

---

## The Role of Magnetic Resonance Imaging and Magnetic Resonance Cholangiopancreatography in Patients with Obstructive Jaundice.

Najeeb S. Jabbo  
FRCS,

Ayad Mahmood Subhi  
MBChB.

Ra'ad H. AL-Kayat  
FICMS-RD

---

### Abstract:

**Objectives:** The aim of this study is to evaluate the sensitivity, specificity and diagnostic accuracy of magnetic resonance cholangio-pancreatography in patients with obstructive jaundice after comparing it with the final diagnosis after surgical exploration and histopathological study.

**Methods:** This study was held at Al-Yarmouk Teaching Hospital where patients with obstructive jaundice were investigated with magnetic resonance cholangio-pancreatography followed by surgical exploration and confirmation of diagnosis. Comparison of both results was carried out.

**Results:** There were 42 patients, 26 females and 16 males. Their mean age was 59 years. 17 patients had common bile duct stones, 17 had malignancy, 3 had hydatid cyst, 2 had benign stricture and one patient had Mirizzi's syndrome, chronic liver disease and biloma for each. After comparison with the final diagnosis after surgical exploration, the sensitivity, specificity and diagnostic accuracy of magnetic resonance cholangio-pancreatography were 100%, 92% and 95.2% respectively for those with common bile duct stones, while they were 94.1%, 100% and 97.6% respectively for those with malignancy.

**Conclusion:** Magnetic resonance cholangio-pancreatography is of high diagnostic accuracy when used for patients with obstructive jaundice of different causes. In addition to its characters of being a non-invasive technique that need neither specific preparation nor anesthesia. We recommend using it on a wider scale in our country.

**Keywords:** Obstructive jaundice, diagnosis, MRCP

---

### Introduction:

Surgical jaundice includes conditions where there is physical obstruction to the bile duct, usually outside the liver. Stone is the most common cause; other causes are carcinoma of the pancreato-ampullary region, cholangiocarcinoma and benign bile duct stricture [1]. Most of the progress in the diagnosis and treatment of biliary tract disease has been made in the last 150 years, but gallstones and their sequel, which cause most of the clinical problem, are not a malady of just modern times. Important advances in diagnostic testing have been made in the twentieth century; this field was opened by the development of cholecystography by Graham and Cole, culminating in the first cholecystography in man in 1924 [2]. Cholescintigraphy was first reported in 1953. Cholangiography by the percutaneous transhepatic cholangiography (PTC) and endoscopic retrograde cholangiopancreatography (ERCP) has been developed since 1950. The application of ultrasonography, computed tomography, choledochoscopy, and interventional radiological technique to the diagnosis and management of biliary tract disease has occurred in the past 2 decades [3].

However MRI-MRCP now becomes the standard technique of noninvasive investigation of biliary tree, ductal dilatation and stricture as well as intraluminal filling defect are clearly seen [4]. The ability of magnetic resonance imaging to depict a dilated biliary tree was first demonstrated by Doms et al in 1986 [5].

MR cholangiography (MRC) and MRCP comprise a body of MR imaging techniques only recently reaching a level of clinical utility. MRC and MRCP refer to the generation of projectional MR images of the biliary tree and pancreatic ducts achieved in such a way as to mimic projectional radiographs obtained by contrast injection during PTC or ERCP. By noninvasively providing a set of projectional images of the pancreaticobiliary tree, MRCP has the potential to limit the use of PTC and ERCP to only those cases in which the diagnostic component of these invasive procedures is preliminary to percutaneous or endoscopic therapeutic intervention. MRCP has gained rapid acceptance by endoscopists and surgeons because of the familiar projectional image format.

### Patients & Methods:

This study which was conducted at AL-Yarmouk Teaching Hospital from April 2001 till January 2003. It includes 42 patients suspected of having obstructive jaundice. They were examined and investigated with radiological and biochemical tests. They had also the investigation of MRI-MRCP. They were studied in details in regards to their age, gender, clinical presentation, and clinical examination. The results of MRI-MRCP, the operative findings and histopathological study when applied were included. The final diagnosis was established by exploration with or

Without histopathology and this was compared with the findings of MRI-MRCP. Jaundiced patient

who had no MRI-MRCP were excluded as well as those refused surgery.

MRI and MRCP examination was carried out using 1.5 Tesla Gyro scan NT from Philips Company with a tunnel aperture 76cm, maximum weight 130 Kg. the average time of examination last about 45 minutes. It was done in the radiological department. History, clinical examination and other available investigations were recorded.

Patients were informed about the technique (i.e. the examination time, gradient noise, being positioned in a narrow space, lying immobile and removing any metallic objects). No specific preparation was needed. No sedation or negative contrast media was required

**Results**

The total number of 42 patients suspected with obstructive jaundice where examined by MRI-MRCP, 26 of our patients (61.9%) were females and 16 patients (38.1%) were males. The age range of our cases was between 22-85 years with a mean age of 59.1+-14.8. Seventeen patients out of 42 (40.5%) were found to have CBD stones, 11 patients were females and 6 were males. The mean age for those with CBD stones was 53.9 years. Seventeen cases of 42 (40.5%) were diagnosed as

malignancy, 10 of them were females and 7 were males. The mean age of those with malignancy was 65 years. Table1. Shows the clinical and physical findings in patients with obstructive jaundice in relation to the cause. Regarding symptoms, abdominal pain and fever were more common in those with CBD stones than those having tumors i.e. 76.5% and 52.9% versus 58.8% and 17.6% respectively, while itching and weight loss were more common in the tumor group i.e. 82.4% and 88.2% versus 70.6% and 17.6% in the CBD stones group respectively. Abdominal mass was detected in 64.7% of patients with tumor, while in those with stones; it was detected in 41.2%.

The most common type of tumour was cholangiocarcinoma (8 patients, 44.4%), carcinoma of head of pancreas in 7 (38.9%), ampullary carcinoma in 2 (11%) and one patient had carcinoma of gall bladder (i.e. 5.6%).

MRI-MRCP examination in cases with common bile duct stones had a sensitivity, specificity and accuracy of 100%, 91.7% and 95% respectively, while in those with malignancy, they were 94.4%, 100% and 97.5% respectively as shown in table 2, while tables 3 & 4 show the comparison of this study with other studies in regards to sensitivity, specificity and diagnostic accuracy in cases of stones and tumor groups

**Table1. Clinical findings in relation to the final diagnosis.**

Final diagnosis	Abdominal pain		itching		fever		Weight loss		Previous cholecystectomy		mass	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<b>CBD stones n =17</b>	13	76.5	12	70.6	9	52.9	3	17.6	1	5.9	7	41.2
<b>Tumors (n=17)</b>	10	58.8	14	82.4	3	17.6	15	88.2	-	-	11	64.7
<b>Hydatid cyst. n=3</b>	2		2		1		-		-		2	
<b>Stricture (n=17)</b>	1	50	-		-		1	50	2	100	-	-
<b>Post cholecystectomy biloma (n=17)</b>	1	100	-	-	1	100	1	100	1	100	1	100
<b>Chronic liver disease (n=17)</b>	1	100	-	-	1	100	-	-	-	-	1	100
<b>Mirrizi's Syndrome (n=17)</b>	1	100	1	100	-	-	-	-	-	-	-	-

Table 2. Evaluation of MRCP findings according to the operative findings.

Final diagnosis	Sensitivity %	Specificity %	Accuracy %	True +ve	PPV %	NPV %	False +ve	False -ve
stones	100	92	95.2	17	89.5	100	2	0
malignancy	94.1	100	97.6	16	100	97.1	0	1
Ca. of pancreas	83.3	97.2	95.2	5	83.3	97.2	1	1
cholangiocarcinoma	62.5	100	92.8	5	100	91.9	0	3
Ampullary Ca.	50	97.5	95.2	1	50	97.5	1	1
Hydatid cyst	66.7	100	97.6	2	100	97.5	0	1
Benign stricture	100	100	100	2	100	100	0	0
Mirrizi syndrome	100	100	1	100	100	100	0	0

Table 3. Comparison of our study with others in cases of choledocholithiasis.

	No. of patients	Sensitivity %	Specifity %	PPV %	NPV %	Diagnosing accuracy
Current study	17	100	92	89.5	100	95.2
Demartines et al (20)	25	100	96	93	100	–
Lomanto et al (21)	60	92	100	–	–	97
Stiris et al (22)	32	87	94	97	82	90
Zidi et al (23)	49	57	100	100	50	–
Becker et al (24)	26	88	91	77	96	91
Ali SY (18)	30	100	100	100	100	100
Flucher (25)		100	100			100

Table 4. Comparison of this study with others in cases of malignancy.

	No. of patients	sensitivity	specificity	PPV	NPV	accuracy
Current study	17	94.1%	100%	100%	97.1%	97.6%
Ali SY (18)	58	98.3%	100%	100%	98.6%	99.2%
Adamek HE, et al (26)	27	81%	100%			
Geogopoulos SK, et al (27)						100%
Flucher et al (25)		86%	98%	86%	98%	97%
Wallner et al (28)						62%
Hall crags et al (29)						60%
Ishizaki et al (30)						30%

#### Discussion:

Obstruction of bile ducts distal to the porta may be secondary to intrinsic tumor, but other causes of obstruction are more common. These causes include iatrogenic strictures of the mid-common duct, common bile duct obstruction caused by pancreatic carcinoma, and obstruction at the ampulla of Vater caused by stones, tumors, hydatid cyst or inflammatory strictures. Rarely, processes arising in the gallbladder may obstruct the bile ducts such as Mirizzi syndrome. Choledocholithiasis is the most common cause of biliary tract obstruction. Approximately 15% of patients with cholelithiasis present with stones in the duct. Thus, establishing correct diagnoses are extremely important before any form of therapy is attempted. With the introduction of computed tomography and ultrasonography, both oral and intravenous cholangiography has been relegated to have a secondary role or simply is not performed. However, neither CT nor ultrasonography is effective in exploring the distal duct or ampullary region. In this context, the sensitivity of ultrasonography and CT in the diagnosis of choledocholithiasis is about 38% to 65% and 60% to 85% respectively [6,7]. The development of ERCP was a turning point in the management of such patients. This technique performs direct cholangiography and pancreatography, and it allows diagnosis, treatment, and/or palliative measures in the same procedure [8]. ERCP had a sensitivity and specificity in the diagnosis of pancreatic tumors of 82% and 90% respectively [9].

However, it has complications and the associated morbidity has been estimated to be around 0.8% to 10% (e.g. pancreatitis, perforation, haemorrhage, and cholangitis), moreover, analgesia is required, and the technique is operator dependent. In this context, cannulation failure is reported to be 9% to 30% of cases, even in experienced hands [10]. The development of MRCP incorporates into MRI a large body of knowledge developed from interpretation of PTC or ERCPs. MRCP is equivalent to ERCP in determining the level of ductal obstruction and in distinguishing benign strictures from malignant ones [11]. MRCP is fast, non-invasive procedure which can distinguish the fluid contents of the pancreaticobiliary tree from adjacent solid structures, and they acquire images of the biliary and pancreatic structures in their native configuration without the pressure distension associated with injection of contrast agents [12]. Agreement in more than 90% of cases between MRC and contrast cholangiography has been reported [13]. MRC provides a set of noninvasive projectional images of the bile ducts and is therefore indicated when diagnostic information gained from the examination would be likely to obviate direct x-ray cholangiography, either because a normal examination would be considered sufficient to exclude pathology or because the next step would likely be surgery. MRC is indicated for diagnostic evaluation of patients in whom endoscopic cholangiography is impossible [14]. This includes many patients with hepaticojejunostomy or Billroth II gastrojejunostomy, patients with gastric

outlet obstruction, and some with ampullary strictures or diverticula. In these patients, MRC can be useful even if there is compelling evidence (e.g., cholangitis or advanced jaundice) that transhepatic biliary drainage is required because MRC helps to map a transhepatic approach.

On the other hand, MRCP cannot be applied for patients with cardiac pacemaker, prosthetic heart valve or metallic clips [15]. Reliable demonstration of common duct stones 6 mm or larger has been reported, but stones smaller than 4 mm are rarely identified with MRCP [16].

In our study, the collection is somehow small due to the new setting of the MRI device in our hospital. Regarding gender, females predominate males in the CBD stone group and malignancy group. Similar results had been documented in a local study by Al-Mudarris AA [17]. Another local study by Ali SY [18] shows that males predominate females in his collection. In the literature, males usually predominate in malignant tumors of the pancreas and periampullary region [19]. In our collection, the most common type of tumor was cholangiocarcinoma followed by carcinoma of head of pancreas. Similar results were documented in Ali SY study [18].

In our study the sensitivity, specificity and diagnostic accuracy of MRI-MRCP in the diagnosis of choledocholithiasis was 100%, 91% and 95% respectively and is comparable to results reported by authors like Demartines et al [20], Lemanto et al [21] while is higher than results reported by Stiris et al [22], Zidi et al [23] and Becker et al [24]. Other studies had reported 100% diagnostic accuracy as in Flucher [25] and Ali SY [18].

The sensitivity, specificity and diagnostic accuracy of our study in patients with malignancy were 94.1%, 100% and 97.6%. Comparable results had been reported by Flucher et al [25] and Adamek et al [26], while Geogopoulos et al [27] reported 100% diagnosing accuracy. Lower results were reported by Wallner et al [28] and Hall Crags et al [29] and Ishizaki [30].

MRI-MRCP is a sensitive non invasive technique with high accuracy in detecting the presence and the cause of biliary obstruction. MRCP is the technique of choice where other invasive techniques such as PTC or ERCP are incomplete, unsuccessful or technically difficult. It is recommended to be used widely in our hospitals over the country.

#### References:

- 1-Sherlock S, Dooley J. Cholestasis, In: diseases of the liver and biliary system, 10<sup>th</sup> ed. Oxford, Blackwell science, 1997; 220-27.
- 2-Cole WH. The development of cholecystography; the first fifty years; Am J Surg., 1978, 136:541
- 3-David LN. The biliary system. In: David C, Sabiston JR, Lyster MO, eds. Textbook of

surgery, 15<sup>th</sup> ed.. The biological basis of modern surgical practice. Philadelphia; W B Saunders, 1997; 1117-30.

- 4-Adam A, Rodde ME, Boweley NB. The biliary tract. In: Grainger RG, Allison D, Baert A, et al. eds. Grainger and Allison's diagnostic Radiology: Textbook of medical imaging, 3<sup>rd</sup> ed. Churchill Livingstone, 1997; 1205.
- 5-Sica GT, Braver J, Connecey MJ, etal. Comparison of endoscope retrograde cholangiopancreatography with MRCP in patients with pancreatitis, Radiology, 1999; 210:605-10.
- 6-Einstein DM, Lapin SA, Ralls PW, Halls JM. The insensitivity of sonography in the detection of choledocholithiasis. Roentgenol. 1984; 142:725-28.
- 7-Varghese JC, Liddell RP, Farrell MA, Murray FE, Osborne DH, Lee MJ. Diagnosing accuracy of magnetic resonance cholangiopancreatography and ultrasound compared with direct cholangiography in the detection of choledocholithiasis. Clin. Radiol. 2000; 55:25-35.
- 8-Schofl RD. Diagnostic endoscopic retrograde cholangiopancreatography. Endoscopy, 2001; 33:147-57.
- 9-Neeley GR, Jaundice. In: Abernathy CM, Abernathy BB. eds. Surgical Secrets, Mosby Company, Philadelphia, 1986; 31:89-94.
- 10- Schofl RD. Diagnostic endoscopic retrograde cholangiopancreatography. Endoscopy, 2001; 33:147-57.
- 11-Lee MG, Lee HJ, Kim MH, et al: Extrahepatic biliary diseases: 3D MR cholangiopancreatography compared with endoscopic retrograde cholangiopancreatography, Radiology 1997; 202:663.
- 12-Outwater EK, Gordon SJ: Imaging the pancreatic and biliary ducts with MR, Radiology 1994; 192:19.
- 13-Barish MA, Yucel EK, Soto JA, et al: MR cholangiography: efficacy of three-dimensional turbo spin-echo technique, Am J Roentgenol 1995; 165:295.
- 14- Soto JA, Yucel EK, Barish MA, et al: MR cholangiopancreatography after unsuccessful or incomplete ERCP, Radiology 1996; 199:91.
- 15-Bushong SC. physical principle of magnetic resonance imaging, In: Bushong SC, Radiology Science for Technologist, 5<sup>th</sup> ed., St. Louis. Mosby.1993; 449-64.
- 16-Guibaud L, Bret PM, Reinhold C, et al: Diagnosis of choledocholithiasis: value of MR cholangiography, Am J Roentgenol 1994; 163:847.
- 17-Al-Mudarris AA. Evaluation of imaging techniques in obstructive jaundice, a study submitted for partial fulfillment of requirements for fellowship of the Iraqi commission for medical specialization in General Surgery, 2000.

- 18-Ali SY. The role of magnetic resonance cholangiopancreatography in patients suspected with pancreatobiliary disorders, a study submitted to the department of radiology, medical college, Baghdad University as a requirement for Diploma in radiology, 2001
- 19-Schwartz SI, Gall bladder and extrahepatic biliary system, In: Schwartz SI, Shires GT, Spencer FC, eds. Principles of Surgery, 5<sup>th</sup> ed., McGraw-Hill Book Company, New York, 1989;1381-1421.
- 20-Dermatines N, Eisner I, Schnabel K, Fried R, Zuber M, Harder F. Evaluation of magnetic resonance cholangiography in the management of bile duct stones. Arch Surg. 2000; 135:148-152.
- 21- Lomanto D, Pavono P, Laghi A et al, Magnetic resonance cholangiopancreatography in the diagnosis of biliopancreatic disease, Am J Surg. 1997; 174:33-38.
- 22-Stiris MG, Tennoe B, Aadland E, Lunde OC. MRCP and ERCP in patients with suspected common bile duct stones. Radiol. 2000, 41:269-72.
- 23- Zidi SH, Prat F, Le Guen O, et al. Use of magnetic resonance cholangiography in the diagnosis of choledocholithiasis, Prospective comparison with a reference imaging method. Gut, 1999; 44:118-22.
- 24-Becker CD, Grossholz M, Becker M, Mentha G, de Pyer R, Terrier F. choledocholithiasis and bile duct stenosis, diagnostic accuracy of MRCP. Radiology, 1998; 207:21-32.
- 25-Flucher A, Turner MA, Gerald W, et al. MR cholangiopancreatography; experience in 300 subject; Radiology 1998;207:21-32.
- 26-Adamek HE, Albert J, Weitz, Breer H, Schilling D, Rie Mannj F. A prospective evaluation of magnetic resonance cholangiopancreatography in patients with suspected bile duct obstruction .Gut 1998; 43(5):680-83.
- 27- Geogopoulous SK, Schwartz LH, Jarnagin WR, Gerdes H. Comparison of magnetic resonance and endoscopic retrograde cholangiopancreatography in malignant pancreatobiliary obstruction. Arch Surg. 1999; 134(9):1002-07.
- 28-Wallner BK, Schumacher KA, Weidennair W, et al. Dilated biliary tract; evaluations with MRI cholangiography with T2 weighted contrast enhance fast sequence, Radiology, 1991; 181:805-08.
- 29-Hall-Cragges M, Allen CM, Owens CM, et al. MR cholangiography, clinical evaluation in 40 cases. Radiology, 1993; 189:423-27.
- 30-Ishizaki, Wakayama T, Okodoy, et al. Magnetic resonance cholangiography for evaluation of obstructed jaundice, A.M.J. Gastroenterology, 1993;88:2072-77.
- 
- Surgical Department, Al-Mustansiriya Medical College, Baghdad, Iraq.  
Al-Yarmouk Teaching Hospital, Baghdad.  
Lecturer, Radiology Department, Al-Mustansiriya Medical College, Baghdad, Iraq