Hyperparathyroidism's classical presentation of “stones, bones and abdominal groans” is now relatively uncommon, with the majority of cases now found biochemically with elevated but asymptomatic (ionised) calcium levels associated with inappropriately high (or not suppressed) parathyroid hormone (PTH).

The major differential diagnosis is Familial Hypocalciuric Hypercalcaemia (FHH). 15-20% of patients with FHH have mildly elevated PTH concentrations but will have low urinary calcium and magnesium excretion.

Once diagnosed, a decision needs to be made as to whether surgery is needed, and if this is decided, then imaging to locate the abnormal parathyroid gland is indicated.

The old adage of “the best localising test for hyperparathyroidism is to localise a good parathyroid surgeon” is true with bilateral neck dissections, with success rates of over 90% usually reported. However, with the emphasis now on minimally invasive surgery, with its significant surgical advantages (including a limited surgical field and a short hospital stay), accurate pre-operative imaging localisation is required.

Baseline imaging is particularly important if the initial surgery was unsuccessful, or if the patient has adverse features such as obesity or a short neck.

It should be emphasised that imaging is not an appropriate test to confirm the diagnosis of hyperparathyroidism but to localise the abnormal gland.

With primary hyperparathyroidism, approximately 85% are due to a single adenoma (and for some reason more than half of these are right lower), 13 % multi-gland hyperplasia and fewer than 2% parathyroid cancer.

Secondary and tertiary hyperparathyroidism is most commonly associated with renal failure, involves multi-gland hyperplasia and is seldom imaged (poorer sensitivity of imaging).

The majority of people have four parathyroid glands, the upper being typically behind the mid to upper lobes of the thyroid and the lower at the lower poles of the thyroid. A normal gland is less (often much less) than 5mm in diameter, weighs a few milligrams and is not visualised by any of the standard imaging techniques.

Anomalies are common, with more than four glands and/or glands situated anywhere in the anterior neck and down to the level of the aortic arch. A number of imaging investigations are available; the most generally applicable are nuclear scanning and ultrasound. The combination of the 2 techniques finds the majority of lesions. CT and MRI generally have a lower sensitivity.

### Nuclear Sestamibi Scan

The nuclear technique depends on the increased metabolic rate in a parathyroid adenoma, and the phenomenon that normal thyroid tissue and parathyroid adenomata take up the favoured radiopharmaceutical (technetium-99m Sestamibi, also used for cardiac scanning because of the same properties). There is generally delayed clearance from the parathyroid tissue compared with the thyroid, which means that after several minutes, the parathyroid tends to stand out above the background.

Pin-hole anterior and oblique images and now tomographic fusion images with “SPECT/low-doseCT” are now routine in localising these. Although size is important, it is less so for the nuclear technique because it depends also on the metabolic rate of the tumour. No preparation is needed and the study takes about 2 hours. Sensitivities of between 80-90% are reported for the current techniques.

### Ultrasound

Ultrasound depends on finding a typically ovoid, relatively echo free and hypervascular lesion in the expected position. The study takes up to 30 minutes. However, it is much more operator dependent and will not detect deeplying or mediastinal parathyroid adenomas.

The two tests can be performed on the same day and the highest yield/specificity is usually found when performed together, with the ultrasound undertaken after the nuclear medicine test.

For both tests, false negative studies occur usually with very small adenomas (<5mm diameter). False positives can occur with thyroid nodular masses which can take up Sestamibi or mimic a parathyroid adenoma on ultrasound.
Parathyroid Scanning

Figure 01

A: Early Sestamibi scan (thyroid + parathyroid)
B: Late Sestamibi scan (left lower parathyroid)
C: SPECT showing parathyroid
D: Low dose CT
E: Fused image
F: Ultrasound showing 8mm parathyroid adenoma (between calipers)

Figure 02

SPECT/CT of mediastinal parathyroid adenoma
+ Top Row: Sestamibi scan
+ Middle Row: low dose CT
+ Bottom Row: fused images