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Research Article

ROLE OF MRCP AND HELICAL CT IN DIAGNOSING CAUSES OF OBSTRUCTIVE JAUNDICE

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ABSTRACT

Background & Objective: The main objective of the study is to determine the accuracy of MRCP over CT in the evaluation of patients with obstructive jaundice.
Material & Methods: The study was conducted in the department of Radio Diagnosis, for a period of 1 and a half year from July 2015-December 2016. Thirty six patients were included in the study. All the patients were referred to the department of radio diagnosis with the clinical suspicion of obstructive jaundice and elevated serum bilirubin levels. CT and then MRCP were done in all the patients. The accuracy of each modality was analysed statistically and correlation was made with the surgical findings or histopathological reports.
Results: Of the thirty six patients, sixteen patients had benign causes of obstructive jaundice while twenty patients had malignant causes of obstructive jaundice. For diagnosing the cause of obstructive jaundice MRI with MRCP has a greater diagnostic accurancy of 94.4% than helical CT with accuracy of 91.6%.The sensitivity of MRI with MRCP is greater than that of helical CT in diagnosing the cause of obstructive jaundice. In diagnosing the site of obstruction. MRCP had a accuracy of 100% while CT had 88% .The performance of MRCP when compared to CT was statistically more significant ($p<0.05$).
Conclusion: In the diagnosis of obstructive jaundice and to know the cause, site and extent of the lesion MRCP being a non invasive, non ionizing procedure seems to be a better choice over CT. The only drawback of MRCP is the cost involved and the availability.

INTRODUCTION

Objectives

- To establish the role of MR with MRCP over Computed Tomography in diagnosing the cause of Obstructive Jaundice.
- To compare the diagnostic yield of MR with MRCP versus Helical CT in diagnosing the causes of Obstructive Jaundice, extent, associated biliary tract anomalies and condition of CBD beyond obstruction.

METHODOLOGY

This study has been carried out in the Department of Radiodiagnosis, J.J.M.C. Medical College, Davangere. A total no of thirty six patients suffering from various diseases of biliary tract and pancreas of all age groups and either sex were included in this study. Median time between CT and MR examination was 4 days (0-10 days).

METHODS

Helical CT was performed on a Toshiba Activion 16 Multislice CT Scanner. Patients were asked to drink 800 ml of diluted oral contrast 1 hour before procedure and 200 ml of diluted oral contrast immediately before procedure. Unenhanced CT with 1mm collimation of the upper abdomen was performed to locate the pancreas. Contrast (80 ml, 300mg I/ml) was then injected intravenously the scans were taken from diaphragm to iliac crest on 5mm collimation, 5mm reconstruction interval, pitch of 1.0, and FOV of 30-40 cms.

MRI-MRCP was performed on Philips ACHIVA 1.5 Tesla MRIScanner. Patient was given concentrated pineapple juice prior to scan. All images were obtained with breath holding and parameters were individualized to optimize each for a suspended breath hold of about 15s.All conventional sequences were acquired in axial plane.

Study definition

Magnetic Resonance Cholangiopancreatography is a relatively new MR imaging technique that has revolutionized the imaging of biliary and pancreatic ducts and has emerged as an accurate, noninvasive means of visualization of the biliary tree and pancreatic duct without injection of contrast material.

With the development of higher magnetic field strength and newer pulse sequences like HASTE (Half Fourier Acquisition

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Single Shot Turbo Spin Echo) and RARE (Rapid Acquisition and Relaxation Enhancement), MRCP with its inherent high contrast resolution, rapidity, multiplanar capability and virtually artifact free display of anatomy and pathology.

It has proved effective in demonstrating bile duct dilatation, stricture and choledocholithiasis. In patients with malignant obstruction or stenosis of biliary-enteric anastomosis, this noninvasive imaging technique demonstrates the site and extent of the stenosis, the degree of proximal dilatation, the presence and size of biliary stones, and associated findings.

The principle of MRCP is based on use of heavily T2 weighted fast spin echo sequences. As a result, stationary or slow moving fluid in biliary & pancreatic duct gives high signal intensity, while solid organs have low signal intensity. Other imaging modalities used in the diagnosis of biliary tree and pancreatic duct are Ultrasonography, Computed Tomography, IV cholangiography and Endoscopic Retrograde Cholangio-pancreatography (ERCP) and Percutaneous Transhepatic Cholangiography (PTC).

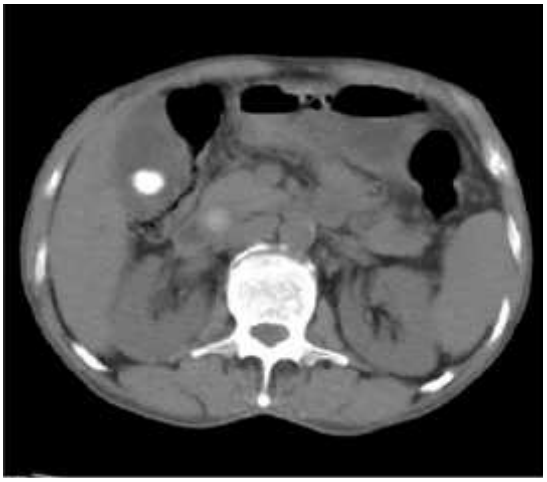
Drawbacks with ultrasonography and CT are, they do not accurately define site and extent of biliary strictures. Ultrasonogrpahy has limitations indiagnosing choledocholithiasis, where as MRCP offers diagnostic accuracy of >90%. IV cholangiography has limitations, in 30-40% of cases there is incomplete opacification of biliary system. ERCP and PTC require biliary intervention and use of contrast media.

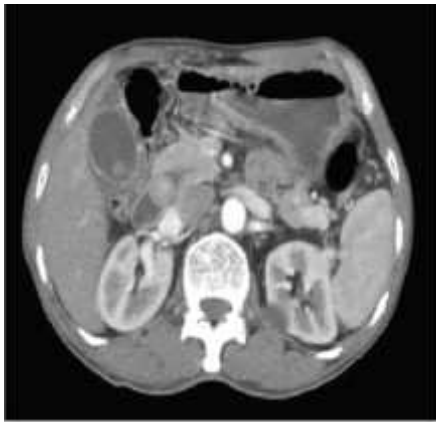
MRCP has few added advantage as follow

- Non-invasive imaging modality
- No ionizing radiation needed
- No need of contrast media
- Multiplanar imaging capability
- No post procedure complications
- It can be performed in critically ill patients
- It can show biliary tract proximal as well as distal to the level of obstruction.

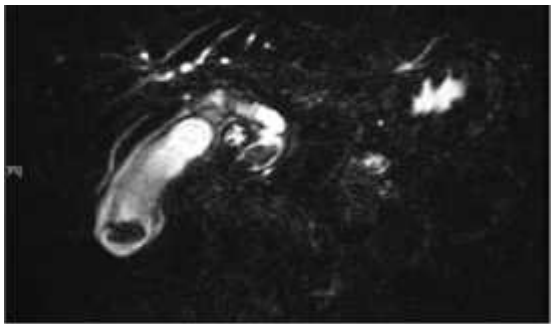
Case 1

Cholelithiasis with Choledocholithiasis





NCCT and CECT abdomen showing hyperdense calculus in GB but no calculus seen in CBD



MRCP showing hypointense calculus in GB and distal CBD surrounded by hyperintense bile

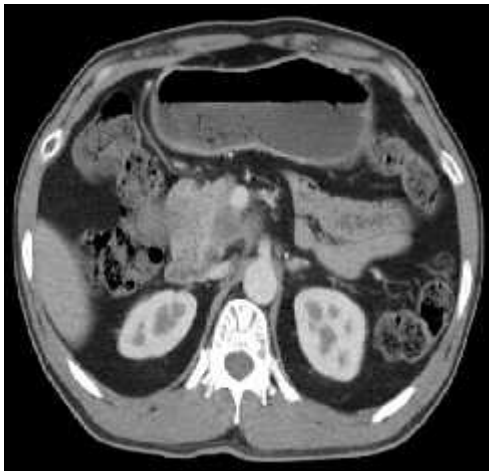
Case 2 Choledococele

NCCT and CECT abdomen well defined cystic lesion in intramural location in second part of duodenum

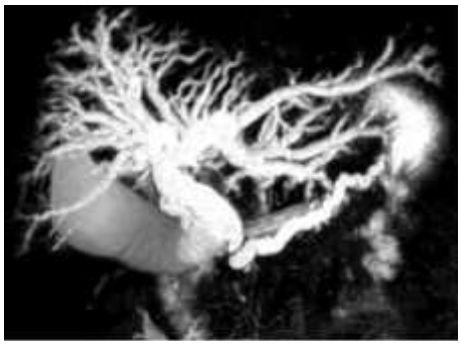
MRCP image showing hyperintense cystic lesion in intramural aspect of second part of duodenum, intrahepatic and extrahepatic biliary radicals are normal.

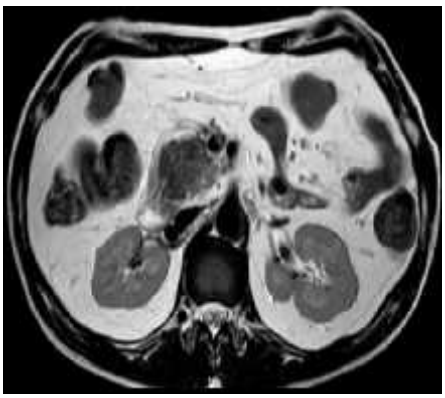
Case 3

Carcinoma Head of Pancreas



CECT abdomen showing well defined enhancing mass lesion in the head of pancreas

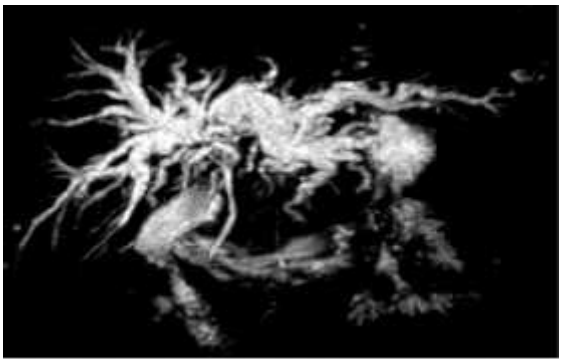




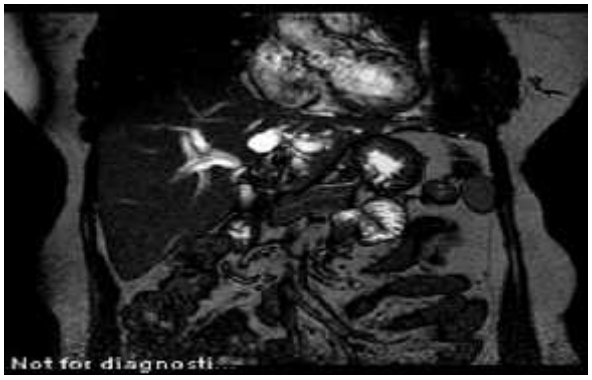
MRCP showing dilatation of intrahepatic biliary radicles and CBD

T2 MR image showing hypointense mass lesion in the region of head of pancreas

Case4 Case of Klatskin's Tumour

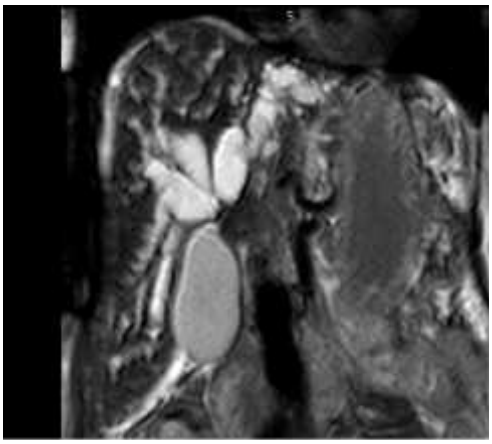


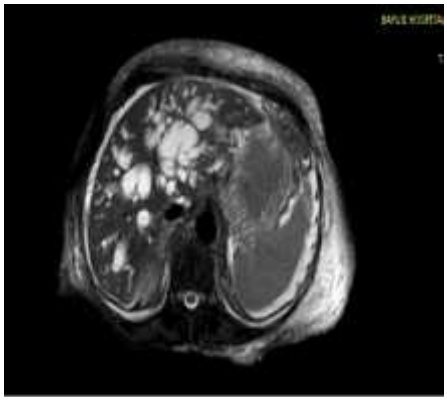
MRCP image showing dilatation of intrahepatic biliary radicals with ill defined mass lesion at the junction of left and right hepatic duct



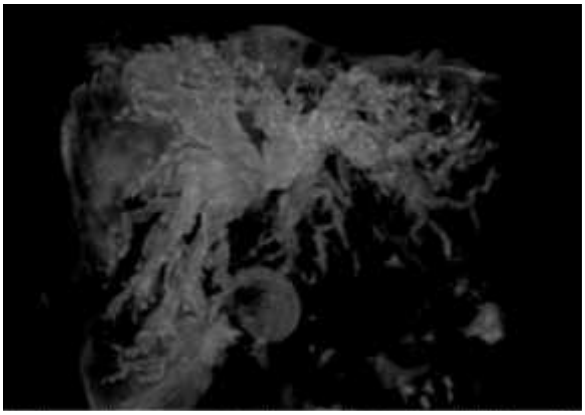
T2 MRI image showing ill definedhypointense mass at the junction of left and right hepatic duct

Case 5 Case of Caroli's Disease



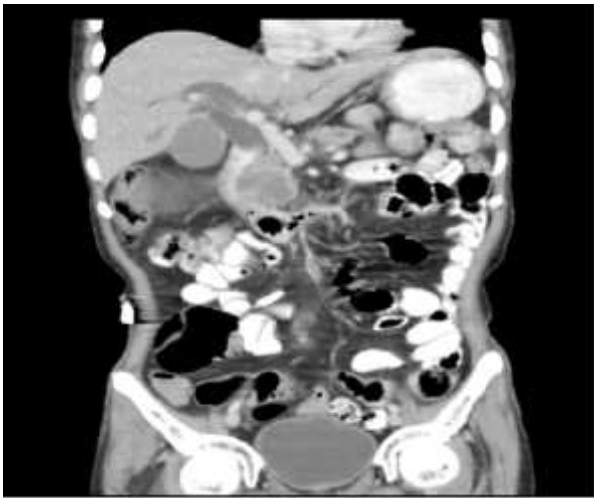


T2W coronal and axial image showing saccular dilatation of intrahepatic biliary radicals containing hyperintense bile

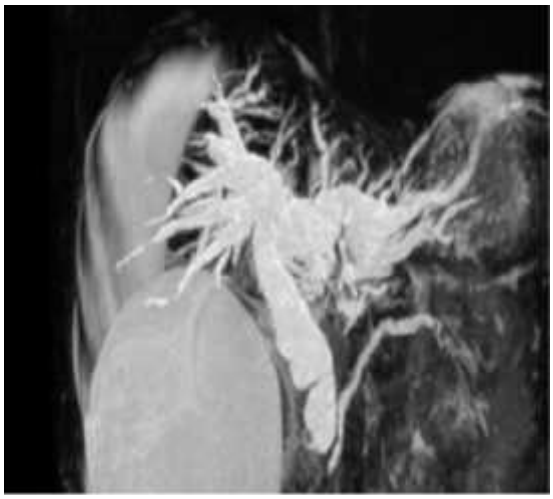


MRCP image showing saccular dilatations in intrahepatic biliary radicals in connection with biliary tree. However CBD is normal.

Case 6 Case of Periampullary Carcinoma



CECT coronal image showing hypodense mass location in second part of duodenum in periampullary region



MRCP image showing diffuse dilatation of intra and extrahepatic biliary radicals and CBD until its termination.

Case 7 Type 1 Choledochal Cyst

T2W image showing cystic dilatation of CBD with hyperintense bile within it.

RESULTS

Our study was conducted to determine the MR -MRCP in the evaluation of patients with obstructive jaundice Vs Helical CT . This study included 36 patients. The youngest patient of our study was 3 months old and the oldest was 85 years. The mean age of patients with benign lesions was 37.4 years and that with malignant lesions was 46.5 years. All the lesions were detected by both CT and MRI with MRCP. CT characterized 15 patients had benign cause of obstructive jaundice, out of which, 1 case (6.6%) turned out to be malignant.

Out of 21 cases characterized as malignant by CT, 2 cases (9.5%) turned out to be benign.

Out of 16 cases characterized benign by MRI with MRCP imaging, only 1 case (6.2%) turned out malignant, which was characterized benign by CT too. Out of 20 cases characterized as malignant by MR with MRCP, 1 case (5%) turned out to be benign.

For calculation of statistics “Statistical Package for the Social Sciences 17 (SPSS 17)”, software was used to analysed the datas and open epi software was used to calculate sensitivity, specificity, NPV, PPV and diagnostic accuracy. p-value was calculated by chi-square test, p-value less than 0.05 was considered as statistically significant.

It is inferred that for diagnosing the causes of obstructive jaundice the Sensitivity, Specificity, PPV, NPV, Accuracy was 87.5%, 95%, 93.33%, 90.48%, 91.67% for CT and 93.75%, 95%. 93.75%, 95%, 94.44% MRI respectively.

Table showing type of lesion causing obstructive jaundice

Type of lesion	No of patients	Percent
Benign	16	44
Malignant	20	56
Total	36	100

Table showing benign cause of obstructive jaundice among the subjects

Benign causes	No of cases	Percent
CBD calculi	4	25
CBD with GB calculi	4	25
Benign stricture	4	25
Anatomic variant	3	19
Cholangitis	1	6
Total	16	100

Table showing malignant causes of obstructive jaundice

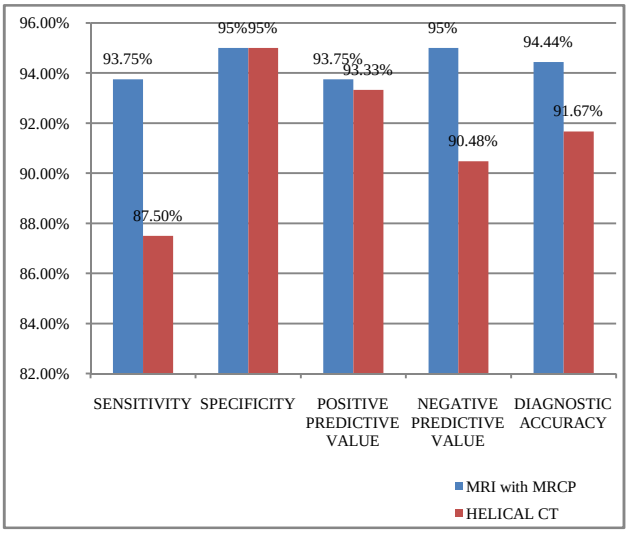
Malignant causes	No of cases	Percent
Periampullaryca	8	40
Cholangiocarcioma	4	20
GB carcinoma	4	20
Klatskinstumor	2	10
Ca head of pancreas	1	5
Matasatic compression	1	5
Total	20	100

Table showing diagnosis by helical CT scan and histopathological diagnosis

		Histopathological diagnosis			significance
		Benign	Malignant		
Helical CT	Benign	14(TP)	1(FP)	15	X2= 24.89 df= 1, p<0.000000607
	Malignant	2(FN)	19(TN)	21	
		16	20	36	

Table showing diagnosis by MRI with MRCP scan and Histopathological diagnosis

		Histopathological diagnosis			Significance
		Benign	Malignant		
MRI with MRCP	Benign	15	1	16	X2= 28.36
	Malignant	1	19	20	df= 1
		16	20	36	p< 0.000000101



Comparison of Diagnostic Values of Helical Ct And Mri With Mrcp In Causes of Obstructive Jaundice

From the above table it can be inferred that for diagnosing cause of obstructive jaundice, MRI with MRCP has greater diagnostic accuracy of 94.4% than Helical CT with accuracy of 91.6%

DISCUSSION

In our study maximum number of patients (47.3%) were adults in the age group of 31-60yrs with 53% sufferers were males. All of our cases presented with jaundice and abdominal pain. Most common sign encountered in our study was icterus. Our study is in concordance with Guibad *et al* 1994; In their study they found an accuracy of 100% in detecting CBD calculi on MRCP in cases with equivocalsonographic and CT results.

In imaging of benign lesions (n=16) MR with MRCP diagnosed CBD with GB calculi in all 8 patients with such a final diagnosis and CT also showed the same in all and both the modalities showing 100% accuracy in detecting CBD and GB calculi. MR with MRCP showed calculus region as an area of signal void, and CT showed it as hyperdense lesion. Our study is in concordance with Soto *et al* 2000; In their study they found sensitivity of 94% and specificity of 100% for detecting bilary calculi in MRCP. Stephan *et al* 2006: In their study they found the sensitivity of diagnosing CBD calculus was 87% and our study showed that CT is more superior than their study.

Stricture disease was diagnosed in 4 patients MR with MRCP clearly showed benign nature of stricture in all four cases approaching 100% accuracy.

MRCP showed clearly the length of the stricture segment very well and differentiated stricture as malignant and benign. Among these in Helical CT two patients were diagnosed to have malignant nature of obstruction, based on characters of distal CBD, such as rounded ending of CBD abruptly.

Histopathology examination of the resected specimen revealed benign nature of obstruction in those two cases which CT reported as malignant. Our study is in concordance with Bhatt *et al*; In their study they found 100% accuracy for MRCP in diagnosing benign CBD strictures.60 One case of cholangitis has been diagnosed wrongly as CBD growth in MR with MRCP, which histology proved it as a benign lesion.

Anatomic variants of 3 cases have been diagnosed on Helical CT and MR with MRCP. One case of biliary atresia and two cases of choledochal cysts.

Both showed diagnostic accuracy of 100%.Our study is in concordance with Bhatt *et al*; In their study they found 100% accuracy for MRCP in diagnosing anatomical variants. In imaging of malignant lesions (n=20), 8 cases of periampullary growth was diagnosed with histopathological correlation. Among these 7 patients were diagnosed to have periampullary growth in MR with MRCP, and Helical CT.

Conventional MRI sections aided a lot in arriving final conclusion. In two of these cases MRCP demonstrated “double duct” sign which helped more in arriving final diagnosis. One patient was diagnosed to have stricture disease among the periampullary growth patients, due to technical fault and due to patient non-cooperation in both the modalities. Hence the diagnostic accuracies of both the modalities approaching 88%.Our study is in concordance with Anderrson *et al* 2005; In their study they found 90%accuracy for MR and 80%accuracy for CT in diagnosing periampullary growth.

In 4 patients with extrahepaticcholangiocarcinoma MR with MRCP diagnosed all four cases with a 100% accuracy with the

help of conventional MRI, while CT clearly showed growth in 2 cases and with suspicion in remaining 2 cases, thus approaching 100% accuracy for MR with MRCP compared to 88-90%accuracy in CT. When studying correlation between imaging findings and final diagnosis we found a stricture with malignant characteristics at MRCP to be the most predictive sign of malignancy. Our study is in accordance with Andersson *et al* 2005; found that among MR with MRCP strictures with malignant characteristics at MRCP were the only independent predictor of malignancy 59. In these respects MRCP was more accurate than CT imaging.

2 patients were diagnosed to have Klatskins tumour , and the accuracy of two modalities remain 100% .Our study is in concordance with Bhatt *et al* 2005; in their study they found accuracy of 100% for MRCP alone in diagnosing Klatskins tumour. But CT was not able to show exact extent of two lesions as MRI did. Thus our study is in concordance with JK Han *et al*; they inferred that Spiral CT less accurate than cholangiography in evaluvation of Klatskinstumor in relation to extent of tumour as CT has less z axis resolution.

One case has been diagnosed to have extrinsic malignant nodal compression in both the modalities approaching 100% accuracy in both.

Among four patients with GB Carcinoma MR with MRCP diagnosed all four cases with 100% accuracy, while CT showed positive finding in 3 cases, with accuracy of 75% and one case it diagnosed as malignant hilar obstruction. Conventional MRI added a lot once again in arriving final diagnosis. Among these, two patient had liver metastasis shown clearly by both the modalities.

Our study is in concordance with Bhatt *et al* 2005; in their study they found an accuracy of 100% for MRCP alone in diagnosing GB Carcinoma. ERCP correlation was got with one patient and findings were correlated with MRCP and found that, MRCP findings were comparable to that of ERCP. Finding of our study is in concordance with Barish *et al* 1995; and Pavone *et al* 1988; in their study they found that MRCP images equivalent and better to ERCP.

CONCLUSION

In our study, among the benign cause of obstructive jaundice CBD calculi were the most common finding constituting about 50% of benign causes and it is detected as an isolated or in association with other pathology. Both CT and MR showed 100% accuracy in detecting calculus disorders. Among the malignant causes periampullary carcinoma is the most common cause and constitutes about 40% of malignant causes. Both CT and MR showed with 95% with 95% sensitivity in detecting malignant pathologies. Both CT and MR showed with 95% sensitivity in detecting malignant pathologies. But it is still MRCP that has potential role in delineating the malignant cause of obstructive jaundice, approaching almost 100% in accuracy. During our study we observed that MRI with MRCP has 94% accuracy in delineating the cause of obstructive jaundice. Compared with Helical CT, MRI with MRCP is equally sensitive and more specific in differentiating the causes of obstructive jaundice as malignant. MRI with MRCP is very accurate than CT/USG in identifying the various benignpathologies, and this modality has shown a dramatic role in identifying anatomic variants including choledochal cysts. With the help of conventional MRI, MRCP has added its advantage of diagnosing malignant pathologies to a extent that it was even possible to stage the malignant tumors. MRI with MRCP can be used to demonstrate the involvement of vascular structures with different sequences at a single setting with MRangiography thus saving time and discomfort to the patient. MR Cholangiopancreatography is very accurate in demonstrating calculi at the distal end of CBD as an area of signal void, also in demonstrating strictures as the cause of dilatation of biliary radicals. It showed the length of stricture segment very well and differentiated stricture as malignant and benign. The benign strictures were smooth tapered margins, where as in malignant strictures there was an abrupt and irregular character of narrowed segment with or without shouldering. MRCP is superior to CT in this regard.

With the help of source image, we can very well show the exact location and extent of malignant tumours (like Ca GB, Klatskin tumour, Cholangiocarcinoma, Ca pancreas), thereby providing a guide map for segmental resection.

Based upon our study following conclusions can be drawn;

It is accurate, non invasive means of evaluating the patients with obstructive jaundice.

It is useful in children, critically ill patients with ease.

It is useful in failed ERCP cases and it also shows biliary tree very well proximal as well as distal to the level of obstruction.

It is better to Helical CT in showing the distal CBD as well as pancreatic duct.

In conclusion in this prospectively collected data of patients, MRI combined with MRCP is equivalent to Helical CT in delineating the cause of obstructive jaundice as malignant, but it is superior to Helical CT in diagnosing benign causes of obstructive jaundice .This difference was mainly explained by the MRCP in imaging malignant/benign biliary and/or pancreatic duct strictures and to bile duct calculi. Dynamic contrast enhanced MRI did not add any better performance to cross sectional MRI combined with MRCP without contrast. From the above table it can be inferred that for diagnosing the cause of obstructive jaundice MRI with MRCP has a greater diagnostic accuracy of 94.4% than helical CT with accuracy of 91.6%.

The sensitivity of MRI with MRCP is greater than that of helical CT in diagnosing the cause of obstructive jaundice.

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