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Role of magnetic resonance cholangiopancreatography in evaluation of asymptomatic and symptomatic patients with unexplained biliary radicals' dilatation using the ultrasound

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Abstract: Introduction: The common bile duct (CBD) dilatation is a common finding during ultrasound and CT examination that usually recommends further assessment to evaluate its significance, cause and outcome, many disorders can cause common bile duct dilatation. A diameter of more than 7 mm (except post cholecystectomy or post ERCP) is regarded as abnormal dilatation and is a sign of cholestasis, multiple reasons causes CBD dilatation ascholedocholithiasis, pancreatic head masses. ERCP has been the gold standard investigation for evaluation of the biliary system for a long duration yet it is relatively invasive with reported complications, so Magnetic resonance cholangiopancreatography (MRCP) become a major diagnostic modality is diagnosis not only of the biliary diseases but also is pancreatic disorders. **Aim of the work:** The purpose of this study was conducted to determine the yield of magnetic resonance cholangiopancreatography (MRCP) in asymptomatic & symptomatic patients with a finding of common biliary duct dilatation, more focusing on the asymptomatic category and the group of symptomatic patients with no obvious cause detected by US scan. **Patients and methods:** Fifty cases were obtained, Some of these cases were complaining of jaundice, epigastric pain or low grade fever, other was not complaining and CBD dilatation was discovered incidentally by US, all cases had CBD dilatation on US > 7 mm. All were subjected to MRCP assessment. **Results:** In our study ultrasound MRCP successfully diagnosed 27 cases of CBD stones, 15 cases of pancreatic head masses as well as 4 causes of benign biliary stricture while US successfully diagnosed 20 cases of CBD stones, 10 cases of pancreatic head masses as well as one cause of benign biliary stricture out of 50 patients, so we found that MRCP has more accuracy than dedicated US is diagnosis of biliary tract pathologies especially distal CBD stones, also MRCP is more accurate than US in detecting pancreatic pathologies. **Conclusion:** MRCP could diagnose almost all causes of biliary tract dilation, also it plays a major role in detecting pancreatic causes of distal biliary radicles obstruction, so we recommend that MRCP is the best tool for diagnosis of biliary radicles obstruction especially when the obstruction was involving the distal CBD and was cause by pancreatic pathology.
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1. Introduction:

The common bile duct (CBD) dilatation is a common finding during ultrasound and CT examination which usually recommends further assessment to evaluate its significance, cause and outcome (1).

The common hepatic duct is formed by the confluence of the extrahepatic segments of the right and left hepatic ducts. The common hepatic duct is then joined by the cystic duct to form the common bile duct (2)

Many disorders can cause common bile duct dilatation. A diameter of more than 7 mm (except post cholecystectomy or post ERCP) is regarded as abnormal dilatation and is a sign of cholestasis, CBD diameter of 7 – 12 mm represent mild dilatation, 12-16 mm represents moderate dilatation and > 16 mm represents severe dilatation (3).

Many reasons causes CBD dilatation as choledocholithiasis, pancreatic head masses, pancreatitis, external compression (e.g. impacted cystic duct stone / adenopathy), sclerosing cholangitis, choledochal cyst type IV, Sphincter of Oddi dyskinesia, Pregnancy, and after cholecystectomy (4).

ERCP has been the gold standard investigation for evaluation of the biliary system for a long duration yet it is relatively invasive with reported complications as pancreatitis, duodenal perforation, duodenal hemorrhage, infections as well as stent migration (5).

Magnetic resonance cholangiopancreatography (MRCP) is a special type of magnetic resonance

imaging (MRI) exam that produces detailed images of the hepatobiliary and pancreatic systems (6-8).

2. Materials and Methods

50 patients attended to the radiology department of Fayoum university hospital and were included on the current study and an informed consent was obtained from all patients as well as the study was approved by the ethical committee in the faculty of medicine of Fayoum University, All patients were subjected to:

-History taking and clinical examination with revision of previous imaging studies.

- Total, direct bilirubin level and alkaline phosphatase level.

-MRCP assessment.

Inclusion criteria:

CBD diameter > 7 mm at ultrasound or CT scans with presence or absence of:-

a. -Elevated total & direct Bilirubin level.
b. -Elevated alkaline phosphate level.
c. -Patients with cysts or masses related to pancreas or CBD at ultrasound or CT examination.
d. -Patients with obstructive biliary symptoms (Jaundice, itching, dark urine).

Exclusion criteria:

e. Marked Ascites.
f. Patients who suffer from cluster phobia.
g. Patients with cardiac pacemakers, patients with Insulin pump, patients with cochlear Implant, in addition to other general contraindications of MRI.

We performed all MRCP with a 1.5-T MR scanner (Toshiba Titan). The following protocol was used:

Survey balance sequence is obtained in axial, coronal and sagittal planes. Axial T1WI, T2WI and T2 SPAIR as well as coronal T2WI of the abdomen with slice thickness of 6-7 mm were acquired before the examination. Axial T2WI was used as a guide to optimally localize the biliary system and to plan the MRCP slabs.

MRCP was performed with two different techniques:

I-Respiratory Triggered, Three Dimensional (3D) MRCP with MIP reconstruction.

II-Breath Hold, Two Dimensional (2D) and Single shot, MRCP (single slice technique).

3. Results

The study group consisted of 50 cases were examined by US, MRCP +/- CT for assessment of their biliary system to detect anatomical variants as well as biliary pathologies.

Cases presented by jaundice, abdominal pain, fever, pruritus and asymptomatic patients with CBD dilatation discovered incidentally by US as described in Table 1.

Total & direct bilirubin as well as alkaline phosphatase level were done for all cases, results illustrated in table 2.

In our study US revealed that 66% of our patients in the study group showed dilated common bile duct between 7and 10 mm, versus 34% had dilatation more than 10 mm, as regards IHBRs dilation was detected in 58% of cases and 24% of our patients showed bulky pancreas. MRCP revealed that 58% of our patients showed dilated common bile duct between 7and 10 mm, versus 42% had dilatation more than 10 mm, IHBRs dilation was observed in 72% of our cases and 40 % showed bulky pancreas (Fig1), (comparison between US and MRCP results was detailed in table 3).

Table (1): Frequency of different clinical findings among study group.

Variables (n=50)	Clinical findings	
	Number	%
Jaundice		
No	**16**	**32%**
Yes	**34**	**68%**
Pruritus		
No	**46**	**92%**
Yes	**4**	**8%**
Abdominal pain		
No	**31**	**62%**
Yes	**19**	**38%**
Fever		
No	**35**	**70%**
Yes	**15**	**30%**
Asymptomatic	**6**	**12%**

Table (2): Description of laboratory investigations among study group.

Laboratory investigations	Mean	SD	Range
Direct bilirubin	1.47	0.4	0-10
Indirect bilirubin	3.17	1.5	0-17
ALP	121.3	55.3	35-504

In the current study CBD stones were diagnosed in 20 cases by US and in 27 cases by MRCP (Fig 2, 3), pancreatic head masses (proved to be neoplastic) were diagnosed in 10 case by US and in 15 case by MCRP (Fig 4), Porta hepatis mass (pathologically proved to be nodal) was diagnosed in one case by US and in two cases by MRCP, Benign biliary stricture was diagnosed in one case by US while MRCP diagnosed 4 cases of benign biliary stricture (Fig 4), finally US and MRCP equally found normal variant biliary dilatation with no pathology in four cases for each (Table 4, Fig 5).

Sensitivity and specificity test for ultrasound in comparison with MRCP illustrates that the accuracy of ultrasound in diagnosis and detection of common bile duct dilatation with sensitivity (100%), specificity (81%), and total accuracy of (90.5%), and for diagnosis and detection of IHBRs with sensitivity (80.6%) specificity (100%), and total accuracy of (90.3%), finally diagnosis and detection of pancreas size with sensitivity (80.0%), specificity (89.0%), and total accuracy of (87%). It indicated US was good positive test in diagnosis of common bile duct dilatation, and good negative test in diagnosis of IHBRs.

While MRCP has sensitivity (100%) and specificity (85%) for detection of CBD dilatation with total accuracy of (92.5 %), for detection of IHBRs dilatation it has sensitivity (83%), specificity (100%) with total accuracy (90%), finally for detection of pancreatic size it has sensitivity (86.5 %), specificity. Pancreatic head mass was detected in 10 patients by ultrasound and 15 cases by MRCP. Gall bladder stones were detected in 20 cases. 8 of them (40.0 %) also had CBD stones. Two (5 %) of twenty seven cases with extrahepatic bile duct stones were asymptomatic (silent) stones and were reported as normal cases by US. two cases (4.0%) with primary sclerosing cholangitis were detected.

The US in the current study had detected different pathologies in 38 (76.0 %) out of fifty five cases, while MRCP had detected different pathologies in 46 (92 %) out of fifty five cases, this difference occurred in cases with distal CBD obstruction.

Table (3) illustrates that there is statistically significant difference with p-value <0.05 between US, and MRCP findings as regards detection of dilated IHBRs with higher percentage of dilated IHBRs were diagnosed by MRCP 72% versus 58% were diagnosed by US. On the other hand there is no statistically significant difference with p-value >0.05 as regards in findings by both ultrasound, and MRCP in diagnosis of common bile duct dilatation, and diagnosis of bulky pancreas.

Table (3): Comparisons of findings in different radiological tools of diagnosis.

Variables	US		MRCP		p-value	Sig.
	No.	%	No.	%		
Common bile duct						
Dilated 7-10 (mm)	33	66%	29	58%	0.1	NS
Dilated > 10 (mm)	17	34%	21	42%		
IHBRS						
Not dilated	21	42%	14	28%	0.02	S
Dilated	29	58%	36	72%		
Pancreas size						
Normal	38	76 %	30	60%	0.9	NS
Bulky	12	24%	20	40%		

Table (4): Different pathologies diagnosed by US and MRCP

	Number of cased diagnosed by U/S	Number of cased diagnosed by MRCP
CBD stones	20	27
Pancreatic head masses	10	15
Porta-hepatis mass	1	2
Benign biliary stricture	1	4
Normal variant dilatation	4	4

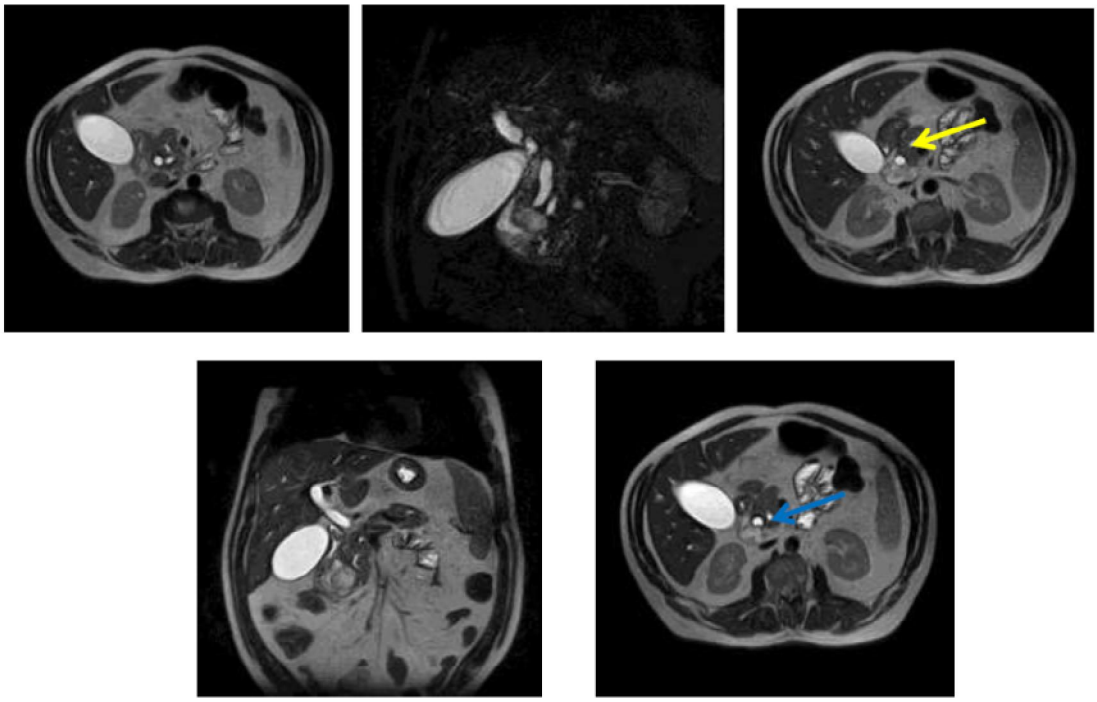

Fig.1. Axial T2 image shows The CBD & pancreatic duct (2 blue arrows), in sagittal T2 image the 2 ducts appeared with double beaded sign (2 blue arrows). (B) Axial & sagittal T2 image shows the relatively prominent pancreas with slightly hypo-intense signal (yellow arrow). note also the mild central & peripheral IHBRs dilatation.

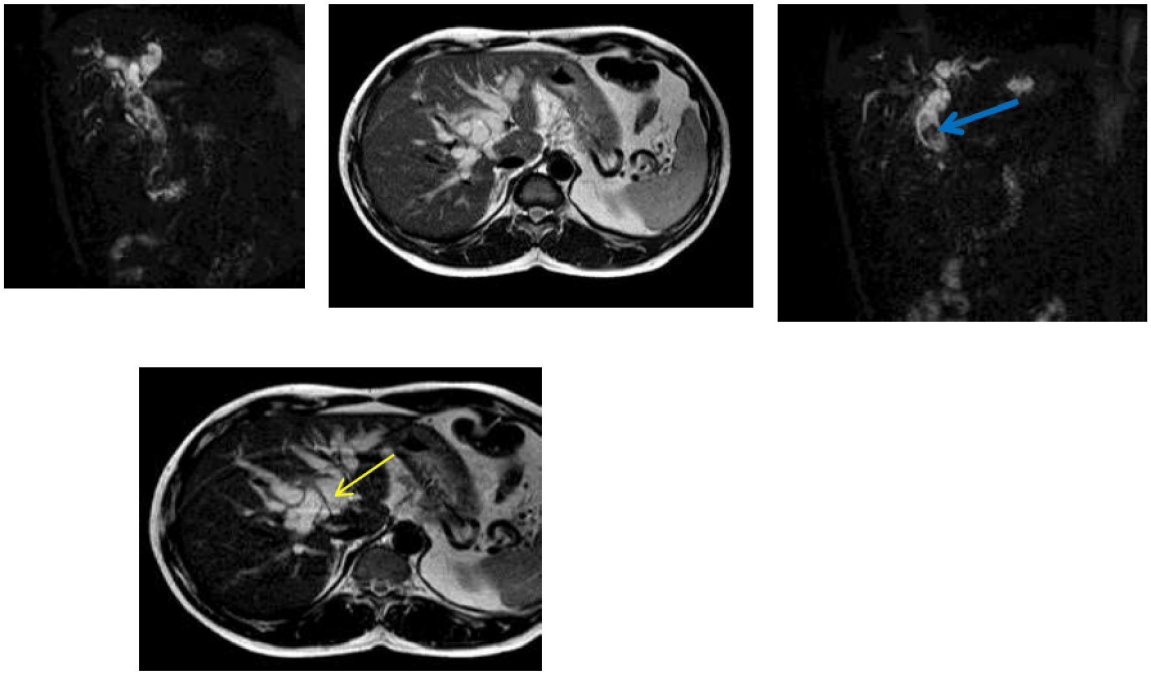

Fig.2. Sagittal T2 image shows large hypo-intense signal representing distal CBD stone (blue arrow); note also the moderate central & peripheral IHBRs dilatationin axial images (yellow arrow).

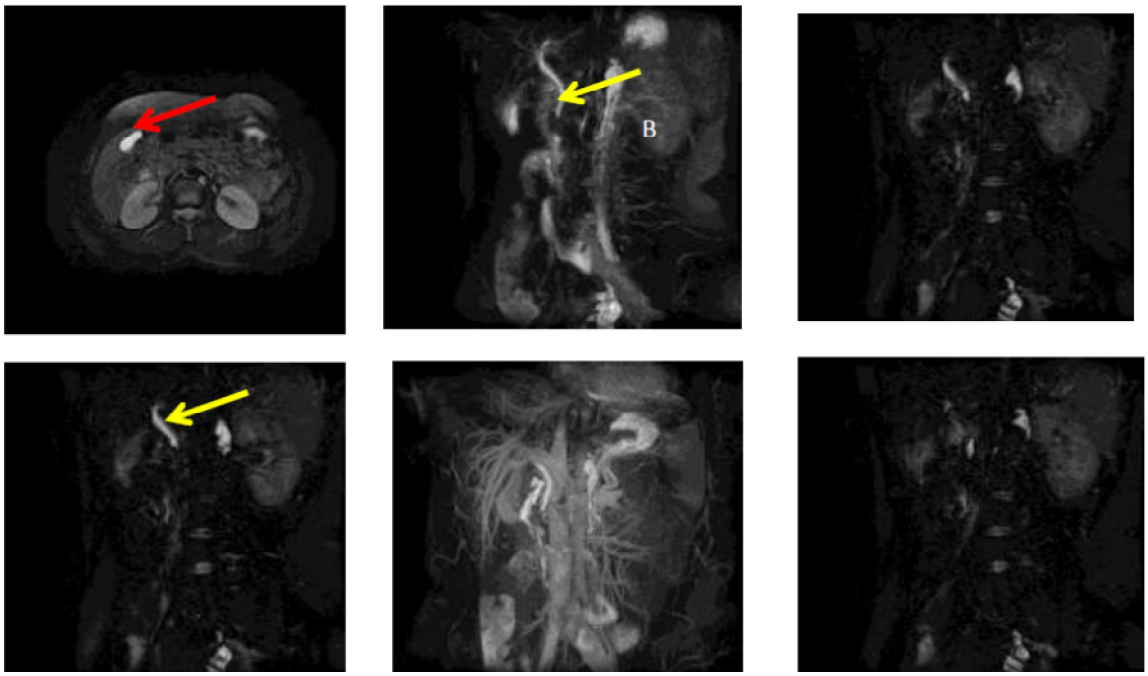

Fig.3. Axial T2 image shows the GB with no filling defects (Red arrow), The (yellow arrows) show serial coronal images and coronal 3D image of the ectatic CBD with sudden abrut change of caliper at the junction between proximal and distal third.

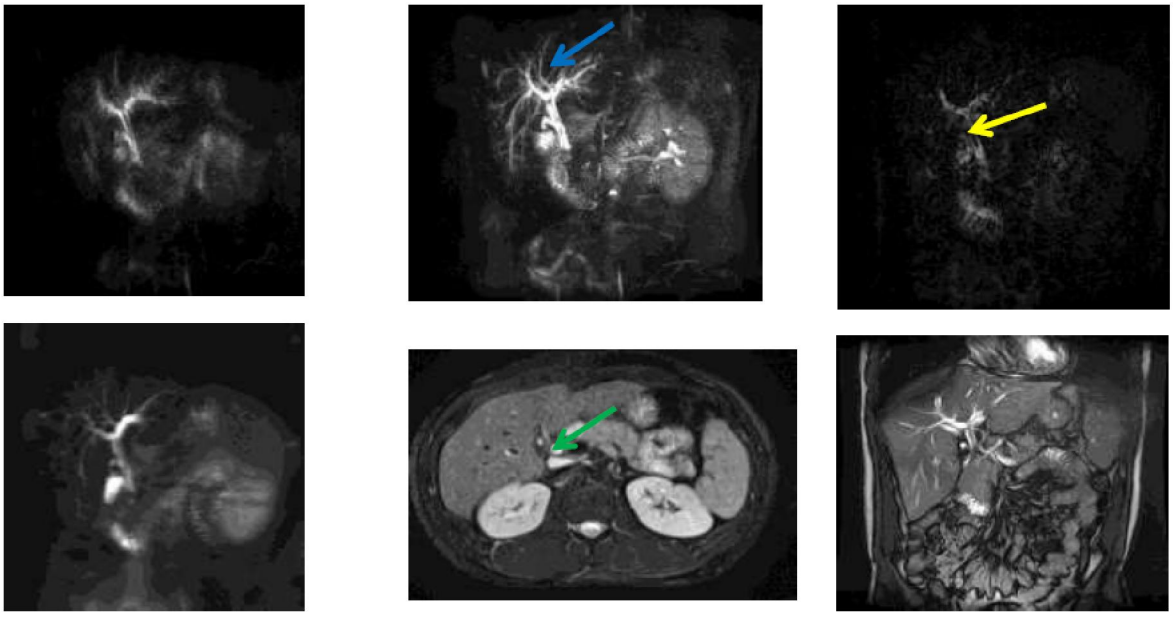

Fig.4. Images show mild central & peripheral IHBRs dilatation (blue arrow), the sagittal as well as 3D image shows the well placed CBD stent (yellow arrow), and distal hypo-intense stone is noted at the (green arrow).

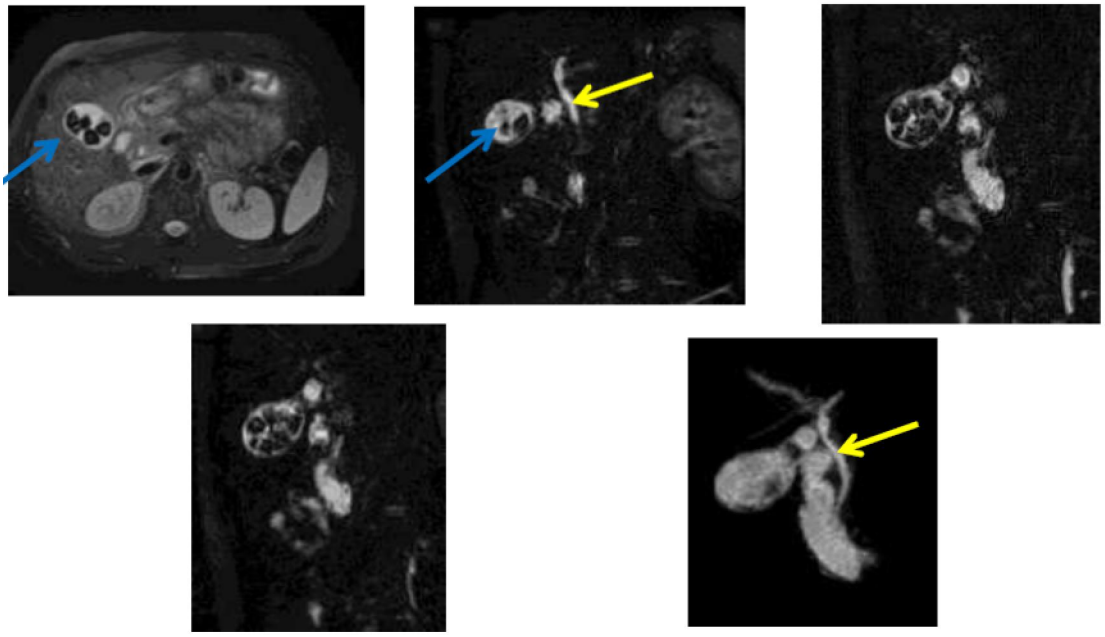

Fig.5. The axial & sagittal T2 images as well as 3D images shows multiple filling defect (stones) within the GB (Blue arrow), The CBD is ectatic as shows at the 3D image with gradual tapering towards the pancreas (yellow arrow), no filling defects noted.

Fig. (6): The image shows marked dilatation of CBD with IHBRs dilatation (yellow arrow), enhances CT abdomen image shows enhancing thickened irregular shaped pancreatic head (white arrow), MRCP confirmed the mass (black arrow).

4. Discussion

Common bile duct (CBD) dilatation is a common finding during ultrasound and CT examination. causes vary from being asymptomatic simple dilatation up to serious conditions as pancreatic head malignancies.

A diameter of more than 7 mm is regarded as abnormal dilatation and is a sign of cholestasis.

ERCP has been the gold standard examination for evaluation & therapeutic intervention of the biliary system for a long duration yet it is relatively invasive with many reported complications, so there was a need for a another relatively cheaper and non-invasive diagnostic modality.

Ultrasound provided a fast noninvasive diagnostic modality, but only with limited ability to assess inferior segments of biliary tract with super added difficulties in the form of central abdominal gases causing masking of the biliary tree segments, ultrasound examination also is operator dependent technique, thus causing different results and assessment (9).

CT provides superior value is assessing the pancreatic head / duodenal region and scanning for malignancy, yet great proportion of biliary tree stones are radiolucent on CT basis, so it has limited role in diagnosis of biliary stones (10).

Magnetic resonance cholangiopancreatography has evolved over the past decade as a major modality for assessment of the biliary tree providing higher tissue resolution with the ability to detect Static or

slow moving fluids within the biliary tree and pancreatic duct (11), (12), (13), (14), (15).

MRCP has advantages because of its technical multiplanar capability and superior soft tissue resolution. Unlike ERCP, MRCP is non-invasive, it can be performed rapidly and it does not expose the patients to ionized radiations or iodinated contrast material.

The current study showed that MRCP was superior to ultrasound in the evaluation of distal biliary radicles obstruction by stones or benign strictures and in the detection of pancreatic head masses and also was more valuable in the assessment of intrahepatic biliary radicles dilation and both of them were equally effective in ruling out pathological dilation versus normal variant dilation of the common bile duct eliminating the need for more invasive procedures to which the patient can be subjected to exclude underlying pathological lesion.

Conclusion:

MRCP could diagnose almost all causes of biliary tract dilation with better sensitivity, specicificty and total accuracy than ultrasound, also it plays a major role in detecting pancreatic causes of distal biliary radicles obstruction, so we recommend that MRCP as the best tool for diagnosis of biliary radicles obstruction especially when the obstruction was involving the distal CBD and was caused by pancreatic pathology.

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