

Assessment of the efficacy of Magnetic Resonance Cholangiopancreatography (MRCP) and Ultrasonography (USG) in detection and characterization in patients suspected with pancreatic and biliary disorder: A comparative study

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Abstract

Aim: To compare the diagnostic accuracy of Magnetic Resonance Cholangiopancreatography (MRCP) with Ultrasound and Computed Tomography (CT) in evaluation of patients with obstructive jaundice.

Methodology: This study was conducted in the Department of Radio Diagnosis, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana for the period of 1 year 3 months. Total 60 patients clinically diagnosed as suffering from obstructive jaundice and having total Bilirubin greater than 5mg/dl were included in this study. Patients who were pregnant and claustrophobic were not included in this study. All the patients were instructed to fast overnight prior to examination. Renal functional status, clinical history of all the patients was noted before undergoing contrast CT. All the patients in the study underwent USG examination first followed by MRCP and finally CT. Both curvilinear and linear probes were used in the study. Images of the biliary tree were recorded for later review. Helical CT was performed on a Philips Ingenuity 128CT Scanner. MRCP was performed on Achieva, Philips Medical System, The Netherlands 1.5 Tesla MRI Scanner. All images were obtained with breath holding and parameters were individualized.

Results: Of 60 patients, 16 (26.7%) patients were ≤ 45 years and 44 (73.3%) were > 45 years. 32 (53.3%) cases were males and 28 (46.7%) were females. There were 37 (61.7%) patients with ≤ 40 days of duration of symptoms and 23 (38.3%) patients with > 40 days of duration of symptoms. In causes of obstruction, choledocholithiasis was responsible for 19 (31.7%), stricture 16 (26.7%), carcinoma of head of pancreas 11 (18.3%), gallbladder carcinoma 6 (10%), periampullary carcinoma 5 (8.3%) and cholangiocarcinoma in 3 (5%) of the cases. Taking MRCP as gold standard, 100% (60 cases) had obstructive jaundice. Whereas 56.7% (34 cases) were diagnosed correctly using USG and 86.7% (52 cases) were diagnosed correctly using CT. The sensitivity of MRCP is 94% and CT is 92%, while it is 100% for USG. In spite of the high sensitivity for USG, the specificity for the same is very low at 70% when compared to that of CT's 72% and MRCP's 100%.

Conclusion: The only drawback of MRCP is the cost involved and the availability. From this study, it is recommended that helical CT can be used as a screening imaging technique to

identify the presence or absence of intrahepatic biliary duct dilatation; thereby shortlisting the patients for MRCP examination.

Keywords: Magnetic Resonance Cholangiopancreatography (MRCP), Ultrasonography (USG), Computed tomography (CT), choledocholithiasis

Introduction

One of the most common and serious types of hepatobiliary illness is obstructive jaundice. For instance, intrahepatic cholestasis ^[1] can be difficult to diagnose and treat. When conjugated bilirubin cannot leave liver cells and enter the intestine, a condition known as obstructive jaundice develops ^[2]. Obstructive jaundice occurs when the pancreatobiliary system becomes blocked. Because of its prevalence in the clinical setting, rapid diagnosis is essential for effective treatment and the avoidance of consequences. Researchers found that blockage was the underlying cause of jaundice in 17.1% of patients ^[3].

In spite of scientific breakthroughs, the surgical methods of treating obstructive jaundice were linked to extremely high rates of morbidity and mortality. However, in the recent decade, much progress has been achieved in our understanding of the pathophysiology, diagnosis, staging, and effective management of obstructive jaundice ^[4]. Due to the widening range of treatment options for jaundice, radiologists are now expected to perform more than only rule out obstructive jaundice. A correct evaluation of disease origin, site, severity, and extent is usually necessary before selecting an appropriate treatment ^[5].

Magnetic resonance Cholangiopancreatography, also known as MRCP, is a noninvasive imaging investigation that plays a primary role in the diagnostic process and therapeutic operative planning of obstructive jaundice ^[6-9]. It is also an important part of the preoperative evaluation of patients who have obstructive jaundice.

Because of this, it is imperative to determine pre-operatively the existence, nature, and location of the obstruction. This is due to the fact that an inappropriate therapeutic strategy can be risky. To confirm or rule out duct obstruction as a first modality, which it does with an accuracy of at least 90% ^[10], ultrasound is the diagnostic tool of choice. The MRCP ^[11] has contributed to a certain degree to the narrowing of the scope of applicability for CT. MRCP techniques have come a long way in recent years, and now they can produce high-resolution images of the biliary tree in a relatively short amount of time, while also staying non-invasive and not requiring the injection of contrast material ^[12].

Materials and Methods

This study was conducted in the Department of Radio Diagnosis, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana for the period of 1 year 3 months. Total 60 patients clinically diagnosed as suffering from obstructive jaundice and having total Bilirubin greater than 5mg/dl were included in this study. Patients who were pregnant and claustrophobic were not included in this study.

Methodology

All the patients were instructed to fast overnight prior to examination. Renal functional status, clinical history of all the patients was noted before undergoing contrast CT. All the patients in the study underwent USG examination first followed by MRCP and finally CT. Both curvilinear and linear probes were used in the study. Images of the biliary tree were recorded for later review. Helical CT was performed on a Philips Ingenuity 128 CT Scanner. Unenhanced CT with 7 mm collimation of the upper abdomen was performed. Contrast (100

ml, 300mg I/ml) was then injected intravenously. The scans were taken from diaphragm to iliac crest on 5mm collimation, 2mm reconstruction interval, pitch of 1.5, and FOV of 30-40 cms. The images were reformatted up to smaller intervals. MRCP was performed on Achieva, Philips Medical System, The Netherlands 1.5 Tesla MRI Scanner. All images were obtained with breath holding and parameters were individualized. Detailed parameters of each sequence are summarized and analyzed.

Results

Of 60 patients, 16 (26.7%) patients were ≤ 45 years and 44 (73.3%) were >45 years. 32 (53.3%) cases were males and 28 (46.7%) were females. There were 37 (61.7%) patients with ≤ 40 days of duration of symptoms and 23 (38.3%) patients with >40 days of duration of symptoms. In causes of obstruction, choledocholithiasis was responsible for 19 (31.7%), stricture 16 (26.7%), carcinoma of head of pancreas 11 (18.3%), gallbladder carcinoma 6 (10%), periampullary carcinoma 5 (8.3%), and cholangiocarcinoma in 3 (5%) of the cases.

Table 1: Demographic details and causes of obstruction

Variables	Number (n=60)	%	
Age	≤ 45	16	26.7
	>45	44	73.3
Gender	Male	32	53.3
	Female	28	46.7
Duration of symptoms (in days)	≤ 40	37	61.7
	>40	23	38.3
Causes of obstruction	Choledocholithiasis	19	31.7
	Stricture	16	26.7
	Carcinoma of head of pancreas	11	18.3
	Gall bladder carcinoma	6	10
	Periampullary carcinoma	5	8.3
	Cholangiocarcinoma	3	5

Taking MRCP as gold standard, 100% (60 cases) had obstructive jaundice. Whereas 56.7% (34 cases) were diagnosed correctly using USG and 86.7% (52 cases) were diagnosed correctly using CT.

Table 2: Number of cases diagnosed with obstructive jaundice through different modalities

Modality	Number of cases diagnosed correctly	%
Ultrasonography	34	56.7
CT	52	86.7
MRCP	60	100
Total	60	100

MRCP has the highest accuracy for detecting benign lesions followed by CT and USG. The sensitivity of MRCP is 94% and CT is 92%, while it is 100% for USG. In spite of the high sensitivity for USG, the specificity for the same is very low at 70% when compared to that of CT's 72% and MRCP's 100%.

Table 3: Comparison of diagnostic values of USG, CT and MRCP in cases of obstructive jaundice

Modality	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
USG	100	70	60	98	68
CT	92	72	78	94	80

MRCP	94	100	100	96	100
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Discussion

With the advent of MRCP, a relatively recent MR imaging method, it is now possible to accurately and noninvasively visualise the biliary tree and pancreatic duct without the use of radiation or contrast material ^[13, 14]. The method was first presented by Wallner *et al.* in 1991. T2-weighted image sequences are used extensively for this purpose because they show water at rest as a strong signal. The Effect of Magnetism on a Magnetic Recording Cholangiopancreatography is emerging as the imaging modality of choice in these patients ^[16, 17] due to its high contrast resolution, quick acquisition, multiplanar capabilities and nearly artefact free depiction of anatomy and disease. MRCP can visualise the whole biliary tree and pancreatic duct without requiring any invasive procedures or intravenous (IV) contrast. The resulting images are on par with those produced from direct cholangiography procedures such as ERCP, the gold standard for ductal abnormalities. With its high likelihood of correct diagnosis, MRCP may one day replace diagnostic ERCP, which should only be performed when intervention is being considered ^[18-20].

Improved high resolution radiological equipment and improved imaging techniques performed by an experienced radiologist provide effective means for diagnosing the etiology of obstructive jaundice. Imaging modalities such as ultrasound, CT, MRI, direct cholangiography and invasive methods such as ERCP can help diagnose the cause of obstructive jaundice as well as identify the level of obstruction ^[21, 22]. Ultrasound has always been used as initial screening method. Many advantages of this technique are present. It is a cost effective and non-invasive modality that is available easily. Most important advantage is its lack of ionizing radiation ^[23, 24].

In our study, the sensitivity of MRCP is 94% and CT is 92%, while it is 100% for USG. In spite of the high sensitivity for USG, the specificity for the same is very low at 70% when compared to that of CT's 72% and MRCP's 100%. Todua *et al.*, ^[25] has mentioned that for choledocholithiasis, CT is similar to ultrasound, with a sensitivity range of 23% to 85% and specificity of 97%. Present study showed similar results. MRCP diagnostic accuracy, sensitivity and specificity are comparable to those reported in the literature (Huassein *et al.*, ^[26], Varghese *et al.*, ^[27]) where sensitivity, specificity and diagnostic accuracy respectively range between 81-100%, 84-100% and 90-96%. Study conducted by Al-Obaidi *et al.*, ^[28] showed higher sensitivity (100%), specificity (98.5%), and accuracy (98.7%) of MRI/MRCP for cases with benign stricture as compared to sensitivity of USG (44.4%) which is consistent with present study.

Andersson M *et al.*, ^[29] concluded in their study that MRI with MRCP was more accurate than CT in differentiating between malignant and benign lesions in patients with suspected periampullary tumors. This is consistent with present study where MRI/MRCP showed 100% accuracy in diagnosing cases with periampullary carcinoma. Verma *et al.*, ^[30] demonstrated the sensitivity and specificity of 85.3% and 88.4% on ultrasound, 84.6% and 94.2% on CT, 92.3% and 86% on MRCP for detecting the benign etiology of obstruction. Ferrari FS *et al.*, ^[31] demonstrated similar findings for benign lesions in their study. The diagnostic accuracy, sensitivity and specificity of USG was 78.62%, 16.67% 97.29%, of CT it was 92.59%, 92.3%, 92.85% and of MRCP was 93.13%, 90%, 94% respectively.

Conclusion

The only two disadvantages of MRCP are the associated costs and the limited availability. As a result of this study, it is proposed that helical CT can be utilized as a screening imaging technique to determine the presence or absence of intrahepatic biliary channel dilatation; this will select the patients who will need to have MRCP test.

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