliary tree that resemble those acquired by invasive radiography techniques like endoscopic retrograde cholangiopancreatography (ERCP).

MRCP, a noninvasive, operator-independent method, can be helpful in assessing pancreaticobiliary diseases.[7] The fundamental tenet of MRCP is that background tissues appear black and bodily fluids, such as bile and pancreatic secretions, appear white on strongly T2-weighted magnetic resonance sequences because they have high signal

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intensities.[8] Marimoto introduced 3D SSFP sequences to enhance image quality. Recently, modified FSE sequences were introduced. RARE (Rapid Acquisition with Rapid Enhancement sequence) and HASTE are these (half Fourier acquisition single-shot turbo spin echo sequences). The optimal choalangiographic sequence for MRCP is, therefore a combination of HASTE & RARE, which requires only 10 minutes of imaging time.[9] Currently, the diagnostic accuracy of MRCP is considered to be equivalent to ERCP for a broad spectrum of benign and malignant pancreatic & biliary diseases.[10]

Out of 65 patients, 78.5% were female, whereas 21.5% were males. Prusty et al.,[11] found the mean age population as 45.2 years. In our study, the mean age of patients was also similar at 40.78 ± 19.31 years. Among 65 patients, the mean age of male patients was 39.07 ± 21.99 years, whereas the mean age of female patients was 41.25 ± 18.48 years. Similar findings were noted by Prusty et al.[11] In the present study, male/ female ratio was 1:3.64. Shukla et al.,[12], which had a male /female ratio of 1: 2.75.

We found 91% abdominal pain, 42% jaundice, 37% vomiting and nausea, 3% abdominal enlargement, and 23% fever in our study. We noticed the same outcomes in the study of Sonawane S et al.,[13]

In our study, the sensitivity of dilated IHBR was found to be 95% for MRCP and 50% for USG. C. Bhatt et al.[14] found no significant difference in the sensitivity and specificity of MRCP in detecting intrahepatic biliary strictures.

Our study results were comparable to the accuracy of MRCP, as evaluated by various authors. In our study, the sensitivity of MRCP was found to be 95.65 % for calculous (choledocholithiasis) and 84.62% for CBD non-calculous, while the sensitivity of USG was found to be 68.75% for calculous (choledocholithiasis) and 26.83% for CBD non-calculous. The overall sensitivity of various studies ranges between 74.6 and 90% for choledocholithiasis, 90 and 94% for CBD malignancy, 85 and 90% for strictures, and 90 and 96% for biliary dilatation.

In the present study, 36.92% had calculus gall bladder pathologies, whereas 24.62 % had non-calculous gallbladder pathologies in whom MRCP sensitivity and specificity were 95.24% and 93.18%, while the sensitivity of USG was found to be 86.96% for calculus gall bladder pathologies and 66.67% for non-calculous gall bladder pathologies. According to Calvo MM[15], the sensitivity of MRCP in detecting cholelithiasis was 97.7%, which is comparable with the results of our study. On MRCP, stones were seen as filling defects in the gall bladder.

Pancreatic dilatation was detected in 14 patients. The sensitivity and specificity of MRCP in diagnosing pancreatic duct dilatation in our study were 90% and 94.55%, while the sensitivity of USG was found to be 75% for pancreatitis pathologies. Meng Z said that MRCP had a sensitivity of 72.7% for finding pancreatic duct dilatation.[16] However, neoplastic pancreatic pathologies are detected only by the MRCP technique.

The first line of treatment for biliary obstruction is USG, although MRCP provides a more accurate diagnosis with fewer false positives. The inherent shortcomings and limits of USG compromise diagnostic accuracy in lower CBD blockages. The diagnosis of CBD and pancreatic duct diseases is substantially more precise using MRCP, and it aids in making therapeutic decisions. It directs the surgeon performing ERCP, lowering the rate of "negative" ERCP.[17] In patients with suspected biliary obstruction, MRCP has revealed results that are comparable to those of ERCP. The best diagnostic method for individuals in whom an endoscopic treatment is not feasible (prior partial gastrectomy, biliary enteric anastomosis, etc.) is MRCP.[18]

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MRCP It accurately describes the illness's nature (infection, tumour, calculus and others), with the location and degree of involvement pointing to the pathology's type. It aids in directing the biopsy and drainage operations, recommending the type of therapy (medical or surgical), and gauging the effectiveness of that therapy. In our research, MRCP had the highest area under the curve (AUC) of 0.942, whereas USG had 0.923 accuracy accuracies in the diagnosis of hepatobiliary and pancreatic pathologies. Therefore, early detection of acute pancreatitis, chronic pancreatitis, benign and malignant pancreatico biliary pathologies related patients with the help of MRCP technique which is cost effective as well as noninvasive modality.

5. CONCLUSION

When comparing MRCP to USG, MRCP had the highest sensitivity, AUC with Dilated IHBR, calculus, non-calculus gall bladder pathologies, calculus, non-calculus common bile duct pathologies, and pancreatic pathologies. MRCP is preferred over USG as it offers detailed pictures of the biliary tree & MRCP is very good at finding fluid collections in the pancreatic area.

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