Abdominal Ultrasound
Pancreas
Presenting symptoms may include:

- Abdominal pain (may go through to back)
- Weight loss
- Jaundice

Pain may be due to pancreatitis or a pancreatic tumour, and jaundice may be due to a mass in the head of the pancreas.
2-6MHz curvilinear transducer with the patient supine

Patient size and overlying bowel gas may compromise images.

Fasting prior to ultrasound allows compression and opposition of the walls of the gastric antrum.
Scan the pancreas in the midline upper abdomen using a combination of axial, sagittal and oblique planes. The initial scan is usually transverse in the epigastric region with some transducer pressure. The pancreas is visualized posterior to the left lobe of liver or gastric antrum.
Sometimes the pancreas is seen easily, but if not, arrested inspiration or expiration may help.

Asking the patient to push out their abdomen against the transducer often brings it into view.

Otherwise, a drink of water to fill the stomach may provide a useful acoustic window, as shown in this transverse image.

Note the head and body of the pancreas posterior to the fluid-filled stomach.
A gradual increase in compression with the transducer may improve image quality by helping to displace gas-filled bowel loops and visualize the pancreas. If this fails, continue with the examination and revisit the pancreas again at the end, by which time loops of bowel may have moved. If not, try examining the patient in an erect position.

The pancreatic parenchyma is similar in echogenicity to normal liver in younger patients, and described as hypoechoic. With age the pancreas becomes more hyperechoic due to increasing parenchyma fat.

Scanning from the left upper quadrant through the spleen can often give good images of the pancreatic tail.
Colour Doppler evaluation is integral to pancreatic imaging and can be useful in assessing vascularity of pancreatic masses or patency of vessels.

Image 1: small cyst in the neck of the pancreas of similar echogenicity to adjacent vessels.

Image 2: colour Doppler allows differentiation of cyst and vessels.
On transverse section the pancreatic neck and body are well-seen, with the liver (LLL) visible anteriorly and the superior mesenteric view (SMV) and splenic vein (SV) visible posteriorly.

Deeper to the pancreas in the midline is the superior mesenteric artery (SMA) and deeper to this the aorta.

Note the left renal vein draining into the inferior vena cava (IVC) and the right renal artery arising from the aorta on the ultrasound image.
Image 1 - transverse image, the pancreatic tail is seen lying anterior to the splenic vein. The coelic axis and stomach are also visible.

Image 2 - sagittal view, showing the body of pancreas posterior to the liver and anterior to the SMV.
The normal size of the pancreas is variable, any alteration in echogenicity or duct dilatation being more important in assessing pathology.

The echogenicity of the pancreas increases with age, with increased fat replacement.

The pancreatic duct diameter also increases with age. Mean diameter 1.5mm in patients under 30 years, and 2.3mm in patients over 80 years. Duct diameters up to 5mm have been reported in elderly patients without associated pancreatic pathology.

A hypoechoic posterior head/uncinate process of pancreas occurs due to focal fatty sparing of the ventral pancreas, may mimic a mass, and is reported in 30-40% of patients having abdominal ultrasound.
Transverse image demonstrating pancreatic adenocarcinoma.

Other common pathologies which affect the pancreas area:

• Acute pancreatitis
• Chronic pancreatitis
• Pancreatic cysts
• Pseudocysts
• Pancreatic cancer
Acute pancreatitis is acute inflammation of the pancreas with acute abdominal pain and raised serum amylase or lipase. This may be mild with pancreatic edema, or severe with parenchymal necrosis, fluid collections and systemic complications.

Gallstones and alcohol are the most common causes of acute pancreatitis. Other causes include some drugs and endoscopic retrograde cholangiopancreatography (ERCP).

In acute pancreatitis, there is usually also peripancreatic free fluid. This image demonstrates mild pancreatitis.
Image 1, - disruption of pancreatic parenchyma in the body/tail of the pancreas, adjacent fluid and solid necrosis.

Image 2, - CT view shows the disrupted pancreas and the peripancreatic necrosis tracking around the pancreatic tail, spleen and left kidney.
Chronic pancreatitis is characterized by replacement of glandular elements of the pancreas by fibrous tissue, resulting in progressive and permanent loss of exocrine and endocrine pancreatic function.

Image 1 - Atrophic pancreas, duct dilatation and stones in parenchyma or within the main duct. Note the posterior acoustic shadowing behind both stones.

Images 2 and 3 - Transverse images of chronic pancreatitis on ultrasound and CT
Pancreatic adenocarcinoma masses are typically hypoechoic, fairly homogeneous solid masses, and often with irregular margins. Occasionally, the tumours are of heterogeneous echotexture with small foci of increased echogenicity, but it is rare for adenocarcinoma to be hyperechoic.

The double duct sign is associated with pancreatic head tumours. A dilated common bile duct (CBD) and main pancreatic duct (MPD) are usually easily detected in the presence of a visible mass. Even in the absence of a visible mass, the dilated ducts are strongly suggestive of a neoplasm. However, the double duct sign is not exclusive to cancers, since any focal mass or inflammation can cause this.
Cystic pancreatic neoplasms may be mucinous or non-mucinous.

Serous cystadenomas (SCA) are non-mucinous benign lesions with multiple <2cm cysts and septations, and may appear as a hyperechoic mass if the cysts are tiny (<2mm).

Mucinous cystic neoplasms may be uni- or multilocular, and the cysts are typically >2cm. Nodular projections or septations may be seen on ultrasound.

Well-defined heterogeneous and mainly solid-looking mass (SCA) in the pancreatic head and neck with a few tiny cysts. The pancreatic body is hyperechoic. Note the incidental finding of a large cyst in the liver.
Intraductal papillary mucinous neoplasms (IMPNs) produce mucin, which distends the duct and papilla. They may be main duct type or branch duct type, the latter presenting as a cystic mass without significant main duct dilatation.

Small incidental pancreatic cysts are being increasingly detected on ultrasound. Many of these are small IPMNs and may not be of clinical significance if less than 2cm in diameter.

This image demonstrates the typical appearance of IPMN.

There is a dilated pancreatic duct and cyst in the head of the pancreas.
Mucinous cystic neoplasm in the tail of the pancreas with eccentric wall thickening.
Knowledge of pancreatic anatomy and its appearance on ultrasound is essential for accurate image interpretation.

Ultrasound of the pancreas is a useful initial imaging modality for suspected pancreatic pathology.

Common pathologies which may be seen on ultrasound include acute/chronic pancreatitis and cystic or solid tumours.

Ultrasound of the pancreas can be difficult and several techniques can be used to improve image quality. If views are inadequate in patients with pancreatic symptoms, further imaging should be suggested.
Thank you