

71. Pancreatic Disease

Fat saturation is important to improve the differentiation between pancreatic parenchyma and peripancreatic fat, both of which demonstrate high SI on conventional T1WI, the former due to aqueous proteins within acinar cells. On FS T1WI normal pancreatic tissue has higher signal intensity than surrounding fat. CE T1WI is also performed with FS, the normal pancreas exhibiting enhancement peaking in the arterial phase and fading thereafter. Pancreatic adenocarcinoma is hypointense to parenchyma on such images. Carcinomas with prominent fibrous components will, however, demonstrate progressive enhancement, appearing hyperintense to parenchyma on delayed imaging. The pancreatic head mass (white arrows) in the region of the ampulla illustrated in the axial images of Fig. 71.1A,B demonstrates moderate to low SI on both (A) T2 and (B) T1WI. This mass obstructs the confluence of the common bile and pancreatic ducts, resulting in dilatation of both structures—the so-called double-duct sign—best seen in the thick-slab MRCP image of Fig. 71.1C. Pancreatic adenocarcinoma and focal, chronic pancreatitis may appear similar.

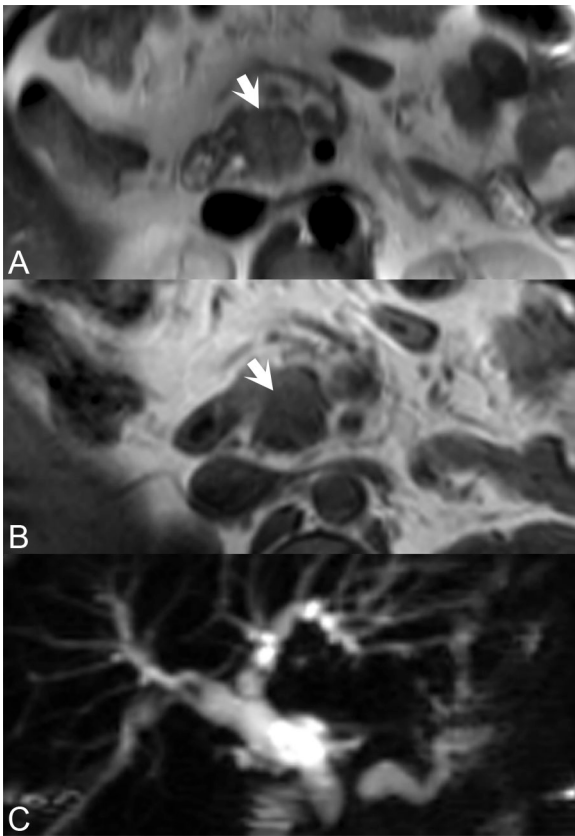


Fig. 71.1

Chronic pancreatitis is less well-defined, enhances in the early hepatic venous phase

relative to the parenchyma, and is more hyperintense on T2WI due to prominent edema. Pancreatic carcinoma is favored by the presence of lymphadenopathy, distant metastases, or vascular encasement—the latter two being contraindications to surgical intervention, with vessel encasement being best detected on CE T1WI as a focal decrease in vessel caliber. The best sequence for detection of lymphadenopathy is DWI. On other sequences conspicuity of lymph nodes varies based on their location. Interstitial phase FS CE T1WI are generally helpful, but porta hepatis nodes are better-seen against the background liver on T2WI. Mesenteric and retroperitoneal nodes are well-detected against abundant surrounding fat on T1WI. Hepatic metastases of pancreatic carcinoma exhibit an MR appearance similar to that of colorectal cancer and other adenocarcinomas (See Chapter 66). Local extension is best visualized on T1WI, owing to the prominent fatty structures in the area, while CE FS T1WI best detects peritoneal metastases—an additional surgical contraindication.

Endocrine neoplasms (i.e. gastrinoma, insulinoma, carcinoid) occur more rarely, demonstrating moderately high and low SI on T2 and T1WI, respectively, with homogeneous arterial phase enhancement on CE T1WI. Ductal and vascular involvement is rare. Hepatic metastases demonstrate a similar MR appearance to the primary tumors (See Chapter 66). Cystic neoplasms of the pancreas are of benign and malignant types and may present with serous or mucinous stroma. Serous cystadenomas exhibit multiple fluid-like SI cysts on T2WI. Occasional low SI septations often demonstrate mild enhancement. These characteristics are also seen in mucinous cystadenomas and cystadenocarcinomas—essentially indistinguishable by MRI—which typically involve the pancreatic body and tail. Larger cysts and high SI on both T1—due to mucinous content—and T2WI favor these lesions over typically benign serous tumors. Mucinous metastases avidly enhance on arterial-phase imaging. Intraductal papillary mucinous neoplasms (IPMN) may involve the main pancreatic duct or its branches and appear similar to other cystic tumors except for their communication with the pancreatic duct. Pancreatic duct dilatation may be seen secondary to copious mucin production by such lesions. Branch duct neoplasms tend to be more benign than their centrally arising counterparts and preferentially involve the pancreatic head.

Inflammatory pancreatic disease and peripancreatic fluid collections are best visualized on FS or STIR T2WI since the high SI edema stands out against suppressed peripancreatic fat on such images. The peripancreatic fluid collection (arrow) anterior to the pancreatic head in Fig. 71.2A demonstrates low SI on axial (A) T1WI. Peripancreatic fat stranding is also present. High SI areas (arrow) on (B) T2WI correspond to the fluid collection although hyperintensity also involves the pancreatic head. The peripancreatic fluid collection shown

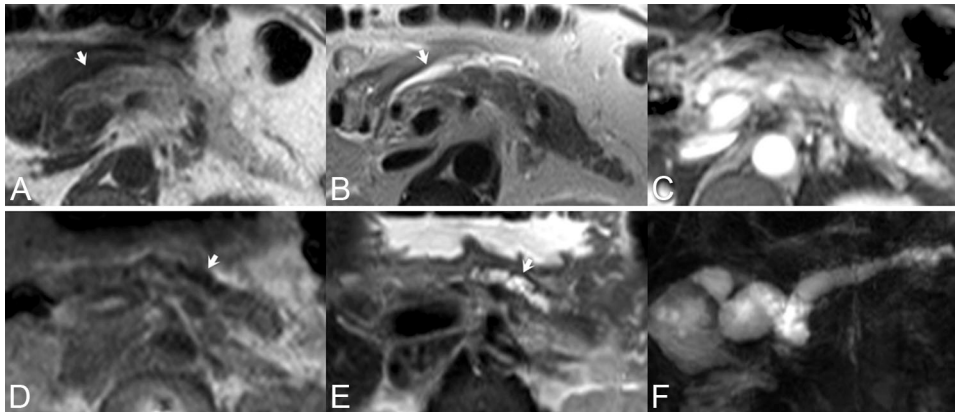


Fig. 71.2

here lacks a definable, progressively enhancing wall on (C) CE T1WI and is thus not likely to represent a true pseudocyst, which usually takes a couple of weeks after onset of inflammation to develop. Heterogeneous pancreatic enhancement on CE images is characteristic of pancreatitis as shown on the illustrated (C) early venous phase CE T1WI. CE imaging may be useful in the detection of necrosis which does not enhance on such images. Hemorrhagic pancreatitis, another potential complication, appears as high SI on FS T1WI. The characteristic MR appearance of chronic pancreatitis relates to the pathophysiology of the condition: chronic, progressive pancreatic inflammation results in acinar atrophy, leading to diminished overall gland size and a reduction in SI on T1WI due to the reduced presence of aqueous proteins within the acini. Associated chronic fibrosis leads to a pattern of gradual enhancement that peaks in the venous phase. The typical appearance of chronic pancreatitis on T1WI is illustrated in Fig. 71.2D wherein pancreatic SI is distinctly lower than that in Fig. 71.2A. Atrophy is present, manifested in part by the markedly dilated pancreatic duct (arrow). On the T2WI and thick slab MRCP images of Fig. 71.2E,F, respectively, a dilated pancreatic duct (arrow) is again present, demonstrating numerous tiny outpouchings on the latter images. Findings of chronic pancreatitis on MRCP are graded via the Cambridge criteria: a normal appearance is Cambridge 1, whereas dilatation in fewer than 3 side branches is equivocal for pancreatitis (Cambridge 2). Mild chronic pancreatitis (Cambridge 3) consists of dilatation or obstruction in more than 3 side branches, moderate pancreatitis (Cambridge 4) of main pancreatic duct dilatation and stenosis, and severe pancreatitis (Cambridge 5) of main duct stenosis with concurrent cysts and ductal calculi. Secretin-enhanced MR—leading to increased ductal dilatation—may aid in assessment of such criteria.

Recent advances in imaging technique, specifically the application of compressed sensing, have improved markedly the capabilities of MR in imaging of the pancreas. Illustrated in Fig. 71.3 are MRCP (MIP) images of a patient with a carcinoma of the pancreatic head

obtained at 1.5 T. Note the dilated hepatic and pancreatic ducts. The (A) conventional 3D SPACE scan required 5:49 min:sec for acquisition, as compared to 2:56 min:sec for the exam with (B) compressed sensing (CS). Both scans were obtained with navigator triggering, and have equivalent image quality.

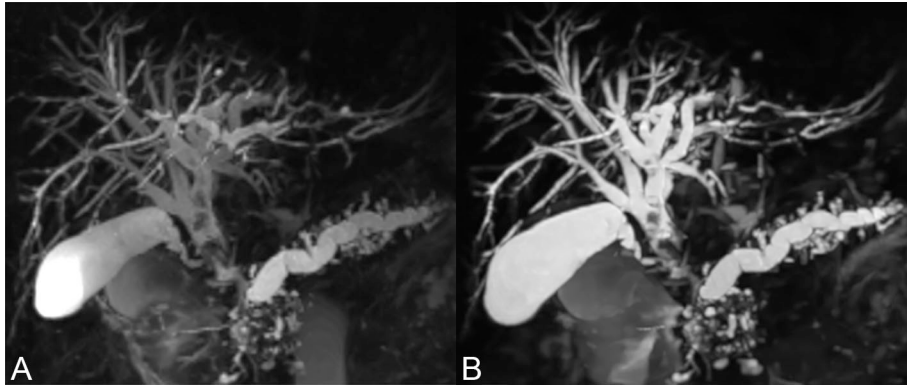


Fig. 71.3

(Adapted with permission from Invest Radiol 2018;53)

Figure 71.4 illustrates a comparison of (A) CS-MRCP and (B) breath-hold CS-MRCP in a patient with a cholangiocarcinoma invading the portal hilum and dilatation of intrahepatic biliary ducts. Despite navigator triggering (and a scan time of about half that of the conventional acquisition – not shown, but still requiring 3 min), (A) is substantially degraded due to motion (with image blurring). The breath-hold exam was obtained in 16 sec, with markedly improved visualization of intrahepatic ducts (arrows).

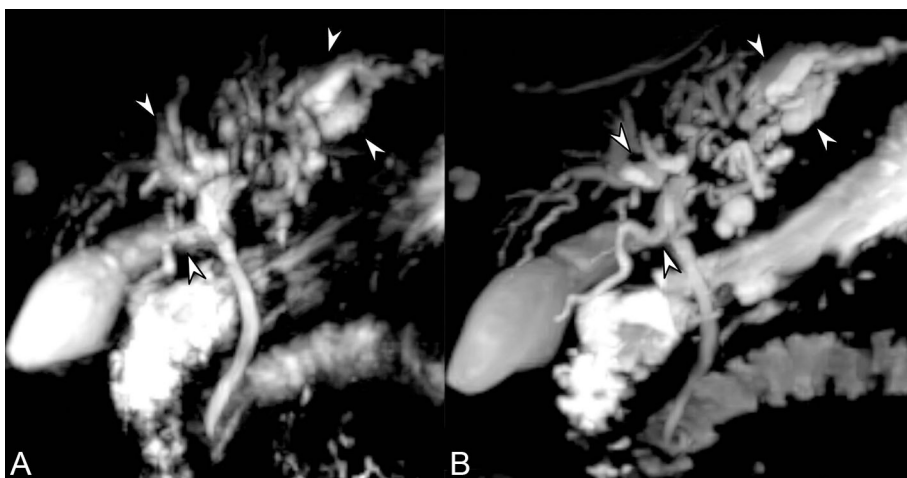


Fig. 71.4

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