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Original Article

Comparison of diagnostic efficacy of MRCP and ERCP in the management of choledocholithiasis

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Abstract

Aim: We compared the accuracy of MRCP and ERCP findings in the management of suspected common bile duct stones.
Material and Methods: Between September and December 2017, 104 patients underwent MRCP and then ERCP to explain the etiology of cholestasis and elevated liver enzymes and / or the bilirubin levels. Laboratory values and MRCP were compared with ERCP findings for the accuracy and reliability of laboratory and radiological findings.
Results: The one-hundred four patients underwent MRCP and then ERCP. Of these, 49 (47.1%) were males. The mean age of the patients was 60.7 ± 16.4 years. When compared MRCP and ERCP findings, the sensitivity of MRCP was 71%, specificity was 35%, negative predictive value (NPV) was 31% and positive predictive value(PPV) was 75%. The accuracy rate was calculated as 61%
Conclusion: The diagnosis of choledocholithiasis, should have been done with primarily MRCP and EUS should be used in cases when MRCP is inadequate. ERCP should be used for only in therapeutic procedures.

Keywords: Choledocholithiasis; MRCP; EUS; ERCP.

INTRODUCTION

Choledocholithiasis occurs in 15-20% of patients with cholelithiasis (1,2). Some common bile duct stones pass into the duodenum spontaneously during an acute attack. How and what extent of this event is uncertain (3). The 10-30% of patients with recurrent pancreatitis, no cause can be found and these cases are diagnosed as idiopathic pancreatitis (4). The diagnosis and treatment algorithm of suspected choledocholithiasis are not fully defined in the literature.

In the management of choledocholithiasis, Magnetic Resonance Cholangio Pancreatography (MRCP), Endoscopic Retrograde Cholangio Pancreatography (ERCP), Intra Operative Cholangiography (IOC) and more recently Endoscopic Ultrasound (EUS) have become prominent. MRCP and EUS are usually used for diagnostic, ERCP and IOC diagnostic and therapeutic purposes (4,5). Since major complications such as ERCP-related bleeding, perforation, sepsis, pancreatitis and very rarely mortality are reported to be up to 5% in the literature, it is very important to avoid unnecessary ERCP procedures for diagnostic purposes.

In this study, we aimed to compare the accuracy of MRCP and ERCP findings in the management of suspected choledocholithiasis with current literature.

MATERIAL and METHODS

Patients who underwent MRCP and then ERCP were included in the study to explain the etiology of cholestasis and elevated liver enzymes and / or the bilirubin levels between September and December 2017 in General Surgery Endoscopy Unit of our hospital. Patients with bile leakage and biliary hydatid cyst, who were diagnosed with cholangiocarcinoma were excluded from the study.

Laboratory values, radiological data such as MRCP and Ultrasonography (USG) were compared with ERCP findings for the accuracy and reliability of laboratory and radiological findings. We performed ERCP to patients who underwent MRCP within 24-48 hours and tried to exclude any negative findings that might be related to possible stone passage. The study was carried out retrospectively on a prospective database. A well written informed consent was obtained from all patients included in this study. The information was collected in accordance with

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the Declaration of Helsinki. The local ethics committee approval was obtained.

Statistical Method

In the descriptive statistics of the data, mean, standard deviation, median lowest, highest, frequency and ratio values were used. The distribution of the variables was measured with the Kolmogorov Simirnov test. Independent samples t-test, Mann-Whitney u test were used for the analysis of quantitative independent data. The chi-square test was used for the analysis of qualitative independent data and Fischer test was used when the chi-square test conditions were not provided. Statistical Package for Social Sciences software version 21.0 (IBM, SPSS, IBM Corp., Armonk, NY, USA) was used to analyze the data.

RESULTS

Data of 104 patients were included in this study. Of these, 49 (47.1%) were males. The mean age of the patients was 60.7 ± 16.4 years. The laboratory values and radiological findings of the patients are given in Table 1 and 2.

Table 1. Demographic data& Laboratory values of patients

Age		60.7 ± 16.4
Sex	**Male**	49 (%47.1)
	Female	55 (%52.9)
AST		125.6± 194.1
ALT		145.2±183.0
ALP		177.4 ±104.5
GGT		306.6 ±284.7
Total Bilirubin		2.7 ± 3.1
Direct Bilirubin		1.5 ± 2.0
Amylase		131.7 ± 471.2
Lipase		263.3 ± 1932.8
Leukocyte		8363.4± 3661.0
Hemoglobin		12.3 ± 1.8
Hematocrit		41.1± 37.7
Platelets (x10⁴)		23.9 ± 7.4
CRP		4.4± 8.4
Jaundice	**(-)**	66 (%63.5)
	(+)	38 (%36.5)
Fever	**(-)**	85 (%81.7)
	(+)	19 (%18.3)
Abdominal Pain	**(-)**	13 (%12.5)
	(+)	91 (%87.5)

Table 2. Radiological findings

USG		
Dilatation of Intrahepatic Biliary Tract (IHBT)	**(-)**	73 (%70.2)
	(+)	31 (%29.8)
Cholelithiasis	**(-)**	67 (%64.4)
	(+)	37 (%35.6)
Cholecystectomy	**(-)**	90 (%86.5)
	(+)	14 (%13.5)
MRCP		
Size of CBD (mm)		11.3 ± 3.7
Size of stone (mm)		7.9 ± 4.5
Dilatation of IHBT	**(-)**	41 (%39.4)
	(+)	62 (%59.6)
Dilatation of CBD	**(-)**	23 (%22.1)
	(+)	81 (%77.9)
Stone & Mud in CBD	**(-)**	32 (%30.8)
	(+)	72 (%69.2)
ERCP		
Size of CBD (mm)		12.6 ± 4.4
Size of stone (mm)		10.3 ± 4.3
Dilatation of CBD	**(-)**	9 (%8.7)
	(+)	95 (%91.3)
Stone & Mud in CBD	**(-)**	28 (%26.9)
	(+)	76 (%73.1)
Stone & Mud extraction	**(-)**	46 (%44.2)
	(+)	58 (%55.8)
Balloon Dilatation	**(-)**	97 (%93.3)
	(+)	7 (%6.7)
Stent Placement	**(-)**	89 (%85.6)
	(+)	15 (%14.4)

CBD: Common bile duct

There was no statistically significant difference in age, gender, AST, ALT, ALP, GGT, total & direct bilirubin, amylase, lipase, leukocyte, hemoglobin, hematocrit, thrombocyte and CRP values in the group with and without choledocholithiasis detected in ERCP (p> 0.05) (Table 3).

Thirty-one patients (36.5%) had jaundice and 91 patients (87.5%) had abdominal pain. Choledocholithiasis was detected in 20 of the patients with jaundice in ERCP. On the other hand, choledocholithiasis was detected in 67 patients with abdominal pain. (Table 4). There was no significant difference when compared the size of the choledocholithiasis, and common bile duct, intrahepatic biliary tract and common bile duct dilatation (p>0.05). There was no statistically significant difference presence of stones in the common bile duct in between the MRCP and ERCP (p> 0.05) (Table 5).

Common bile duct dilatation was found 20 out of 81 patients in MRCP and choledocholithiasis was not detected in ERCP at these patients. Fifteen out of 23 patients who had no dilatation of common bile duct in MRCP, choledocholitiasis was detected in ERCP.

In our study, the sensitivity of MRCP was detected 71%, specificity 35%, negative predictive value (NPV) 31% and positive predictive value(PPV) 75%. The accuracy rate was calculated as 61% (Table 6).

Table 3. Comparison of biochemical parameters between groups

ERCP		Choledocholithiasis (-)			Choledocholithiasis (+)			p	
Age		60.6	±	16.5	60.7	±	16.6	0.964	t
Sex	Male	12		42.9%	37		48.7%	0.597	X^2
	Female	16		57.1%	39		51.3%		
AST		161.4	±	241.5	112.4	±	173.4	0.692	m
ALT		144.7	±	182.9	145.3	±	184.3	0.901	m
ALP		175.7	±	108.9	178.1	±	103.5	0.860	m
GGT		300.7	±	285.9	308.8	±	286.1	0.962	m
Total Bilirubin		2.2	±	2.4	2.9	±	3.3	0.337	m
Direct Billirubin		1.3	±	1.6	1.6	±	2.1	0.695	m
Amylase		213	±	844	101	±	207	0.122	m
Lipase		736	±	3699	87	±	201	0.447	m
Leukocyte		8768	±	3526	8214	±	3721	0.424	m
Hemoglobine		12.0	±	1.4	12.4	±	1.9	0.722	m
Hematocrit		36.3	±	4.3	42.9	±	44.0	0.464	m
Platelets (x10^4)		24.1	±	6.3	23.8	±	7.8	0.533	m
CRP		3.8	±	5.8	4.6	±	9.1	0.442	m

Table 4. Comparison of clinical findings between groups

		Choledocholithiasis (-)		Choledocholithiasis (+)		p	
		n	%	n	%		
Jaundice	(-)	20	71.4%	46	60.5%	0.606	X^2
	(+)	8	28.6%	30	39.5%		
Fever	(-)	24	85.7%	61	80.3%	0.523	X^2
	(+)	4	14.3%	15	19.7%		
Abdominal pain	(-)	4	14.3%	9	11.8%	0.738	X^2
	(+)	24	85.7%	67	88.2%		

Table 5. Comparison of MRCP & ERCP

		Choledocholithiasis in ERCP (-)			Choledocholithiasis in ERCP (+)			p	
MRCP									
Size of CBD (mm)		11.5	±	3.2	11.3	±	3.8	0.602	m
Size of stone		5.9	±	3.7	8.4	±	4.6	0.187	m
Dilatation of IHBT	(-)	13		46.4%	28		36.8%	0.401	X^2
	(+)	15		53.6%	47		61.8%		
Dilatation of CBD	(-)	8		28.6%	15		19.7%	0.336	X^2
	(+)	20		71.4%	61		80.3%		
Stone& mud in CBD	(-)	10		35.7%	22		28.9%	0.507	K
	(+)	18		64.3%	54		71.1%		

CBD: Common bile duct

Table 6. The detection rates of choledocholithiasis in MRCP

	ERCP +	ERCP-		
MRCP +	54	18	PPV	75%
MRCP -	22	10	NPV	31%
	Sensivity 71%	Spesifity 35%	Accuraccy	61%

DISCUSSION

Choledocholtiasis usually occurs in the gallbladder and then passes into common bile duct. Choledocholithiasis occurs in 6 to 15% of the general population and leads to life-threating complications such as pain, jaundice, cholangitis, and pancreatitis (6-8). The majority of choledocholithiasis pass into the duodenum with a spontaneous stone passage. If this transition does not occur, it will block ampullary bulb and lead to clinical conditions such as biliary pancreatitis, mechanical icterus and cholangitis (9). Sensitivity and specificity of diagnostic modalities are important in the diagnosis of choledocholithiasis. USG has a better sensitivity rate of 77-87% in detecting choledochal dilatation, although its sensitivity in detecting choledocholithiasis is as low as 15-40% (10,11).

The hepatobiliary and pancreatic system can be examined in detail and correctly with the MRCP (12,14). MRCP is safe for elderly and comorbid patients, because of ionized radiation and contrast agent were not use and there is no need for anesthesia and sedation when compared to EUS and ERCP and it was used since 1991 (14,15).

MRCP is the superior than USG, EUS and ERCP to determine extra biliary ductal pathologies that may be associated with the patient's clinic, and to be independent of the operator in determining the pancreatic and biliary tract pathologies (14,16). In addition, especially stones less than 4 mm cannot be detected and the lack of therapeutic interventions can be the disadvantages (15,17).

The time period between the MRCP and ERCP may have some stone passage and this change the statistical parameters. In the literature, MRCP sensitivity in detecting choledocholithiasis is reported to be 95-97% and specificity is 82-89% (18). In this study, 104 patients with acute biliary pancreatitis were included in the study. We think that this may have increased the specificity and sensitivity.

ERCP has a high diagnostic sensitivity in detecting common bile duct stones (19). Besides, there are therapeutic advantages such as sphincterotomy, evaluation of the ampulla Vater, biopsy and stent placement (5,20). ERCP failure rate varies between 3 and 10% depending on operator experience (21,22). Diagnostic use of ERCP is not recommended because of risks such as pancreatitis, bleeding, perforation and cholangitis (23). The role and time of ERCP in the management of acute biliary pancreatitis is controversial. There are studies showing that ERCP during acute attack does not decrease mortality and also increases morbidity (24).

EUS provides very high resolution images depending on the proximity of the endoscope probe to the internal tissue. With this dynamic and high-resolution imaging, the EUS is very sensitive to choledocholithiasis smaller than 5 mm (25,26,27). Some studies showed that EUS was to be equal or superior to other modalities in detecting microlithiasis and biliary sludge. EUS has been shown NPV of %95.4 for the diagnosis of choledocholitiasis and sensitivity of %96 for microlithiasis (28). EUS is also important in diagnosing chronic pancreatitis causing idiopathic acute pancreatitis (29,30). Fossard et al. demonstrated in % 92 of patients EUS was able to determine the etiology of IAP (31). EUS is also a reliable modality (32,33) in detecting pancreas divisium, occult ampulla mass and pancreatic cancer, and biopsy can be performed and staged if all of them are detected (10,11,25,26). However, EUS has a risk of sedation, bleeding, and perforation. ERCP has long been used in the diagnosis of IAP. The ERCP diagnosis rate in IAP ranges from 38 to 78%. MRCP has a diagnosis rate of 22% for IAP (16). Today MRCP is used as a non-invasive alternative method. In a study comparing EUS and MRCP, EUS sensitivity 93% specificity was 96% and MRCP sensitivity and specificity was 95% (34).

MRCP and ERCP sensitivity decreases as the stone size diminished (25,35). In addition, small stones can be missed in ERCP, and spontaneous stone passage may become in to the duodenum in the waiting time period for ERCP. In ERCP, small air bubbles can be mistakenly interpreted as stones. This may reduce the diagnostic accuracy of MRCP (36).

Makmun et al. (37) compared the sensitivity and specificity of MRCP, EUS and ERCP and reported the sensitivity, specificity, PPV and NPV for MRCP as 81%, 40%, 74% 50%, respectively. Similar results were found in this study like in our study (37). Meeralam et al. (38) reported that MRCP sensitivity ranged from 40% to 89%. However, ERCP was not performed after MRCP in all patients and the patients with negative findings in MRCP and those who had no clinical complaints at 3 months follow-up were considered negative. We think that this increases the specificity and sensitivity of this study. When our results were compared with current literature, sensitivity, specificity, PPV and NPV rates were found to be low. The reason for this is that in other studies, specific patient groups (eg biliary pancreatitis, mechanical icterus) have been studied and all patients with MRCP did not underwent ERCP.

EUS and MRCP diagnoses with excellent accuracy for choledocholithiais. Patients with negative findings in MRCP, should be perform EUS and if stone is detected, stone extraction should be performed by ERCP while the patient is sedated. In particular, EUS and ERCP have been shown to be safer at the same session than different times (39). In another study, the EUS and ERCP were compared and the EUS sensitivity was 100% and the specificity was 96% and it was specified as the gold standard (40). In another study comparing EUS and MRCP, the EUS specificity was 96-100% and MRCP was determined as 92-100% (41). In particular, EUS should be in the diagnostic algorithms for the management of small and suspected choledocholithiasis because of its higher sensitivity and specificity than MRCP.

CONCLUSION

In the diagnosis of choledocholithiasis, primarily MRCP

should be used and EUS should be used in cases when MRCP is inadequate or dubious. ERCP should be used only in therapeutic procedures due to the risk of complications, radiation and contrast agents.

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