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Clinical Radiology
The Royal College of Radiologists

Recommendations for cross-sectional imaging in cancer management, Second edition

Pancreas

Faculty of Clinical Radiology

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Pancreas

Clinical background

Pancreatic cancer constitutes 3% of all cancers in the UK.[1] The most common histological type is ductal adenocarcinoma which has a predilection for the pancreatic head and neck. Patients often present with obstructive jaundice. Ampullary carcinomas and distal common bile duct carcinomas may be indistinguishable from pancreatic head ductal adenocarcinomas but, despite having separate pathological staging systems, the therapeutic issues and work-up are identical.

Primary treatment is surgical in which all macroscopic tumour can be excised. CT and MRI are similar in their capability to assess local tumour extent with both tending to underestimate disease extent. Resection can be considered in the absence of metastatic disease or involvement of the visceral arteries or the portal venous structures. In selected cases, short segments of the superior mesenteric or portal vein may be resected. Liver metastases, which are often small, and peritoneal metastases preclude resection. CT and MRI are poor predictors of lymph node involvement. Diagnostic staging should be performed before bile duct stent insertion. Artefact from both plastic and metal stents can obscure small tumours on both CT and endoscopic ultrasound (EUS). In many countries, surgery is also performed without stent insertion, but this is frequently not possible in the UK. The prognosis following resection is poor with five-year survival less than 10%.[2]

Percutaneous biopsy should not be performed in potentially resectable cases but is usually performed before chemotherapy. Biliary drainage is usually the major palliative procedure required; some patients may also require duodenal stent insertion for relief of gastric outlet obstruction. Chemotherapy and radiotherapy have limited and predominantly palliative roles (although interest in this is growing). EUS is of value in problem-solving with small tumours, may allow biopsy without breaching the peritoneum and enable coeliac axis neural blocks to be done for pain relief.

Neuroendocrine tumours and cystic neoplasms of the pancreas are less common but have a more favourable prognosis. Neuroendocrine pancreatic tumours may present as a consequence of a hyper-functioning syndrome (often small tumours), as a non-functioning mass, or as part of multiple endocrine neoplasia type 1 (may be multiple tumours).

Who should be imaged?

If a pancreatic neoplasm is suspected, either clinically or as a consequence of a prior investigation, diagnostic CT should be performed using a staging protocol. Pancreatic neoplasms may present with non-specific symptoms and therefore may be detected on CT undertaken as a survey abdominal scan. Such tumours are often advanced and recall for a dedicated staging CT is often unnecessary.

Staging objectives

- To determine evidence of involvement of the visceral arteries and portal venous system.
- To identify deposits in the liver and peritoneum.
- To detect lymph node enlargement.
- To identify bile duct and duodenal obstruction.
- To evaluate whether the pancreatic pathology is inflammatory or malignant and thereby
- To decide preoperatively whether radical surgery is required.
- To determine the size of the tumour where chemoradiotherapy might be used in the palliative setting (usually tumours <5 cm in diameter).

Staging

Ultrasound is the primary investigation in identifying biliary obstruction as the cause of jaundice. CT is the investigation of choice if a pancreatic neoplasm is suspected.[3] MRI is an alternative if a tumour is identified at MRCP, or to problem-solve if there are indeterminate features CT. The principal use of MRI in pancreatic carcinoma is to clarify the nature of indeterminate liver lesions detected on CT. EUS is also of value in problem-solving, particularly with small focal pancreatic lesions.

CT

- Oral administration of 1 litre of water as a contrast agent to fill the stomach and duodenum.
- 100–150 ml of intravenous iodinated contrast medium injected at 3–4 ml/sec.
- MDCT (dual-phase acquisition) commenced at 35–40 seconds (pancreatic phase) and 65–70 seconds (portal venous phase) after onset of injection. Bolus tracking to optimise the vascular phases may be beneficial.
- Using MDCT images should be acquired at 0.625–1.25 mm slice thickness in the pancreatic phase and 2 mm in the portal venous phase (depending on 8, 16 or 64-slice scanner).

Values of $CTDI_{vol}$ should normally be below the relevant national reference dose for the region of scan and patient group (see Appendix and Radiation protection for the patient in CT in Section 2).

MRI

A negative oral contrast agent is helpful with a phased array surface coil.

Protocol for imaging of pancreatic tumours

Sequence	Plane	Slice thickness	Field of view
T1W with water excitation/ fat suppression	Axial	4 ± 1 mm	Large
T2W	Axial/coronal oblique*	4 ± 1 mm	Large
T1W with contrast medium enhancement	Axial/coronal oblique*	4 ± 1 mm	Large
T2W	Axial	5 ± 2 mm	Small
T1W with contrast medium	Axial	5 ± 2 mm	Small

* Dependent on the location of the tumour (see text)

- With the dynamic gadolinium-enhanced MR series, the optimal plane depends on the location of the tumour. The pancreatic and portal venous phase acquisitions are best acquired using an oblique coronal plane for pancreatic head tumours followed by an axial acquisition. For tumours of the body and tail and for neuroendocrine tumours, the initial acquisitions are best obtained axially. This is less critical if 3D techniques are employed because an isotropic dataset can be obtained that can be reconstructed in any plane.
- A delayed axial acquisition through the pancreas at ten minutes is of value in neuroendocrine tumours.
- 3D T1 with fat saturation is preferable to 2D sequences for MRCP because image quality is much improved.

PET-CT

On ^{18}FDG PET-CT scans, acute pancreatitis and pancreatic carcinoma both show increased ^{18}FDG uptake, and it is therefore not possible to differentiate these conditions, although there may be some value to PET imaging when distinguishing chronic pancreatitis from carcinoma. ^{18}FDG PET-CT is not indicated routinely in pancreatic cancer but has utility in staging of patients with potentially operable pancreatic adenocarcinoma where cross-sectional imaging is equivocal for metastatic disease and a positive PET-CT would lead to a decision not to operate.[4] It can also be useful in

selected patients with suspected recurrence where other imaging is equivocal or negative.

Follow-up

Routine imaging after surgery is not warranted as palliative chemotherapy is generally only considered when there is symptomatic disease. Follow-up imaging is conducted when there is clinical evidence of recurrence. Follow-up is performed to assess response to chemotherapy (+/-radiotherapy) and is, therefore, performed at a frequency to correspond with the chemotherapy regimens.

Tips

- Coronal or sagittal reformatted CT images can be very useful to evaluate vascular involvement. More complex reconstructions such as curved planar reformats are occasionally helpful.

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