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Accurate Diagnosis of Obstructive Jaundice MRCP vs USG vs CT Scan

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ABSTRACT
Obstructive jaundice represents a prevalent clinical concern linked to an increased risk of mortality and morbidity. This radiological study aims to assess the diagnostic accuracy of MRCP in comparison to USG and CT for cases presenting with obstructive jaundice. A cross-sectional prospective study was conducted within the Department of Radiology at an Indian hospital involving 67 individuals with clinically confirmed obstructive jaundice and total bilirubin levels exceeding 5 mg dL^{-1}. Each participant underwent a sequential examination, starting with USG, followed by MRCP and concluding with a CT scan. Among the 67 subjects, 27 exhibited benign lesions, while 40 presented with malignant lesions. MRCP demonstrated a 95.52% accuracy in identifying the location of blockages, surpassing CT and USG. Both MRCP and CT exhibited almost equal sensitivity, whereas USG showed a sensitivity of 98% for benign causes. Despite the high sensitivity of USG, its specificity was relatively low, in contrast to CT and MRCP. Consequently, while USG serves as an excellent screening tool for benign obstructive jaundice lesions, CT and MRCP emerged as more specific diagnostic modalities. For diagnosing obstructive jaundice and elucidating the etiology, location, and size of the lesion, MRCP emerges as a preferable choice among radiological techniques, outperforming alternatives such as USG, CT, ERCP.

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Key Words
Jaundice, MRCP, sonography, CT scan

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INTRODUCTION

Obstructive jaundice stands as a prevalent clinical concern, posing an elevated risk of mortality and morbidity. While 90% of patients can have intrahepatic and extrahepatic blockage determined through relevant clinical data, identifying the cause and location of obstruction relies heavily on imaging modalities. In the context of obstructive jaundice, the primary objective of any imaging modality is to ascertain the presence of blockage, its precise location, extent and probable origin. Given the expanding array of treatment options for jaundiced patients, radiologists must go beyond distinguishing between obstructive and non-obstructive jaundice. Optimal therapeutic decisions typically hinge on a comprehensive evaluation of the etiology, location, severity and extent of the ailment[1,2]. Ultrasonography (USG), computed tomography (CT), endoscopic retrograde cholangio pancreato graphy (ERCP) and magnetic resonance cholangio pancreato graphy (MRCP) are the most commonly utilized imaging modalities. Percutaneous Transhepatic Cholangio graphy (PTC) is employed for drainage procedures. Radiological imaging plays a pivotal role in guiding treatment decisions for individuals with obstructive jaundice. Options such as USG, CT, magnetic resonance imaging (MRI), MRCP, and ERCP are considered for identifying acute pancreatitis, with the choice guided by the specific objectives of the research[3,4].

MRCP emerges as the imaging modality of preference due to its inherent high contrast resolution, speed, multiplanar capabilities and essentially artifact-free depiction of anatomy and disease. The acquired picture quality is comparable to direct cholangio graphy procedures like ERCP, acknowledged as the gold standard in ductal diseases. Initial MR Cholangio pancreato graphy findings employed gradient echo sequences and steady-state free precession methods, while the latest imaging techniques include Rapid Acquisition with Relaxation Enhancement (RARE) and Half-Fourier Acquisition Single-Shot TurboSpin-Echo (HASTE)[5,6].

Despite the non-invasiveness of ultrasonography and CT, they present certain drawbacks. USG is often ineffective in pinpointing the blockage's location, while CT carries a higher risk of radiation exposure and insufficient sensitivity for detecting stones. Procedures like ERCP and PTC, though valuable, demand technical expertise and the use of contrast media, posing potential operational challenges and associated complications[7,8]. This radiological study aimed to assess the diagnostic accuracy of MRCP in comparison to USG and CT for cases presenting with obstructive jaundice.

MATERIAL AND METHODS

All participants underwent a sequence of diagnostic procedures, commencing with a USG examination, followed sequentially by MRCP, and culminating in a CT scan. The USG examinations were conducted utilizing latest curved and linear probes, enabling comprehensive imaging of the biliary tree. Concurrently, helical CT scans of the upper abdomen, with an unenhanced 7mm collimation, were performed using a Dual CT Scanner. Following the administration of an intravenous contrast solution (100 ml, 300 mg I/ml), scans were executed with a 5mm collimation, 2mm reconstruction interval, a pitch of 1.5 and a field of view (FOV) ranging from 30 to 40 cms.

The resizing of images to fit smaller intervals was implemented. The MRCP was accomplished using a 1.5 Tesla MRI Scanner and parameters such as the level of blockage across four anatomical segments (hepatic, suprapancreatic, pancreatic, ampullary), presence of bile duct calculi and identification of bile duct calculi were thoroughly examined. These imaging modalities, including MRCP, CT and USG, were evaluated independently and in a blinded manner, devoid of any awareness of the outcomes of alternative tests or clinical observations. The ultimate diagnosis hinged on correlations established through surgical or histological means. Lesions deemed most likely benign were categorized as such, while those exhibiting characteristics indicative of malignancy were classified accordingly.

RESULTS

Out of the 67 individuals examined, 27 manifested benign lesions, while 40 exhibited malignant lesions. Notably, MRCP and CT accurately identified the majority of lesions as indicated in Table 1 and Fig 1. Conversely, USG successfully identified all benign lesions: however, it erroneously characterized some malignant tumors as benign. An analysis of the presented data in Table 2 reveals that MRCP exhibits the highest accuracy In detecting benign lesions, followed by CT and USG. The sensitivity of MRCP and CT is comparable across both modalities. Despite USG's

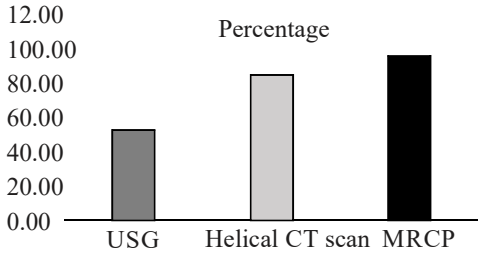

Fig. 1: Diagnostic Accuracy Comparison for Obstructive Jaundice

Table 1: Correct diagnosis in the studied population

Imaging Modality	No of Cases Diagnosed Correctly (n = 67)	Percentage
USG	35	52.24
Helical CT Scan	56	83.58
MRCP	64	95.52

Table 2: Comparison of USG, Helical CT and MRCP in benign causes of Obstructive Jaundice

Imaging Modality	USG	Helical CT Scan	MRCP
Sensitivity (%)	98	88	89
Specificity (%)	70	69	95
Positive Predictive Value (%)	64	80	95
Negative Predictive Value (%)	99	91	93
Accuracy (%)	69	82	93

Table 3: Comparison of USG, Helical CT and MRCP in malignant causes of Obstructive Jaundice

Imaging Modality	USG	Helical CT Scan	MRCP
Sensitivity (%)	68	72	95
Specificity (%)	95	89	93
Positive Predictive Value (%)	94	87	93
Negative Predictive Value (%)	64	73	95
Accuracy (%)	70	81	95

high sensitivity, its specificity is notably lower when compared to CT and MRCP, as illustrated in Tables 3 and 3. Therefore, USG proves to be an excellent screening tool for identifying benign lesions in cases of obstructive jaundice, while CT and MRCP stand out as more specific investigative modalities.

DISCUSSIONS

Preceding MRCP and CT examinations, all patients underwent USG. While USG effectively identified lesions associated with cholelithiasis, it encountered challenges in diagnosing distal CBD calculi, a task proficiently accomplished by MRCP[8,9]. Our findings align with the study conducted by Hiroyuki Irie *et al*[9], reporting 100% accuracy in detecting CBD calculi with MRCP when sonographic and CT results were equivocal. In cases involving both CBD and GB calculi, MRCP and CT accurately diagnosed all instances. MRCP depicted the calculus region as a signal void, contrasting with CT's representation as a hyperdense lesion. Our study concurs with Soto *et al*[10], who observed a sensitivity of 94% and specificity of 100% for detecting biliary calculi in MRCP.

Regan *et al*[11] reported an 87% sensitivity in diagnosing CBD calculus, while our study indicates that CT surpasses this sensitivity. In a prospective study by Van Hoe *et al*[12], comparing various radiologic modalities for evaluating bile duct obstruction, USG emerged as the most useful tool, especially when contrasted with CT and direct cholangio graphy. Robert *et al*.[13], in their study on obstructive jaundice using ISG, concluded that USG exhibited a sensitivity of 85% in locating the site of obstruction. Despite its effectiveness in screening obstructive jaundice, USG's specificity appears to be low in many studies[14]. Several researchers explored CT as the preferred modality for obstructive jaundice. Cesar *et al*[15] demonstrated accurate results comparable to direct cholangio graphy in evaluating the site of obstruction with CT. Another study focused on CT's efficacy in narrating surgical or radiologic drainage procedures in patients with biliary obstruction proximal to the pancreatic segment[16]. With the growing popularity of CT, MR Cholangio graphy was introduced by Matthew[17]. Although initial studies using rapid sequence gradient echo acquisition with three-dimensional post-processing technique showed promise, improvement in technique is essential to overcome spatial resolution limitations and low signal-to-noise ratio.

3D MR cholangio graphy, employing contrast-enhanced Fourier acquired steady-state technique (CE-FAST), was assessed in patients with malignancy-related obstructive jaundice. Despite inferior spatial resolution compared to direct cholangio graphy, 3D MR cholangi ography demonstrated clear visualization of dilatation and obstruction of bile ducts, correlating 100% with PTBD gram. The non-invasive nature of MR Cholangio graphy, though inferior in spatial resolution, was deemed less traumatic for patients[18].

The evolution of MRCP studies shifted from gradient echo sequences to fast or turbo spin echo pulse sequences, specifically RARE and HASTE[19]. These techniques, allowing image acquisition within seconds, mitigate motion artifacts and enhance image quality during a single breath hold. Considering the limitations of Helical CT, USG, and the invasiveness of ERCP, MRCP emerges as a potential standalone imaging modality for patients with obstructive jaundice. It gains further superiority with the addition of conventional MRI sections, offering non-invasive imaging without ionizing radiation, contrast media, operator dependence, or post-procedure complications. MRCP excels in critically ill patients, providing comprehensive views of the biliary tract both proximal and distal to the obstruction. However, like all investigations, MRCP has limitations and

cannot be used for patients with metallic implants, pacemakers, claustrophobia, provide therapeutic options like ERCP.

CONCLUSION

In the diagnostic evaluation of obstructive jaundice and the determination of the lesion's etiology, location, and size, MRCP emerges as a superior choice compared to other radiological techniques, including USG, CT scan.

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