Valley International Journals
Open Access Journal

International Journal Of Medical Science And Clinical Inventions
Volume 3 issue 4 2016 page no. 1786-1790 e-ISSN: 2348-991X p-ISSN: 2454-9576
Available Online At: http://valleyinternational.net/index.php/our-jou/ijmsci

Magnetic Resonance Cholangio Pancreatography In Biliary Obstruction: Pathologic Correlation

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Abstract:
The aim of this work was to evaluate the role of magnetic resonance cholangiopancreatography (MRCP)) in the diagnosis of biliary obstruction in correlation with operative, pathologic or endoscopic retrograde cholangiopanceatograpy (ERCP) results.
Methods:
Fifty patients with obstructive jaundice were included in this study, 18 males and 32 females ranging in age from 10 years to 84 years, with the mean age is 47 years. They all had initial abdominal US followed by MRCP.
Results:
The whole sensitivity of MRCP in the diagnosis of choledocolithisis =86.6%, for strictures = 80% and its sensitivity for malignancy = 80%. MRCP showed 100% sensitivity in the diagnosis of inflammatory conditions of the biliary system.
Conclusions:
MRCP has a great role in diagnosing causes of obstructive jaundice and defining the level of obstruction. The commonest cause of biliary obstruction – even in post cholecystectomy patients- was stones of the bile ducts which could be easily diagnosed by MRCP with high sensitivity. Accurate assessment of biliary anomalies provides a road-map for interventional procedures to avoid duct injury.

Key words: MRCP, biliary, stones, obstruction, jaundice

I. INTRODUCTION

Obstructive jaundice is one of the most common problems in clinical practice. Accurate definition of the level and cause of biliary obstruction is mandatory to prevent unnecessary invasive procedures like endoscopic retrograde cholangio-pancreatography (ERCP) or repeated biopsies. There are multiple causes of biliary obstruction. Choledocholithiasis is by far the commonest one [1].

Strictures of the bile ducts may be benign, due to inflammation, benign tumors, post ERCP or post cholecystectomy, or malignant; the commonest is cholangiocarcinoma. Benign strictures are always short with smooth outlines, while malignant ones are irregular and usually associated with masses. Other main causes include carcinoma of the pancreas, gall bladder, liver, liver metastasis and advanced carcinoma of stomach or duodenum [2].

Obstructive jaundice may be also one of the manifestations of post cholecystectomy syndrome. The cause is usually retained or recurrent stones. Other causes include post-operative stricture of the common bile duct (CBD), compression of the bile ducts by biliary and post-operative fluid collections [3].

Ultrasound is (US) the modality of choice to diagnose the level and cause of biliary obstruction. It is used initially in almost all patients with obstructive jaundice, but it has some limitations in detecting very small stones and stones of the most distal part of the CBD, especially in obese patients. ERCP is the gold standard technique in biliary diseases. Because of its high invasiveness and complication hazards, it is used mainly as a therapeutic technique in stone extraction and dilatation of stenosed ducts. Recently, magnetic resonance cholangiopancreatography (MRCP) has been used frequently in the diagnosis of biliary diseases. It is safe, non-invasive with no ionizing radiation, sedation or contrast intake. It is a safe alternative to ERCP and direct cholangiography in the diagnosis of biliary obstruction [4,5].

MRCP has high sensitivity and specificity for biliary diseases including stones, strictures, benign and malignant lesions. However, it has some limitations. It is not suitable for patients with claustrophobia and patients with some metallic prosthesis. In addition, its main disadvantage is its lack of therapeutic intervention capability.

II. PATIENTS AND METHODS

A. Patients

This study included 50 patients, 18 males and 32 females ranging in age from 10 years to 84 years with the mean age is 47 years. All patients presented with laboratory confirmed obstructive jaundice in addition to other manifestations

DOI: 10.18535/ijmsci/v3i4.7

suggestive of biliary problems e.g. biliary colic, pain in the right hypochondrium or fever. Out of them, sixteen patients presented with post cholecystectomy complications, in addition to three patients presented with post ERCP jaundice and abdominal pains. All patients had a preliminary abdominal US. MRCP was requested to verify the cause and level of biliary obstruction before proceeding to the most invasive ERCP or surgery.

B. Methods

1) MRCP Technique:

MRCP was performed using 1.5 T Siemens machine and phased-array coil in the supine position. Patients were asked to fast 4-6 hours before the technique to allow proper filing and good visualization of the gall bladder. All sequences were acquired during a single breath-hold. No sedation, oral or I.V. contrast agents were used.

2) MR sequences:

1. Three plan localizing images were obtained and used to plan MRCP sequence.
2. Axial-T2-FS-NAV, field of view = 330 mm and slice thickness = 5 mm
3. Axial-T2- BH, field of view = 330 mm and slice thickness = 5 mm
4. Axial-T2_HASTE290_TE
5. AX T1 IN-OUT PHASE_ABD, field of view = 330 mm and slice thickness = 5 mm
6. COR HASTE THICK, field of view = 250 mm and slice thickness = 50 mm
7. T1-fL2D-TRA-P2-MBH, field of view = 330 mm and slice thickness = 4 mm
8. COR 3D-MRCP, field of view = 300 mm and slice thickness = 1.30 mm

C. Image interpretation

Images of MRCP were interpreted by radiologists specialized in abdominal MRI with emphasis on the following points: presence of biliary dilatation and its location whether intra or extrahepatic, the cause of obstruction, presence of filling defects suggestive of stones , strictures (short or long, smooth or irregular), masses and anomalies of the bile ducts.

D. Statistical Analysis

The demographic data of the patients, together with US and MRCP findings were collected and statistically analyzed, and then correlated with the final diagnosis of ERCP, operative intervention, pathology results or follow up. The diagnostic accuracy (sensitivity) was calculated using R package DTCompair. No specificity was measured because in this research there were no truly negative cases.

III. RESULTS AND DISCUSSION

A. Results

Four patients were normal, one patient had an accepted post cholecystectomy dilatation of the CBD and 45 patients had MRCP evidences of biliary obstruction. Nine patients were excluded either because of failed ERCP (3 patients), or were lost during follow up (6 patients). The cause of obstruction was identified in the remaining 36 patients according to the results of ERCP (14 patients), laparoscopic cholecystectomy (13 patients, including 2 with additional open cholangiography), laparotomy (3 patients), open cholecystectomy with T-tube insertion (1 patient), , PTC (one patient), liver biopsy (one patient), drainage (one patient), CT (one patient), follow up by US (on patient) and follow up after medical treatment (2 patients). Some patients had more than one confirmatory procedure.

We classified the patients into 2 groups; group 1 including patients with jaundice and no history of previous operation of the biliary system, and group 2 including patients presented with jaundice after cholecystectomy. MRCP findings were summarized in tables 1and 2:

Table 1: MRCP findings in group 1

MRCP findings	Number of patients
Calcular gall bladder	11
Stones of the biliary radicles	6
Dilated biliary radicles	11
Anatomical variation of the bile duct	5
Acute calcular cholecystitis	3
Chronic calcular cholecystitis	2
Non calcular cholecystitis	3
Chronic cholangitis	1
Cholangiocarcinoma	1
Periampullary adenocarcinoma	1
Pancreatic head mass	2
Chronic pancreatitis	1
Adenomyomatosis of the gall bladder	1
Extrinsic impression of the CD by blood vessel	1
Bile sludge of the gall bladder	1

Table 2: MRCP findings in group 2

MRCP findings	Number of patients
Dilated biliary radicles	4
Stones of the biliary radicles	3
Post-operative collection	2
Cholangitis	1
Choledocal cyst	1
Hepatico-jujenostomy stricture	1

Correlating MRCP findings with the final results revealed:

In group 1:

The cause of obstruction was choledolithiasis in 12 patients (Figure 1) - MRCP missed 2 cases of stones, one was diagnosed as adenomyomatosis , and the other one was missed - , periampullary adenocarcinoma in one patient, pancreatic head mass in 2 patients, cholangiocracinoma in 2 patients . One case of cholangiocarcinoma was missed by MRCP and diagnosed as cholecystitis and liver abscess, chronic pancreatitis in one patient, cholestatic hepatitis in one patient (seen by MRCP as multiple stones within dilated biliary radicles), cholangitis (one patient),

DOI: 10.18535/ijmsci/v3i4.7

cholecystitis in 5 patients (acute calcular in 3 patients, chronic calcular in one patient and non calcular in one patient).

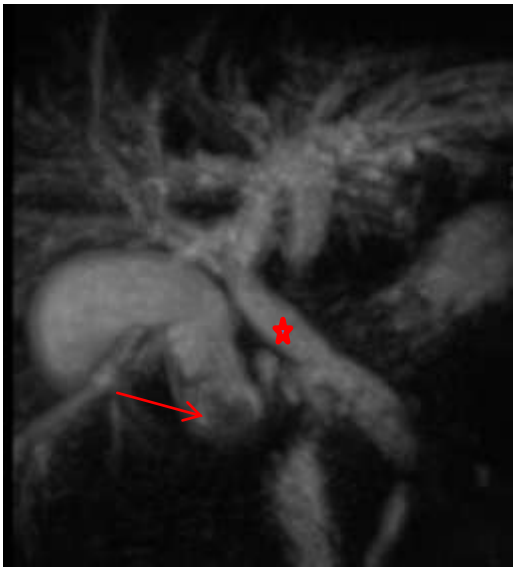

Figure 1:MRCP HAST showing stone in dilated tortuous cystic duct (arrow). The star points to the CBD.

In group 2:

The cause of obstruction was choledocholithiasis in 3 patients (Figure 2), common hepatic duct (CHD) adhesion in one patient (diagnosed by MRCP as obstruction of the CHD), hepatico-jujunostomy stricture in one patient, compression by cystic structure in one patient (on exploration, the cyst was not communicating with the bile ducts excluding MRCP diagnosis of choledocal cyst), post-operative collection in 2 patients and cholangitis in one patient (seen as dilated biliary radicles by MRCP).

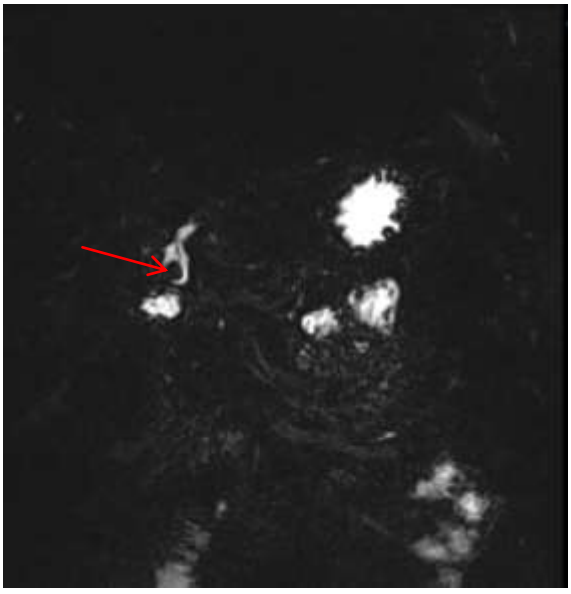

Figure 2: Coronal 3D MRCP. cholecystectomy with residual stone appears as a signal void structure within dilated CHD (arrow).

Anomalies of the bile ducts are important associated findings. One was vertical course of the pancreatic duct which was abnormally inserted – together with the CBD- into the third part of the duodenum (Figure 3), in addition to four cases of abnormal or low insertion of the CD.

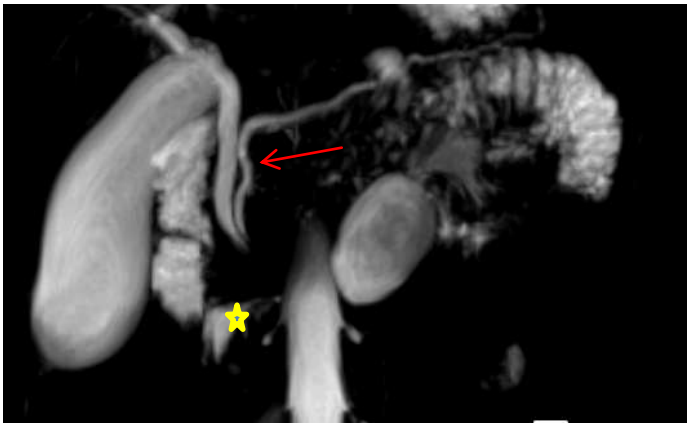

Figure 3: MRCP MIP range .Vertical course of the distal segment of the pancreatic duct (arrow) which is inserted together with the CBD into the third part of the duodenum (star).

The whole sensitivity of MRCP in the diagnosis of choledocolithisis =86.6%, for strictures = 80% and its sensitivity for malignancy = 80%. MRCP showed 100% sensitivity in the diagnosis of inflammatory conditions of the biliary system.

B. Discussion

The most common MRCP finding that explain the cause of biliary obstruction in our patients is choledocholithiasis (17 patients with no previous operations and 3 post-operative cases). It is known that choledocholithiasis is the most common cause of biliary obstruction [1]. In addition, retained or recurrent calculi of the CBD, and remnants of the cystic duct (CD) are the commonest causes of post cholecystectomy complications [4]. In MRCP, stones appear as well defined signal void structures within the hyper intense bile of the biliary system or within the CBD and CD remnants of post-operative cases. In our study, MRCP could identify all stones of the gall bladder and bile ducts- as confirmed by laparoscopic cholecystectomy or ERCP extraction- with 2 false negative cases. One was adenomyomatosis and the stone was missed and the other was impacted stone in the intramural portion of the CBD and misdiagnosed as passed stone.

On the other hand, MRCP could diagnose stone of the gall bladder that was misdiagnosed by US as polyp. The sensitivity of MRCP for choledocholithiasis is 86.6% which is comparable with what is mentioned in literatures e.g. (Calvo et al., [6], Varghese et al., [7]) where the sensitivity range between 81%–100%, and for post cholecystectomy cases, MRCP sensitivity is as high as 95–100% and the specificity is 88–89% for detecting CBD residual / recurrent calculi [4] . MRCP is an essential diagnostic tool that should be done in all cases of obstructive biliopathy before

DOI: 10.18535/ijmsci/v3i4.7

proceeding to the more invasive, risky techniques like endoscopic US or ERCP unless an intervention procedure is planned.

Stricture of the bile ducts is another common cause of obstructive jaundice. Causes of strictures include benign and malignant lesions. In our study, MRCP could diagnose one case of benign stricture due to chronic pancreatitis (proved by CT), and a case of irregular dilatation and stenosis of the CBD with dilated IHBR which was diagnosed as cholangiocarcinoma (pathologically proved after partial hepatectomy). Cholangiocarcinoma usually presents as a stricture. Although morphological features of benign and malignant strictures are defined, differentiation may be difficult at times. A case of cholangiocarcinoma was missed by MRCP which could detect IHBR and CBD dilatation with no masses or strictures in addition to evidence of calcular cholecystitis . ERCP proved the case to be cholangiocarcinoma [8]. The reported sensitivity of MRCP for biliary strictures ranges from 78% to 100% [9, 10]. Comparable results were obtained in our study where MRCP sensitivity for benign and malignant strictures is 80%.

Post cholecystectomy strictures are the most common late complication which may develop from months up to one year after the operation. It occurs in up to 0.6% of cases after cholecystectomy. It usually occurs in the CBD or close to the insertion of the cystic duct or may affect an injured anatomical variant. On MRCP, they appear as a short with smooth regular margins [11]. In the current study, we had 2 cases of post-operative strictures, one at the CHD (proved during laparotomy), and the other was stenosed hepaticojujenostomy (proved by PTC).

In our study, MRCP was more sensitive than ERCP in the diagnosis of a case of periampulary adenocarcinoma, where the latter failed to detect the filling defect caused by the mass, while both could detect the dilated biliary tracts as well the pancreatic duct. Laparotomy and pathology proved periampullary adenocarcinoma. It is mentioned in literatures that ERCP has an advantage over MRCP in periampulary carcinoma as it allows direct visualization of this area. Nevertheless, MRCP is as effective as ERCP for the detection of pancreatic carcinoma. [12]

Two cases of pancreatic head masses were seen by MRCP as dilatation of the intra and extrahepatic biliary radicles with dilated gall bladder and bile sludge. ERCP confirmed the diagnosis in both of them. One case was inoperable and the other one had laparotomy and the pathology revealed cancer head of pancreas.

Anomalies of the biliary system are common. Knowing these anomalies is crucial before operative interference to avoid intraoperative complications. MRCP is an ideal modality to detect them. In the current study, 5 cases of anomalies are detected. Two were confirmed by ERCP and three were detected during laparoscopic cholecystectomy. One case of long cystic duct was missed by MRCP and seen by ERCP.

Two cases of post cholecystectomy abdominal pain and jaundice were diagnosed by MRCP as having gall bladder bed collection (with perihepatic collection in one of them). Although US diagnosis of post-operative collection was obvious, yet the cause of jaundice was not explained. The jaundice was likely due to the external compression on the biliary ducts by the fluid collection. The collection was drained in one patient, and the other patient was followed by US till improved.

MRCP identification of biliary leaks following cholecystectomy has a sensitivity and specificity of 86% and 83%, respectively [13]. It is reported that the rate of bile duct injuries is slightly more in laparoscopic surgery than open surgery (0.5% and 0.15%, respectively). Injured ducts lead to biliary leakage. Fluid collections in the gallbladder bed occur in up to 14% of patients following cholecystectomy and tend to resolve spontaneously; collections persisting for more than a week or fluid outside the gallbladder bed e.g. hilar or subhepatic close to the CBD raise the suspicion of a biliary leak and/or injury S[4].

IV. Conclusion

MRCP has a great role in diagnosing causes of obstructive jaundice and defining the level of obstruction. The sensitivities of MRCP in detecting choledocholithiasis, strictures, malignancy and anomalies of the biliary system are 86.6%, 80%, 80% and 83.3% respectively. MRCP shows 100% sensitivity for inflammatory conditions of the biliary system. The commonest post cholecystectomy complication is residual stones of the bile ducts which could be easily diagnosed by MRCP with high sensitivity. Accurate assessment of biliary anomalies provides a road-map for interventional procedures to avoid duct injury.

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DOI: 10.18535/ijmsci/v3i4.7