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To establish the accuracy of MRCP over USG & CT in diagnosing the case of obstructive Jaundice with radiological study

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Abstract
Aim: The aim of the radiological Study to Establish the Accuracy of MRCP over USG & CT in Diagnosing the Case of Obstructive Jaundice.
Methods: Fifty patients clinically diagnosed as suffering from obstructive jaundice and total Bilirubin greater than 5mg/dl were included in this study. All the patients in the study underwent USG examination first followed by MRCP and finally CT.
Results: The 100, 43 patients had benign lesions while 57 patients had malignant lesions. While MRCP and CT had diagnosed 95 lesions, USG could diagnose all the benign lesions. However USG had diagnosed several of the malignant lesions as benign. MRCP has 99% accuracy in detecting the site of obstruction followed by CT and USG. The sensitivity of MRCP and CT is the same for both modalities while it is 99% for USG. Inspite of the high sensitivity for USG, the specificity for the same is very low at 72% when compared to that of CT's 72% and MRCP's 97%. MRCP is again the most accurate investigation with an accuracy upto 99%. The sensitivity and specificity of MRCP is high making it more accurate while USG and CT have high sensitivity their specificities are low. The MRCP has the largest area among the three investigations, proving it to be the most efficient investigation in the detection of malignant lesions. The p value again is >0.05 making it significant. Thus MRCP is statistically more significant CT and USG in the diagnosis of obstructive jaundice.
Conclusion: We concluded that, in the diagnosis of obstructive jaundice and to know the cause, site and extent of the lesion MRCP being a non-invasive, non-ionizing procedure seems to be a better choice over other radiological procedures like USG, CT or ERCP.

Keywords: MRCP, USG & CT in diagnosing, Jaundice, radiological study, Obstructive jaundice

Introduction

Obstructive jaundice is one of the most frequent and grave form of hepatobiliary disease. It can pose problems in diagnosis and management, particularly intrahepatic cholestasis [1]. Despite the technical advances, the operative modes of management of obstructive jaundice were associated with very high morbidity and mortality. Yet, during the last decade significant advances have been made in our understanding with regard to the pathogenesis, diagnosis, staging and the efficacy of management of obstructive jaundice [2]. The expanding spectrum of therapeutic options for the jaundiced patient has made it necessary for the radiologist to do more than simply discriminating between obstructive and non-obstructive jaundice. Correct choices among therapeutic options usually rest upon a precise assessment of etiology, location, level and extent of disease [3].

So, it is mandatory to determine pre-operatively the existence, the nature and site of obstruction because an ill chosen therapeutic approach can be dangerous. US has been always considered the first choice technique in the study of biliary obstructive disease, due to its accessibility, speed, ease of performance and low cost [4]. Traditional Computed Tomography (CT) scan is usually considered more accurate than US for helping determine the specific cause and level of obstruction [5]. Both ultrasound and CT scan are regarded as safe and non-invasive procedures in evaluating the status of the biliary tract. Ultrasound is used as an initial modality to confirm or exclude duct obstruction, which it does with at least 90% accuracy [6]. The range of application of CT has been partially restricted by MRCP. MRCP techniques have greatly evolved, providing high Section resolution images of the biliary tree with short exam duration, while remaining non-invasive without contrast medium

Injection [7].
Ultrasonography and CT are non-invasive, they have their drawbacks as well. USG is ineffective in accurately diagnosing the site of obstruction in most cases. CT has an increased risk of radiation and is also not sufficiently sensitive for detecting stones. ERCP and PTC are complicated procedures and require technical expertise and contrast media. Also several complications from the procedure may arise [8].

Materials and methods

A cross-sectional prospective study was conducted in the Department of Radiology after taking the approval of the protocol review committee and institutional ethics committee. After taking informed consent detailed history was taken from the patient or the relatives. The technique, risks, benefits, results and associated complications of the procedure were discussed with all patients.

Inclusion criteria

100 patients clinically diagnosed as suffering from obstructive jaundice and total Bilirubin greater than 5mg/dl were included in this study.

Exclusion criteria

Patients with claustrophobia, renal insufficiency, Pregnancy, MR incompatibility were excluded from this study.

Procedure: All the patients in the study underwent USG examination first followed by MRCP and finally CT. All the patients in the study underwent USG examination first followed by MRCP and finally CT. USG was performed using a GE Healthcare Voluson 730 pro equipment. 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 GE Healthcare Hi-Speed CTe Dual CT Scanner. Unenhanced CT with 7mm 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 Philips Healthcare Intera 1.5 Tesla MRI Scanner.
The following Parameters were studied for MRCP- Level of obstruction (four Anatomical Segments), Hepatic, Suprapancreatic, Pancreatic, Ampullary, Presence of bile duct calculi, non-visualized, definitely visualized.
MRCP, CT and USG scans were analyzed separately in a blinded fashion without knowledge of the results of other examinations, or of clinical findings. Final diagnosis was established with per operative or histopathological correlation. Probably benign lesions were considered as benign and similarly probably malignant lesions were considered as malignant.

Results

This study was conducted to establish the superiority of MRCP when compared to CT & USG in the evaluation of obstructive jaundice. A total of 100 patients were included in the study. Of the 100, 43 patients had benign lesions while 57 patients had malignant lesions. While MRCP and CT had diagnosed 95 lesions, USG could diagnose all the benign lesions. However USG had diagnosed several of the malignant lesions as benign.

Table 1: Gender distribution of patients

Gender	Number of patients	Percentage %
Female	37	37
Male	63	63

Table 2: Site of Obstruction in patients

Modality	No of cases detected correctly = 100	Percentage %
Ultrasonography	57	57
Helical CT	95	95
MRCP	99	99

MRCP has 99% accuracy in detecting the site of obstruction followed by CT and USG [Table 2].

Table 3: Comparison of diagnostic values of USG, Helical CT and MRCP in benign causes of Obstructive Jaundice.

Modality	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
USG	99	72	66	100	72
CT	93	72	82	95	88
MRCP	93	97	99	97	97

From the above [Table 3] it is inferred that MRCP has the highest accuracy for detecting benign lesions followed by CT and USG. The sensitivity of MRCP and CT is the same for both modalities while it is 99% for USG.
Inspite of the high sensitivity for USG, the specificity for the same is very low at 72% when compared to that of CT's 72% and MRCP's 97%. Thus USG is a very good screening tool for benign lesions for obstructive jaundice while CT and MRCP are the specific investigations.
MRCP is the most sensitive and specific investigation. The p value is also <0.05 making MRCP statistically better investigation than CT and USG in detecting benign lesions.

Table 4: Comparison of diagnostic values of USG, Helical CT and MRCP in malignant causes of Obstructive Jaundice.

Modality	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
USG	74	99	99	65	71
CT	74	93	89	75	85
MRCP	99	97	97	99	99

The above [Table 4] suggests that MRCP is again the most accurate investigation with an accuracy upto 99%. The sensitivity and specificity of MRCP is high making it more accurate while USG and CT have high sensitivity their

specificities are low. The MRCP has the largest area among the three investigations, proving it to be the most efficient investigation in the detection of malignant lesions. The p value again is >0.05 making it significant. Thus MRCP is statistically more significant CT and USG in the diagnosis of obstructive jaundice.

Discussion

With the introduction of MRCP for diagnosing the biliary and pancreatic ductal pathologies, invasive procedure such as ERCP can be avoided. MRCP is used as a second line investigation following USG in patients with obstructive jaundice.

USG was done prior to MRCP and CT for all patients. While USG all lesions with cholelithiasis, it had difficulty in diagnosing distal CBD calculi in about 3 patients which was easily picked up by MRCP [9, 10]. Our study is in concordance with Hiroyuki Irie *et al.* [10]. In their study they found an accuracy of 100% in detecting CBD calculi on MRCP in cases with equivocal sonographic and CT results. Of the eight patients diagnosed with CBD and GB calculi both MRCP and CT had accurately diagnosed all the eight cases. MRCP showed calculus region as an area of signal void and CT showed it as hyper dense lesion. Our study is in concordance with Soto *et al.* [10]. In their study they found, sensitivity of 94% and specificity of 100% for detecting bilary calculi in MRCP57. Regan *et al.* [12]. In their study they found the sensitivity of diagnosing CBD calculus was 87% and our study showed that CT is more superior to their study. Van Hoe *et al.* [13] in prospective study of 15 patients with bile duct obstruction with various radiologic modalities, were compared for their capability to demonstrate the level and cause of obstruction, and found that USG appears to be the single most useful modality in evaluation of bile duct obstruction, compared to CT & Direct cholangiography. Robert N. *et al.*, [14] in her study of 35 patients with obstructive jaundice using ISG concluded that USG had a sensitivity of 85% in finding the site of obstruction. USG being a simple, safe and non-invasive tool, it can be used in the first line of investigation in patients with obstructive jaundice. Threasa H [15]. Have analyzed the role of USG in the detection, characterization and staging of Cholangiocarcinoma and have concluded that in well trained hands, with high resolution equipments it is possible to detect and characterize this rare tumor using USG as sensitively as with other radiological modalities. Cesar S *et al.*, [16]. have analyzed 14 patients with obstructive jaundice using 3D USG. The level of obstruction was correctly depicted in all patients, and a dilated common bile duct, common hepatic duct, gallbladder, and main intrahepatic ducts were well visualized on minimum transparent mode images. The findings on minimum transparent mode images were well correlated with those on cholangiography; however, the perspective of the whole biliary tree on minimum transparent mode images was inferior to that on cholangiography in all cases. Though USG is a very effective modality in the screening of obstructive jaundice its specificity seems to be low in many studies. CT as a modality of choice for obstructive jaundice was investigated by several researchers. In a study conducted by Cesar *et al.*, [16] in evaluating the site of obstruction with CT the results were accurate and comparable to that of direct cholangiography. Another study was conducted to analyze biliary obstruction proximal to the pancreatic segment with CT. They concluded that CT is the most valuable as a non-invasive means of narrating surgical or radiologic drainage procedure in patients with biliary obstruction [17]. As CT was becoming popular MR Cholangiography was introduced by Matthew A [18]. Some authors used the rapid sequence gradient echo acquisition with three-dimensional post processing technique to evaluate the biliary system in five healthy volunteers and 13 patients of obstructive jaundice. The results were compared with other imaging modalities (US, CT scan and conventional radiographs obtained during PTC or ERCP). Authors concluded that MRCP has the capability for non-invasive imaging of the biliary tree in patients with obstructive jaundice but improvement in technique is needed to overcome limited spatial resolution and low signal to noise ratio. 3D MR cholangiography using contrast enhanced Fourier acquired steady state technique (CE-FAST) was evaluated in 12 patients with malignancy related obstructive jaundice and the results were correlated with percutaneous trans hepatic biliary drainage performed 0-21 days later. Authors found dilatation and obstruction of the bile ducts were clearly demonstrated in all patients on MRCP and there was 100% correlation with PTBD gram. We concluded that though spatial resolution of 3D MR cholangiography is slightly inferior to the direct cholangiography the information obtained is similar to PTC and the non-invasive MR Cholangiography procedure is less traumatic for the patient [11]. The initial results with MR Cholangiopancreatography studies were achieved with gradient echo sequences by using a steady-state free precession techniques [19] Subsequently, MR Cholangiopancreatography studies were performed with fast or turbo spin echo pulse sequence (FSE). These sequences were not only slow and required longer scan time for adequate spatial resolution but were also prone to motion induced artifacts and signal loss. The latest imaging techniques for MRCP are Rapid Acquisition with relaxation Enhancement (RARE) and Half-Fourier Acquisition Single-Shot Turbo-Spin-Echo (HASTE) [20]. Using RARE and HASTE sequences, image acquisition is possible within a few seconds, allowing MRCP to be performed comfortably during a single breath hold thus markedly reducing the motion artifacts and improving the quality of images. After the introduction of MRCP several studies were performed to compare the efficacy of MRCP with various other radiological modalities.

Conclusion

We concluded that, In the diagnosis of obstructive jaundice and to know the cause, site and extent of the lesion MRCP being a non-invasive, non-ionizing procedure seems to be a better choice over other radiological procedures like USG, CT or ERCP.

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