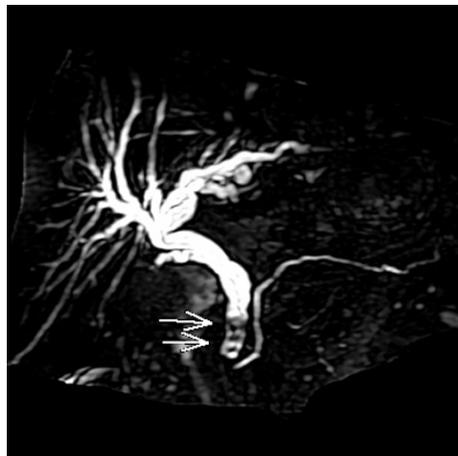


# Eye On Imaging

## MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY (MRCP)

**M**agnetic resonance cholangiopancreatography (MRCP) is a technique for non-invasive evaluation of biliary and pancreatic disease. Heavily T2-weighted sequences, obtained in the coronal and axial planes with either breath-hold or respiratory gating, result in increased signal intensity of the slowly-moving, fluid-filled biliary tract and pancreatic duct. MRCP itself requires no intravenous gadolinium; however, it is common to utilize contrast for extraductal evaluation of the hepatic and pancreatic parenchyma, or the ampulla of Vater.

There are several advantages of MRCP compared to endoscopic retrograde cholangiopancreatography (ERCP). It is non-invasive, less expensive, requires no radiation or anesthesia, allows visualization of ducts proximal to an obstruction, and provides imaging of extraductal abnormalities. Nevertheless, ERCP remains indispensable for confirmation of MRCP abnormalities. In addition, biopsy and interventional procedures can be done endoscopically at the time of ERCP. The following will be a brief review of some of the clinical applications of MRCP.

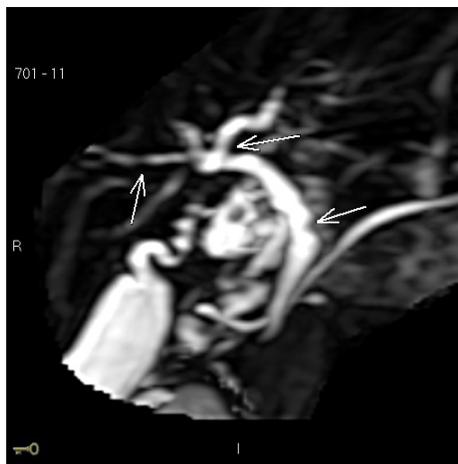


**(Figure 1)** Multiple calculi in the distal common bile duct with biliary dilatation

### BILIARY TRACT

Clinical indications for evaluation of the biliary tract include right upper quadrant pain (especially in a post cholecystectomy patient), abnormal liver function tests, ductal dilatation of unknown etiology on ultrasound or CT, and preoperative or postoperative evaluation.

A common MRCP abnormality is choledocholithiasis or common bile duct calculi (Figure 1). The size and number of calculi are well demonstrated as dark "filling defects" within the high signal intensity of the common bile duct, and large calculi usually result in obstructive dilatation. Calculi as small as 2-3 mm can also be visualized and are much less likely to cause dilatation.



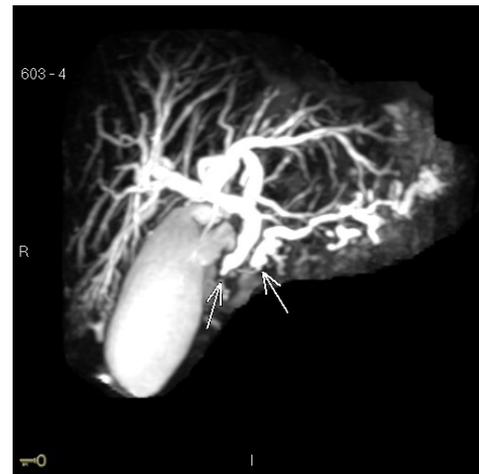
**(Figure 2)** Intrahepatic and extrahepatic biliary strictures in a patient with chronic ulcerative colitis and primary sclerosing cholangitis

Benign strictures of the extrahepatic biliary tract may be obstructive or nonobstructive. Most of these are secondary to previous infection, passage of a calculus, pancreatitis, trauma, or a postoperative complication. Multiple strictures are seen in primary sclerosing cholangitis (PSC) (Figure 2), which is a chronic idiopathic inflammatory process of the bile ducts; it has an association with inflammatory bowel disease, especially ulcerative colitis. Simultaneous involvement of the intrahepatic and extrahepatic biliary tract is the most common presentation. Findings include multifocal short strictures, beading, pruning, webs, diverticula, and intrahepatic calculi. Wall thickening and postcontrast enhancement may be seen in the extrahepatic biliary tract, and cholangiocarcinoma occurs infrequently. MRCP is ideal for surveillance imaging in these patients.

Malignant strictures are most often obstructive and secondary to carcinoma of the pancreas, resulting in the "double duct sign", which is dilatation of both the common bile duct and pancreatic duct secondary to a pancreatic head mass (Figure 3).

The site of obstruction is well demonstrated on MRCP, although intravenous contrast administration is necessary to appreciate the full extent of the obstructing mass. Less common causes of malignant obstruction are cholangiocarcinoma or lymphadenopathy. Obstruction of the ampullary portion of the common bile duct may be due to carcinoma, and a mass is often appreciated. Benign obstruction of the ampulla may be due to edema from calculus or pancreatitis, or from idiopathic stenosis. Stenosis cannot be specifically diagnosed, but it can be suggested when there is abrupt caliber change at the ampulla, dilatation of the biliary tract, and absence of mass or edema.

MRCP may be used preoperatively to document common variations of the intrahepatic biliary tract or cystic duct insertion. Postoperative complications such as retained calculi, bile leak, or ligation injury, can also be evaluated.



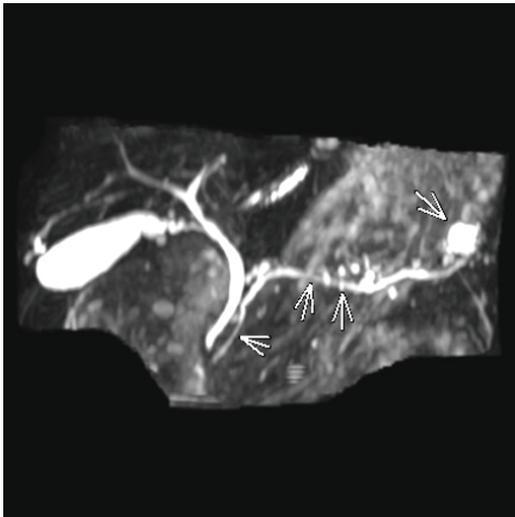
**(Figure 3)** Carcinoma of the head of the pancreas with biliary and pancreatic ductal obstruction

### BIOGRAPHY

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Dr. Marshall Bein received his AB degree in biology from Boston University and his MD, MS from the University of Louisville School of Medicine. He completed internship and residency in Internal Medicine at the Hospital of the University of Pennsylvania, and residency in Diagnostic Radiology at UCLA. He remained in academic radiology at UCLA for nearly five years and then entered private practice radiology. Dr. Bein has special interest and expertise in all aspects of body imaging, especially CT and MR.



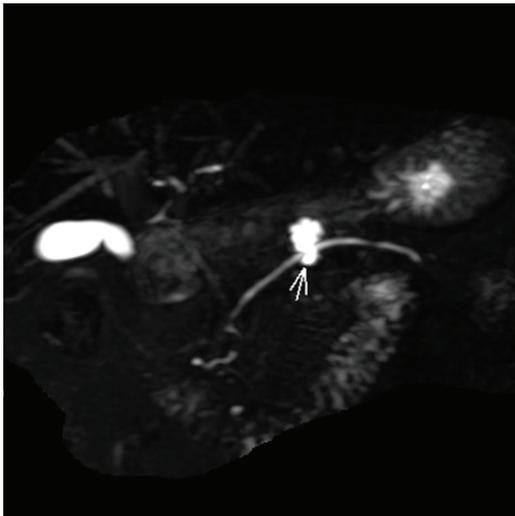


**(Figure 4)** Chronic pancreatitis with side-branch ectasia, main duct strictures, and pseudocysts

#### PANCREATIC DUCT

Clinical indications for evaluation of the pancreatic duct include epigastric pain, elevated amylase or lipase, and cystic abnormalities seen at ultrasound or CT. The main duct is visualized in 85-100% of cases while normal side-branches are seen in approximately 10%.

Chronic pancreatitis is a common abnormality noted on MRCP (Figure 4). It is a chronic inflammatory process that leads to exocrine dysfunction and morphologic changes within the pancreas and the ducts. Side-branch ectasia is the most specific finding; other ductal abnormalities include multifocal dilations and strictures, irregular contour, and filling defects due to calculi, mucinous plugs, or debris.

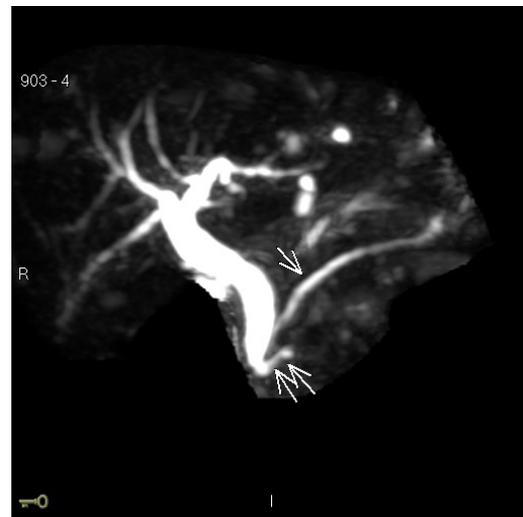


**(Figure 5)** Side-branch intraductal papillary mucinous neoplasm

Pseudocysts are also a common finding, representing encapsulated collections of pancreatic fluid that may or may not communicate with the main duct. MRCP is more sensitive than ERCP in their detection, because less than 50% may fill with contrast at ERCP.

A different type of cystic abnormality that demonstrates communication with the main pancreatic duct is intraductal papillary mucinous neoplasm (IPMN) (Figure 5). Pathologic abnormalities include hyperplasia, papillary adenomas, dysplasia, or carcinoma. It can arise from the main pancreatic duct with resultant diffuse dilatation and a patulous ampulla, or it can arise from a side-branch as a lobulated multicystic lesion. When a cystic abnormality communicates with the main pancreatic duct on MRCP, the differential diagnosis is pseudocyst versus IPMN. If there is no communication, the diagnosis includes pseudocyst, non-inflammatory cyst, or the serous/mucinous cystic neoplasms.

Pancreas divisum is the most common congenital anomaly of the pancreatic ductal system and it can be sensitively and specifically diagnosed with MRCP (Figure 6). This results from failure of fusion of the dorsal and ventral pancreatic ducts. The ventral duct (duct of Wirsung) drains only the ventral pancreas (head and uncinete process) via the major papilla and does not communicate with the main pancreatic duct. The majority of the gland (body and tail) drains into the minor papilla via the main pancreatic duct to the dorsal duct (duct of Santorini). Most patients with this anomaly are asymptomatic but some exhibit recurrent episodes of pancreatitis.



**(Figure 6)** Pancreas divisum with small ventral duct and incidental biliary dilatation from ampullary stenosis

1. Mortelet KJ, et al. Multimodality Imaging of Pancreatic and Biliary Congenital Anomalies. *RadioGraphics* 2006;26:715-731
2. Watanabe Y, et al. MR Imaging of Acute Biliary Disorders. *RadioGraphics* 2007;27:477-495