The Radiological Assessment to Determine the MRCP's Accuracy over USG and CT in Diagnosing the Patients Suffering from Obstructive Jaundice

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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:** A cross-sectional prospective study was conducted in the Department of Radiology, Narayan medical college & Hospital, Jamuhar, Sasaram, Bihar, India, for 15 months. 50 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:** Of the 50, seventeen patients had benign lesions while 26 patients had malignant lesions. While MRCP and CT had diagnosed 48 of the seventeen lesions, USG could diagnose all the benign lesions. However, USG had diagnosed several of the malignant lesions as benign. MRCP has 98% 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 98%forUSG. In spite of the high sensitivity for USG, the specificity for the same is very low at 64% when compared to that of CT's 64% and MRCP's 98%. Thus, USG is a very good screening tool for benign lesions for obstructive jaundice while CT and MRCP are the specific investigations. The MRCP is again the most accurate investigation with an accuracy up to 98%. 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. **Conclusion:** 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: Obstructive Jaundice, USG, CT, ERCP

Introduction

Obstructive jaundice is one of the widespread clinical problems which has increased incidence of mortality and morbidity. Intra hepatic and extra hepatic obstruction in 90% of patients, can be made out through suitable clinical data but

the cause and site of obstruction is diagnosed mostly by imaging modalities. The main aim of any imaging modality in obstructive jaundice is to identify the presence of obstruction, its location, extent, possible etiology. 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[1,2]. The commonly used imaging modalities include Ultrasonography (USG), Computed Tomography (CT), Endoscopic Retrograde Cholangiopancreatography (ERCP) and Magnetic Resonance Cholangiopancreatography (MRCP). Percutaneous Trans hepatic Cholangiography (PTC) is used for drainage procedures[3]. Radiological imaging is vital in making a decision in management of patients with Obstructive Jaundice. Imaging choices available in diagnosing acute pancreatitis include USG, computed tomography (CT), Magnetic Resonance imaging (MRI), MRCP and ERCP. The choice depends upon the reason for investigation[4]. Magnetic Resonance Cholangiopancreatography with its inherent high contrast resolution, rapidity, multiplanar capability and virtually artefact free display of anatomy and pathology, is proving to be imaging of choice in these patients. The quality of images obtained is comparable with those of direct cholangiography procedure like ERCP, which is considered as standard of reference in ductal pathologies. It has proved effective in demonstrating bile duct dilatation, stricture and Choledocholithiasis. The initial results with MR cholangio pancreatography studies were achieved with gradient echo sequences by using a steady-state free precession technique. The latest imaging techniques for MRCP are Rapid Acquisition with relaxation Enhancement (RARE) and Half-Fourier Acquisition

Single-Shot Turbos spin-Echo (HASTE)[5,6]. Though 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[7].

Materials and methods

A cross-sectional prospective study was conducted in the Department of Radiology, Narayan medical college & Hospital, Jamuhar, Sasaram, Bihar, India, for 15 months. After taking the approval of the protocol review committee and institutional ethics committee. 50 patients clinically diagnosed as suffering from obstructive jaundice and total Bilirubin greater than 5mg/dl were included in this study. 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 Affinity 70-Phillips. Both curvilinear and linear probes were used in the study. Images of the biliary tree were recorded for later review. 16 slice CT Scan Somatom Emotion, Siemens. Unenhanced CT with 7 mm collimation of the upper abdomen was performed. Contrast (100 ml, 300 mgI/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 Siemens 1.5 Tesla MRI MAGNETOM

ESSENZA. The following Parameters were studied for MRCP-Level of obstruction (four Anatomical Segments), Hepatic, Supra pancreatic, 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 preoperative or histopathological correlation. Among these twenty-six patients underwent surgery; five patients underwent cytology and remaining with other modalities of investigation. 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 50 patients were included in the study.

of the 50, seventeen patients had benign lesions while 26 patients had malignant lesions. While MRCP and CT had diagnosed 48 of the seventeen lesions, USG could diagnose all the benign lesions. However, USG ha diagnosed several of the malignant lesions as benign.

Table1: Site of Obstruction in the studied population

Modality	No of Cases Detected Correctly=50	Percentage%
Ultrasonography	27	54
Helical CT	43	86
MRCP	49	98

MRCP has 98% accuracy in detecting the site of obstruction followed by CT and USG (Table1).

Table2: Comparison of diagnostic values of USG, Helical CT and MRCP in benign causes of Obstructive Jaundice

Modality	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
USG	100	70	64	100	70
CT	92	70	80	94	86
MRCP	92	98	98	96	96

From the above (Table 2) 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 98% for USG.

In spite of the high sensitivity for USG, the specificity for the same is very low at 64% when compared to that of CT's 64% and MRCP's 98%. Thus, USG is a very good

screening tool for benign lesions for obstructive jaundice while CT and MRCP are the specific investigations.

From the above ROC curve, we infer that MRCP has the largest area proving that 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.

Table3: 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	72	98	98	64	70
CT	72	92	90	74	84
MRCP	98	96	96	98	98

The above [Table 3] suggests that MRCP is again the most accurate investigation with accuracy up to 98%. 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.

Discussion

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[8,9]. Our study is in concordance with Hiroyuki Irie et al[9] 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 hyperdense 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 biliary calculi in MRCP57. Regan et al[11]. 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,[12] 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,[13] 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.[14] 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,[15] 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,[15] 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[16]. As CT was becoming popular MR Cholangiography was introduced by Matthew A.[17] 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. Authors concluded that though spatial resolution of 3D MR cholangiography is slightly inferior to the direct cholangiogrpahy the information obtained is similar to PTC and the non-invasive MR Cholangiography procedure is less traumatic for the patient[10]. The initial results with MR cholangiopancreatography studies were achieved with gradient echo sequences by using a steady-state free precession techniques[18]. 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)[19]. 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. The results and the conclusions of these studies are enumerated below. Considering few limitations of Helical CT and USG and

invasiveness and complications of ERCP, MRCP alone can become the imaging modality of choice in imaging patients with obstructive jaundice, and it becomes still more superior on adding conventional MRI sections to it because, it is Non-Invasive imaging modality. No-Ionising radiation needed. No need of contrast media. Multiplanar imaging capability. Non-operator dependant. No post procedure complications. It can show biliary tract proximal as well as distal to obstruction. Like all investigations MRCP also has a few limitations. It cannot be used for patients with metallic implants or pacemakers or patients having claustrophobia. It cannot provide therapeutic options like ERCP.

Conclusion

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. The only drawback of MRCP is the cost involved and the availability.

Reference

1. Honickman SP, Mueller PR, Witternberg J, Simeone JF, Ferrucci JT, Cronan JJ, Van Sonnenberg E. Ultrasound in obstructive jaundice: prospective evaluation of site and cause. Radiology. May 1983;147(1):811–15.
2. Suraj Sonawane, Sachin Bagale, Sunil Patil. MRCP – a problem solving diagnostic tool in pancreaticobiliary pathologies. International Journal of Contemporary Medicine Surgery and Radiology. 2018;3(2):144-148.
3. Buscail L, Escorrou J, Moreau J, Delvaux M, Louvel D, Lapeyre F, Tregant P, FrexinosJ.Endoscopic ultrasonography in chronic pancreatitis: a comparative prospective study with conventional ultrasonography, computed

tomography and ERCP. Pancreas.1995. 10(1):251–257.

4. Sharma V, Rana SS, Sharma RK, Kang M, Gupta R and Bhasin DK. A study of radiological scoring system evaluating extrapancreatic inflammation with conventional radiological and clinical scores in predicting outcomes in acute pancreatitis. Ann Gastroenterol 2015;28(3): 399-404.

5. Shadan A, Malik GM, Kamill MMA, Umar K, Showkat H, Willayat A, et al. Role of MRCP in the evaluation of suspected biliary and pancreatic disease. JK Pract. 2011;16(1–2):19–23.

6. Mary Kurian J, Kumar John P, Hegde P, Murthy C, Kumar A. A Comparative Evaluation of USG and MRCP Findings in Biliary and Pancreatic Pathologies. Int J Contemp Med Res 2017;4(1):212-215.

7. Caroline Reinhold and Patrice M. Bret: Current status of MRCP. AJR 1996; 166(3): 1285-1295

8. Schwartzetal: Neoplastic Pancreato-biliary Duct obstruction: Evaluation with breath hold MRCP. AJR 1998; 170:1491-1495.

9. Hiroyuki Irie, Hiroshi Honda et al: Value of MR cholangiopancreatography in evaluating choledochoal cyst. AJR 1998; 171:1381-1545

10. Jorge A, Soto et al: MRCP: Findings on 3D fast spin-echo imaging. AJR1995; 165:1397-1401.

11. Regan et al: Choledocholithiasis: Evaluation with MRCP. AJR:167, December1996;1441-1445.

12. Van Hoe et al: Normal vaterian Sphincter Complex-Evaluation of Morphology and Contractility with dynamic Single shot MRCP. AJR1998; 170:1497-1500

13. Robert N. Gibson, Eugene Yeung, Jeremy N. Thompson, et al: Bile Duct Obstruction: Radiologic Evaluation of Level, Cause and Tumour resectability. Radiology 1986; 160:43-47

14. Threasa H. Reiman, Dennis Balfe, et al: Suprapancreatic Biliary Obstruction: CT Evaluation. Radiology1987; 163:49-56.

15. Cesar S. Pedrosa, Rafael Casanova, et al: Computed Tomography inObstructiveJaundice.Radiology1981;139:635-645

16. G.J. Robinson et al: MRCP in obstructive jaundice. Radiology 1997, Imaging, Science& Oncology,124.

17. Matthew A. Barish et al: MRCP: Efficacy of 3-D Turbo spin-echotechnique. AJR1995; 165:295-301.

18. Tomoaki Ichikawa, Hiroki Harodome, et al: Pancreatic Ductal Adenocarcinoma: Preoperative Assessment with Helical CT versus Dynamic MR imaging. Radiology1997; 202:655-662.

19. Laurent Guibaud et al: MRCP in Neonates and Infants: Feasibility and preliminary applications. AJR1998; 170:27-31