SPECT CT and PET CT

SPECT/CT and PET/CT

Single photon emission computed tomography (SPECT) and positron emission tomography (PET) are nuclear medicine imaging techniques that provide metabolic and functional information, unlike CT and MRI. They have both been combined with CT and MRI to provide detailed anatomical and metabolic information. PET/CT looks promising as a tool for the detection of distant metastases in bladder cancer. To date, the technique has not been used extensively in patients with renal cancer. In men with testicular cancer, it is recommended in the

(a) Bosniak I cyst; (b) Bosniak II cyst; (c) Bosniak IIF cyst; (b) (d) (a) T2 weighted. (b) Diffusion weighted (DWI).

follow-up of patients with seminoma with any residual mass. PET/CT may use a number of di ff erent radiotracers, including 11 18 18 C-choline, F-choline (Figure 81.26), F-fluciclovine and 68 the newer gallium-68 (GA)-labelled antibodies targeting prostate-specific membrane antigen (PSMA) for the detection and staging of prostate cancer and its recurrence after initial definitive therapy . Bone scan A bone scan is most frequently used when bone metastases are suspected based on symptoms or other investigations. It is also used in the routine staging of patients with high-risk prostate cancer, although there is a <5% chance of a bone scan being positive until the PSA is >40 /uni00A0 ng/mL. Dimercaptosuccinic acid renogram 99m Tc dimercaptosuccinic acid (DMSA) is a technetium radiopharmaceutical used in renal imaging to evaluate renal structure, especially in the paediatric population, where it is used to detect renal scarring (Figure 81.27). Diethylenetriaminepenta-acetate renogram 99m Tc diethylenetriaminepenta-acetate (DTPA) is another technetium radiopharmaceutical used in renal imaging. Previously it was used frequently in patients suspected of having ureteropelvic junction (UPJ) obstruction but it has largely been superseded by the mercaptoacetyltriglycine (MAG3) renogram in such cases. Mercaptoacetyltriglycine renogram 99m Tc Mercaptoacetyltriglycine (MAG3) is now the radio - pharmaceutical of choice used in the assessment of patients with suspected upper urinary tract obstruction such as UPJ obstruction. The shape of the renogram curve (following subtraction of background activity) is dependent, first, on MAG3 uptake from the circulation to the kidney and, second, on MAG3 elimina - tion from the kidney into the bladder. Classically , the nor mal MAG3 renogram curve has three phases (Figure 81.28): 1 The curve rises steeply upwards following intravenous tracer injection. This is indicative of the speed of tracer injection and its delivery to the kidneys (i.e. renal vascular supply). 2 A more gradual slope that represents renal handling of MAG3 (renal uptake by tubular secretion and glomerular filtration) and peaks between 2 and 5 minutes. The time taken for the curve to peak following tracer injection is referred to as T . This may be delayed in patients with max renovascular insu ffi ciency , renal failure and obstruction. 3 Commences after the peak. It is associated with the

(b) Figure 81.26 A 55-year-old patient with an increasing prostate-speci /f_i c antigen level 27 months after radical prostatectomy. Coronal (left), axial (middle) and sagittal (right) fused image projections of choline positron emission tomography/computed tomography (PET/CT) scans. 11 C-choline uptake in the right (large arrow) and left (thin arrow) iliac regions revealed lymph node involvement. 18F- /f_l uorodeoxyglucose PET (courtesy of Hussein Farghaly). (a) Focal (b) This was not observed with

emergence of tracer in the bladder and represents elimination (but also delivery) of tracer from the kidney . After 3 minutes, both elimination and uptake are in competition, but the former subsequently dominates. It is this elimination curve that is dependent on the upper tract urodynamics. Renogram curves of a number of nor mal and pathological conditions are shown in Figure 81.29 .

(b) Figure 81.27 Dimercaptosuc

cinic acid scans. (a) Normal kidneys; (b) horseshoe kidney; (c) focal renal scarring (arrow); (d) renal tumour (arrow). Figure 81.28 Diagrammatic representation of the three principal phases (vascular, concentration and excretion) of a mercaptoacetyl triglycine renogram curve. The time taken for the activity to become half of the peak level is called the half-time excretion and is used to determine the presence or absence of obstruction to urine out /f_l ow. Increased half-time suggests obstruction.

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