JMU

Jurnal Medika Udayana

ISSN: 2597-8012 JURNAL MEDIKA UDAYANA, VOL. 13 NO.08, AGUSTUS, 2024

DOAJ DIRECTORY OF OPEN ACCESS JOURNALS

Accredited SINTA 3

Received: 2024-04-10 Revision: 2024-06-30 Accepted:01-07-2024

DIAGNOSTIC VALUE OF ABDOMINAL CT SCAN AND MRCP IN DETERMINING THE CAUSE OF BILIARY TRACT OBSTRUCTION

Alvia Novita Badjeber1, Bachtiar Murtala1, Mirna Muis1, Andi Alfian2, Nu'man As Daud3
1Department of Radiology, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia
2Department of Public Health Sciences, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia
3Department of Internal Medicine, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia
alvianovita@gmail.com

ABSTRACT

This study aims to determine the diagnostic value of abdominal CT scan and MRCP in determining the cause of biliary tract obstruction. This research was conducted at the Department of Radiology at RSUP dr. Wahidin Sudirohusodo Makassar with a total sample of 41 samples who suited the inclusion criteria. Analysis was performed on abdominal CT scans and MRCP of patients with biliary tract obstruction to determine the cause and location of the obstruction. The results were then compared with operation report.The results showed that the abdominal MDCT scan had a sensitivity of 67% and a specificity of 100% in diagnosing stones; 100% sensitivity and 77.5% specificity in diagnosing benign strictures; 88% sensitivity and 100% specificity in diagnosing masses, while MRCP has 83.3% sensitivity and 100% specificity in diagnosing stones; 100% sensitivity with 86.8% specificity in diagnosing benign strictures, 88% sensitivity and 100% specificity in diagnosing masses. There is a concordance between the results of the diagnosis between the MDCT scan of the abdomen and the MRCP with the results of surgery to determine the cause and location of the obstruction of the biliary tract. From the results of this study, it can be concluded that MRCP has higher diagnostic accuracy, sensitivity, and specificity values compared to abdominal CT scans in determining the cause and location of biliary tract obstruction.

Keywords: MDCT scan abdomen., MRCP., biliary tract obstruction

INTRODUCTION

Biliary tract obstruction is a condition that occurs as a result of blockage of the bile duct system leading to impaired bile flow from the liver to the intestinal tract. Biliary obstruction can occur anywhere along the biliary system pathway and can lead to serious complications such as liver dysfunction, renal failure, nutritional deficiencies, bleeding problems and infections. Biliary obstruction is common and affects a large proportion of the world's population, causing significant morbidity and mortality. Biliary obstruction can be divided into various benign and malignant etiologies. These include choledocholithiasis (gallstones in the bile ducts), choledochal cysts (dilation/cysts of the bile ducts), Mirizzi syndrome (gallstones in the cystic ducts compressing the bile ducts), benign structural diseases such as Primary sclerosing cholangitis (PSC), fibrotic strictures of the gallstone ducts or iatrogenic strictures of the bile duct cannulation. Neoplastic stricture disease causing biliary obstruction may include cholangiocarcinoma (bile duct cancer), pancreatic caput cancer leading to distal bile duct stricture, and ampullary carcinoma or adenoma. Other aetiologies of biliary obstruction may include infectious diseases such as parasitic cholangiopathy (Clonorchis sinensis, Ascaris lumbricoides) leading to intra- or extrahepatic obstruction of bile flow, inflammatory and autoimmune diseases such as AIDS cholangiopathy, and autoimmune cholangiopathy.[1-3]Many research studies have shown that clinical data such as history, physical examination, and laboratory tests can accurately identify up to 90% of patients whose jaundice is caused by extrahepatic obstruction. However, a complete assessment of biliary obstruction often requires the use of various imaging modalities to confirm the presence, extent, and cause of obstruction, and to assist in treatment planning. Current technologies include transabdominal ultrasound (US), endoscopic retrograde cholangio-pancreatography (ERCP), trans hepatic cholangiopancreatography (PTC), endoscopic ultrasound (EUS), magnetic resonance cholangiopancreato-graphy (MRCP), and CT scans.[4] Computed tomography (CT) scan and magnetic resonance cholangiopancreatography (MRCP) are the most complex and advanced diagnostic methods in the examination of biliary obstruction, allowing the surgeon to decide quickly on the most appropriate course of action for each individual. CT scans can provide details about the obstructing structures providing an etiologic diagnosis of a lithiasis or non-lithiasis obstruction, are able to establish the benign or malignant nature of a lesion, and can also elicit information about other local or regional lesions. MRCP shows the obstruction, its exact location, its dimensions, the length of the obstructed CBD segment, and the degree of upstream dilation where another advantage of MRCP is that it does not use X-rays.[5] Knowing the diagnostic value of abdominal CT scan and MRCP in determining the cause of biliary tract obstruction based on surgical outcomes.

MATERIALS AND METHODS

This study is a cross-sectional study with retrospective and prospective secondary data collection, conducted at the Radiology Installation of the Doctor Wahidin Sudirohusodo Hospital Makassar. Medical record data of patients with biliary tract obstruction who underwent abdominal MDCT scan and MRCP at Radiology Installation of Doctor Wahidin Sudirohusodo Hospital Makassar were collected from January 2021 to May 2022. Inclusion criteria included intrahepatic or extrahepatic cholestatic patients or both who had undergone abdominal CT scan without and with contrast and MRCP and had undergone surgery and intrahepatic or extrahepatic cholestatic patients or both who had undergone MRCP and had undergone surgery; While the exclusion criteria were patients with abdominal CT scan results without and or with contrast and MRCP examination but the results of the operation report were incomplete, patients with abdominal CT scan results without and or with contrast and MRCP examination outside the radiology department of Wahidin Sudirohusodo Hospital and all patients with intrahepatic or extrahepatic cholestatic with inconclusive abdominal CT scan or MRI examination results. We evaluated the location of biliary obstruction and the cause of biliary obstruction on abdominal MDCT scan and MRCP, then compared it with the results of the operation report. Data were analyzed regarding the suitability of abdominal MDCT scan and MRCP examination with surgical results using the Kappa test. Data processing will use Statistical Program Social Science (SPSS) software version 23.0. Research permission was obtained with the approval of the Ethics Committee for Biomedical Research in Humans, Faculty of Medicine, Hasanuddin University, Makassar

RESULT

Table 1: Characteristics of the sample

Characteristics		n (41)	%
Age (Years)	21-30	5	12.2
	31-40	4	9.8
	41-50	12	29.3
	51-60	13	31.7
	61-70	6	14.6
	71-80	1	2.4
Type of Gender	Male	23	56.1
	Female	18	43.9

Based on table 1, it is known that the highest age category range is 51-60 years old as many as 13 samples (31.7%) and 41-50 years old as many as 12 samples (29.3%). While the least was in the age range of 71-80 years as many as 1 sample (2.4%), with male gender more than female.

Table 2.Causes and locations of biliary obstruction by surgery

Characteristics		**n (41)**	**%**
Cause	Stone	12	29.3
	Striktur	3	7.3
	Massa	26	63.4
Location of the lesion	Duktus bilier	16	39
	Duktus Pankreas	16	39
	Ampulla Vater	5	12.2
	Duodenum	3	7.3
	Paraaorta	1	2.4

In Table 2, the causes of cholestatic according to the operation report were stones as many as 12 samples (29.3%), strictures as many as 3 samples (7.3%), masses as many as 26 samples (63.4%). The most common cause of cholestatic according to the results of the operation report was mass. The most common lesion location was in the biliary duct (16 samples (39%) and pancreatic duct (16 samples (39%).

Table 3.Comparison of diagnostic results of the cause of biliary obstruction on abdominal CT scan and MRCP

Cause	CT Abdomen	MRCP
Stone	8 (19.5%)	10 (24.4%)
Striktur	10 (24.4%)	8 (19.5%)
Massa	23 (56.1%)	23 (56.1%)

In table 3, stone findings on abdominal CT scans were found in 8 samples (19.5%), strictures in 10 samples (24.4%) and masses in 23 samples (56.1). While stone findings on MRCP were found in 10 samples (24.4%), strictures in 8 samples (19.5%) and masses in 23 samples (56.1%). In general, the findings of the causes of biliary obstruction on abdominal CT scan and MRCP are almost the same.

Table 4. Diagnostic accuracy, sensitivity and specificity of causes of biliary obstruction on abdominal CT scan examination

Cause	**N**				**%**		
	TP	FP	FN	TN	DA	SE	SP
Stone	8	0	4	29	90.2	67	100
Benign stricture	3	7	0	31	82.9	100	77.5
Massa	23	0	3	15	92.6	88	100

Notes: TP (True positive), FP (False positive), FN (False negative), TN (True negative), DA (Diagnostic Acuracy); SE (Sensitivity); SP (Specifity)

Table 5. Diagnostic accuracy, sensitivity and specificity of causes of biliary obstruction on MRCP examination

Cause	**N**				**%**		
	TP	FP	FN	TN	DA	SE	SP
Stone	10	0	2	29	95.1	83.3	100
Benign stricture	3	5	0	32	87.8	100	86.8
Massa	23	0	3	15	92.6	88	100

Note: TP (True positive), FP (False positive), FN (False negative), TN (True negative), DA (Diagnostic Acuracy); SE (Sensitivity); SP (Specifity)

In tables 4 and 5, it appears that MRCP has higher diagnostic accuracy, sensitivity and specificity than abdominal CT in diagnosing stones and benign strictures, while for diagnosing masses both modalities have similar values

Table 6. Diagnostic accuracy, sensitivity and specificity of biliary obstruction location on abdominal CT scan with MRCP

LOCATION	CT Abdomen			MRCP		
	DA(%)	SE(%)	SP(%)	DA(%)	SE(%)	SP(%)
Duktus bilier	90.2	87.5	92	92.6	93.7	92
Duktus Pankreas	87.8	83.3	91.3	95.1	87.5	100
Ampulla vater	78	40	83	82.9	86.1	60
Duodenum	95.1	33.1	100	95.1	33.1	100
Paraaorta	97.5	100	97.5	97.5	100	97.5

NOTE: DA (Diagnostic Acuracy); SE (Sensitivity); SP (Specifity)

Table 6 shows that MRCP has higher diagnostic accuracy, sensitivity and specificity than abdominal CT in diagnosing lesions in the biliary duct, pancreas and ampulla vater, while for lesions in the duodenum and paraaorta these two modalities have the same value.

Table 7. Kappa coefficient test for the concordance of the diagnosis of the cause of obstruction on abdominal MDCT scan with the results of the operation report

MDCT scan abdomen	Operasi			Total	Kappa	P value
	Stone	Striktur	Massa			
Stone	8	0	0	8	0.70	0.000
Striktur	4	3	3	10		
Massa	0	0	23	23		
Total	12	3	26	41		

In table 7, it was found that the concordance between abdominal MDCT scan and surgery in patients with stones was 8 patients, strictures were 3 patients and masses were 23 patients. The Kappa coefficient test results obtained 0.70 with a p value of 0.000.

Table 8. Kappa coefficient test for the concordance of the results of diagnosing the cause of obstruction on MRCP with the results of the operation report

MRCP	Surgery			Total	Kappa	P value
	Stone	Striktur	Massa			
Stone	10	0	0	10	0.782	0.000
Striktur	2	3	3	8		
Massa	0	0	23	23		
Total	12	3	26	41		

In table 8, it was found that the concordance between MRCP and surgery in patients with stones was 10 patients, strictures were 3 patients and masses were 23 patients. The Kappa coefficient test results obtained 0.782 with a p value of 0.000.

Table 9: Kappa coefficient test for concordance of biliary obstruction location on abdominal MDCT scan with operation report result

MDCT scan abdomen	Operasi					Total	Kappa	P
	CBD	DP	AV	D	PA			
CBD	14	0	2	0	0	16	0.642	0.000
DP	1	13	1	0	0	15		
AV	0	3	2	2	0	7		
D	0	0	0	1	0	1		
PA	1	0	0	0	1	2		
Total	16	16	5	3	1	41		

NOTE: DP (duktus pankreas); AV (ampulla vater); D(duodenum); PA (paraaorta)

In table 9, it was found that the location of obstruction between abdominal MDCT scans and surgery in the CBD was 14 patients, 13 patients of pancreas, 2 patients of ampulla voter, 1 patient of duodenum and 1 patient of Para aorta. Kappa coefficient test results obtained 0.642 with a p value of 0.000.

Table 10. Kappa coefficient test for the concordance of the location of biliary obstruction on abdominal MRCP scan with the results of the surgery report

MRCP	Operasi					Total	Kappa	P
	CBD	DP	AV	D	PA			
CBD	15	0	2	0	0	17	0.749	0.000
DP	0	14	0	0	0	14		
AV	0	2	3	2	0	7		
D	0	0	0	1	0	1		
PA	1	0	0	0	1	2		
Total	16	16	5	3	1	41		

In table 10, it was found that the location of obstruction between MRCP and surgery in the CBD was 15 patients, 14 patients of pancreas, 3 patients of ampulla voter, 1 patient of duodenum and 1 patient of Para aorta. Kappa coefficient test results obtained 0.749 with a p value of 0.000.

DISCUSSION

Biliary obstruction is one of the conditions that require the role of the Radiology department to be able to establish a diagnosis, so that the cause can be known and taken action. The use of abdominal CT scan and MRI-MRCP modalities is a very good choice in detecting the cause of biliary tract obstruction.In this study, it was found that male gender was more diagnosed with biliary tract obstruction, namely 23 samples (56.1%) than female 18 samples (43.9%). This is in accordance with research conducted by Singh et al found the ratio of women and men is 1.4: But in contrast to research conducted by Mathew et al, the number of men and women who experienced biliary obstruction was the same.[6,7] The age range with the most biliary tract obstruction was 51-60 years old as many as 13 samples (31.7%) and 41-50 years old as many as 12 samples (29.3%). This is in accordance with research conducted by Mathew et al that the most common age of biliary obstruction is the age range of 41-60 years. Research conducted by Singh et al also found that the most common age for biliary obstruction was the 40 to 60 decade.[6,7] In table 2, it was found that the cause of cholestatic according to the operation report was stones as many as 12 samples (29.3%), strictures as many as 3 samples (7.3%), masses as many as 26 samples (63.4%). The most common lesion location was in the biliary duct as many as 16 samples (39%) and pancreas as many as 16 samples (39%).In tables 4 and 5, MRCP has higher diagnostic accuracy, sensitivity and specificity than abdominal CT in diagnosing stones and benign strictures, while for diagnosing masses these two modalities have the same value. Table 6 shows that MRCP has higher diagnostic accuracy, sensitivity and specificity than abdominal CT in diagnosing lesions in the biliary duct, pancreas and ampulla voter, while for lesions in the duodenum and Para aorta both modalities have the same value. The diagnostic accuracy, sensitivity and specificity of MRCP are comparable to those reported in the literature of Calvo et al, Huassein et al, Boraschi et al, Varghese et al, where sensitivity, specificity and diagnostic accuracy ranged from 81-100%, 84-100% and 90-96%, respectively. The study conducted by Al-Obaidi et al showed high sensitivity (100%), specificity (98.5%), accuracy (98.7%) of MRI/MRCP for cases with benign strictures. The present study showed diagnostic accuracy, sensitivity and specificity of 95.3%, 91.2%, 91.6% of CT and 98.5%, 97.5%, 96.9% of MRCP for benign causes of biliary obstruction.[8-12] In table 7, it was found that the concordance between abdominal MDCT scan and surgery in patients with stones was 8 patients, strictures were 3 patients and masses were 23 patients. The Kappa coefficient test results obtained 0.70 with a p value of 0.000. In table 7, there is a discrepancy in the diagnosis of stricture based on abdominal MDCT scan, while the operation report shows stones (4 patients) and masses (3 patients). This could be due to certain types of stones such as cholesterol stones that can show the same density as biliary fluid, making it difficult to distinguish even with a picture of ductal dilatation, so that it can appear as a stricture on a CT scan. Lee et al also stated that CT scan has low sensitivity in showing cholesterol stones but has high sensitivity in showing calcium stones that will appear hyperdense. In the case of tumors, generally tumor images can show images resembling strictures on MDCT scans, which are very post-contrast. However, the enhancement depends again on the amount of contrast and the phase of image capture after contrast is injected. Too fast an image capture time or too little contrast will result in less than optimal stenting that can be misinterpreted as a benign stricture.[13] In table 8, it was found that the concordance between MRCP and surgery in patients with stones was 10 patients, strictures were 3 patients and masses were 23 patients. The Kappa coefficient test results obtained 0.782 with a p value of 0.000. This shows that abdominal CT scan and MRI-MRCP have strong agreement in diagnosing the cause of biliary tract obstruction. Table 8 shows a discrepancy in the diagnosis of strictures based on MRCP, while the results of surgery showed stones (2 patients) and masses (3 patients). Griffin et al stated that false positive results of strictures can be found due to artifacts on MRCP, namely pulsatile vascular compression of surrounding vessels that resemble strictures. The most frequent locations of extrinsic compression are the common hepatic duct, left hepatic duct and the center of the CBD. False negative results on MRCP can be caused by low resolution of MRCP, the presence of motion artifact that complicates the diagnosis, very small size of stones or masses, masses that give the appearance of malignant strictures, location of stones or masses at the distal end of the CBD or ampulla.[14,15] In table 9, it was found that the location of obstruction between abdominal MDCT scans and surgery in the CBD was 14 patients, 13 patients of pancreas, 2 patients of ampulla voter, 1 patient of duodenum and 1 patient of Para aorta. The Kappa coefficient test results obtained 0.642 with a p value of 0.000. In table 9, it was found that the location of obstruction between MRCP and surgery in the CBD was 15 patients, pancreas was 14 patients, ampulla vater was 3 patients, duodenum was 1 patient and Para aorta was 1 patient. The Kappa coefficient test results obtained 0.749 with a p value of 0.000. This shows that abdominal CT scan and MRI-MRCP have strong agreement in determining the location of biliary tract obstruction.Table 10 shows that there were several patients who showed location discrepancies between MRCP and surgical results. This is mostly due to the mass, where in large, infiltrative masses and extending to multiple organs it is difficult to determine the origin of the mass. Therefore, there is currently clinician and radiologist consensus to use the term "periampullary tumor" to denote masses located 2 cm from the ampulla vater in the duodenum, including pancreatic duct masses, distal to the CBD, ampulla tumors and duodenal tumors.[16] Research conducted by Indira Naranayaswami et al, in assessing the accuracy of CT in evaluating the cause of obstruction and to assess various imaging images of malignant causes of biliary tract obstruction. In a prospective study conducted by Ahmetoghlo A et al using CT scans in patients with biliary obstruction, the accuracy of diagnosis of biliary obstruction on CT scans was 83.3%, MDCT scans were also sensitive and specific in diagnosing stones 93% and 89%.[17] Based on the results of this study, it can be concluded that abdominal CT scan without or with contrast can assess the cause and location of biliary obstruction. Based on the literature, MDCT scans and post processing reconstruction techniques provide good visualization of the biliary system. However, CT scan cannot replace the role of MRCP in assessing the cause and location of obstruction, especially in cases of intraluminal stones. MRCP is a flow sequence MRI and does not require intravenous contrast and is a highly specific modality for biliary pathology that precisely delineates the location of biliary tract obstruction. MRCP also precisely shows the number of stones, their size (starting from 1mm). However, MRCP also has the disadvantages of low resolution, and the presence of motion artifact which complicates the diagnosis especially in mass cases. Table 10 shows that there were several patients who showed location discrepancies between MRCP and surgical results. This is mostly due to the mass, where in large, infiltrative masses and extending to multiple organs it is difficult to determine the origin of the mass. Therefore, there is currently clinician and radiologist consensus to use the term "periampullary tumor" to denote masses located 2 cm from the ampulla vater in the duodenum, including pancreatic duct masses, distal to the CBD, ampulla tumors and duodenal tumors.[16]

REFERENCE

1. Hundt M, Basit H, John S. StatPearls [Internet]. Physiology, Bile Secretion. StatPearls Publishing; Treasure Island (FL): Oct 3, 2020.
2. Kruis T, Güse-Jaschuck S, Siegmund B, Adam T, Epple HJ. Use of microbiological and patient data for choice of empirical antibiotic therapy in acute cholangitis. BMC Gastroenterol. 2020 Mar 12;20(1):65.
3. Taylor T, Wheatley M, Gupta N, Nusbaum J. Jaundice in the emergency department: meeting the challenges of diagnosis and treatment [digest]. Emerg Med Pract. 2018 Apr 02;20(Suppl 4):1-2.
4. Tse F, Jeffrey SB, Romagnulo R, Fiedman G. Nonoperative imaging techniques in suspected biliary tract obstruction. HPB, 2006; 8: 409.425. Taylor&Francis
5. Petrescu I, Bratu AM, Petrescu S, Popa BV, Cristian D, Burcos T. CT vs. MRCP in choledocholithiasis jaundice. Journal of Medicine and Life Vol. 8, Issue 2, April-June 2015, pp.226-231
6. Mathew RP, Moorkath A, Basti RS, Suresh HB. Value and Accuracy of Multidetector Computed Tomography in Obstructive Jaundice. Department of Radio-Diagnosis: Father Muller Medical College, Mangalore, Karnateka, India; 2016.
7. Singh, A., Mann, H.S., Thukral, C.L. and Singh, N.R., 2014. Diagnostic accuracy of MRCP as compared to ultrasound/CT in patients with obstructive jaundice. Journal of clinical and diagnostic research: JCDR, 8(3), p.103.
8. Calvo MM, Bujanda L, Calderon A, et al. Role of magnetic resonance cholangiopancreatography in patients with suspected choledocholith- iasis. Mayo Clin Proc. 2002; 77: 422–28.
9. Hussein FM, Alsumait B, Aman S, et al. Diagnosis of choledocholithiasis and bile duct stenosis by magnetic resonance cholangiogram. Australas Radiol. 2002; 46: 41–46.
10. Boraschi P, Neri E, Braccini G, et al. Choledocholithiasis: diagnostic ac- curacy of MR cholangiopancreatography. Three-year experience. Magn Reson Imaging. 1999; 17: 1245–53.
11. Varghese Liddell, et al. MRCP versus U\S in the detection of choledocholithiasis. Clinical radiology. 2000,55:25-35.
12. Safa Al-Obaidi, Mohammed RidhaAlwan Al-Hilli, Atheer Adnan Fadhel. The Role of Ultrasound and Magnetic Resonance Imaging in the Diagnosis of Obstructive Jaundice. The Iraqi Postgraduate Medical Journal. 2007;6(1):7-17.
13. Lee JG. Diagnosis and management of acute cholangitis. Nat Rev Gastroenterol Hepatol. 2009; 6(9):533-41
14. Griffin N., Charles-Edwards G., Grant L. A. Magnetic resonance cholangiopancreatography: the ABC of MRCP. *Insights Imaging*. 2012;**3**(1):11–21
15. ElSayed, E.Y., El Maati, A.A.A. and Mahfouz, M., 2013. Diagnostic value of magnetic resonance cholangiopancreatography in cholestatic jaundice. The Egyptian Journal of Radiology and Nuclear Medicine, 44(2), pp.137-146.
16. Sugita, R., Furuta, A., Ito, K., Fujita, N., Ichinohasama, R. and Takahashi, S., 2004. Periampullary tumors: high-spatial-resolution MR imaging and histopathologic findings in ampullary region specimens. Radiology, 231(3), pp.767-774.
17. Narayanaswamy I, Erasu AR, Prakash R. The Role of Multidetector Row Computed Tomography in Biliary Tract Malignancy. Department of Radio-Diagnosis: Vydehi Institute of Medical Sciences and Research, Bangalore, Karnataka, India; 2015. Ahmetoghlo

doi:10.24843.MU.2024.V13.i08.P04