



RESEARCH ARTICLE

MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY (MRCP) – FOR EVALUATION OF PANCREATICO-BILIARY DISEASES

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ABSTRACT

Introduction: Magnetic Resonance Cholangiopancreatography (MRCP) using heavily T2 weighted sequences is a non-invasive modality useful for evaluation of pancreatic and biliary system.

Purpose of study: Our aim was to study MRCP findings in various pancreatico-biliary diseases.

Results: Total 45 patients were studied out of which pancreatic pathologies were present in 14 patients, biliary pathologies were present in 27 patients, and both were present in 4 patients. Inflammatory lesions and calculi were the commonest pathologies both were present in 20 cases each, followed by congenital lesions (n=6), neoplastic lesions (n=4) and stricture in 1 patient.

Conclusion: MRCP plays an important role in diagnosis of biliary and pancreatic pathologies.

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INTRODUCTION

Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive modality used as an alternative to endoscopic retrograde cholangiopancreatography. (Halefoglu, 2007; Magnetic resonance cholangiopancreatography, 1997) It is a useful tool for the evaluation of pancreatic and biliary system disorders. (Halefoglu, 2007) Heavily T2 weighted sequences are used, this causes the signal of slow fluid filled structures such as biliary and pancreatic ducts to be increased. (Halefoglu, 2007; Nyree Griffin *et al.*, 2011; Govind *et al.*, 2008) The most common indications are choledocholithiasis, chronic pancreatitis, congenital anomalies of the bile and pancreatic ducts. MRCP is also used after administration of secretin. Secretin enhances the secretion of fluid and bicarbonates from exocrine pancreas and increases the tone of the sphincter of oddi. This causes transient increase in diameter of the main pancreatic duct and hence helps in improved visualization. (Yoshihiko Fukukura *et al.*, 2001) Secretin administration helps in detection of side branch abnormalities and exocrine functions of pancreas can be assessed. (Frank *et al.*, 2004) The other advantage of secretin administration is that false positive stenosis gets ruled out. (Yoshihiko Fukukura *et al.*, 2001)

Aims and objectives

To study MRCP findings in various Pancreaticobiliary diseases.

MATERIALS AND METHODS

We studied 45 patients, who presented in department of RadioDiagnosis at Dr. Vasantrao Pawar medical college, hospital and research center, Nashik. All patients referred to the RadioDiagnosis department for MRCP examination and diagnosed as biliary or pancreatic diseases were included in the study. All MRI examinations were performed on 1.5 T magnet MR system (Siemens MagnetomEssenza). Imaging was performed using a body coil with the patient in supine position.

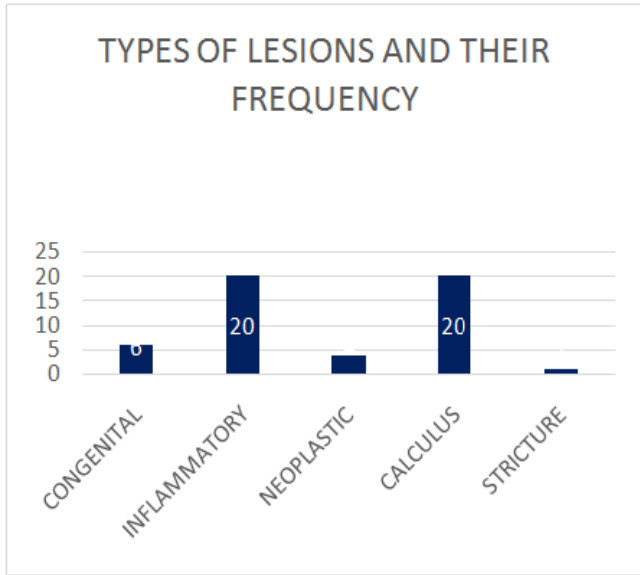
RESULTS

45 patients were included in the study. The most common lesions were those of biliary tract seen in 60% of patients. This was followed by pancreatic lesions seen in 31% of patients. Involvement of both pancreatic and biliary system was seen in 9% of patients. Amongst the lesions, the most common were inflammatory and obstructive, each seen in 39% of cases. This was followed by congenital lesions seen in 12% of patients. Neoplastic lesions were seen in 8% of cases while strictures were seen in 2% of patients. According to our study, MRCP is an excellent tool for the diagnosis of pancreatico-biliary lesions.

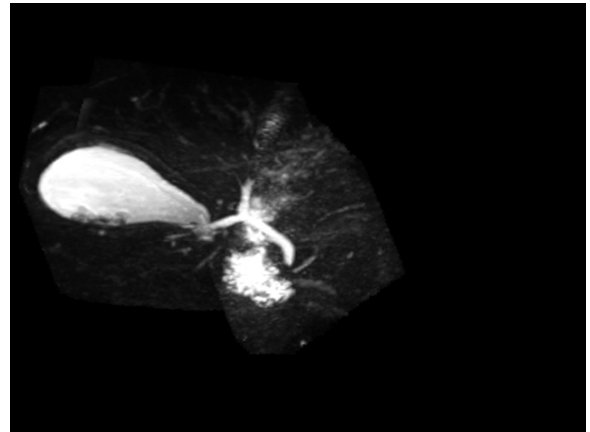
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Table 1. Different types of pathologies



CHOLELITHIASIS



CHOLEDOCHOLIATHIASIS

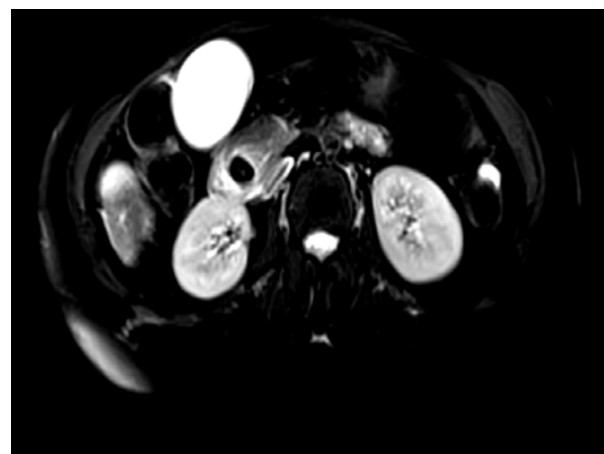
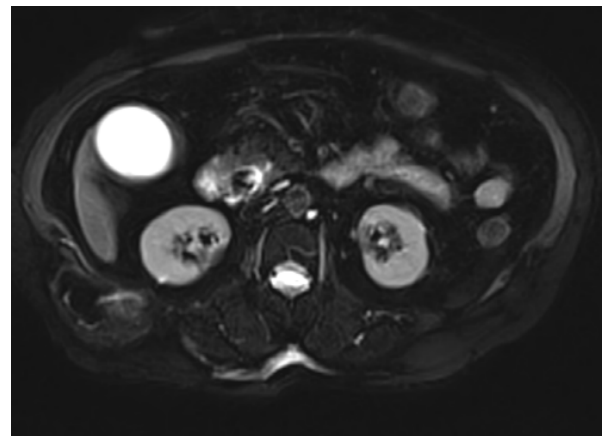


Chart 1. Various pathological findings encountered in our study

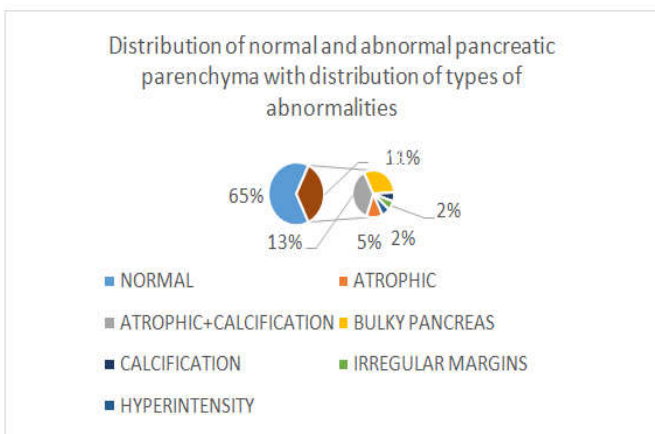
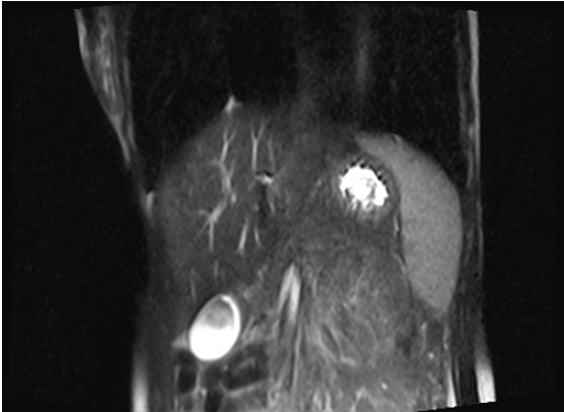
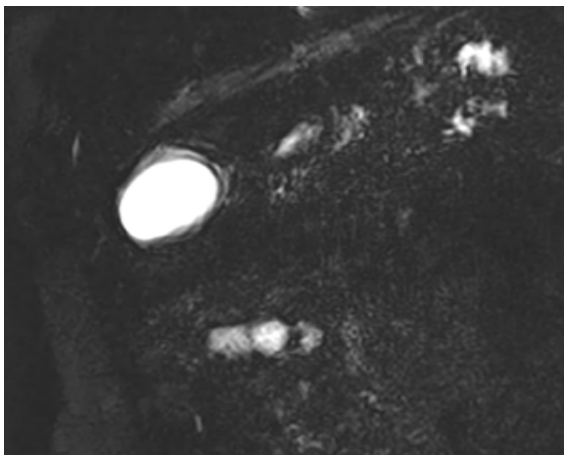
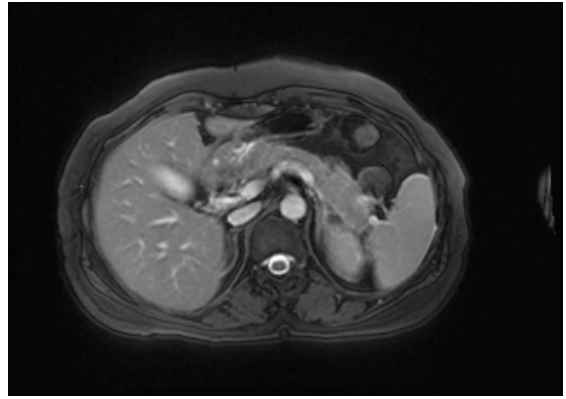


Chart 2. Distribution of normal and abnormal pancreatic parenchyma with different abnormalities

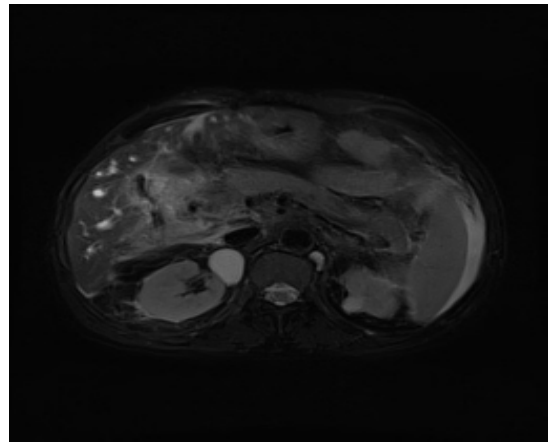
CHOLECYSTITIS



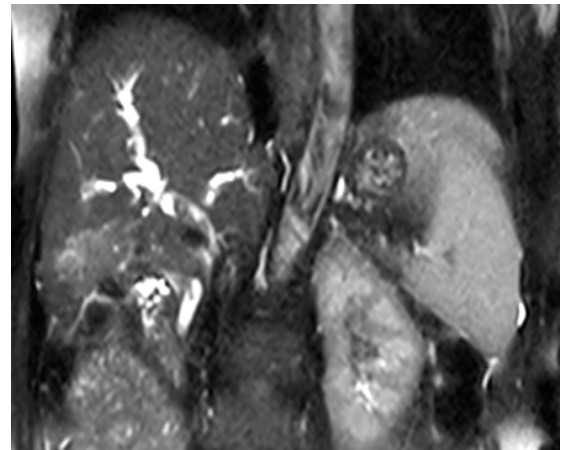
ACUTE PANCREATITIS



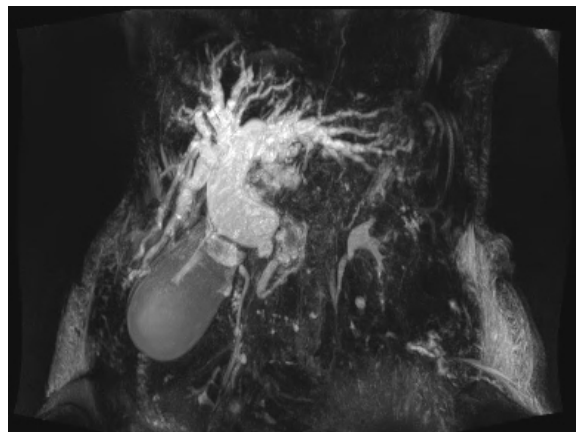
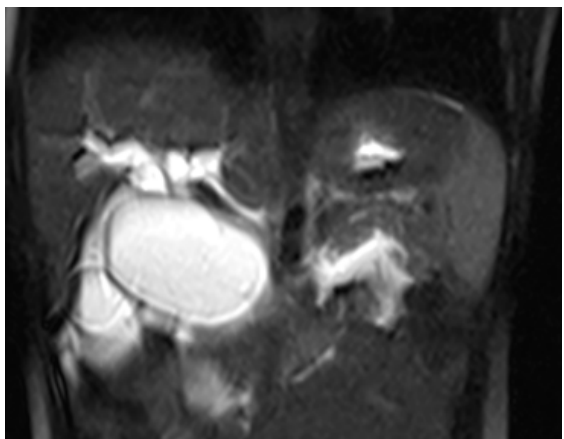
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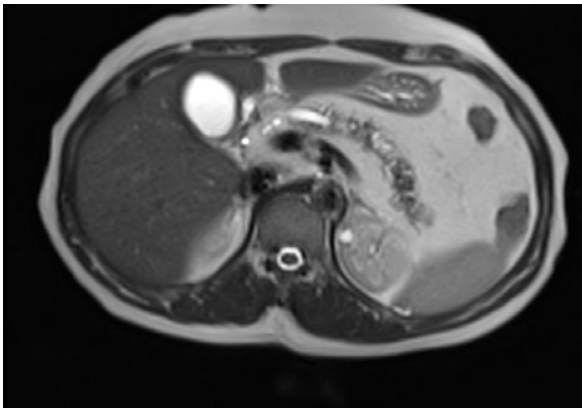
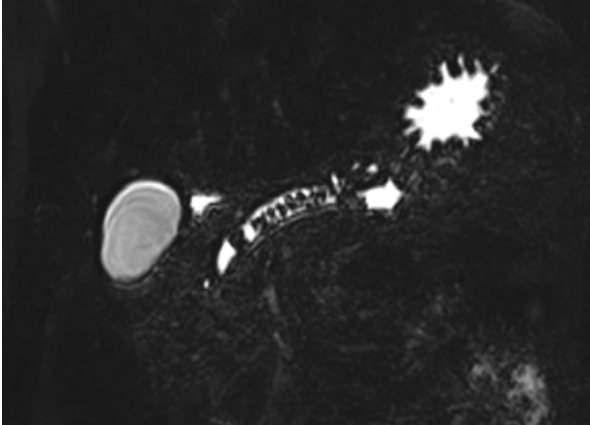
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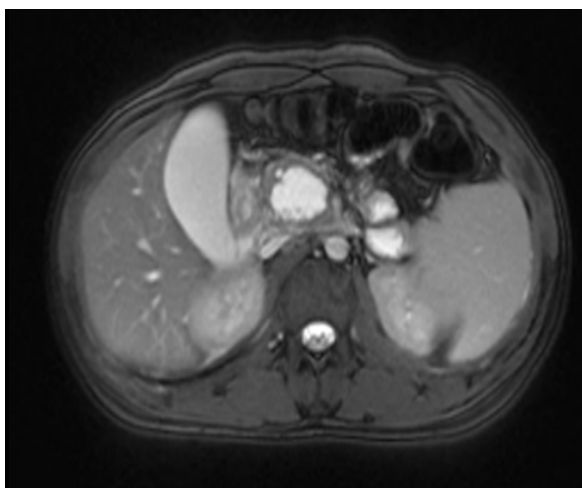
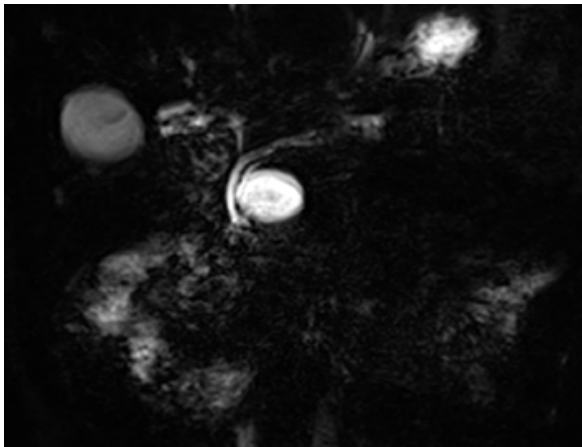
Ca HEAD OF PANCREAS



CHRONIC PANCREATITIS



PSEUDOCYST OF PANCREAS



Technique

The sequence of choice for MRCP is SSFSE (Single shot fast spin echo) as it does not have problems related to motion artifact. (Halefoglul, 2007) The other reasons why SSFSE is chosen is because it has greater contrast to noise ratio and increased spatial resolution. (Halefoglul, 2007) It is done using the thick and thin collimation technique. (Halefoglul, 2007) Maximum intensity projection is used to do three dimensional reconstruction. (Halefoglul, 2007; Magnetic resonance cholangiopancreatography, 1997) Rapid acquisition and relaxation enhancement (RARE) technique is also employed (Magnetic resonance cholangiopancreatography, 1997; Yoshihiko Fukukura *et al.*, 2001; Ros3 KJM 2 and PR, 2001). With single shot RARE and half Fourier RARE, it is possible to use breath hold techniques. (Jorge *et al.*, 1999)

Patient preparation

In order to promote gastric emptying and gall bladder filling, patient is advised to fast for 4-6 hours. (Halefoglul, 2007; Nyree Griffin *et al.*, 2011)

Normal anatomy on MRCP

Both intra-hepatic and extra-hepatic biliary radicals are seen on MRCP. The intra-hepatic radicals measures less than 3 mm, while extra-hepatic bile ducts measures less than 7 mm normally. (Nyree Griffin *et al.*, 2011) The right hepatic duct is divided into anterior and posterior branches. The anterior part is vertical while the posterior part is horizontal. (Nyree Griffin *et al.*, 2011) The posterior branch fuses with the anterior part on the medial aspect. Eventually the right hepatic duct fuses with the left duct to form the common hepatic duct. The pancreatic duct is normally less than 3 mm. (Nyree Griffin *et al.*, 2011)

DISCUSSION

MRCP in different conditions

Choledocholithiasis

MRCP is superior to CT and USG for the detection of choledocholithiasis.¹ It is seen as a filling defect in the common bile duct as the biliary stones are of low signal intensity.^{1,9} The thicker the slice thickness, the lower is the sensitivity of detection of common bile duct stones.¹

Benign biliary strictures

They occur mostly as a result of iatrogenic trauma.¹ It helps in localization of strictures and the extent of the extra-hepatic bile duct strictures.¹ MRCP can identify the dilated biliary tree above the obstruction and is therefore useful to diagnose multiple strictures.² It also helps to identify the non-dilated biliary tree distal to obstruction.²

Sclerosing cholangitis

In sclerosing cholangitis, there is sclerosis and fibrosis of the bile ducts leading to stenosis of the extra-hepatic and intra-hepatic bile ducts.^{1,10} Primary sclerosing cholangitis is chronic idiopathic inflammation of the bile ducts seen mostly in association with ulcerative colitis.^{10,4} Multi-focal strictures

develop giving it a beaded appearance.^{1,10} The intra-segmental and peripheral ducts are dilated as a result of strictures of the central ducts.¹⁰ MRCP is mostly used to diagnose complications in a case of sclerosing cholangitis.¹

Cholangiocarcinoma

Cholangiocarcinoma on MRCP usually presents as biliary obstruction with proximal dilatation.¹ Cholangiocarcinoma is very well identified with T1 weighted imaging with contrast administration.¹

Biliary injuries

MRCP helps in detection of biliary injuries. When bile duct is injured, fluid accumulates in the sub-hepatic space and this is detected with MRCP.¹

Congenital anomalies of the biliary and pancreatic ducts

Duct of Wirsung drains through the major papillae while the duct of Santorini drains through the minor papilla. Duct of Wirsung is the main drainage route in approx. 90% of individuals while the Duct of Santorini is present in approx. 40% individuals.¹ Failure of fusion of the major and minor ducts results in pancreatic divisum.^{1,11}

Pancreatic divisum

It is the most common congenital anomaly of the pancreatic duct.¹¹ The main symptoms related to pancreatic divisum are either abdominal pain or acute pancreatitis.¹²

Santorinicoele

It is the abnormal dilatation of the distal dorsal duct, just proximal to the minor papillae.¹²

Annular pancreas

Pancreatic tissue surrounds the second part of duodenum in annular pancreas.¹¹ This aberrant pancreatic tissue remains in continuity with the head of pancreas.¹¹

Common biliary variants include

Right posterior duct draining into left hepatic duct before joining the right anterior duct.⁷ In about 10% of the patients, right posterior duct, right anterior duct and left hepatic duct all drain directly into the common hepatic duct. This is called as triple confluence. In patients with triple confluence, the right hepatic duct is almost always absent.⁷

The most common cystic duct variations include

Luschka's duct – These are small ductules and they pass from the right lobe of liver upto the gall bladder fossa. It mostly joins either the common hepatic duct or right hepatic duct. It is mostly injured during laparoscopic cholecystectomy.¹³ Low cystic duct insertion. In this, there is fusion of the cystic duct with distal third of the extra-hepatic bile duct. It is seen in around 10% of population.⁷ Medial insertion of the cystic duct. The cystic duct is inserted into the left side of the common hepatic duct. It is also seen in approx. 10% of population.⁷

Cystic duct running parallel to common hepatic duct. It is seen in approx. 2 to 25% of population.⁷

Aberrant bile duct – An isolated bile duct draining a particular hepatic segment.^{7,13}

Accessory bile duct – Additional bile duct draining the same area of the liver.^{7,13}

Cystic duct inserted high on the common hepatic duct.^{7,13}

Biliary Atresia

Failure to visualize extra-hepatic biliary tree can help in diagnosing biliary atresia on MRCP.⁴

Choledochal cysts

Choledochal cysts are abnormal dilatation of the extra-hepatic or intra-hepatic bile ducts.¹⁴ It is more common in females. It occurs as a result of anomalous pancreato-biliary ductal communication.¹⁵ According to a study by Craig et al, dysfunctional sphincter of oddi results in choledochal cyst formation.¹⁵ Todani classified choledochal cysts into five types.¹⁴ MRCP is disadvantageous in patients with large choledochal cysts.¹⁵

Chronic pancreatitis

It is a chronic inflammatory process that results in structural damage to the pancreas with eventual impairment of endocrine and exocrine function.^{6,16} Findings in chronic pancreatitis that are appreciated in MRCP are dilatation of duct, narrowing of ducts, strictures and irregularity.¹ The irregular dilatation of ducts and side branches gives it a chain of lakes appearance. The pancreatic duct while traversing through the mass gets progressively stenosed, this is known as Duct penetrating sign.⁶ Intra-ductal calculi are seen as irregular filling defect with surrounding fluid collection. This is known as Meniscus sign.¹ It is mostly used for diagnosing complications.

Pancreatic pseudocyst

Pseudocysts are loculated collections of pancreatic secretions seen in and around the pancreas.⁶ They can be isolated or may be communicating with the main pancreatic duct.⁶ MRCP is more sensitive than ERCP in diagnosing pancreatic pseudocyst.¹

Pancreatic duct obstruction

When pancreatic duct obstruction is present, MRCP depicts both the proximal and distal main pancreatic ducts to the stenosis.⁵

Neoplastic biliary or pancreatic duct obstruction

On MRCP, pancreatic carcinoma presents as encasement or obstruction of the bile duct or pancreatic duct.¹ Dilatation of both these ducts is highly suggestive of malignancy and is called Double duct sign.^{1,6} In around 20% cases, the pancreatic duct can be normal. In peri-ampullary carcinoma there is abrupt termination of the pancreatic duct with dilatation along with obstruction of common bile duct.¹ Intra-ductal papillary

mucinous tumors which arise from the epithelium of main pancreatic duct and produces large amount of mucin can be diagnosed with MRCP.¹

Post-surgical biliary tract alterations

MRCP has a sensitivity of 100% in diagnosing anastomotic strictures.¹

Advantages of MRCP

It is non-invasive and non-operator dependent.¹

It does not require contrast.⁵

It has no radiation exposure.⁵

Disadvantages of MRCP

It has low spatial resolution¹

Administration of secretin can induce pancreatitis.⁵

Thick slab MRCP can hinder visualization of small filling defects because of volume averaging artifacts.³

Extra-ductal vascular compression may mimic a stricture.³

Conclusion

MRCP is a non-invasive alternative to ERCP and plays an important role in diagnosis of biliary and pancreatic pathologies.

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Conflict of interest: None declared

Ethical approval: Not required

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