

Value of magnetic resonance cholangiopancreatography prior to endoscopic retrograde cholangiopancreatography in ultrasonographically and laboratory diagnosed obstructive jaundice

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Objective

The aim was to assess the value of magnetic resonance cholangiopancreatography (MRCP) before endoscopic retrograde cholangiopancreatography (ERCP) in ultrasonographically and laboratory diagnosed obstructive jaundice.

Background

Obstructive jaundice is highly prevalent in Egypt, resulting in high morbidity, with increasing cost-burden. Numerous investigations are proposed for diagnosis of obstructive jaundice, such as ERCP and MRCP, with high sensitivity and specificity among other investigations, for diagnosing the cause of obstructive jaundice. However, ERCP is considered an invasive method that must be preserved as a life boat for therapy.

Patients and methods

A prospective randomized controlled study was conducted at General Surgery Department, Menoufia University Hospital, on 60 patients divided to two groups. First group patients underwent MRCP (30 patients) before ERCP, and the second group patients underwent ERCP only (30 patients).

Results

In the first group (MRCP±ERCP), scheduled ERCP was canceled in 10 patients of 30 patients (33.3%) owing to negative MRCP detection for stone or tumor. ERCP was done for 20 patients of 30 patients (66.6%), with successful intervention (94.7%) either in extraction of stone (in case of small stones) or stent placement (in large stones or tumors). In the second group, ERCP directly was done for 30 patients. Unnecessary ERCP was done for nine (30%) cases. Success intervention rate for ERCP in detection of stone or malignancy was 90.4%.

This study showed a peak increase in accuracy, sensitivity, and specificity after addition of MRCP before ERCP in the diagnosis the cause of obstructive jaundice.

Conclusion

This study showed that MRCP before ERCP is very beneficial, decreases considerably the number of unnecessary ERCP, and decreases postoperative complications of ERCP.

Keywords:

endoscopic retrograde cholangiopancreatography, magnetic resonance cholangiopancreatography, obstructive jaundice, sensitivity

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Introduction

Jaundice is defined as a yellowing of skin, mucous membranes, and sclera owing to the deposition of yellow-orange bile pigment, that is, bilirubin [1].

On the basis of causes, jaundice can be classified into three types: prehepatic jaundice, hepatic jaundice, and posthepatic jaundice [2].

Posthepatic jaundice is a type of jaundice in which the cause lies in the biliary portion of hepatobiliary system. The major cause of posthepatic jaundice is extrahepatic biliary obstruction. Therefore, it is also known as obstructive jaundice [3].

Obstructive jaundice results from biliary obstruction, which is the blockage of any duct that carries bile from liver to gall bladder and then to small intestine [4].

The most common causes of obstructive jaundice are choledocholithiasis, structures of the biliary tract, cholangiocarcinoma, carcinoma of pancreas, pancreatitis, parasites, and primary sclerosing cholangitis [5].

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Regardless of the cause of cholestasis, serum bilirubin values (especially direct) are usually elevated. In the early phases of obstruction and with incomplete or intermittent obstruction, serum bilirubin levels may only be mildly elevated [6].

Ultrasonography (USG) is fairly accurate to detect dilated and nondilated bile ducts. USG allows dynamic and real-time evaluation of the biliary tree. Diagnostic procedures using ultrasound are painless, harmless, relatively inexpensive, easily available, and free of ionizing radiation [7].

Endoscopic retrograde cholangiopancreatography (ERCP) is a technique that combines endoscopy and fluoroscopy for diagnosing and treating biliary or pancreatic ductal abnormalities. An endoscope with a camera and light at the end is inserted through the esophagus, to the stomach, and to the duodenum. Contrast media is injected into the biliary and pancreatic ducts, which are visualized on radiography. ERCP additionally offers an advantage of treatment once the diagnosis is established. Stenting, sphincterotomy or gall stone removal can be performed in the same sitting. Biopsies can also be taken for tissue diagnosis [8].

Magnetic resonance cholangiopancreatography (MRCP) is a noninvasive imaging technique that uses MRI as a means to visualize the biliary duct and the pancreatic duct, without the need for contrast. This was introduced in 1991, and since then, the spatial resolution of this technique has improved considerably [9].

Patients and methods

A prospective randomized controlled study was conducted at General Surgery Department, Menoufia University Hospital. Ethical approval was granted for the study by Ethics Committee of Faculty of Medicine, Menoufia University, according to the Declaration of Helsinki. A written informed consent was taken from patients before the study. Duration of the study was 1 year since May 2019.

A total of 60 patients complaining of jaundice and abdominal pain diagnosed as obstructive jaundice with USG and laboratory investigation were recruited and divided into two groups. First group patients underwent MRCP (30 patients). MRCP was done for all patients and then ERCP was done according of MRCP finding if positive or negative for common bile duct (CBD) stones or suspected malignancy. The second group patients underwent ERCP directly (30 patients).

MRCP was conducted at MRI Unit in Radiology Department, and ERCP was done at Surgery Department at Menoufia University Hospital. MRI scanner used was 1.5-T scanner (Magnetom Avanto, Siemens, Erlangen, Germany) using an in-house using 16-channel body coil.

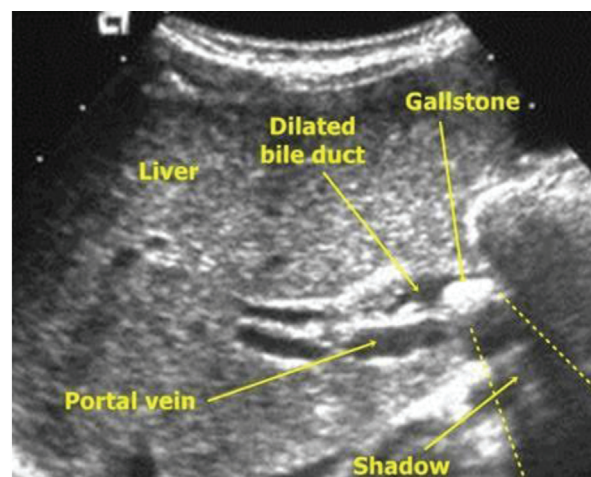
Inclusion criteria

The patients presented with biliary obstruction either calcular or malignant diagnosed by laboratory investigation (high total, direct bilirubin, and alkaline phosphatase) and radiological investigation [abdominal USG showing dilated CBD and dilated intrahepatic biliary radicals (IHBRs)], with positive or negative stone or tumor, were included.

Exclusion criteria

Patients having a contraindication to MRCP, like cardiac pacemaker, cochlear implant, non-MR compatible clips used for brain aneurysms, and claustrophobia; patients undergoing Roux-en-Y gastric bypass and previous CBD exploration; and those having contraindications to ERCP were excluded.

All patients were subjected to history taking; clinical examination, including general examination and local examination; and laboratory and radiological (U/S) investigations.



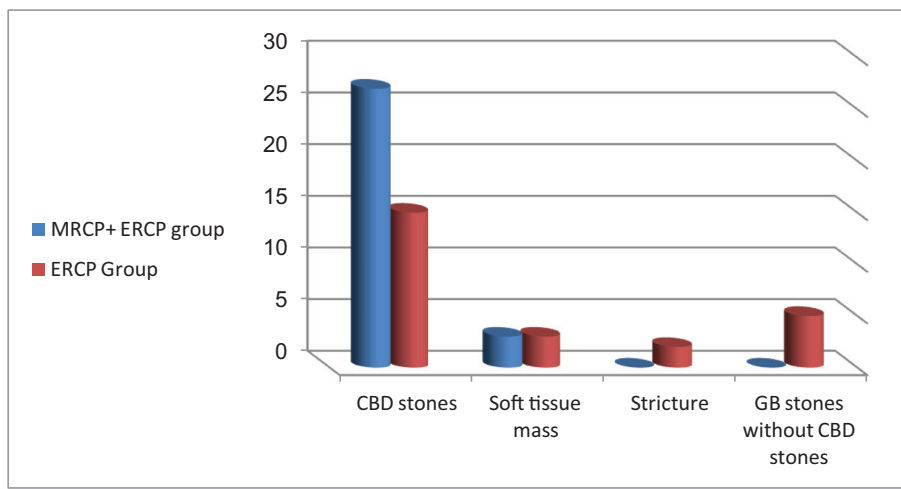
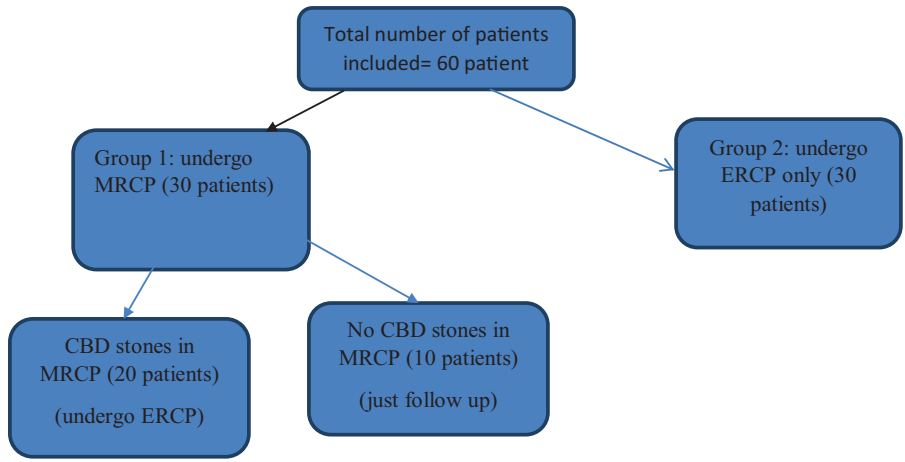
Ultrasound image of Obstructive Jaundice

Results

Sociodemographic data

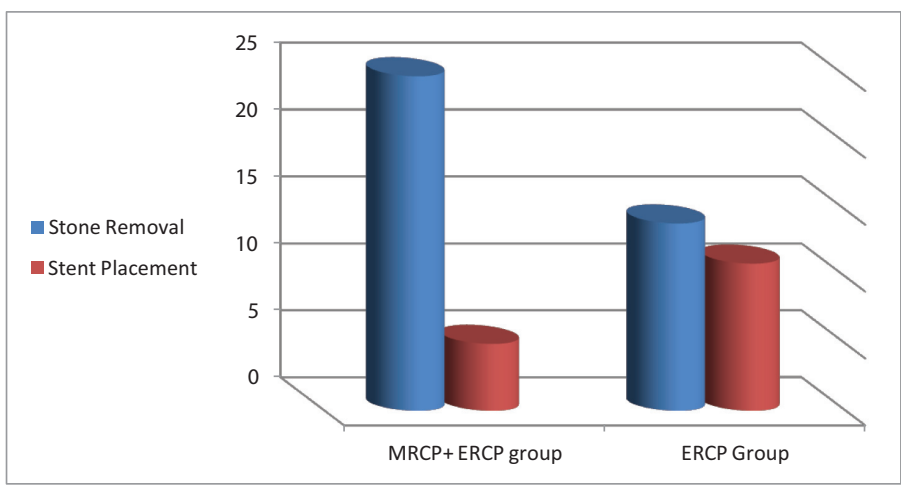
A prospective randomized controlled study was conducted at General Surgery Department, Menoufia University Hospital. We admitted 60 patients divided into two groups: the first group underwent MRCP. This group was subdivided into two categories: patients who underwent ERCP after MRCP, and another category, which

Figure 1



Shows causes of Obstructive Jaundice in two groups.

Figure 2

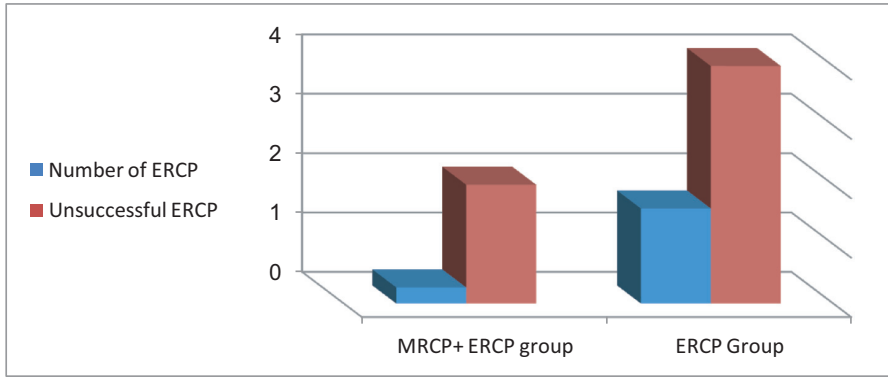


Shows Outcome parameter (Stone extraction, Stent placement).

underwent MRCP only, as we did not find CBD stones or any cause of obstruction (passed stones), so there was no need of ERCP. The second

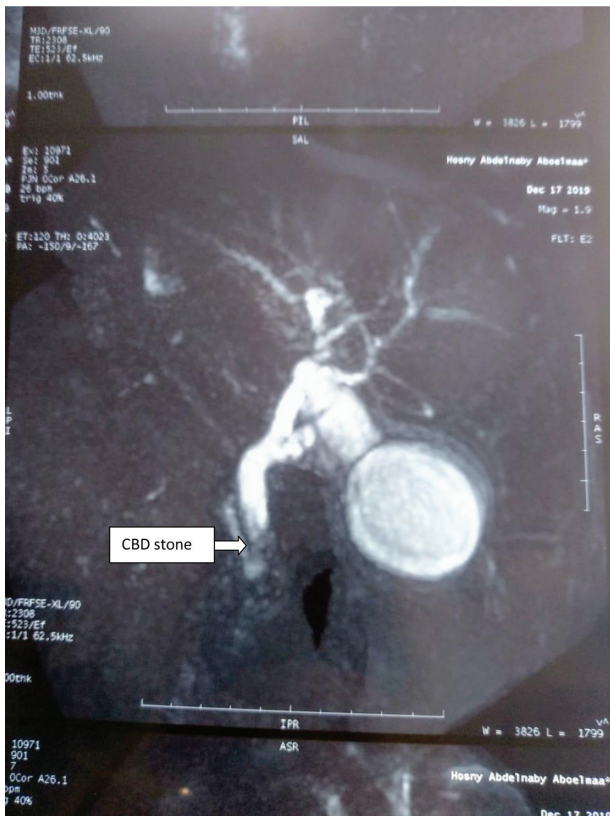
group underwent ERCP directly. Age varied from 23 to 70 years, with a mean of 43.5 ± 13.4 . Females represented the majority of our included patients

Figure 3



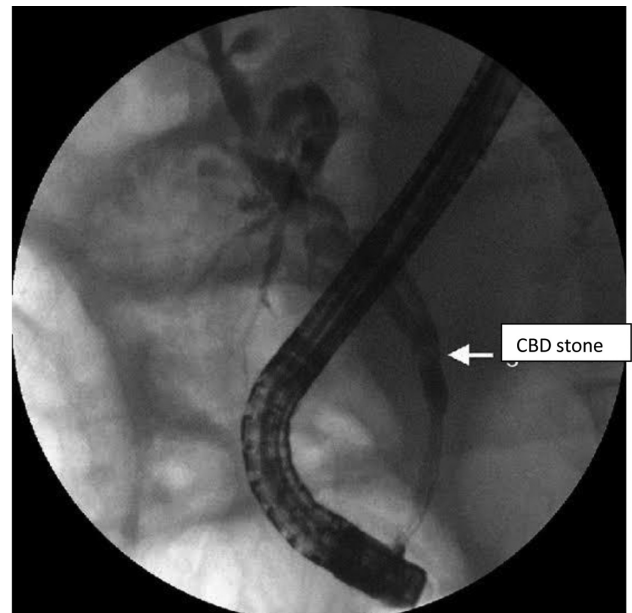
shows Outcome parameter (Number of ERCP, Unnecessary ERCP). ERCP, endoscopic retrograde cholangiopancreatography

Figure 4



Shows MRCP of patient with CBD stone. CBD, common bile duct; MRCP, magnetic resonance cholangiopancreatography.

Figure 5



Cholangiography show CBD stone. CBD, common bile duct.

(62.7%), with no statistically significant difference between male and female participants. Most patients had no comorbidities (90.6%). Overall, 68% of patients presented with epigastric pain, whereas 32% of patients presented with obstructive jaundice (Figs 1–6 and Tables 1–4).

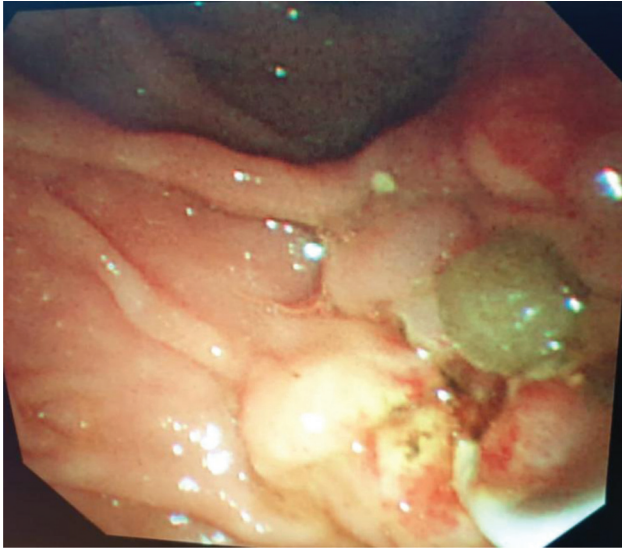
Radiology findings of the participants

All patients included underwent abdominal USG in addition to MRCP in the first group.

Regarding USG, mean CBD diameter of patients was 12.09±4.9. We found no significant difference between CBD diameters between two groups. Most patients had multiple stones (74.6%), and 15 patients had no stones (10 patients had biliary mud, and five patients had mucocele).

MRCP can differentiate the causes of obstructive jaundice: 60% of patients had CBD stones, 33.3% of patients had no CBD stones with GB stones (indicating passed stones), and 6.6% of patients had soft tissue mass. We found a significant difference between the two groups regarding appropriate intervention (ERCP) for patient with OJ, as in first group undergoing MRCP, gall stones without CBD stones were found in 10 cases. However, in the second group undergoing ERCP, we found nine cases had gall

Figure 6



Show ERCP during extraction of stone. ERCP, endoscopic retrograde cholangiopancreatography.

bladder stones without CBD stones, without clinical significance of undergoing ERCP.

Laboratory parameters of all participants

Total and direct bilirubin, alkaline phosphatase, GGT, and tumor markers (CEA and CA19-9) were performed for all patients. Mean total bilirubin of all participants was 5.58 ± 5.1 , whereas direct bilirubin was 3.45 ± 3.9 . Mean alkaline phosphatase was 333.9 ± 131 , and mean GGT was 209.5 ± 102.9 . Eight patients were found to have high tumor markers.

In first group that underwent MRCP followed by ERCP, we calculated total and direct bilirubin on admission and follow-up every 2 days. Overall, 56% of patients returned to normal values on follow-up of total and direct bilirubin levels through 3–5 days. In spite of decline in total and direct bilirubin levels, we performed ERCP for these patients and found floating stones.

ERCP diagnostic and therapeutic finding in different groups

We measured the outcome of efficacy of two groups according to stone extraction, stent placement, number of repeated ERCP followed of initial ERCP, and necessary ERCP.

In the first group (MRCP±ERCP), scheduled ERCP was canceled in 10 patients of 30 patients (33.3%) owing to negative MRCP finding for stone or tumor. ERCP was done for 20 patients of 30 patients (66.6%), with success intervention (94.7%) in either extraction of stone (in case of small stones) or stent placement

Table 1 Sociodemographic data of all participants and their relation to the group of patients

Parameters	First group (N=30)	Second group (N=30)
Age		
Mean±SD	47.3±13.8	46.3±14.2
Range	25–64	21–61
Sex		
Male	10	17
Female	20	13
Comorbidities		
HTN	0	0
DM	1	3
No	29	27
Presentation		
Epigastric pain	15	18
Jaundice	15	12

DM, diabetes mellitus; HTN, hypertension.

Table 2 Radiology findings of all participants and their relation to the group of patients

Parameters	First group (N=30)	Second group (N=30)
Abdominal ultrasonography		
CBD diameter	14.9±4	13.9±4
Gall bladder		
Multiple stones	23	22
No stones	7	8

CBD, common bile duct.

(in large stones or tumors). Small stones resemble most ERCP findings (55%), followed by large stones (20%) and malignancy (15%). Unnecessary ERCP was done for one (5%) case and failed cannulation in one (5%) case. During follow-up of patients, one case of 10 cases underwent MRCP, with no need of ERCP, developed recurrent obstructive jaundice. Suspected cases of malignancy underwent stent placement and follow-up at Menoufia National Liver Institute and National Oncology Center.

In the second group, ERCP directly was done for 30 patients. Success intervention of ERCP in detection of stone or malignancy was 90.4%, with failed cannulation in two cases of 21 (9.5%) cases. Nine cases underwent unnecessary ERCP (30%). ERCP detected small stones in 43.3% of patients, large stones in 10% of patients, and suspected malignancy (stricture) in 10% of patients. We did extraction of stone (in case of small stones) or stent placement (in case of large stones or stricture). Suspected cases of malignancy underwent stent placement and follow-up at Menoufia National Liver Institute and National Oncology Centre.

We measured the number of ERCP following initial ERCP to indicate whether we can diagnose the cause

Table 3 Outcome measures of ERCP between two groups (MRCP before ERCP) and ERCP

Parameters	MRCP+ERCP group (N=20) [n (%)]	ERCP group (N=30) [n (%)]
Positive stone by ERCP	16 (80)	16 (56.3)
Small stones	12 (55)	13 (43.3)
Large stones	4 (20)	3 (10)
Positive stricture by ERCP	2 (10)	3 (10)
Success intervention	18 (94.7)	19 (90.4)
Failed cannulation	1 (5)	2 (9.5)
Stent placement		
Yes	7 (35)	6 (20)
No	13 (65)	24 (80)
Number of repeated ERCP		
Mean±SD	0.27±0.04	1.6±0.7
Range	0–1	1–3
Unnecessary ERCP	1 (5)	9 (30)

ERCP, endoscopic retrograde cholangiopancreatography; MRCP, magnetic resonance cholangiopancreatography.

Table 4 Postoperative parameters between two groups

Parameters	MRCP+ERCP group (N=20) [n (%)]	ERCP group (N=30) [n (%)]
Complication		
Pancreatitis	2 (4)	4 (8)
Mild	2 (4)	3 (6)
Sever	0	1 (2)
No	18 (96)	26 (92)
Hospital stay		
Mean±SD	1.2±0.2	1.1±0.2
Range	0.5–1.5	0.5–1.5

ERCP, endoscopic retrograde cholangiopancreatography; MRCP, magnetic resonance cholangiopancreatography.

of obstructive jaundice. The group undergoing MRCP before ERCP had the least mean number of ERCP by 0.27. However, in the group ERCP, patients had a large mean number of ERCP 1.6, with significant *P* value of 0.001.

One case in THE first group underwent unnecessary ERCP, whereas nine patients in the second group underwent unnecessary ERCP, with significant *P* value of 0.001.

MRCP is more sensitive, specific, and accurate in the detection the causes of obstructive jaundice and its site, size, and nature, so the successful rate of ERCP after MRCP is higher than ERCP alone.

Postoperative parameters and finding in different groups

Hospital stay was lower in patients undergoing MRCP of only 0.5 day, whereas in patients undergoing ERCP initially or before MRCP was higher at 1.1 and 1.2 days, respectively, with significant difference (*P*=0.05). Postoperatively, two cases in the first group complained of mild pancreatitis (2%), whereas four cases in the second group complained of mild pancreatitis (8%) and three cases of severe pancreatitis (6%).

Discussion

Our study evaluated a cohort of patients presented with obstructive jaundice who may require ERCP to determine the frequency of MRCP use and the factors and outcomes associated with MRCP before ERCP. There are several important findings from this study. The first is that ERCP use is quite common among patients at high risk of obstructive jaundice and is associated with increased cost and length of stay but does not influence patient or procedural outcomes. The second is that the decision to perform MRCP is influenced primarily by the absence of CBD stones on US imaging [10].

We conducted a prospective study at Menoufia University Hospital. We recruited 60 patients categorized into two groups: the first group underwent MRCP before ERCP, and the second group underwent ERCP directly. Age varied from 23 to 73 years, with a mean of 45.2±15.9 years. No significant difference between different groups in age. A retrospective study by Anand and colleagues recruited 224 patients with a mean age of 53 years, which is considered a larger age group than our study, and showed the same result regarding rational use of

ERCP and considered MRCP use before ERCP a life boat for diagnosis of obstructive jaundice [11].

In terms of clinical outcomes, patients undergoing MRCP had no significant difference in mortality compared with patients undergoing ERCP only. Procedural characteristics and complications were also similar between both groups. An interesting finding was that the eight patients (42% of MRCP group) who had normal MRCP did not undergo ERCP, which further raised the question of the utility of undergoing ERCP if the MRCP finding was normal.

Other studies have also demonstrated that MRCP results do not significantly affect the decision to perform ERCP. Sahai and colleagues conducted a prospective assessment of the ability of MRCP to obviate ERCP in patients with a variety of pancreaticobiliary disorders and found that MRCP would prevent less than 3% of ERCPs [12].

All patients included underwent abdominal USG in addition to MRCP in the first group.

Regarding USG, mean CBD diameter of patients was 12.09 ± 4.9 . We found no significant difference between CBD diameters between the two groups. Most patients had multiple stones (74.6%) and 15 patients had no stones (10 patients had biliary mud, and five patients had mucocele).

MRCP can differentiate causes of obstructive jaundice: 60% of patients had CBD stones, 33.3% of patients had no CBD stones with GB stones (indicating passed stones), and 6.6% of patients had soft tissue mass. We found a significant difference between two group regarding appropriate intervention (ERCP) for patient with OJ, as in the first group undergoing MRCP, gall stones without CBD stones were found in 10 cases. However, in the second group undergoing ERCP, we found nine cases had gall bladder stones without CBD stones, without clinical significance of undergoing ERCP.

Our study is in harmony with the study by GOPLAKRISHNAN S which recruited 50 patients; they evaluated various causes of biliary ductal obstruction, such as choledocholithiasis (56%), malignancy (12%), and stricture (28%). In our study, choledocholithiasis was the commonest benign and ampullary malignancy to be the most common malignant cause of biliary obstruction, which is consistent with most of the studies carried out

worldwide. Most authors have found biliary obstruction to be frequent in women [13].

Conclusion

Our study showed that MRCP before ERCP is very beneficial, decreases considerably the number of unnecessary ERCP, and decreases postoperative complications of ERCP. MRCP has high sensitivity for CBD obstruction such as stones, strictures, and malignancies. MRCP has comparable sensitivity for malignancies and offers additional advantage of successful CBD stone extraction by ERCP. Sensitivity of MRCP for ancillary findings like gall stones and intrahepatic biliary radical dilatation is comparable to ERCP.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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