Original Article

J Babol Univ Med Sci
23; 2021. P: 158-163

Comparison of Diagnostic Power of MRCP and ERCP in the Diagnosis of Bile Duct Stones

M. Mohammadi Firouzjaei (MD)[1], R. Mehraeen (MD)*[2], S. M. Hamidian (MD)[2]

1.School of Medicine, Babol University of Medical Sciences, Babol, I.R.Iran

2.Clinical Research Development Unite of Rouhani Hospital, Babol University of Medical Sciences, Babol, I.R.Iran

J Babol Univ Med Sci; 23; 2021; PP: 158-163

Received: Oct 18th 2020, Revised: Dec 13rd 2020, Accepted: Jan 25th 2021.

ABSTRACT

BACKGROUND AND OBJECTIVE: Examination of bile ducts and pancreas by magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP) are two methods in the diagnosis of biliary tract diseases. Since ERCP is more invasive than MRCP, this study was performed to evaluate the diagnostic value of MRCP compared to ERCP.

METHODS: This cross-sectional study was performed on 130 patients over 18 years of age who were suspected of common bile duct stone, also known as choledocholithiasis, based on tests and clinical examinations. MRCP was performed first and then ERCP was performed and the results of these two methods were compared.

FINDINGS: The mean age of the subjects was 59.6±13.7 years. 53 were male (40.8%) and 77 were female (59.2%). Stone was reported with MRCP in 91 patients (70%) and ERCP in 96 patients (73.8%). The sensitivity of MRCP in the diagnosis of common bile duct stones compared to ERCP was 88.5% while the the specificity, positive predictive value, negative predictive value and diagnostic value of MRCP in the diagnosis of common bile duct stones compared to ERCP were 82.3%, 93.4%, 71.7%, 86.1%, respectively.

CONCLUSION: The results of the study showed that MRCP has a high diagnostic power in the diagnosis of common bile duct stones. Therefore, it can be used as a primary method to detect the presence or absence of common bile duct stones.

KEY WORDS: *Diagnostic Value, MRCP, ERCP, Biliary Tract Diseases.*

Please cite this article as follows:

Mohammadi Firouzjaei M, Mehraeen R, Hamidian SM. Comparison of Diagnostic Power of MRCP and ERCP in the Diagnosis of Bile Duct Stones. J Babol Univ Med Sci. 2021; 23: 158-63.

***Corresponding Author: R. Mehraeen (MD)**

Address: Clinical Research Development Unite of Rouhani Hospital, Babol University of Medical Sciences, Babol, I.R.Iran

Tel: +98 11 32204048

E-mail: sany_monzavi@yahoo.com

[DOR: 20.1001.1.15614107.1400.23.1.24.3]

[DOI: 10.22088/jbums.23.1.158]

Introduction

Gallstone disease is one of the most common diseases that leads to hospitalization and surgical interventions. Choledocholithiasis develops in 10 to 20% of patients with gallstones, of which 3 to 10% who undergo cholecystectomy have Common Bile Duct (CBD) stones (1). CBD stones can cause cholangitis, obstruction, jaundice, acute pancreatitis and sepsis. Therefore, the correct diagnosis of choledocholithiasis is important in clinical decisions. There are several methods for diagnosing it, including abdominal ultrasound, CT scan, and MRCP, which are non-invasive and cheaper than ERCP. Meanwhile, MRCP has a higher diagnostic power than other methods (2).

In the early 1970s, endoscopic retrograde cholangiopancreatography (ERCP) became the gold standard for assessing CBD and biliary tree. ERCP is endoscopic cannulation of the major papilla with imaging of the pancreatic duct and bile duct (3-5). Among the diagnostic methods, ERCP is the most accurate and is considered as the gold standard in the evaluation of dilated CBD, but due to its invasiveness and the possibility of complications such as acute pancreatitis (1.7-3.7%), biliary tract infection (0.6-5%), bleeding (0.3-2%) and duodenal perforation (0.1-1%) (5), this technique is only suggested in cases of dilated CBD where the presence of pathology is high and treatment interventions are required, and other imaging techniques such as MRCP are used in patients with a low to moderate risk of pathology. Abdominal ultrasound and CT scan are performed in patients with abdominal pain in most hospitals. The sensitivity and specificity of unenhanced helical CT Scan in determining CBD stones have been reported to be 50-88% and 84-98%, respectively (6, 7).

Magnetic resonance cholangiopancreatography (MRCP) was recognized in 1991 as a non-invasive method for bile tree imaging. Although ERCP is the best method for both diagnosis and treatment of pancreaticobiliary diseases, due to its complications, ERCP was prevented from being used routinely for diagnostic purposes (8, 9). Anand et al. concluded that the use of MRCP before ERCP increases the length of hospital stay as well as hospital costs (10). However, some researchers have stated that MRCP has great power and accuracy in diagnosing biliary tract diseases (11). Mercer et al. concluded in their study that selective MRCP, along with ERCP and sphincterotomy, is very effective and safe in cases where laparoscopic procedures and time are not available (12). In fact, MRCP has replaced ERCP as a method of choice in difficult and impossible conditions (13) and its diagnostic results are similar to ERCP (2). Although ERCP is the gold standard method for diagnosing biliary tract diseases, a number of advantages such as non-invasiveness and lower cost of MRCP compared to ERCP, no need for operator and anesthesia, contrast agent and lack of radiation, which are specific to MRCP (2, 14) has led us to turn to MRCP for diagnosis.

Therefore, in order to diagnose dilated CBD early, using non-invasive and inexpensive methods, reducing mortality and morbidity and early detection of pancreatic-biliary malignancy, this study was conducted to compare the diagnostic power of MRCP and ERCP in biliary tract diseases in patients hospitalized in Ayatollah Rouhani Hospital in Babol, northern Iran in 2016.

Methods

This cross-sectional study was approved by the ethics committee of Babol University of Medical Sciences with the code IR.MUBABOL.HRI.REC.1395.37. After obtaining informed consent, the study was conducted among 130 patients who referred to Ayatollah Rouhani Center in Babol due to biliary tract diseases within one year and underwent MRCP and ERCP.

Patients with a history of any manipulation, whether previous surgery or previous ERCP and stent placement, were excluded from the study. During the study, patients who needed treatment or other diagnostic measures were treated. The MRCP was performed by a GE 1.5 Tesla 16 Channel Machine located at the Hekmat Center of Ayatollah Rouhani Hospital in Babol and interpreted by a radiologist. Gastroenterologist was performed and the results of these two methods were compared. ERCP was performed by COMED C-Arm Equipment with ID code R.ON.CARM.1 and by a gastroenterologist and the results of these two methods were compared.

Information including age, gender, smoking, drug use, reason for referral, AST, ALT, ALK-p, Bilirubin and MRCP and ERCP results and interviews with patients and their companions were completed in a questionnaire and were then analyzed using SPSS version 22 and Chi-square test and $p<0.05$ was considered significant.

[DOR: 20.1001.1.15614107.1400.23.1.24.3]
[DOI: 10.22088/jbums.23.1.158]

Results

The mean age of the subjects was 59.6±13.7 years. In this study, 53 patients were male (40.8%) and 77 were female (59.2%). In these 130 patients, 18 patients (13.8%) were smokers and 112 patients (86.1%) were non-smokers and 22 patients (16.9%) were opium users. Patients were not significantly different in terms of gender, age and other variables in the groups with CBD and without CBD stone. Clinical symptoms in the subjects included 98 (75.4%) cases of abdominal pain, 22 (16.9%) cases of jaundice, 3 (2.3%) cases of pruritus and 7 (5.4%) cases of fever and chills. 49 patients (37.6%) had an AST of less than 50, 78 patients (59.1%) had between 50 and 150, and 15 patients (11.4%) had more than 150. 38 patients (29.2%) had an ALT of less than 50, 69 patients (52.5%) between 50 and 150, and 22 patients (16.9%) had more than 150. 39 patients (30%) had an ALP of less than 300, 74 patients (56.9%) had 300 to 600, and 17 patients (13.1%) had more than 600 (Table 1). Of these 130 patients who underwent MRCP, 91 (70%) had stones in the common bile duct and 39 (30%) had no stones. In ERCP, of these 130 patients, 96 (73.8%) had stones and 34 (26.2%) had no stones (Table 2). The sensitivity of MRCP in the diagnosis of common bile duct stones compared to ERCP is 88.5%. In addition, specificity, positive predictive value, negative predictive value and diagnostic value of MRCP in the diagnosis of common bile duct stones in comparison with ERCP are 82.3%, 93.4%, 71.7%, 86.1%, respectively (Table 3). Smoking, gender, opium use, and age had no association with common bile duct stones.

Table 1. Comparison of laboratory parameters in patients with bile duct stone based on having or not having stones

	With CBD stone Mean±SD or Number (%)	Without CBD stone Mean±SD or Number (%)	p-value
AST (IU/L)	75.7±60.7	56.52±29.08	0.056
ALT (IU/L)	100.7±91.6	91.6±89.8	0.067
ALP (IU/L)	396.8±199.8	354.4±222.7	0.058
Bilirubin (mg/dl)	2.56±1.9	1.8±0.77	0.072
AST			
<50	33(25.3)	16(12.3)	0.061
50-150	59(45.3)	19(14.6)	
>150	14(10.7)	1(0.7)	
ALT			
<50	26(20)	12(9.2)	0.070
50-150	54(41.5)	15(11.5)	
>150	16(12.3)	6(4.6)	
ALP			
<300	23(17.6)	16(12.3)	0.055
300-600	59(45.3)	15(11.5)	
>600	14(10.7)	3(2.3)	
Bilirubin			
<1.6	28(21.5)	10(7)	0.064
1.6-4	55(42.3)	20(15.3)	
>4	13(10)	4(3.07)	

Table 2. Comparison of MRCP and ERCP diagnoses based on the presence or absence of stone

	ERCP		
	Without CBD stones Number(%)	With CBD stones Number(%)	Total Number(%)
MRCP			
Without CBD stones	28(21.5)	11(8.5)	39(30)
With CBD stones	6(4.6)	85(65.4)	91(70)
Total	34(26.2)	96(73.8)	130(100)

[DOR: 20.1001.1.15614107.1400.23.1.24.3]
[DOI: 10.22088/jbums.23.1.158]

Table 3. Diagnostic value of MRCP compared to ERCP as gold standard

Variable	MRCP	95% confidence interval
Sensitivity	88.5%	80.42-94.14%
Specificity	82.5%	65.47-93.24%
$LR^{\pm}$	5.02	2.42-10.41
LR^{-}	0.14	0.08-0.25
PPV	93.4%	87.23-96.71%
NPV	71.7%	58.83-81.93%
Accuracy	86.1%	79.89-92.19%

Discussion

The results of our study showed that the diagnostic power of MRCP in the diagnosis of bile duct stones is 86.1 and also has a sensitivity and specificity of 88.5 and 82.3, respectively, which are very similar to the results of previous studies in which the diagnostic power of MRCP was considered high compared to ERCP. In the study of Moon et al., the sensitivities of abdominal ultrasound, CT Scan, MRCP, ERCP, EUS in the diagnosis of choledocholithiasis were 20%, 40%, 80%, 90% and 95%, respectively. It was also stated that the sensitivity of MRCP in the detection of CBD stones decreases with the increase in CBD diameter and becomes about 72.7% (15). This sensitivity is almost consistent with our study.

In another study by Chen et al., the sensitivity of MRCP was 95% and its specificity was 95% (14), which is almost consistent with other studies. The sensitivity and specificity of MRCP in our study was higher than the study of Gurbulak et al. In his study, the sensitivity, specificity and accuracy of MRCP were 71%, 35% and 61%, respectively, and in the end, they recommended that in MRCP-based diagnosis, MRCP should first be performed and in cases where MRCP is suspected or cannot be performed, endoscopic ultrasonography (EUS) should be used and ERCP should only be performed in therapeutic cases (16).

The reason for the difference with our study is the higher accuracy of the MRI machine, which was 1.5 Tesla. Studies have shown that MRCP can show more anatomical details of the bile tree and has a sensitivity of 100-181% and a specificity of 92-100% in the diagnosis of bile duct stones, which is similar to our study. This study also showed that the accuracy of MRCP in detecting CBD stones is comparable to ERCP (3). In a systematic review of 25 articles, Kaltenthaler et al. found that the sensitivity and specificity of MRCP in the detection of CBD stones were 50-100% and 83-100%, respectively (17), which was similar to this study. Mandelia et al. estimated the sensitivity and specificity of MRCP in the diagnosis of CBD to be 95% and 90%, respectively, and concluded that all individuals suspected of having CBD should undergo MRCP (18). Chen et al. stated that the diagnostic power of MRCP and US was equal and about 27%. ERCP had the highest diagnostic power at about 100% (19).

The study by Isherwood et al. showed that increased levels of ALK-p at the time of admission, although having low sensitivity, were a better and stronger marker than ALT and Bilirubin in patients with common bile duct stones. It was stated that in general, LFTs are a poor predictor in the diagnosis of CBD stones (20). Prat et al. also concluded that age, serum levels of bilirubin, AST, ALT, ALK-p, and jaundice, fever, and CBD dilatation were associated with the presence of stones in CBD (21). However, in our study, there was no significant relationship between laboratory tests and the presence or absence of CBD, which could be an accidental finding. The results of this study showed that MRCP has a high sensitivity and specificity in the diagnosis of CBD stones and can be used as a primary diagnostic method in the diagnosis of common bile duct stones. The results of this study can accelerate the diagnosis and reduce treatment costs and prevent unnecessary invasive diagnoses in patients.

One of the limitations of this study is the time-consuming nature of the study and that this study was performed only on patients who referred to Ayatollah Rouhani Hospital in Babol and underwent MRCP in this center, and due to this limitation, we could not investigate more cases and more biliary disorders and assess the diagnostic value of MRCP in other biliary disorders, which has been one of the biggest limitations of this study. It is recommended that further studies be performed with larger sample size, especially focusing on patients with other biliary disorders.

Acknowledgment

We would like to thank the Vice Chancellor for Research and Technology of Babol University of Medical Sciences for financial support of the research, as well as Mr. Hemmat Gholinia, Dr. Shahriyar Savadkoohi, and Dr. Reza Khaleghnejad.

[DOR: 20.1001.1.15614107.1400.23.1.24.3]
[DOI: 10.22088/jbums.23.1.158]

References

1.Chen W-X, Zhang Y, Li Y-M, Xu G-Q, Fang Y, Cai S-P. Endoscopic retrograde cholangiopancreatography in evaluation of choledochal dilatation in patients with obstructive jaundice. Hepatobiliary Pancreat Dis Int. 2002;1(1):111-3.

2.Makmun D, Fauzi A, Shatri H. Sensitivity and Specificity of Magnetic Resonance Cholangiopancreatography versus Endoscopic Ultrasonography against Endoscopic Retrograde Cholangiopancreatography in Diagnosing Choledocholithiasis: The Indonesian Experience. Clin Endosc. 2017;50(5):486-90.

3.Freitas ML, Bell RL, Duffy AJ. Choledocholithiasis: Evolving standards for diagnosis and management. World J Gastroenterol. 2006;12(20):3162-7.

4.Cohen S, Bacon BR, Berlin JA, Fleischer D, Hecht GA, Loehrer Sr PJ, et al. National Institutes of Health State-of-the-Science Conference Statement: ERCP for diagnosis and therapy, January 14-16, 2002. Gastrointest Endosc. 2002;56(6):803-9.

5.McCuneWS, Shorb PE, Moscovitz H. Endoscopic cannulation of the ampulla of vater: a preliminary report. Ann Surg. 1968;167(5):752-6.

6.ASGE Standards of practice Committee, Maple JT, Ben-Mencham T, Anderson MA, Appalaneni V, Banerjee S, et al. The role of endoscopy in the evaluation of suspected choledocholithiasis. Gastrointest Endosc. 2010;71(1):1-9.

7.Tseng C-W, Chen C-C, Chen T-S, Chang F-Y, Lin H-C, Lee S-D. Can Computed tomography With Coronal Reconstruction Improve The diagnosis of choledocholithiasis?. J Gastroenterol Hepatol. 2008;23(10):1586-9.

8.Loperfido S, Angelini G, Benedetti G, Chilovi F, Costan F, De Berardinis F, et al. Major early complications from diagnostic and therapeutic ERCP: a prospective multicenter study. Gastrointest Endosc. 1998;48(1):1-10.

9.Al-Dhuhli H. Role of Magnetic Resonance Cholangiopancreatography in the Evaluation of biliary Disease. Sultan Qaboos Univ Med J. 2009;9(3):341-52.

10.Anand G, Patel YA, Yeh H-C, Khashab MA, Lennon AM, Shin EJ, et al. Factors and outcomes associated with MRCP use prior to ERCP in patients at high risk for choledocholithiasis. Can J Gastroenterol Hepatol. 2016;2016:5132052.

11.Varghese JC, Farrell MA, Courtney G, Osborne H, Murray FE, Lee MJ. A prospective comparison of magnetic resonance cholangiopancreatography with endoscopic retrograde cholangiopancreatography in the evaluation of patients with suspected biliary tract disease. Clin Radiol. 1999;54(8):513-20.

12.Mercer MS, Singh S, Paterson I. Selective MRCP in the management of suspected common bile duct stones. HPB (Oxford). 2007;9(2):125-30.

13.Varghese JC, Farrell MA, Courtney G, Osborne H, Murray FE, Lee MJ. Role of MR cholangiopancreatography in patients with failed or inadequate ERCP. AJR Am J Roentgenol. 1999;173(6):1527-33.

14.Chen W, Mo JJ, Lin L, Li C-Q, Zhang J-F. Diagnostic value of magnetic resonance cholangiopancreatography in choledocholithiasis. World J Gastroenterol. 2015;21(11):3351-60.

15.Moon JH, Cho YD, Cha SW, Cheon YK, Ahn HC, Kim YS, et al. The detection of bile duct Stones in suspected Biliary pancreatitis: comparison of MRCP, ERCP and intraductal US. Am J Gastroenterol. 2005;100(5):1051-7.

16.Gurbulak B, Ucuncu MZ. Comparison of diagnostic efficacy of MRCP and ERCP in the management of the choledocholithiasis. Ann Med Res. 2019;26(3):413-8.

17.Kaltenthaler EC, Walters SJ, Chilcott J, Blakeborough A, Vergel YB, Thomas S. MRCP compared to diagnostic ERCP for diagnosis when biliary obstruction is suspected: a systematic review. BMC Med Imaging. 2006 14;6:9.

18.Mandelia A, Gupta AK, Verma DK, Sharma S. The Value of Magnetic Resonance Cholangio-Pancreatography (MRCP) in the Detection of Choledocholithiasis. J Clin Dign Res. 2013;7(9):1941-5.

19.Chen W-X, Xie Q-G, Zhang W-F, Zhang X, Hu TT, Xu P, et al. Multiple imaging techniques in the diagnosis of ampullary carcinoma. Hepatobiliary Pancreat Dis Int. 2008;7(6):649-53.

[DOR: 20.1001.1.15614107.1400.23.1.24.3]
[DOI: 10.22088/jbums.23.1.158]

20.Isherwood J, Garcea G, Williams R, Metcalfe M, Dennison AR. Serology and Ultrasound for diagnosis of Choledocholithiasis. Ann R Coll Surg Engl. 2014;96(3):224-8.
21.Prat F, Meduri B, Ducot B, Chiche R, Salimbeni-Bartolini R, Pelletier G. Prediction of common bile duct stones by noninvasive tests.Ann Surg. 1999;229(3):362-8.

[DOR: 20.1001.1.15614107.1400.23.1.24.3]
[DOI: 10.22088/jbums.23.1.158]