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KEY WORDS: MRCP, pancreatico-billiary diseases, pancreatitis, pancreatico-billiary malignancies, cholelithiasis, choledocholithiasis, congenital anomalies.

EVALUATION OF SUSPECTED PANCREATICO-BILIARY DISEASES BY MRCP (MAGNETIC RESONANCE CHOLANGIO-PANCREATICOGRAPHY)

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ABSTRACT

Evaluation of the pancreaticobilliary diseases is important for appropriate management of patients. Ultrasonography is routinely done investigation in suspected patients of pancreaticobilliary diseases. This study was done to evaluate the role of MRCP in suspected cases of pancreaticobilliary disease. We have studied 25 patients in which, MRCP findings were correlated with final diagnosis in 16 patients and rest 9 patients were advised follow up. In this study, we have found pancreatitis as most common disease followed by pancreaticobilliary malignancies and pancreaticobilliary congenital anomalies as a least common.

Summary –
MRCP is a non-invasive imaging modality which gives clear details of pancreaticobilliary tree in suspected cases of pancreaticobilliary diseases. In our study pancreatitis was most common pancreaticobilliary disease. Choledocholithiasis, congenital pancreaticobilliary anomalies and biliary strictures are best evaluated on MRCP.

Introduction:
MRCP is magnetic resonance cholangiopancreaticography has emerged as a potent non-invasive alternative approach to evaluate the pancreatico-billiary system. [1] The lack of need for sedation, intravenous contrast and radiation exposure and the advantage of it being non- invasive, able to delineate lesions at all levels in addition to being highly sensitive. [2, 3]

Other widely used non-invasive methods include ultrasonography and computed tomography. ERCP is an invasive modality which is considered as the gold standard for the diagnosis of pancreaticobiliary disease. However, requirement of personnel experties for procedure, sedation and use of ionizing radiation with higher complication rates are limiting factors.

Aims and objectives:
1. To evaluate the role of MRCP in the diagnosis of pancreaticobilliary diseases.
2. To describe features of pancreaticobilliary diseases on MRCP with their extension
3. To identify congenital anomalies

Material and Methods:
Patients presented with signs and symptoms of obstructive jaundice with prior ultrasound, having equivocal results were enrolled in the study. Total 25 patients done, during november 2015 to january 2017. Patients were counseled regarding the procedure and after ruling out contraindications the MR cholangio- pancreatograms were obtained on 1.5 Tesla Philips MRI scanner.

The standard protocol followed for MRCP was T1-_TFE _IP _FB AXIAL, T2W – TSE – FB AXIAL, T2W _ SPAIR_FB AXIAL, T2W _ SPAIR_FB_COR, SSh_MRCPrad_RAD, sMRCP_3D_HR_3D, BTFE_ RT AXIAL, BTFE_portal COR. Images were recorded as hard copy and on CD. All MRCP images were reviewed by experienced radiologist. Additional investigations like laboratory investigations and other imaging findings were noted and stored for analysis. Patients were followed up with either surgery/ HPE or put on regular follow up.

Study design: A prospective study.
Source of data: Patients referred to the department of radio diagnosis, GMCH, Aurangabad for MRCP.
Sample size: A total of 25 patients.
Inclusion Criteria: All the patients of obstructive jaundice with equivocal ultrasound findings.
Exclusion criteria: No significant exclusion criteria were formulated however, we did not include patients who were not willing for MRCP and patients with claustrophobia.

Results:
Total 25 patients were evaluated, among these 18 (72 %) patients were male and 7 (28 %) were female. Mean age of study population was 50.2 years (range 0 to 100 years). Maximum cases were between 40 to 70 years of age. Benign pathologies were seen in 10 to 60 years and malignant pathologies in 40 to 70 years.

Total 7 (28 %) cases of pancreatitis were detected. Majority of these, 5 cases were of chronic pancreatitis out of which 2 patients had pseudocysts as a complication. There was one case of acute pancreatitis and another of acute on chronic pancreatitis in known case of chronic pancreatitis.

Malignant pathologies were noted in 6 (24%) cases. In which, there were 4 (16%) cases of cholangiocarcinoma and other 2 cases included one case of carcinoma gall bladder (4%) and other of periampullary carcinoma (4%). Out of 4 cases of cholangiocarcinoma there was one case of klatskin tumour (4%).

There were 5 (20 %) (3 male and 2 female) cases of choledocholithiasis. Among these, there were 2 (8%) isolated cases of choledocholithiasis, 2 (8%) cases with associated cholelithiasis and 1 (4%) case with associated chronic cholecystitis . Cholecystitis was detected in 4 (16 %) (2 Male and 2 Female) patients in which two cases were of calculus cholecystitis, one case of cholecystitis with Mirrizi syndrome and another one of chronic cholecystitis with choledcocholithiasis .

Under congenital anomalies 2 (8%) cases were there. Each case of choledochal cyst (type IVa) and of pancreas divisum was noted. Patient with pancreas divisum also had changes of pancreatitis. There was one case of benign CBD stricture, with stricture in its terminal part. Among 25 patients one patient had normal study.

Table 1 . (MRCP and final Diagnosis of 25 patients under study)

Sr.No.	MRCP Diagnosis	No. of patients	Percentage	Final diagnosis
1	Calculus Cholecystitis	2	8	Confirmed on surgery
2	Chronic Cholecystitis with Choledocholithiasis	1	4	Confirmed on surgery
3	Cholecystitis with Mirizzi Syndrome and Portal Hypertension	1	4	Confirmed on surgery
4	Choledocholithiasis	2	8	Confirmed on surgery
5	Cholelithiasis and Choledocholithiasis	2	8	Confirmed on surgery
6	Cholangiocarcinoma	4	16	Confirmed on histopathology
7	Acute Pancreatitis	1	4	Follow up , correlated with sr.amylase and lipase
8	Acute on Chronic Pancreatitis	1	4	Follow up , correlated with sr.amylase and lipase
9	Chronic Pancreatitis	3	12	Follow up , correlated with sr.amylase and lipase
10	Chronic Pancreatitis with Pseudocyst	2	8	Follow up ,correlated with sr.amylase and lipase
11	Periampullary Carcinoma	1	4	Confirmed on surgery / HPE
12	Choledochal Cyst	1	4	Confirmed on surgery
13	Pancreas Divisum with Pancreatitis	1	4	Follow up correlated with sr.amylase and lipase.
14	Benign CBD Stricture	1	4	Confirmed on surgery
15	Carcinoma gall bladder (neck)	1	4	Confirmed on surgery / HPE
16	Normal Study	1	4	Follow up
	Total	**25**	**100**	

Discussion –

MRCP is magnetic resonance cholangiopancreaticography. It is a non-invasive modality to evaluate the pancreatico-billiary system. [1] Various modalities used for evaluation of pancreatico-billiary pathologies are ultrasonography, Computed tomography, endoscopic retrograde cholangiopancreaticography and percutaneous transhepatic cholangiography (invasive). MRCP provides better visualization of pancreatic ductal and hepatobilliary system. There is no need for sedation, intravenous contrast and radiation exposure. [2, 3] MRCP is vital investigation for evaluating patients with obstructive jaundice. MRCP provides more anatomical and ductal morphological details than that of CECT (contrast enhanced computed tomography). However, in cases with large neoplastic masses such as intrahepatic cholangiocarcinoma, carcinoma gall bladder and pancreatitis CECT and MRCP had equivocal role. In suspected patients of choledocholithiasis MRCP is useful for evaluating ductal details which are not visualized on ultrasonography. For suspected pancreaticobilliary congenital anomalies MRCP is investigation of choice, as CECT or USG do not provide detail ductal anatomy and examination can be limited by patient's motion, gaseous reverberation especially in USG (ultrasonography). In reference to pancreaticobilliary diseases, MRI-specific artifacts can mimic as biliary obstruction and choledochal stones. Improper breath holding and gross ascites can hinder proper scanning of patient. [4]

Our study shows male preponderance in pancreaticobiliary diseases and correlates with Shivanand et al (58%) and Miyazaki et al (66%) studies. However, Upadhaya et al (54%), Ferrari (53%) and Soto's (53%) studies showed female preponderance. [5, 6, 7, 8, 9] Benign pathologies were seen more in 10 to 60 years and malignant pathologies in 40 to 70 years of age. As compared to the shivanand et al study which shows benign pathologies among 11 – 50 years and malignant pathologies in 41-75 years range .[5] Cholecystitis showed no gender preponderance.

Pancreatitis is a condition in which there is inflammation of pancreatic parenchyma. In shivanand et al. study pancreatitis was seen in 18 % patients. [5] In our study, there were total 7 (28 %) cases of pancreatitis. Depending on duration of the disease it can be acute or chronic. In acute pancreatitis, pancreatic parenchyma is hypo intense to liver on T1W and hyper intense on T2W images. T2W with fat supression shows subtle interlobular septal abnormalities. There can be edematous thickening of capsule or subcapsular collection. Peripancreatic fat inflammation with retroperitoneal fluid collection is seen. Many patients shows thickening of anterior gerota's fascia.[10, 11] Two patients showed changes of acute pancreatitis, presenting as altered signal intensity of pancreatic parenchyma as described above with peripancreatic inflammation and fluid collection.

In chronic pancreatitis, in early stages there is decreased signal intensity on T1W images with diminished enhancement on gadolinium contrast study as result of fibrosis. Irregularity of main pancreatic duct and its side branches may be present. In addition to diminished signal intensity on T1W with fat suppression images, there is low parenchymal enhancement on early arterial phase and progressive enhancement on delayed phase. Dilatation and ectasia of main pancreatic duct can be seen. Intraductal calcifications can be present with parenchymal atrophy. In our study majority of 5 cases were of chronic pancreatitis (20%). In which, there was presence of pancreatic parenchymal atrophy with dilated main pancreatic duct, intraductal calcification was also noted. In two patients associated pseudocysts were noted as a complication. Shadan at al. showed chronic pancreatitis in 10 % cases. [10, 11, 12]

Pseudocyst appears as water intensity pockets of collection, which is hyperintense on T2W fat suppressed images. These cysts can have communication with pancreatic duct. Among various complications of pancreatitis there were two cases of pseudocysts in our study. [10, 11]

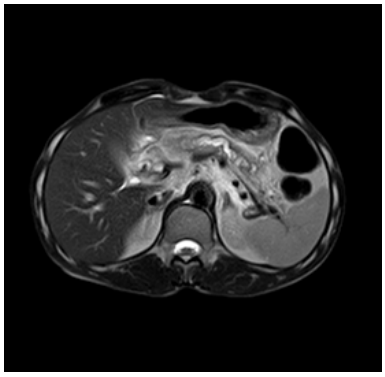

Figure1. BTFE_RT axial image, showing dilated and tortuous main pancreatic duct with atropic pancreatic parenchyma in patient of chronic pancreatitis.

Various malignant pathologies noted in study were cholangiocarcinoma, periampullary carcinoma and carcinoma gall bladder.

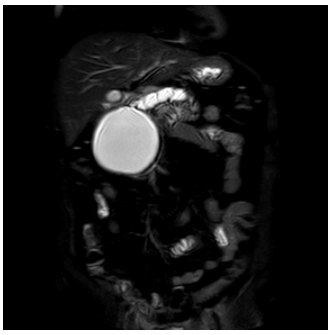

Figure2. T2W_SPAIR coronal image, showing large pseudocyst with dilated main pancreatic duct in patient of chronic pancreatitis.

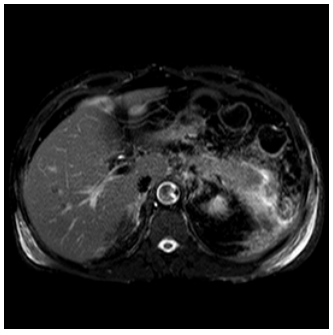

Figure3.T2W_SPAIR axial image, showing bulky pancreas (distal part of body and tail) with peripancreatic fluid collection and fat stranding in patient of acute pancreatitis.

Various malignant pathologies noted in study were cholangiocarcinoma, periampullary carcinoma and carcinoma gall bladder.

Table 2 . Comparison (in percentage) of malignant pathologies in our study with other studies. [5, 7, 9, 14, 12, 13]

Study	Cholangiocarcinoma	Periampullary carcinoma	Carcinoma gall bladder	Carcinoma pancreas
Our study	16%	4%	4%	-
Shivanand et al.	12%	6%	6%	-
Bhatt et al.	12%	4%	2%	-
Shadan et al.	4%	4%	4%	8%
Schwartz et al.	21.8%	6.2%	28.1%	37.5%
Upadhaya et al.	9%	10%	19%	9%
Soto et al.	13.9%	9.3%	4.6%	18.6%

Cholangiocarcinomas arise from epithelium of bile duct. These are rare. These are divided as intrahepatic (generally mass forming), perihilar and distal extrahepatic on anatomical basis. Perihilar cholangiocarcinoma also known as klatskin tumour are most common. These appear hypo-intense on T1W in phase SGRE, hyper-intense on T2W FSE with fat saturation and shows enhancement on post gadolinium T1W 3D SGRE images. [15] In our study among 4 (16%) cases, two cases were of extraheaptic cholangiocarcinoma which showed assymetrical thickening of terminal bile duct. It was hypo-intense on T1W and hyper-intense on T2W images. On gadolinium post contrast study, it showed enhancement. One patient showed intrahepatic mass. And in one case there was mass lesion at perihilar region (klatskin tumour). Our study closely correlates with shivanand et al, bhatt et al and soto et al study. [5, 9, 13]

Periampullary carcinomas arise in 2 cm of major duodenal papilla in involves carcinoma of ampulla, distal CBD, pancreas and duodenum. Discrete nodular mass in periampullary region can be ampullary carcinoma (usually hypo-intense on T2weighted images, Double duct sign seen), Pancreatic carcinoma (usually hypo-intense on T1W images and shows poor enhancement on gadolinium study .On T2W images, these show variable appearance hypo, iso or hyper-intense according to the severity of desmoplastic reaction), duodenal carcinoma – can be seen as small or large fungating mass or duodenal wall thickening). [16] One case (4%) in our study, there was hypointense mass on T1w images and showed hyperintensity on T2W images in pancreatic head region. Mass was causing obstruction with dilatation of both common bile duct and main pancreatic duct (double duct sign). Our study correlates with Bhatt et al and shadan et al study. [12, 13]

Gall bladder neoplastic masses appear hypointense to iso intense on T1W images and hyperintense on T2W images. These can present as mass lesion, focal or assymetric thickening of GB wall. Sometimes it can present as polypoidal lesion. [17] In our study there was one case of gall bladder carcinoma, which showed mass lesion arising from anterior wall. It was hypointense on T1W and hyperintense on T2W images with enhancement on post gadolinium contrast study. It correlates with Shadan et al study. [12]

Figure4. T2W_SPAIRcoronal image, showing ill-defined hypointense mass lesion at distal CBD with its proximal dilatation.

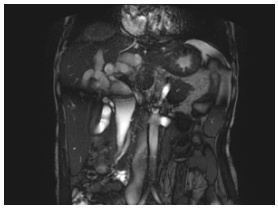

Figure5.T2W_SPAIR coronal image, showing ill-defined hypointense mass lesion in periampullary region dilated common bile duct and main pancreatic duct giving " double duct sign" in case of periampullary carcinoma. Dilatation of central intrahepatic biliary radicles is also noted.

Cholelithiasis and choledocholithisis is a condition in which there is presence of gallstones in gall bladder and common bile duct respectively. Gallstones appear as focal intraluminal signal void. Various shapes noted are rounded, oval, or faceted. [18] In our study there were total 5 (20 %) patients with choledocholithiasis. Among these in two patients cholelithiasis was present and one patient there were associated changes of cholecystitis. Shivanand et al and Shadan et al showed 20% cases of cholelithiasis associated with choledocholithiasis. In Macaulay et al, Upadhaya et al and Reinhold et al studies there were only cases of isolated choledocholithiasis. [5, 7, 12, 19, 20]

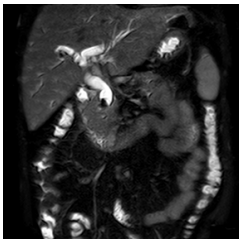

Figure6.T2W_SPAIR coronal image, showing gallstone (focal intraluminal signal void) in distal common bile duct with its proximal dilatation in patient of choledocholithiasis.

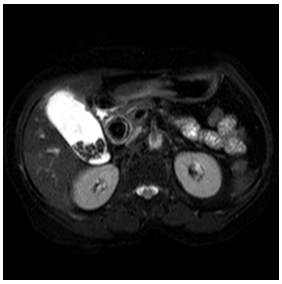

Figure7.T2W_SPAIR axial image, showing multiple small gallstones (focal intraluminal signal void) in gall bladder and large gallstone in common bile duct in patient of cholelithiasis with choledocholithiasis.

Cholecystitis is inflammation of gall bladder. On MRCP, there is thickening of gall bladder wall which shows high signal on T2W images. Pericholecystic fluid can be seen. [18] In our study there were three (12 %) patients of cholecystitis which showed thickening of gall bladder wall with T2W high signal. Two of them showed association with gallstones and other one case was associated with choledocholithiasis.

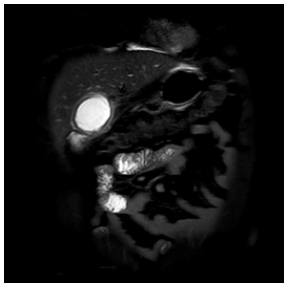

Figure8. T2W_SPAIR coronal image, showing thickening

Among congenital anomalies, one case each of choledochal cyst and pancreatic divisum was noted. Choledochal cysts are the congenital dilatations of biliary tree.

Todani classification is used for choledochal cyst as follows. (Cysts show water intensity, hypo intense on T1W and hyper intense on T2W images).

Type I –Dilatation of extra hepatic bile ducts, Type II – CBD diverticulum, Type III –Choledochocoele (focal dilatation of distal CBD in papillary region), Type IVa- Multiple dilatations in intra and extrahepatic bile ducts, Type IVb- Multiple dilatations in extrahepatic bile ducts only, Type V- Caroli's disease.

Among these Type I cyst is most common. [21, 22] In our patient there were multiple dilatations of intra and extrahepatic bile ducts which is type IVa choledochal cyst. Congenital anomalies detected in various other studies (shivanand et al, Kim et al, Upadhaya et al) include choledochal cysts. [5, 7, 23]

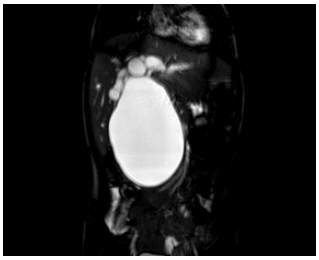

Figure9.T2W_SPAIRcoronal image, showing dilatation of intrahepatic and extrahepatic bile ducts in case of type IVa choledochal cyst.

Pancreatic divisum is a condition in which there is failure of fusion of main and accessory pancreatic duct. Patient can present with recurrent acute pancreatitis. There are three types described. Type1 – Complete failure of fusion, Type 2- Abscent duct of wirsung, Type 3 – Filamentous communication between dorsal duct of santorini and ventral duct of wirsung. [24] MRCP is better than CT scan in detecting pancreatic divisum as it most of the times is associated with pancreatitis, and in type B and C pancreatitis detection of pancreatic divisum is difficult. Also assessment of pancreatic divisum is only possible when pancreatic duct is properly visualized in MDCT scan. [25, 26] However in MRCP ductal anatomy is very well visualized. In our patient, there was complete failure of fusion of main and accessory pancreatic duct (Type I variety).. Pancreatic divisum was seen in 2 % cases in Shivanand et al and 5 % in Manfredi et al study. [5, 27]

Biliary strictures can benign or malignant. Both can present as a focal or long segment narrowing. Benign strictures are generally smooth margined, shows symmetrical dilatation. There is short segment involvement and are not associated with mass. Malignant strictures are generally irregular margined, asymmetrically dilated. There is long segment involvement, usually associated with mass lesion so abrupt cut off can be seen. These are hyperenhancing relative to liver in portal venous phase, length is more than 12 mm and wall thickness more than 3 mm. [21] In our study, there was single case (4%) of benign biliary stricture, it was smooth margined with symmetrical dilatation. There was no presence of any mass. It correlates with Shadan et al and Bhatt et al study.

Table 3. Comparison(in percentage) of CBD (common bile duct) stricture in our study with other studies. [5, 7, 12, 13, 28]

Study name	Benign stricture	Malignant stricture	Postoperative anastomotic stricture
Our study	4 %	-	-
Shivanand et al.	10 %	6 %	-
Shadan et al.	4%	-	2%
Bhatt et al.	4%	8%	4%
Upadhaya et al.	6%	9%	6%
Hurter et al.	9.6%	5.7%	-

Mirrizi syndrome is an entity in which stones which appear as focal intraluminal signal void present in cystic duct causes extrinsic compression over common bile duct leading to obstructive jaundice. [18] In our patient (4 %), there was presence of gallstone in cystic duct which was causing compression of common bile duct leading to dilatation of intrahepatic biliary radicles. Also changes of cholecystitis were present.

In this study, pancreatitis was the most common pancreaticobilliary disease. Patients with chronic pancreatitis were more as compared to acute pancreatitis with pseudocyst formation being its common complication. Cholangiocarcinoma was observed in in 16% of cases with one case each of carcinoma gall bladder and periampullary carcinoma. Isolated choledocholithiasis cases were more common as compared to the isolated cholelithiasis and cases with both cholelithiasis and choledocholithiasis. Two cases of congenital anomalies in study which were diagnosed better on MRCP as compared to CECT and USG. CBD stricture was noted in single (4 %) of case with benign etiology. Depending upon 16 cases in which surgical / histopathological / FNAC correlation was done, following statistical values are derived. Rest 9 patients are on follow up.

In our study, sensitivity and specificity for choledocholithiasis, cholecystitis, benign CBD stricture, choledochal cyst and malignant pathologies was 100 %. In Shivanand et al study sensitivity and specificity for cholecystitis was 63% and 100 % respectively , for choledochal cyst it was 100% respectively and for malignant pathologies it was 96% and 94% respectively . [5]

Conclusion:

In our study, pancreatitis was the most common pancreatic obilliary disesase.Choledocholithiasis, congenital pancreaticobilliary anomalies and level and extent of CBD stricture are best evaluated on MRCP. In large neoplastic masses, MRCP is important investigation for assessing detail ductal anatomy.

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