

TO DETERMINE THE DIAGNOSTIC ACCURACY OF ULTRASONOGRAPHY IN DETECTING CHOLEDOCHOLITHIASIS IN PATIENTS OF OBSTRUCTIVE JAUNDICE KEEPING MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY AS GOLD STANDARD

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ABSTRACT

OBJECTIVE: To determine the diagnostic accuracy of ultrasonography in detecting choledocholithiasis in obstructive jaundice patients taking magnetic resonance cholangiopancreatography as gold standard. **MATERIAL AND METHODS:** This Cross-Sectional validation study was conducted at department of Radiology, KRL Hospital, Islamabad from 31st January 2021 to 31st July 2021. A total of 150 patients of both gender presenting with obstructive jaundice were included in the study. The patient underwent directly under a limited sonographic scan covering the area of pancreato-biliary region. The ultrasound was performed by using a curved low frequency probe (2-5 MHz). The pancreato-biliary region was evaluated with grayscale ultrasound. Findings from both ultrasound and MRCP were noted. **RESULTS:** Age range in this study was from 18 to 70 years with mean age of 42.113 – 7.64 years and mean weight was 80.220 – 6.76 Kg. Ultrasound showed sensitivity of 76.3%, specificity 92.3%, diagnostic accuracy 86%, PPV 86.5% and NPV by 85.7%. **CONCLUSION:** Ultrasound has a moderate sensitivity, high specificity and a high diagnostic accuracy in diagnosis of obstructive jaundice.

Keywords: Obstructive jaundice, Choledocholithiasis, Ultrasound, MRCP

Introduction

The presence of stones within the common bile duct (CBD) is called choledocholithiasis. It is estimated that common bile duct stones are present in anywhere from 1-15% of patients with cholelithiasis.¹ The current treatment of bile duct stones is endoscopic retrograde cholangiopancreatography (ERCP), or in some cases, laparoscopic cholecystectomy with bile duct exploration.² In most US centers, when bile duct stones present, ERCP is usually followed with laparoscopic cholecystectomy.³ Cholesterol stones form approxi-

mately 75% of the secondary common bile duct stones in the United States, while black pigment stones comprise the remainder.⁴ Primary common bile duct stones are usually brown pigment stones. Obstruction of the CBD by gallstones results in symptoms and complications that include pain, jaundice, and sepsis.⁵ A transabdominal ultrasound is the first investigation that should be requested for the patient suspected of any biliary disease, including choledocholithiasis.⁶ In most cases, an abdominal ultrasound will show

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a dilated common bile duct (more than 6mm) and stones within the common bile ducts.⁷ The detection of CBD stones is typically obscured by the presence of gas in the duodenum, but ultrasound can identify CBD dilation accurately with up to 90% accuracy.⁸ If a strong suspicion still exists based on history, physical, and laboratory findings in the face of a negative ultrasound, then a magnetic resonance cholangiopancreatography (MRCP) can be ordered. MRCP is also a non-invasive test with 92% sensitivity and a specificity of 100%.⁹

In a study by Hanif H, et al. has shown that ultrasound has sensitivity of 84.13%, specificity 68.18%, PPV 88.33%, NPV 60% and diagnostic accuracy was 80% in detecting choledocholithiasis in obstructive jaundice patients.¹⁰ Ultrasonography is initial modality used in the evaluation of obstructive jaundice patients. In resource poor systems, ultrasound is often the only available method with many other modalities being too costly or inaccessible to many patients. If ultrasound proved to be more sensitive and specific diagnostic modality by finding out variability in diagnostic accuracy in our study, modifying and adding data in established facts, it should be next investigation in obstructive jaundice patients resulting in timely management and reducing unnecessary time consuming and invasive procedures.¹¹

Material and Methods

This Cross-Sectional validation study was conducted at department of Radiology, KRL Hospital, Islamabad from 31st January 2021 to 31st July 2021. Study was duly approved by KRL ethical review committee (KRL-HI-PUB-ERC/Jul23/30). Data was collected through non-probability consecutive sampling and sample size is 150. The patients who were included in the study were both males and females in the age range of 18 to 70 years with obstructive jaundice while pregnant women, claustrophobic to MRI and those having H/o brain aneurysm clips, cochlear implants, cardiac pacemakers, trauma abdomen were excluded from the study. Informed consent was taken. Basic demographics like age, gender and weight on weighing scale were recorded. Patients were nil orally for 6-8 hours prior to the examination. The patient underwent directly under a limited sonographic scan covering



Figure 1: Ultrasound image showing dilated CBD with a calculus in the distal CBD-choledocholithiasis

the area of pancreato-biliary region. The ultrasound was performed by using a curved low frequency probe (2-5MHz) by logic P/6 machine. (Fig.1) MRCP on Philips MRI machine of 1.5-T was then carried out. A three dimensional (including axial, coronal and oblique images), fat suppressed, heavily T2 weighted FSE sequence with multi-slice acquisition was made during MRCP. All pulse sequences were acquired in breath-hold (10 seconds) except T2 HASTE transverse gated sequences. In addition, Maximum intensity projection (MIP) reconstruction was generated from each multislice data set. Findings from both ultrasound and MRCP were noted and choledocholithiasis was recorded as peroperational definition on especially designed proforma. Data was analyzed with statistical analysis software (SPSS-23). Mean – SD was presented for quantitative variables like age and weight. Frequency and percentage were computed for qualitative variables like gender. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for ultrasound against MRCP was calculated by using 2X2 model.

Results

Age range in this study was from 18 to 70 years with mean age of 42.113 – 7.64 years and mean weight was 80.220 – 6.76 Kg. Majority of patients were males i.e. 70.7%. Ultrasound diagnosed 52(34.7%) and MRCP diagnosed 59(39.3%) patients with choledocholithiasis as shown in (Tab.1). Ultrasound showed

Ultrasound	MRCP		Total
	Positive	Negative	
Positive	45 (TP)	7 (FP)	52
Negative	14 (FN)	84 (TN)	98
Total	59	91	150

Table 1: Comparison of ultrasound versus MRCP for choledocholithiasis

Ultrasound	MRCP		Total	Pvalue
	Positive	Negative		
Positive	17 (TP)	16 (FP)	33	0.836
Negative	40 (FN)	41 (TN)	81	
Total	57	57	114	

Table 2: Stratification with respect to age (18-40 years) of ultrasound versus MRCP

Ultrasound	MRCP		Total	Pvalue
	Positive	Negative		
Positive	35 (TP)	43 (FP)	78	0.235
Negative	58 (FN)	50 (TN)	108	
Total	93	93	186	

Table 3: Stratification with respect to age (41-70 years) of ultrasound versus MRCP

Ultrasound	MRCP		Total	Pvalue
	Positive	Negative		
Positive	36 (TP)	41 (FP)	77	0.475
Negative	70 (FN)	65 (TN)	135	
Total	106	106	212	

Table 4: Stratification with respect to gender (male) of ultrasound versus MRCP

Ultrasound	MRCP		Total	Pvalue
	Positive	Negative		
Positive	20 (TP)	20 (FP)	40	1.000
Negative	56 (FN)	56 (TN)	112	
Total	76	76	152	

Table 5: Stratification with respect to weight (≤ 80 kg) of ultrasound versus MRCP

Ultrasound	MRCP		Total	Pvalue
	Positive	Negative		
Positive	32 (TP)	39 (FP)	71	0.249
Negative	42 (FN)	35 (TN)	77	
Total	74	74	148	

Table 6: Stratification with respect to weight (≥ 80 kg) of ultrasound versus MRCP

sensitivity of 76.3%, specificity 92.3%, diagnostic accuracy 86%, PPV 86.5% and NPV by 85.7%. Stratification with respect to age, gender and weight of Ultrasound versus MRCP are shown in (Tab.2-6) respectively.

Discussion

When evaluating a case of obstructive jaundice, the aim of the radiologist is to confirm the cause and site of obstruction. The success rate in diagnosing specific cause has continued to improve with advancing high resolution equipment, scanning technique and interpretive skills.¹²⁻¹⁵ 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.^{16,17} USG is widely available with no need for contrast injection and no radiation risk.^{18 - 20} CT is more accurate than USG, but requires IV Iodinated contrast injection and uses ionizing radiation. MRCP has the advantage of being modality which does not use ionizing radiation or iodinated contrast.¹⁶⁻¹⁸ The quality of images obtained is comparable with that of direct cholangiography procedures like ERCP. In the present study, we compared the diagnostic efficacy of two non invasive and non radiation modalities, USG and MRI in detecting the level and cause of obstruction.¹⁹⁻²¹

Majority of the our study population (62%) were adults in the age group of 41 - 70 years. However, in the study by Al-Obaidiet al.²¹ most of the patients were in 60 - 69 years age group. Moreover, our reported sensitivity is also lower than the one reported by Kanietal., that reported 97% sensitivity.²² This variation in sensitivity can be attributed to the fact that distal part of common bile duct is difficult to visualize on ultrasound. In a study by Hanif H, et al. has shown that ultrasound has sensitivity of 84.13%, specificity 68.18%, PPV 88.33%, NPV 60% and diagnostic accuracy was 80% in detecting choledocholithiasis in obstructive jaundice patients.²³ Moreover, intra pancreatic part as well as ampullary region can also not be visualized well on ultrasound. An other potential

reason for this could be due to the body habitus of the patient. Moreover, bowel gas shadows may also obscure the details leading to difficult visualization of the common bile duct distally.²⁴ Our present study demonstrated that the specificity of ultrasound in diagnosis of obstructive jaundice is 92.3%. Singh et al. reported the specificity of ultrasound to be 88% in detecting choledocholithiasis in obstructive jaundice.²⁵ Ferrari et al. demonstrated that specificity of ultrasound in obstructive jaundice is 98.2%.²⁶

Conclusion

It is concluded that ultrasound, which is a valuable non-invasive preliminary procedure, can be used as a screening imaging technique to identify the presence or absence of choledocholithiasis in obstructive jaundiced patients thereby short listing the patients for MRCP examination which would result in prompt radiological-surgical consultation and reducing morbidity and mortality resulting from delay in unnecessary investigation.

Conflict of Interest: All authors declared no conflict of interest.

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