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Research Article

Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography (MRCP) in Choledocholithiasis Taking Endoscopic Retrograde Cholangiopancreatography (ERCP) as Gold Standard

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Abstract

Objective: To evaluate the diagnostic accuracy of Magnetic resonance cholangiopancreatography (MRCP) in choledocholithiasis taking Endoscopic retrograde cholangiopancreatography (ERCP) as gold standard.

Methodology: This cross-sectional study was conducted during the time period extended from January to June 2013 at Ziauddin University hospital, department of Radiology and Imaging to determine the Diagnostic accuracy of Magnetic resonance cholangiopancreatography (MRCP) in comparison with Endoscopic retrograde cholangiopancreatography (ERCP). Patients with probable choledocholithiasis cases were referred to radiology section for MRCP and later ERCP. Pretest and posttest probabilities of the diagnostic tests were evaluated.

Results: Mean age of the participants was 38.7 years. Of 101 patients, 69 (68.3%) male and 32 (31.7%) were female. Frequency of choledocholithiasis was found out to be 21 (20.8%) by ERCP and 22 (21.8%) by MRCP. The Sensitivity of MRCP in diagnosis of choledocholithiasis was 95.2%, specificity 97.5% positive predictive value 90.9%, negative predictive value 98.7% and diagnostic accuracy was 97%.

Conclusions: MRCP is a sensitive and specific test for diagnosis of choledocholithiasis. It can be a preferred substitute of ERCP where contraindications to ERCP and invasive nature of the test is a concern.

Keywords: *ERCP; MRCP; Biliary Tract Obstruction; Choledocholithiasis*

Introduction

Choledocholithiasis, a condition depicted as presence of stone/s in common bile duct is a prevalent condition and may present as jaundice, biliary colic and abnormal liver function tests or in many cases the patient remains completely asymptomatic, ancillary to the cause of extra biliary obstruction [1]. Other complications which may arise from presence of stone/s are bacterial cholangitis, secondary biliary cirrhosis and gallstone pancreatitis [2]. The management requires diagnostic measures such as abdominal ultrasound, Computed Tomography (CT) abdomen, magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP), however treatment involves surgical or conservative treatment where surgery is contraindicated [3,4].

These diagnostic tests have diverse range of precision and pretest probabilities. The sensitivity and specificity of ultrasound for choledocholithiasis are 55% and 90% respectively, in comparison to ERCP. The use of Ultrasound requires operator skills to accurately diagnose and body habitus/bowel gases sometimes prevent adequate visualization of biliary tract. Computed tomography has a sensitivity between 60% - 90% and Specificity 84% - 100% compare to ERCP for detection of bile duct stones, however CT scan expose the patient to radiation [5].

ERCP is considered as a gold standard modality for diagnosis of bile duct stones. It is an invasive procedure [6]. Complications include bleeding from sphincter site, pancreatitis, duodenal perforation and fatality. Contrast agents used in ERCP are also additional risk especially in atopic patients and those with renal failure. MRCP is an excellent and non-invasive diagnostic modality for choledocholithiasis. Surgeons, gastroenterologists and radiologists are usually compelled to use MRCP due to its rate of accuracy and safety in addition that it is well endured by the patients [7]. On the other hand, no contrast agents are used in MRCP, so it is desirable for patients with allergy to the materials containing iodine or those with a history of atopic disease. The lower cost, absence of ionizing radiation, operator independence also makes MRCP as an attractive alternative to diagnostic ERCP. The sensitivity and specificity of MRCP is 100% and 95.3% respectively for choledocholithiasis [8].

Objective

To assess the diagnostic accuracy of Magnetic resonance cholangiopancreatography (MRCP) in choledocholithiasis considering Endoscopic retrograde cholangiopancreatography (ERCP) as gold standard.

Methodology

The Study was conducted on patients presenting with suspected choledocholithiasis, to Ziauddin University hospital, Karachi during January 2013 to June 2013. Ethical approval was obtained from the ethical review committee of the University. Patients of 20-55 years of age and either gender, suspected of having choledocholithiasis for at least 6 months of duration according to operational definition were included in the study. Already diagnosed cases of choledocholithiasis, patients with severe clinical conditions in whom therapeutic requirement were urgent, patients with at least 1 absolute contraindication to either diagnostic technique (MRCP, ERCP) such as Patient with atopy, renal failure, metallic pace maker and stents, and non-consenting patients were excluded from the study.

Oral and written consent was taken from each participant and were briefed regarding the nature of the study and its protocols. After taking consent, the patients were referred to radiology department for MRCP and later ERCP meeting the inclusion criteria of our study.

Tesla 1.5 MR unit was used to image all participants by two different image acquisition protocols.

MRCP reporting was done by senior consultant radiologist with minimum 5year s of experience and its findings were recorded on proforma by the researcher. Patients would then be followed and the results of ERCP was collected from gastroenterologist having 5 years of experience and recorded on proforma (Annexure I) by principal investigator.

The statistical analysis was done by using SPSS windows package version 22. The frequency and percentages were calculated for choledocholithiasis and mean ± SD for age distribution was computed. A 2×2 table was constructed and sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of MRCP keeping ERCP as the gold standard was calculate. Confounders were controlled by age & gender by applying Chi square test to see the effects of these on outcome variable taken p-value of <= 0.05 as significant.

Result

A total of 101 patients participated in the study. The mean age of enrolled participants was 38.7 years and 73.27% patients are below 45 years of age. Of 101 patients, 69 (68.3%) male and 32 (31.7%) were female with male to female ratio of 2.2:1. Frequency of choledocholithiasis was 21 (20.8%) by ERCP (Figure 1) and 22 (21.8%) by MRCP (Figure 2).

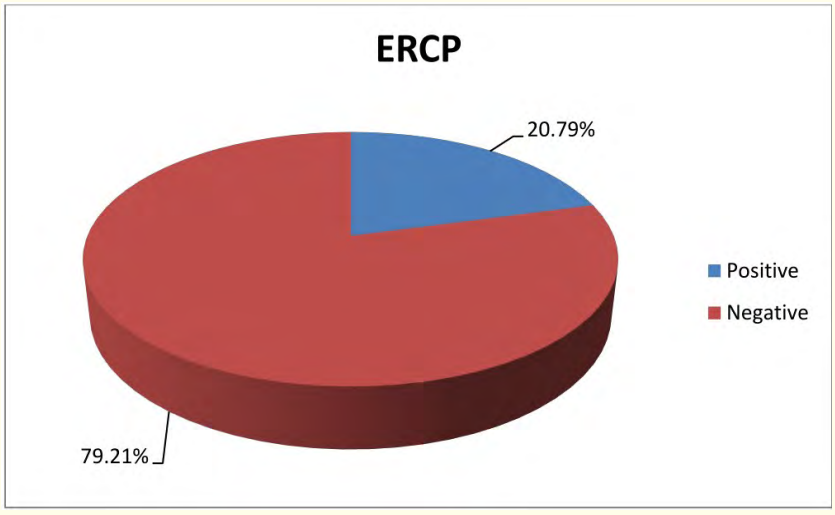

Figure 1: *Frequency of choledocholithiasis by endoscopic retrograde cholangiopancreatography (ERCP) (n = 101).*

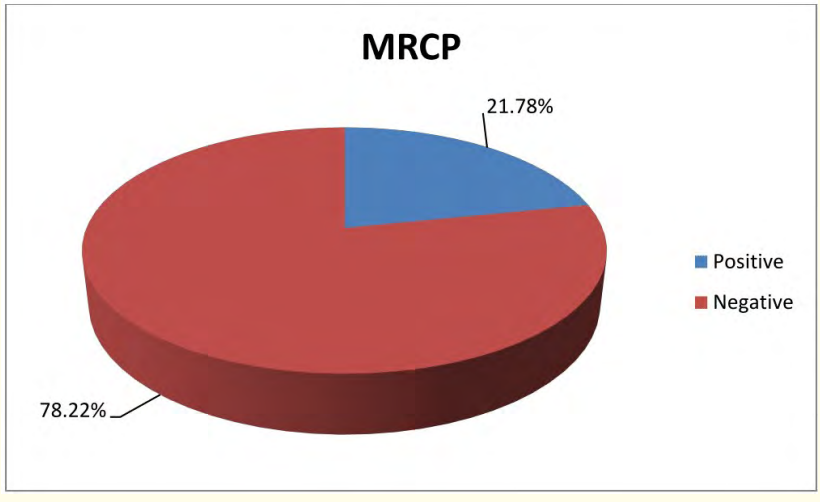

Figure 1: *Frequency of choledocholithiasis by magnetic resonance cholangiopancreatography (mrcp) (N = 101).*

The Sensitivity of MRCP in diagnosis of choledocholithiasis was 95.2%, specificity 97.5% positive predictive value 90.9%, negative predictive value 98.7% and diagnostic accuracy was found to be 97%.

Stratified analysis of diagnostic accuracy of MRCP in detecting choledocholithiasis by age and gender is summarized in tables 1-5.

Positive		ERCP		Total
		Negative		
MRCP	Positive	20	2	22
	Negative	1	78	79
Total		21	80	101

Table 1: *Diagnostic accuracy of MRCP in choledocholithiasis.*
Sensitivity: 95.2%, Specificity: 97.5%, PPV: 90.9%, NPV: 98.7%, Accuracy: 97%

In Stratified analysis by age < 45 years, the Sensitivity of MRCP in diagnosis of choledocolithiasis was 93.8%, specificity 100% positive predictive value 100%, negative predictive value 98.3% and diagnostic accuracy was 99% (Table 2).

MRCP	ERCP		P-value
	Positive	Negative	
Positive	15	0	< 0.001
Negative	1	58	

Table 2: *Stratification of diagnostic accuracy of MRCP in choledocholithiasis by age < 45 years.*
Sensitivity: 93.8%, Specificity: 100%, PPV: 100%, NPV: 98.3%, Accuracy: 99%

However, Stratified analysis by age ≥ 45 years showed the Sensitivity of MRCP in diagnosis of choledocholithiasis was 100%, specificity 90.9% positive predictive value 71.4%, negative predictive value 100% and diagnostic accuracy was 93% (Table 3).

MRCP	ERCP		P-value
	Positive	Negative	
Positive	5	2	< 0.001
Negative	0	20	

Table 3: *Stratification of diagnostic accuracy of MRCP in choledocholithiasis by age ≥ 45 years.*
Sensitivity: 100%, Specificity: 90.9%, PPV: 71.4%, NPV: 100%, Accuracy: 93%

By male gender stratification, the Sensitivity of MRCP in diagnosis of choledocholithiasis was 92.9%, specificity 98.2% positive predictive value 92.9%, negative predictive value 98.2% and diagnostic accuracy was 98% (Table 4). In Stratified analysis done on female gender, the Sensitivity of MRCP in diagnosis of choledocholithiasis was 100%, specificity 96% positive predictive value 87.5%, negative predictive value 100% and diagnostic accuracy was 97% (Table 5).

MRCP	ERCP		P-value
	Positive	Negative	
Positive	13	1	< 0.001
Negative	1	54	

Table 4: *Stratification of diagnostic accuracy of MRCP in choledocholithiasis by Male gender. Sensitivity: 92.9%, Specificity: 98.2%, PPV: 92.9%, NPV: 98.2%, Accuracy: 98%*

MRCP	ERCP		P-value
	Positive	Negative	
Positive	7	1	< 0.001
Negative	0	24	

Table 5: *Stratification of diagnostic accuracy of MRCP in Choledocholithiasis by female gender. Sensitivity: 100%, Specificity: 96%, PPV: 87.5%, NPV: 100%, Accuracy: 97%*

Discussion

Gallstones causing obstructive jaundice are a frequent presentation. Thorough history, clinical examination and sensitive diagnostic tests such as CT scan, MRCP and ERCP are the cornerstone for the diagnosis of choledocholithiasis [9].

For the diagnosis of pancreatic and biliary pathology endoscopic retrograde cholangiopancreatography (ERCP) is considered as the benchmark investigation which also has a therapeutic potential.

However, it is associated with complications since this is invasive procedure and results varies from one operator to another depends upon experience [10]. MRCP is a noninvasive technique for evaluating hepatobilliary tree and its reported sensitivity is (81 - 100%), specificity (94 - 98%), positive (86 - 93%) and negative (94 - 98%) predictive values and diagnostic accuracy (94 - 97%). The high predictability and yield values are comparable to those of ERCP, and can be an alternative to ERCP in certain circumstances [11]. MRCP technique did not require ionizing radiation and any contrast agent [6,9]. In certain situations, MRCP may be preferable like Billroth II gastrectomy, hilar strictures, lesions coupled with complete pancreatic and bile duct splitting, and highly sensitive in detecting the duct obstruction [12,13]. In this study, we found that the sensitivity of MRCP in diagnosis of choledocholithiasis was 95.2%, specificity 97.5% positive predictive value 90.9%, negative predictive value 98.7% and diagnostic accuracy was 97%. Stiris., *et al*. reported the sensitivity was 87.5% and the specificity was 94.4%., compared to our study, in which MRCP diagnosed only cases of choledocholithiasis [14].

Jhong., *et al*. assessed the capability of MRCP to detect to choledocholithiasis and demonstrated that the sensitivity for detecting choledocholithiasis declined with dilated bile ducts (bile duct diameter more than 10 mm). The results in our study showed that MRCP, is being 95.2% sensitive [6]. Similarly, Kaltenthaler., *et al*. reported sensitivity and specificity for choledocholithiasis as 93% and 94% respectively. However, risk of complications associated with ERCP could be minimized in such patients with the use of MRCP. In another study intended to investigate the diagnostic accuracy of MRCP in hepatobiliary disorders where Positive and negative predictive values for choledocholithiasis were 100%, 95.3%, 100% and 97.9% [15], thus labeling MRCP as a potential substitute of ERCP.

Conclusion

MRCP appears to be sensitive and specific for choledocholithiasis which is one of frequent causes of obstructive jaundice, additionally MRCP is noninvasive diagnostic modality which can be performed in a short duration. We observed that the diagnostic accuracy of MRCP

in diagnosis of choledocholithiasis is 97%. Based on the results of this study it is recommended that MRCP should be considered as viable option performed in such cases.

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