

ROLE OF MRCP IN DIAGNOSING PANCREATICOBILIARY DISORDERS WITH SURGICAL AND HISTOPATHOLOGICAL CORRELATION- A PROSPECTIVE STUDY IN A TERTIARY CARE CENTRE, GGH, KAKINADA, ANDHRA PRADESH

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ABSTRACT

BACKGROUND

Magnetic Resonance Cholangiopancreatography (MRCP) was introduced in 1991 as a noninvasive method of imaging the biliary tree. Although, Endoscopic Cholangiopancreatography (ERCP) has been the mainstay for diagnosing and treating pancreaticobiliary disease, complications such as pancreatitis, cholangitis, haemorrhage and duodenal perforation have made its limited use as a routine diagnostic test. Although, ERCP is still the standard of reference for imaging the pancreaticobiliary system, MRCP is the examination of choice in a setting where ERCP is difficult or impossible. It is useful in cases with severe biliary obstruction to evaluate the ducts proximal to the obstruction.

MATERIALS AND METHODS

In this prospective cohort study, 50 patients were studied predominantly by MRI and also by CT and ultrasound (wherever necessary). Imaging findings were evaluated, tabulated and correlated with surgical and histopathological findings and also clinical findings (wherever available). The findings were statistically analysed.

RESULTS

Most patients were in age range of 20-30 years. Male:females ratio was 5:3. Most of the cases came with pain abdomen and jaundice for evaluation were subjected to MRCP. Among those most common cases were chronic pancreatitis, cholelithiasis, pseudocysts and postop follow up cases to evaluate postop biliary strictures/biliary enteric anastomotic strictures and bile leaks.

CONCLUSION

MRCP in combination with other investigations like ultrasound, CT and clinical findings can be helpful in early diagnosis and for proper management of the patient.

KEYWORDS

Magnetic Resonance Imaging, Magnetic Resonance Cholangiopancreatography (MRCP), Intrahepatic Biliary Radicals (IHBD), Common Bile Duct (CBD), Pancreatic Duct (PD).

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BACKGROUND

Magnetic Resonance Cholangiopancreatography (MRCP) was introduced in 1991 as a noninvasive method of imaging the biliary tree (intra and extrahepatic biliary tree and pancreatic ductal system). Although, Endoscopic Cholangiopancreatography (ERCP) has been the mainstay

for diagnosing and treating pancreaticobiliary disease, complications such as pancreatitis, cholangitis, haemorrhage and duodenal perforation have limited its use as a routine diagnostic test.¹ MRCP can provide the diagnostic range equivalent to the ERCP and so it can replace the ERCP in high-risk patient to avoid significant morbidity. MRCP is the examination of choice in a setting where ERCP is difficult, impossible and contraindicated. It is useful in cases with severe biliary obstruction to evaluate the ducts proximal to the obstruction.²

Though congenital anomalies of the pancreas and pancreatic duct are relatively uncommon and they are often discovered as an incidental finding in asymptomatic patients, some of these anomalies may lead to various clinical symptoms. Recognition of these anomalies is important

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because these anomalies maybe a surgically correctable cause of recurrent pancreatitis or the cause of gastric outlet obstruction. MRCP is the imaging modality of choice for the workup of suspected developmental anomalies of the pancreas and ductal anatomic variants.³ Obstructive jaundice can lead to complications like ascending cholangitis, hepatorenal syndrome and malabsorption and hence requires urgent surgical intervention. The role of radiologist therefore is important in early diagnosis and in accurately delineating the level and the cause of obstruction, thus helping in staging as well as preoperative assessment of tumour resectability.⁴

Magnetic Resonance (MR) imaging besides being noninvasive has the advantages of allowing detailed evaluation of the pancreaticobiliary tract with a large Field of View (FOV), excellent patient tolerance and three-dimensional (3D) data sets that can be cholangiopancreaticographically displayed. Two unique properties of bile that are exploited to produce MRCP images are its relatively high water content and stasis of bile in comparison with the blood flowing through adjacent vessels in the portal tract⁵ producing projection images like ERCP. Hence, MRCP has virtually replaced ERCP as the primary investigative modality in all cases of obstructive jaundice not requiring early endoscopic intervention.

MATERIALS AND METHODS

This prospective cohort study was conducted from August 2016 to January 2017 for a period of 6 months and included 50 patients referred by various clinical departments and all cases were evaluated by magnetic resonance imaging with relevant history. Imaging findings were evaluated and tabulated and correlated with surgical and histopathological findings and also clinical findings (wherever available). The findings were statistically analysed.

Inclusion Criteria

- MRCP and also ultrasound/CECT wherever necessary.
- Histopathological, surgical and clinical correlation (wherever available).
- Postoperative status.

Exclusion Criteria

- Paediatric cases.
- Trauma cases.

Technique and Protocols

No contrast is administered within the body. Fasting for 4 hours prior to the examination is required to reduce gastroduodenal secretions, reduce motility to eliminate motion artifacts and to promote distension of gallbladder. MRCP is performed on a 1.5-T MRI system using a phased-array body coil. All protocols obtain heavily T2 weighted sequences. Most commonly obtained sequences are- RARE: rapid acquisition with relaxation enhancement, FRFSE: fast-recovery fast spin-echo coronal oblique 3D respiratory triggered, HASTE: half-Fourier acquisition single-shot turbo spin-echo. Axial 2D breath hold sequence, which provide

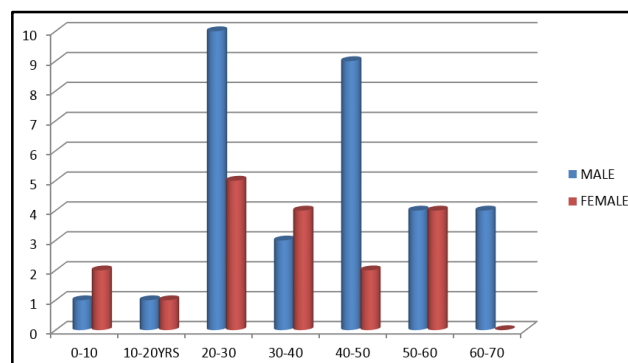
superior images and can be performed in single breath hold (<20 secs) and a fat suppressed sequence, additional sequence, which can be acquired to evaluate duct wall is fat suppressed T1 GRE sequence. For optimum visualisation of ducts, acquired images are reformatted in different planes using Multiplanar Reconstruction (MPR) and Maximum Intensity Projection (MIP).

RESULTS

Most patients were in age range of 20-30 years. Male:females ratio was 5:3. Most of the cases with pain abdomen for evaluation were sent to MRCP. Among those, most common cases were of chronic pancreatitis (12), cholelithiasis (6), choledocholithiasis (3), pseudocysts (9) and postop follow up cases (7) to evaluate postop biliary/biliary enteric anastomotic strictures and bile leaks. Periampullary carcinoma (4), acute pancreatitis with peripancreatic fluid collections (3), retroperitoneal (cystic lymphangioma) cyst (1) and choledochal cyst (1).

Age	Male	Female	Total	Percentage
0-10 yrs.	1	2	3	6%
10-20	1	1	2	4%
20-30	10	5	15	30%
30-40	3	4	7	14%
40-50	9	2	11	22%
50-60	4	4	8	16%
60-70	4	0	4	8%

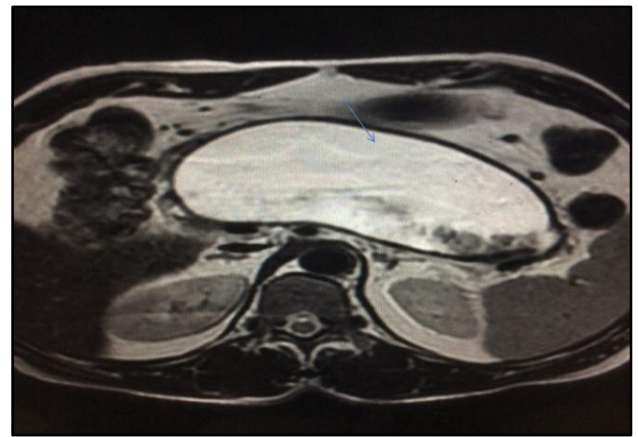
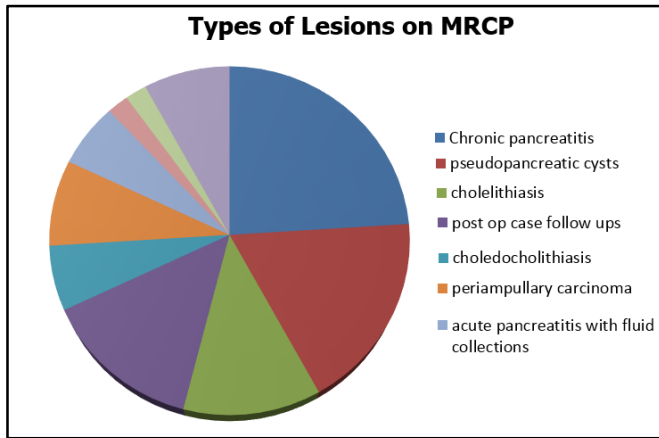
Table 1. Age and Sex Distribution



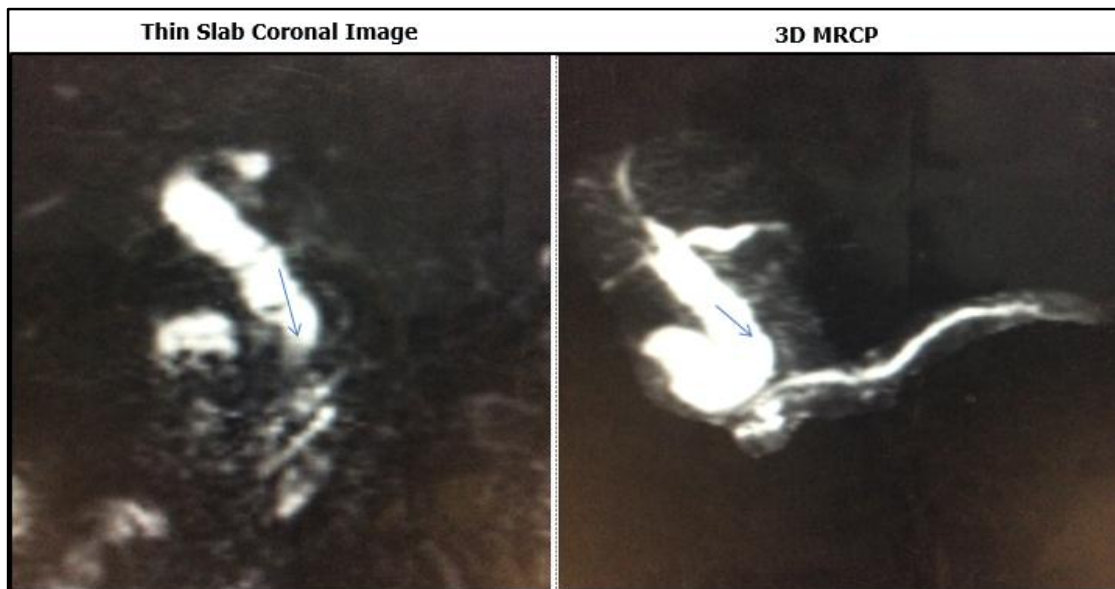
Graph 1. Age and Sex Distribution

Types of Lesions on MRCP	No.
Chronic pancreatitis	12
Pseudopancreatic cysts (secondary to acute/chronic pancreatitis)	9
Cholelithiasis	6
Postoperative cases followup	7
Choledocholithiasis	3
Periampullary carcinoma- 4 (Ca head of the pancreas- 2, distal cholangiocarcinoma- 1, GIST second part of duodenum- 1)	4
Acute pancreatitis with peripancreatic fluid collections	3
Retroperitoneal cyst	1
Choledochal cyst	1
Normal MRCP	4

Table 2. Types of Lesions on MRCP



**Figure 1. Pseudopancreatic Cyst
Axial T2 FRFSE Showing Pseudocyst**



**Figure 2. Dilatation of Entire Extrahepatic
Bile Duct. Type 1a Choledochal Cyst**

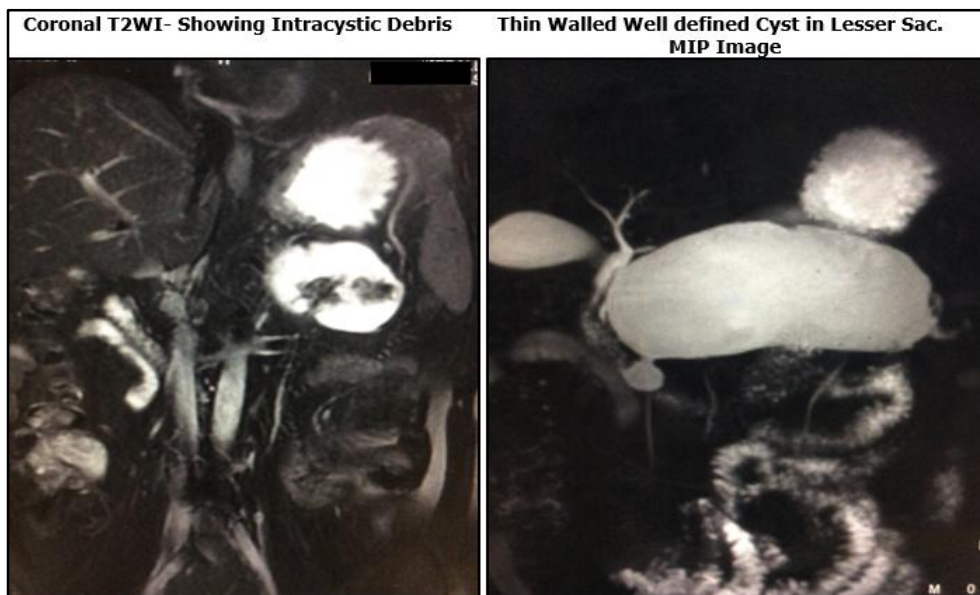


Figure 3. Pseudocyst of Pancreas

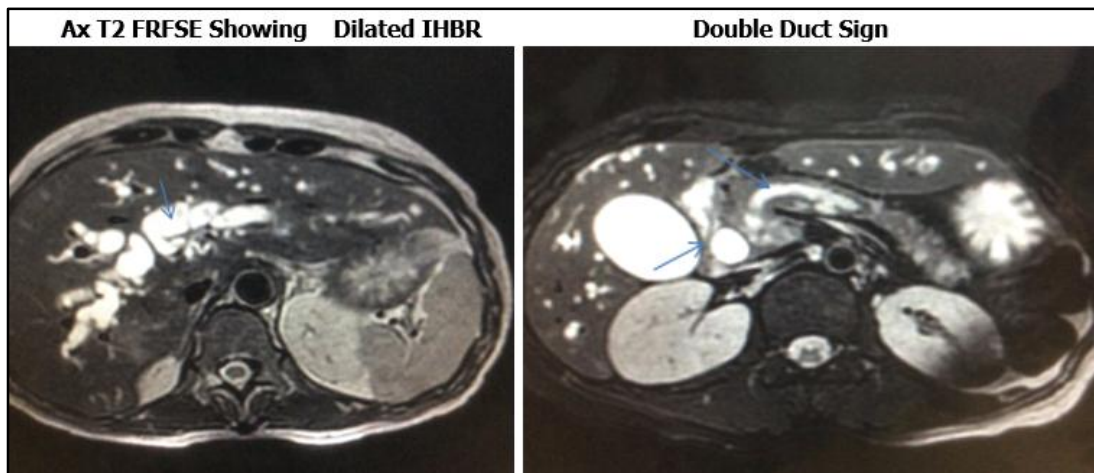


Figure 4. Case of Obstructive Jaundice Showing IHBD and Double Duct Sign- A Case of Chronic Pancreatitis with Ca Head of Pancreas

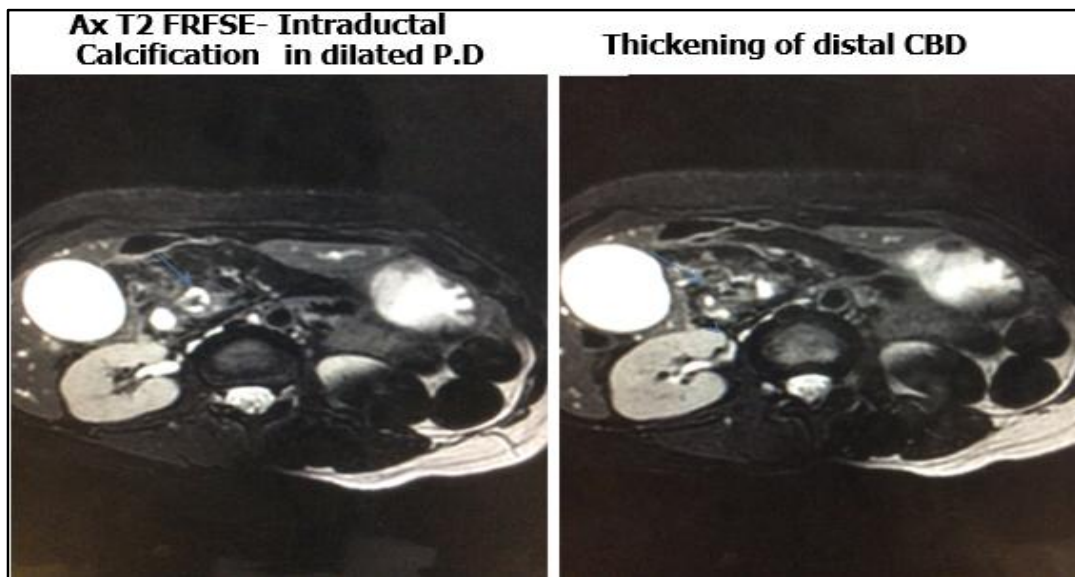


Figure 5. Chronic Pancreatitis with Distal CBD Stricture

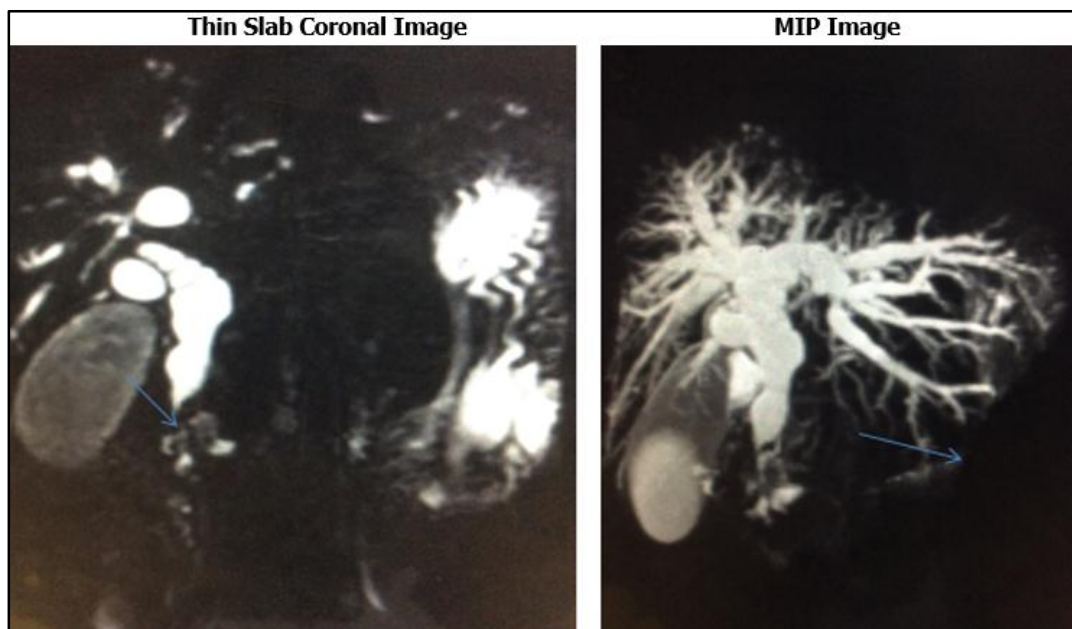


Figure 6. Case of Ca Head of the Pancreas with Abrupt Termination of Distal CBD with Upstream Dilatation

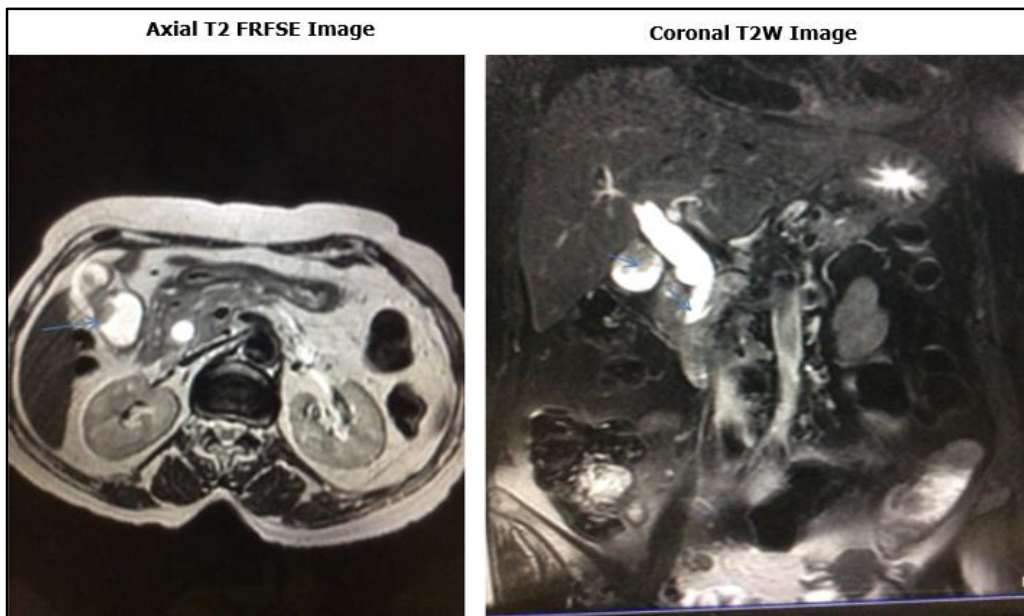


Figure 7. GB Mass with Distal CBD Stricture



Figure 8. MIP Image Showing Loop like PD - Anatomical Variant, Abrupt Termination of Distal CBD - Distal Cholangiocarcinoma and GB Mass

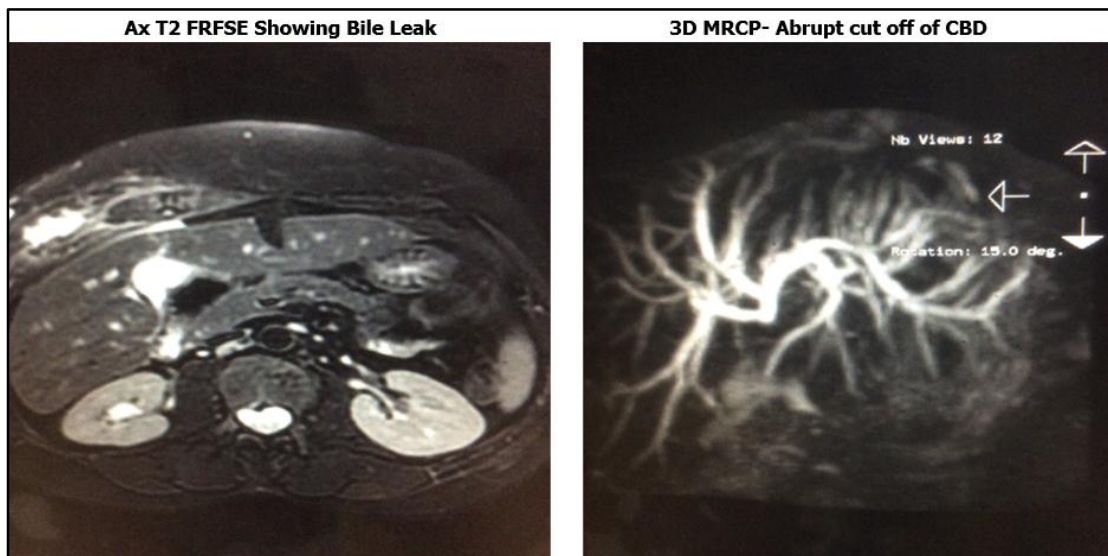


Figure 9. Postop Complication

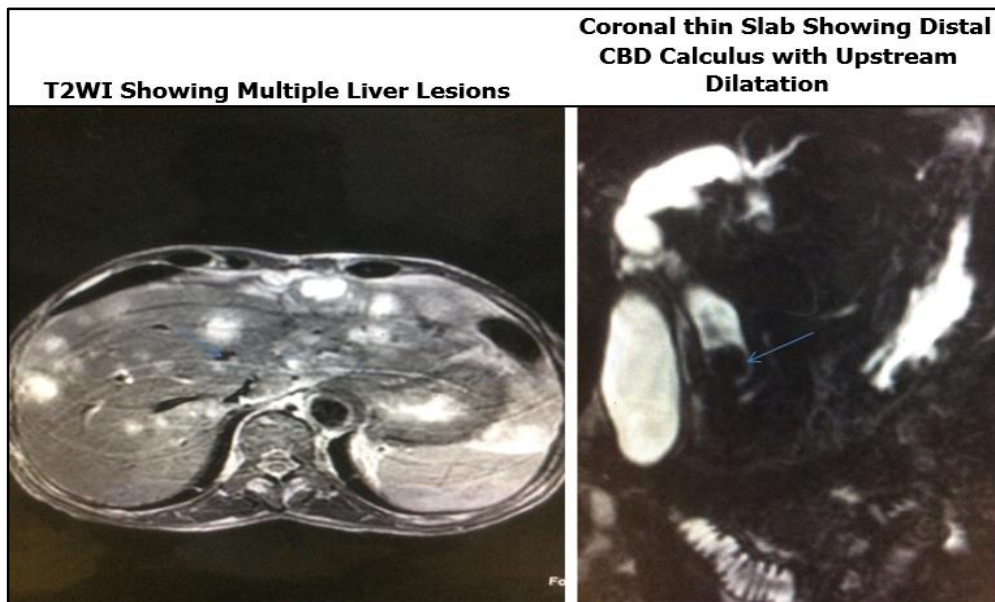


Figure 10. Distal CBD Stone with Ascending Cholangitis and Multiple Liver Abscess

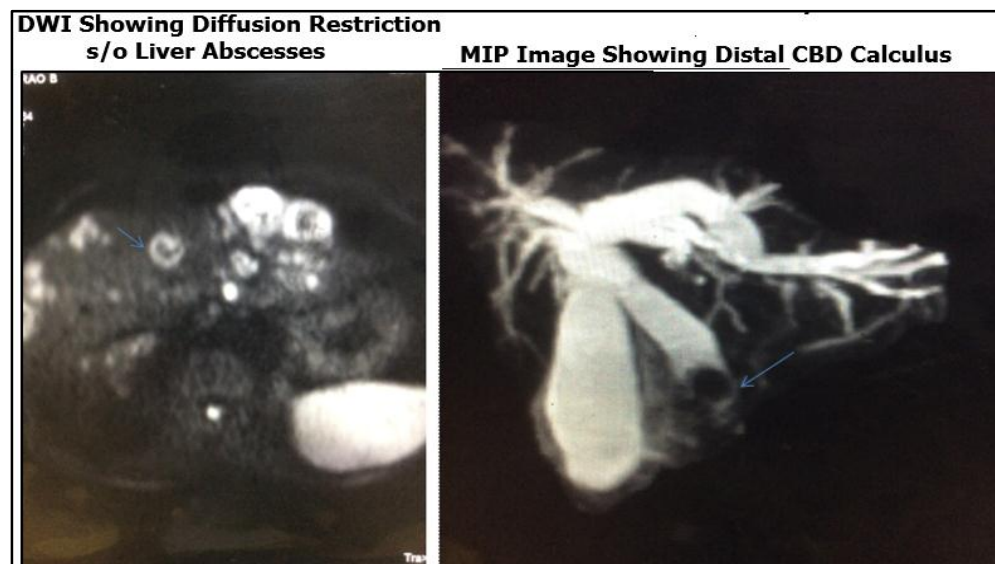


Figure 11. Multiple Liver Abscesses

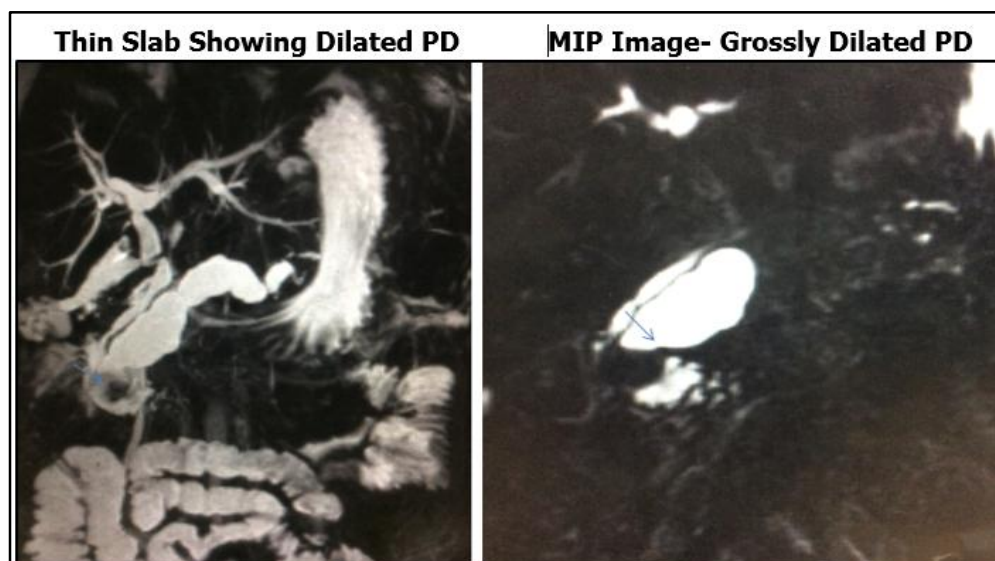


Figure 12. Distal Pancreatic Duct Calculus

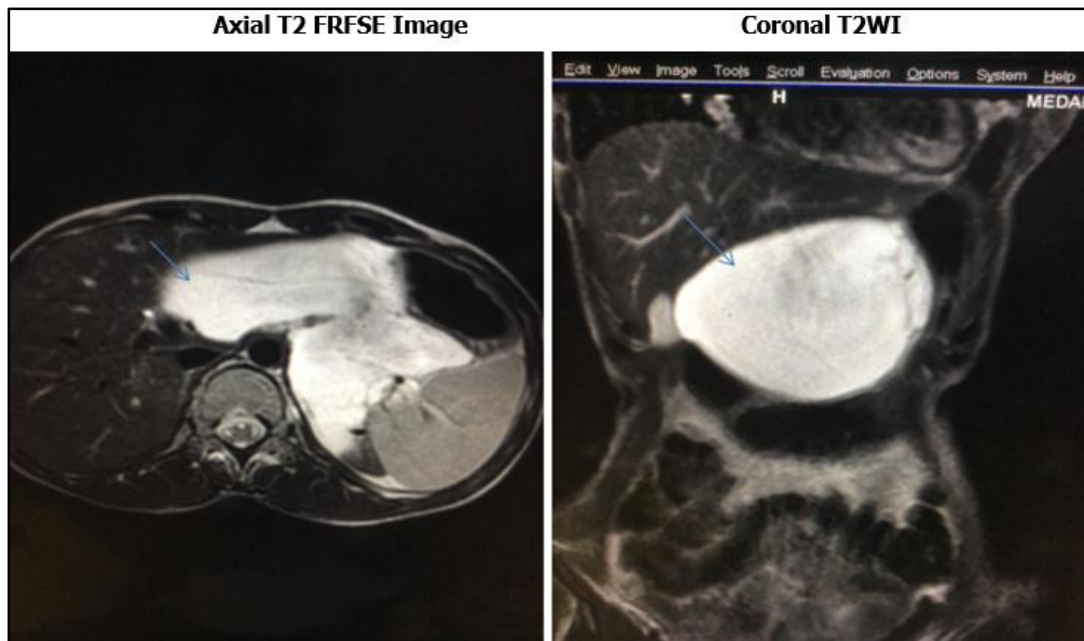


Figure 13. Multiseptated Cyst in Lesser Sac as Incidental Finding- Retroperitoneal Lymphangioma

DISCUSSION

Clinical applications are imaging of biliary congenital anomalies and anatomic variants, evaluation of biliary duct obstructions, cholangiocarcinoma, invasive gallbladder cancer, pancreatic cancer, choledocholithiasis, biliary enteric anastomosis, acute cholecystitis, post-surgical complications, primary sclerosing cholangitis, etc.

Choledochal cysts are congenital anomalies of the bile ducts. They consist of cystic or fusiform dilatations of the extrahepatic biliary tree, intrahepatic biliary radicles or both. These are classified into five major types using the Todani classification.⁶ Type 1 is the most common (80-90% of cases) and consists of dilatations of the entire common hepatic and common bile ducts or of segments of each. Complications arising from the cysts include cholelithiasis, choledocholithiasis, carcinoma, pancreatitis, cholangitis and cyst rupture. MRCP is used to define the extent of the cyst, determine the presence of an Anomalous Pancreaticobiliary Junction (APBJ) and to detect associated complications.

We have seen a case of type 1 choledochal cyst. Ultrasound abdomen and ERCP done. They found abnormal dilatation of CBD and suspected choledochal cyst. Sent for MRCP and confirmed as choledochal cyst and posted for surgery (hepatojejunostomy). Intraoperatively, there is dilated CBD. Postop biopsy confirmed choledochal cyst. Postop period is uneventful and advised for regular follow up.

Two features are considered responsible for the development of choledochal cyst. A length of more than 15 mm of the common channel formed after the union of PD and CBD outside the wall of duodenum and the angle of union between PD and CBD. Both these features allowing reflux of pancreatic juice in the bile ducts causing their ectatic dilatation. Based on these two features, Komi et al⁷ classified APBJ into three types.

Other developmental anomalies of pancreas are pancreas divisum, annular pancreas, ectopic pancreas,

pancreatic agenesis and hypoplasia of the dorsal pancreas and accessory pancreatic lobe, but we haven't seen even 1 case in adults for the past 6 months and among anatomical variants of pancreatic duct we have seen a case of loop-shaped course of PD.

Chronic inflammation of the pancreas results in parenchymal destruction with fibrosis, fat necrosis and dystrophic calcification. Strictures in the main pancreatic duct may eventually develop a 'chain-of-lakes' appearance with alternating stenosis and dilatation. Side branch ectasia and intraductal calculi occur. In advanced cases - marked dilatation of both PD and CBD simulating the 'double duct' sign seen with carcinoma of the head of pancreas. Sensitivity of MRCP in the detection of early side branch increases with secretin-stimulated MRCP. We have seen 12 cases of chronic pancreatitis.

We have seen 3 cases of acute pancreatitis with peripancreatic fluid collections and 9 pseudopancreatic cysts secondary to acute/chronic pancreatitis.

On MRCP, calculi appear as foci of low signal intensity irrespective of their composition. A combination of thick slab MRCP technique and thin section multislice images increases the sensitivity for detection of large as well as small (1-4 mm) stones. The differential diagnosis for a filling defect in the biliary tree includes calculus, neoplasm, blood clot, air bubble or sludge. Stones have round, oval or angular shape and are located in the dependent part of the bile duct. We have seen 6 cases of cholelithiasis and 3 cases of choledocholithiasis. A female patient came with pain abdomen and fever and obstructive jaundice. MRCP revealed large 2 distal CBD calculi and multiple liver abscesses probably secondary to ascending cholangitis. Choledochoduodenostomy (side to side) done for this patient.

Local irritation caused by the stone or associated cholangitis may lead to findings of wall thickening, mucosal enhancement and periductal fat stranding. However, in the

presence of mural enhancement, possibility of malignancy should be considered.⁸

Gallbladder cancer most often occurs in elderly women and is usually associated with gallstones (90% of cases). Other risk factors include a chronic typhoid carrier state, choledochal cyst, gallbladder polyp, anomalous APBJ and porcelain gallbladder. Gallbladder carcinomas are characterised by local invasion, extensive regional lymph node metastasis, vascular encasement and distant metastases. It is the most aggressive of the biliary cancers. Hence, early diagnosis is crucial for patient management.

Morphologically, gallbladder carcinoma can present as a mass completely occupying or replacing the gallbladder lumen, focal or diffuse asymmetric gallbladder wall thickening or as an intraluminal polypoidal lesion.⁹ Mass forming type is the most common causing obstructive jaundice due to hilar extension.¹⁰ We have seen one case of GB mass. Patient presented with pain abdomen and loss of appetite. MRCP showing distended GB with intraluminal growth, distal CBD stricture with moderate IHBD and dilated CBD. On ERCP, there is growth at distal CBD. Biopsy came as adenocarcinoma (distal cholangiocarcinoma) as the patient had mass in GB also. She is not fit for the surgery and so sent for chemotherapy. Sigmoid/loop-like PD (anatomical variant) seen as an incidental finding in this patient.

A female patient presented with obstructive jaundice. MRCP revealed distal CBD showing abrupt tapering with moderate IHBD, distended GB with sludge, but ERCP procedure cannot be done due to narrowing of distal CBD. Serum CA-19-9 levels are elevated >100 IU in this case. Suspected Ca pancreas and posted for surgery. Intraoperatively, mass present in head of the pancreas. Whipple procedure is done. Biopsy report revealed moderately-differentiated adenocarcinoma of head of the pancreas. Postop no leaks and patient sent for radio and chemotherapy for further evaluation.

To help differentiate between benign and malignant causes of biliary strictures and dilatation. Malignant lesions usually manifest as irregular strictures with shouldered margins, whereas benign stenosis tends to have smooth borders with tapered margins. MR cholangiography helps accurately determine the status of the biliary ductal system in patients with malignant obstruction by identifying the exact site of the obstruction and the length of the stricture. Differentiation between benign and malignant causes of distal obstruction is difficult with cross-sectional imaging and usually depends on finding a mass associated with the stricture.¹¹

The role of imaging in pancreatic carcinoma is confirming the diagnosis, localising the lesion, staging the tumour, determining the resectability, advising the surgeon preoperatively of relevant anatomical vascular variants. The characteristic imaging finding on MRCP is of obstruction leading to dilatation of PD, common bile duct or both. Dilatation of both ducts leads to double duct sign. Other finding suggestive of malignant cause is irregular narrowing of pancreatic and bile ducts in the region of pancreatic head.

Tumours within the head of the pancreas can invade the distal common bile duct simulating strictures caused by cholangiocarcinoma.

We have seen 1 case of distal cholangiocarcinoma. We have 2 cases of Ca head of the pancreas and 1 case GIST in second part of duodenum).

Postoperative bile duct injury can be classified as a leak, stricture or complete transection with possible biliary obstruction. Pertinent findings to assess on MRCP include the presence or absence of biliary duct dilatation, stricture, free fluid, fluid collection or nonvisualisation of a bile duct segment that may suggest injury.¹² We have seen few postop leaks and 1 case of accidental aberrant bile duct transection seen as discontinuation of CHD in postop status (post lap cholecystectomy) case.

We have seen 1 case of retroperitoneal cyst - Ultrasound and CT/MRI revealed multiseptated cyst/retroperitoneal cyst in lesser sac. Histopathology revealed as retroperitoneal lymphangioma found as incidental finding when evaluated for a female patient with pain abdomen.

Limitations of the Technique

The disadvantages of MRCP include- Decreased spatial resolution making MRCP less sensitive to abnormalities of the peripheral intrahepatic ducts (e.g., sclerosing cholangitis) and pancreatic ductal side branches (e.g., chronic pancreatitis) and imaging in the physiologic, non-distended state, which decreases the sensitivity to subtle ductal abnormalities.

CONCLUSION

MRCP has specific advantages over ERCP as it is noninvasive, cheaper, uses no radiation, requires no anaesthesia and is less operator dependent. When combined with conventional T1- and T2-weighted sequences, it allows detection of extra ductal disease. The technology is still evolving to make the MRCP examination faster, sharper and with higher spatial resolution.

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