Imaging of the parathyroid and thyroid A surgeon's perspective

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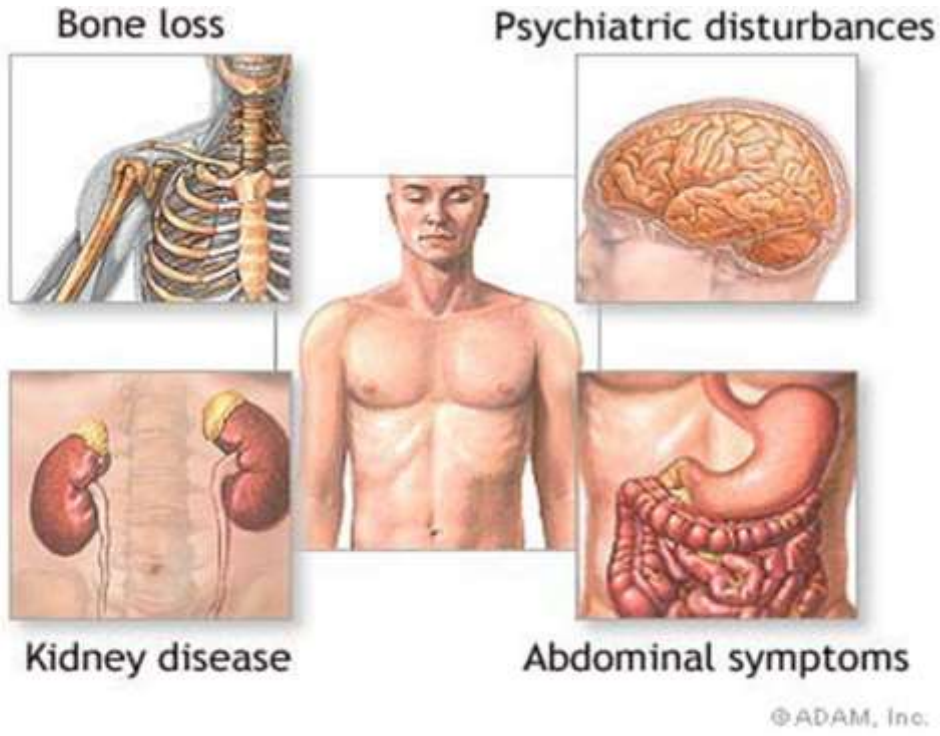
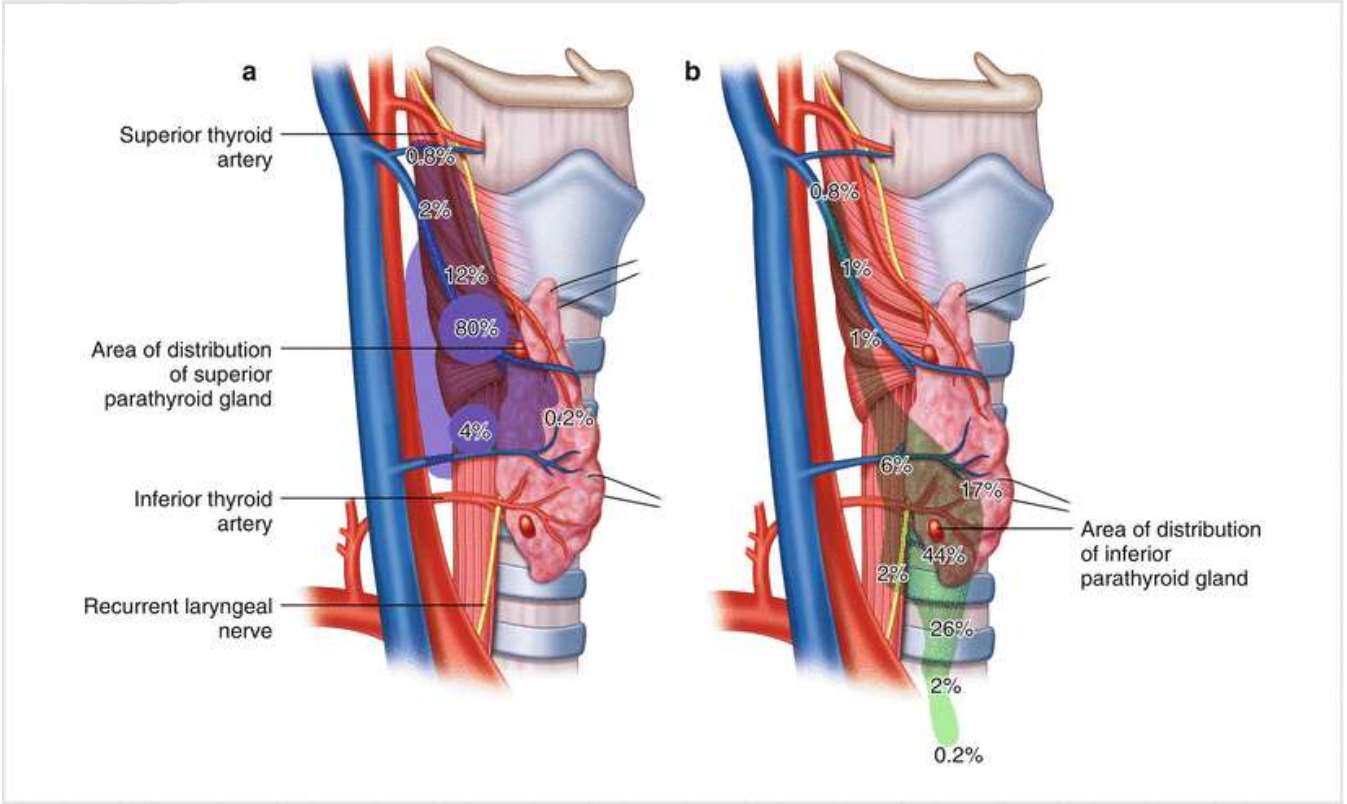
Primary hyperparathyroidsm

- Biochemical diagnosis – raised calcium with normal/raised PTH levels
- Increasing found incidentally
- Usually sporadic
- < 10% associated with genetic syndromes
  - MEN1, familial isolated PHPT, HPT-JT syndrome
  - Patients < 50 years genetic testing advised pre-op
- Surgery is the only cure



Parathyroid embryology

- 4 parathyroid glands in pairs
- 3-13% too few or supernumerary glands
- Superior parathyroids arise from 4th branchial pouch
- Inferior parathyroids arise from 3rd branchial pouch
- Inferior parathyroids descend with the thymus
- Superior parathyroids more consistent location
- Inferior parathyroids more likely to be ectopic

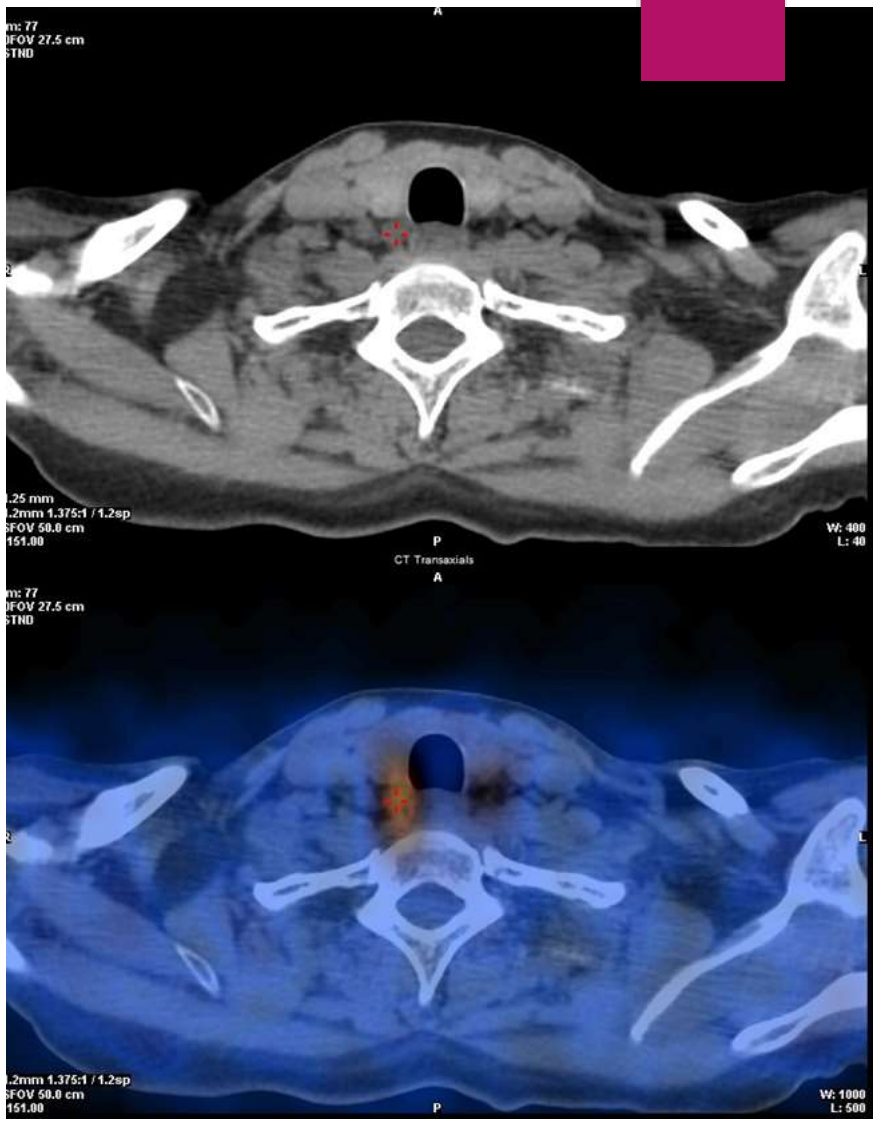


Symptomatic patients	Asymptomatic patients
Hypercalcaemic crisis	Age < 50 years
Renal calculi	Serum calcium level > 0.25 mmol/L above the upper limit of normal
Fragility fractures	Creatinine clearance reduced to <60 ml/min
Osteoporosis	T-score <2.5 at any site
Suspicion of parathyroid cancer	Silent renal calculi on imaging

Indications for parathyroid surgery

Indications for imaging in PHPT

- The diagnosis is confirmed
- The patient fulfils the criteria for surgery
- Patient is fit enough for surgery and wishes to undergo an operation
- Imaging is NOT used to select patients for surgery



Considerations for surgery

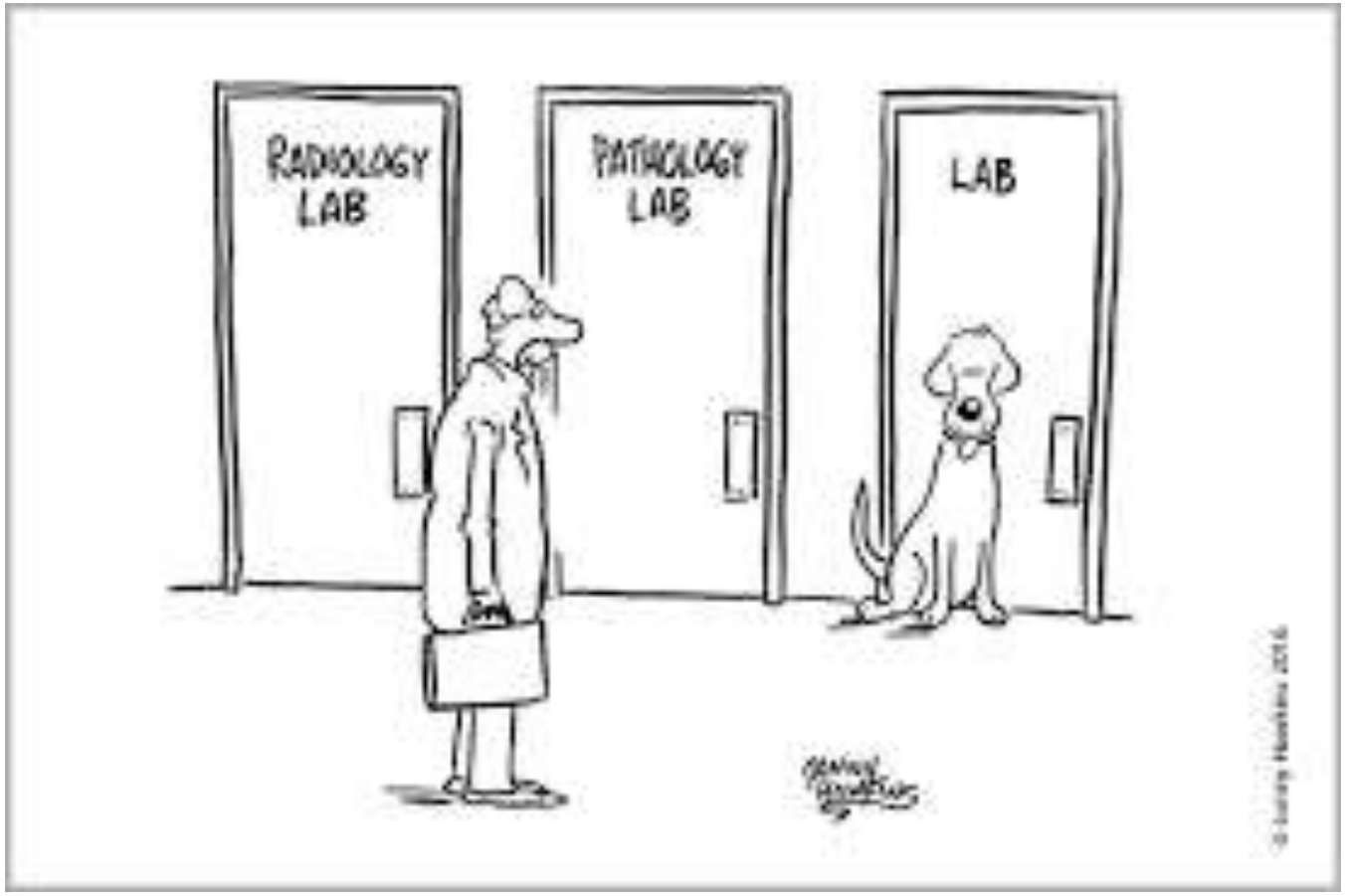
- 85-90% single adenoma
- 3% double adenoma
- 10% multi-gland disease (hyperplasia)
- < 1% parathyroid cancer

- Patients with genetic syndrome likely to have multi-gland disease

Parathyroid surgery

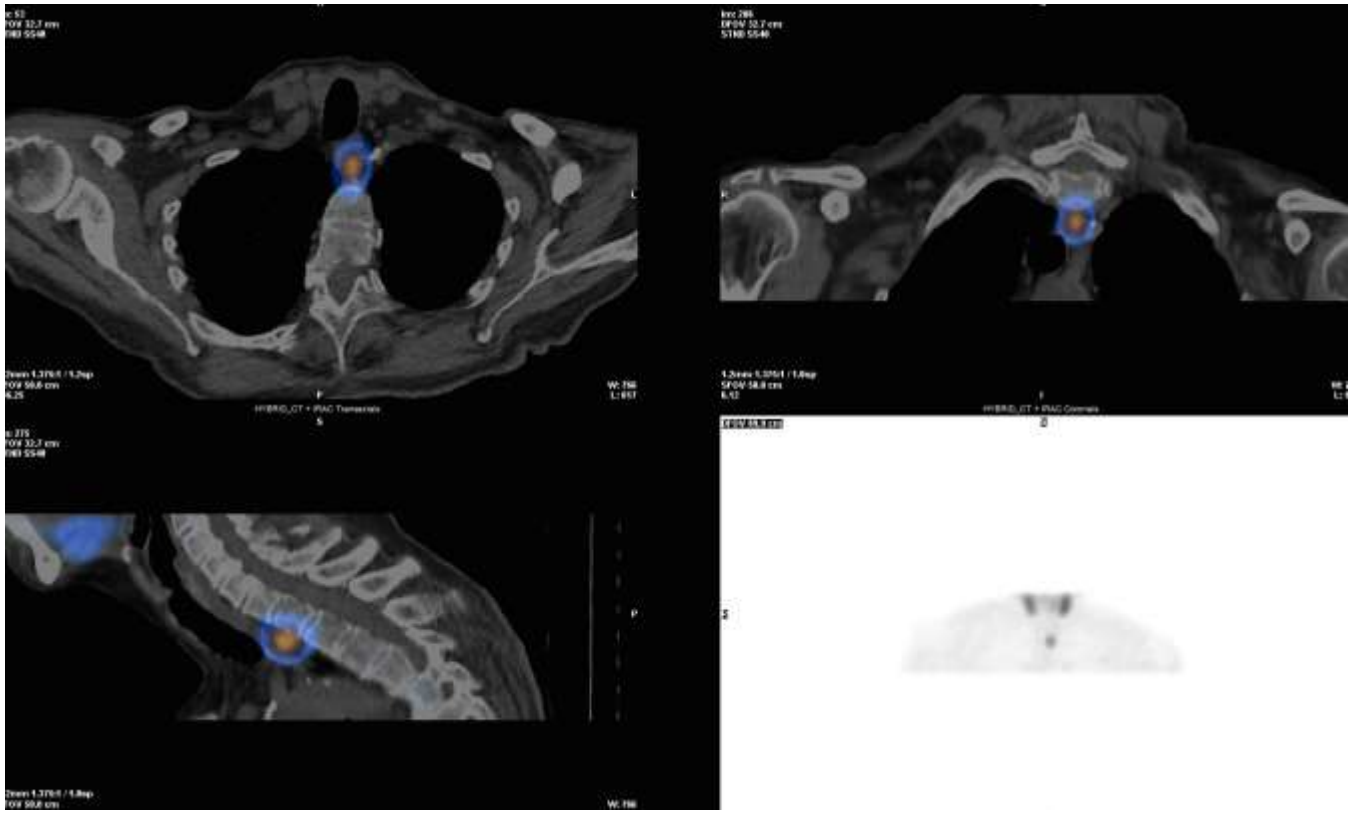
Planning surgery in PHPT

- Imaging important for planning surgery:
  - Bilateral neck exploration
  - Unilateral neck exploration
  - Minimally invasive parathyroidectomy
- Adjuncts to surgery
  - IOPTH
  - Frozen section



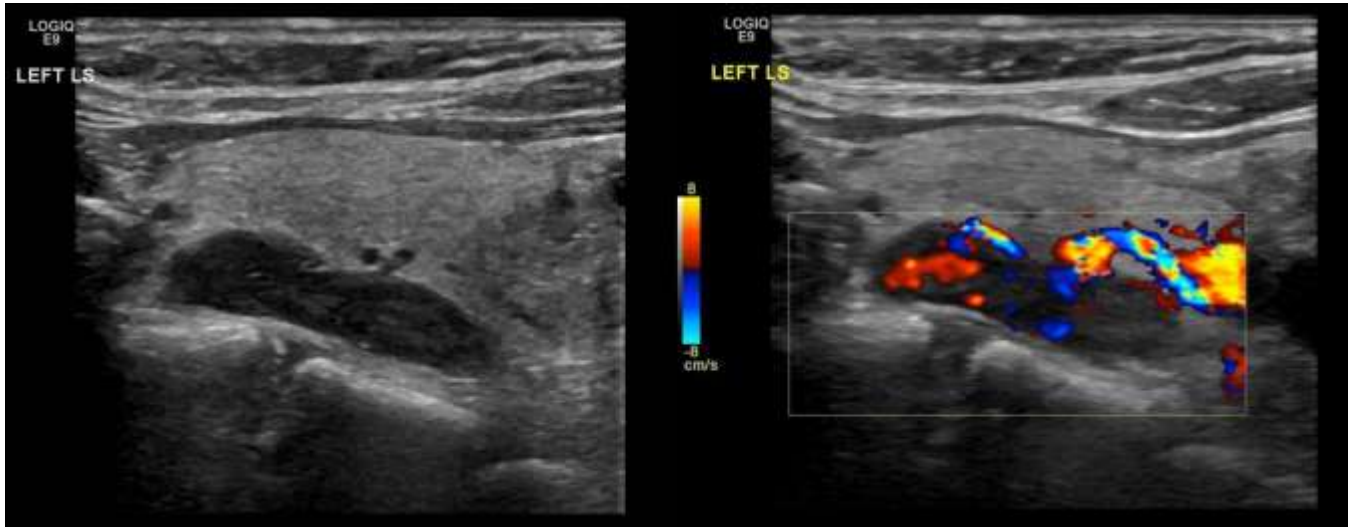
Imaging for PHPT in Leeds

- First line imaging:
  - SPECT-CT
  - USS
- Second line
  - MRI
  - 4D CT
  - Choline PET-CT



Radiology reports that help surgeons

- Anatomical location and landmarks
- Relationship to thyroid
- Size of thyroid
  - MNG
  - Nodules
- Ectopic locations
- Intra-thyroidal parathyroids
- Potential parathyroid cancers

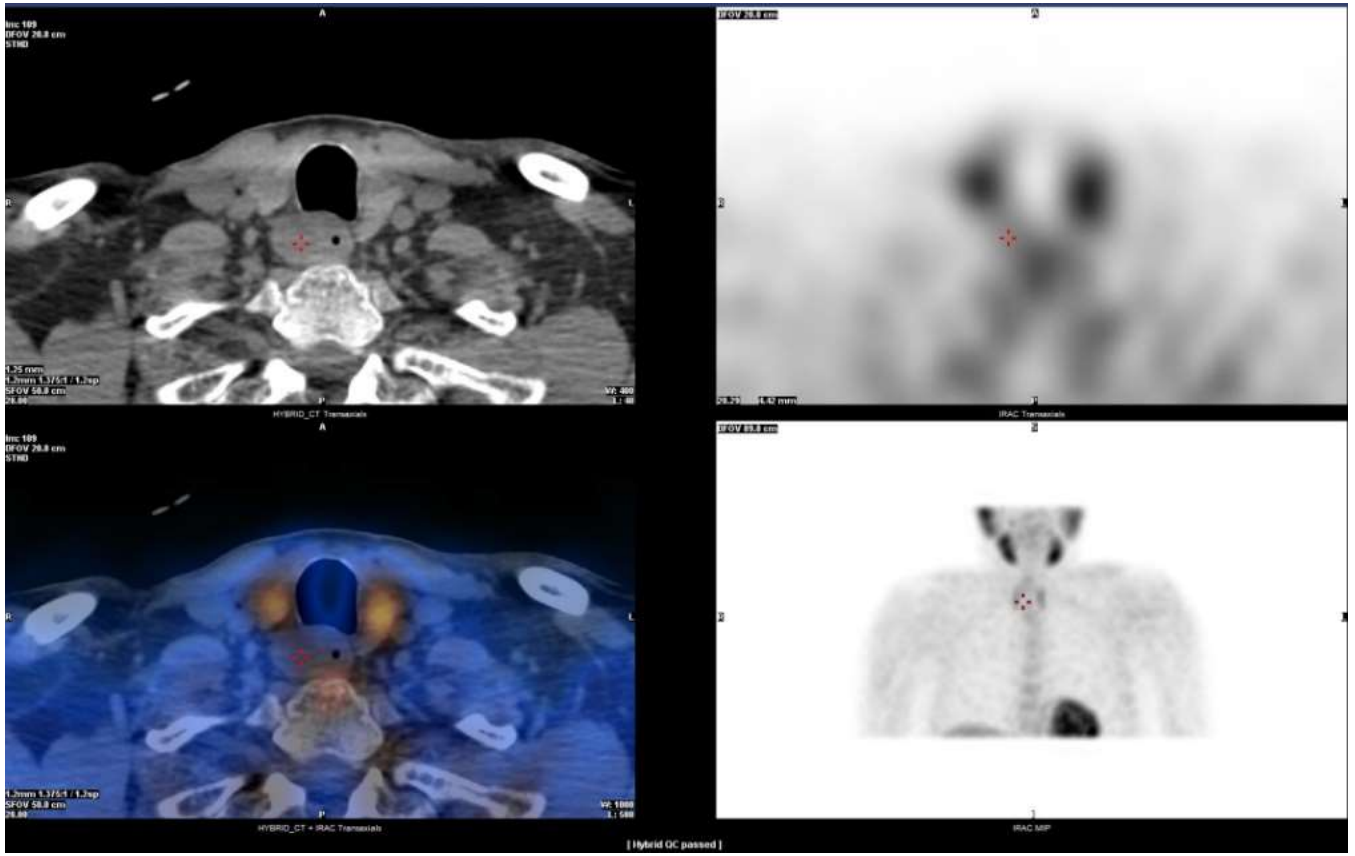


What my radiology colleague reports

- Location – side, quadrant, embryological, ectopia
- Site – landmarks
- Number
- Size – small glands tend to be hyperplasia even if a single gland seen
- Atypical findings – size, margins, vascularity, lobulation, invasion of gland, vocal cord palsy
- Variant anatomy – aberrant subclavian, tracheal diverticulum
- Level of confidence

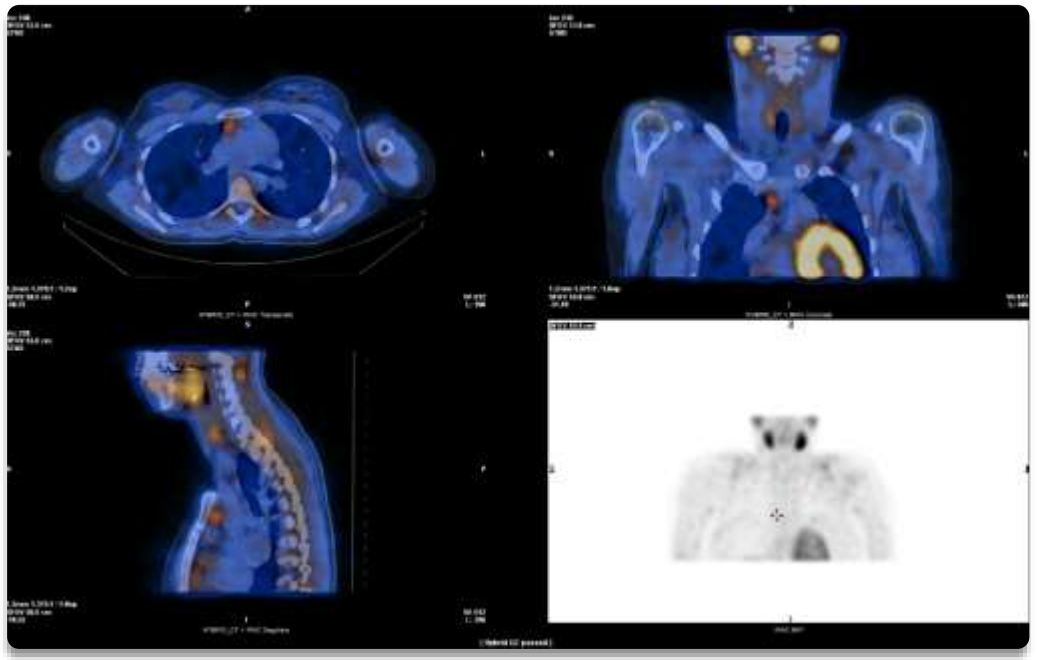
For example…

There is slightly asymmetric enlargement of the right thyroid compared to the left. The subsequent SPECT-CT demonstrates a 3.7 cm prolapsed right superior parathyroid adenoma commencing just below the level of the cricoid cartilage on the right



Limitations of SPECT-CT

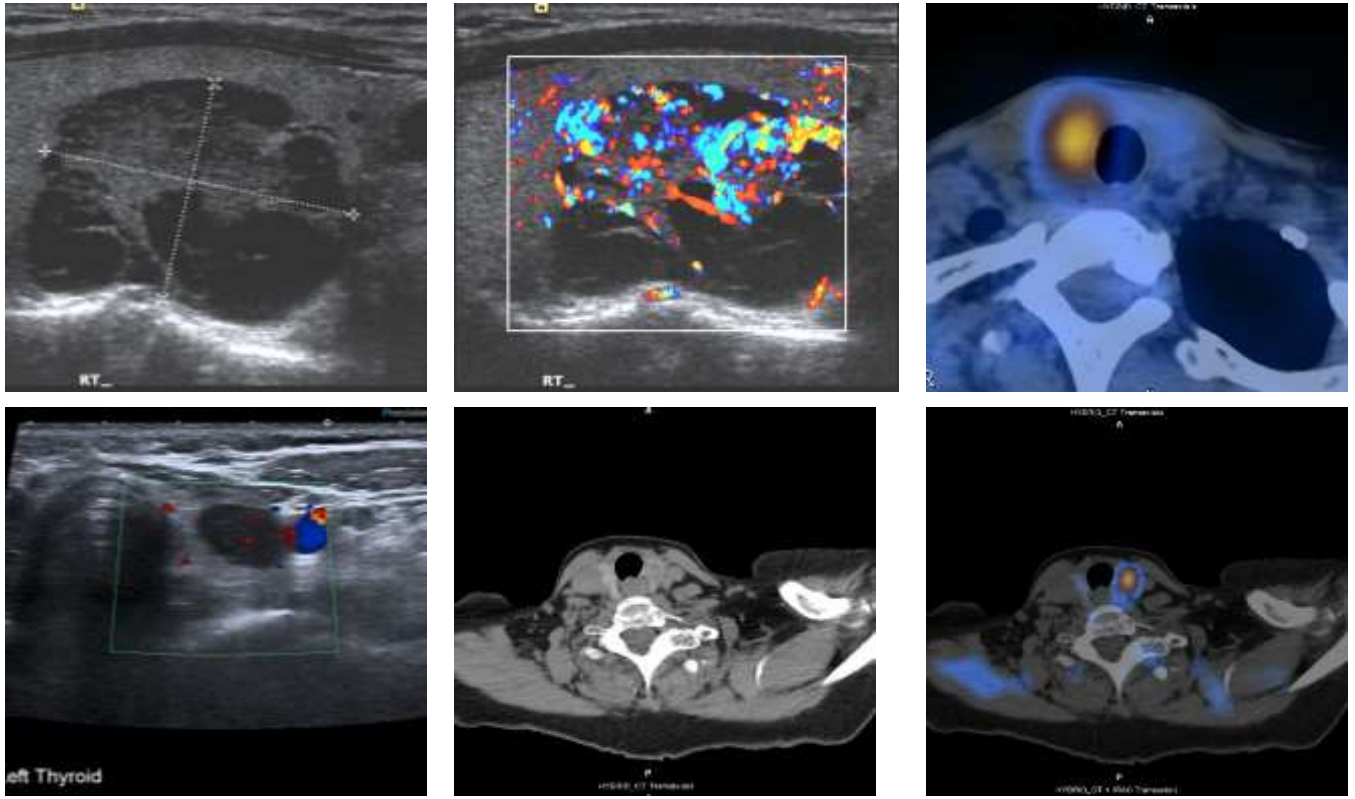
- False positive uptake:
  - Thyroid adenomas / carcinomas
  - MNG
  - Sarcoidosis
  - Other tumours – breast & lung cancer, myeloma
- Accuracy reduced with smaller adenomas
- Used in conjunction with ultrasound



Ultrasound for PHPT

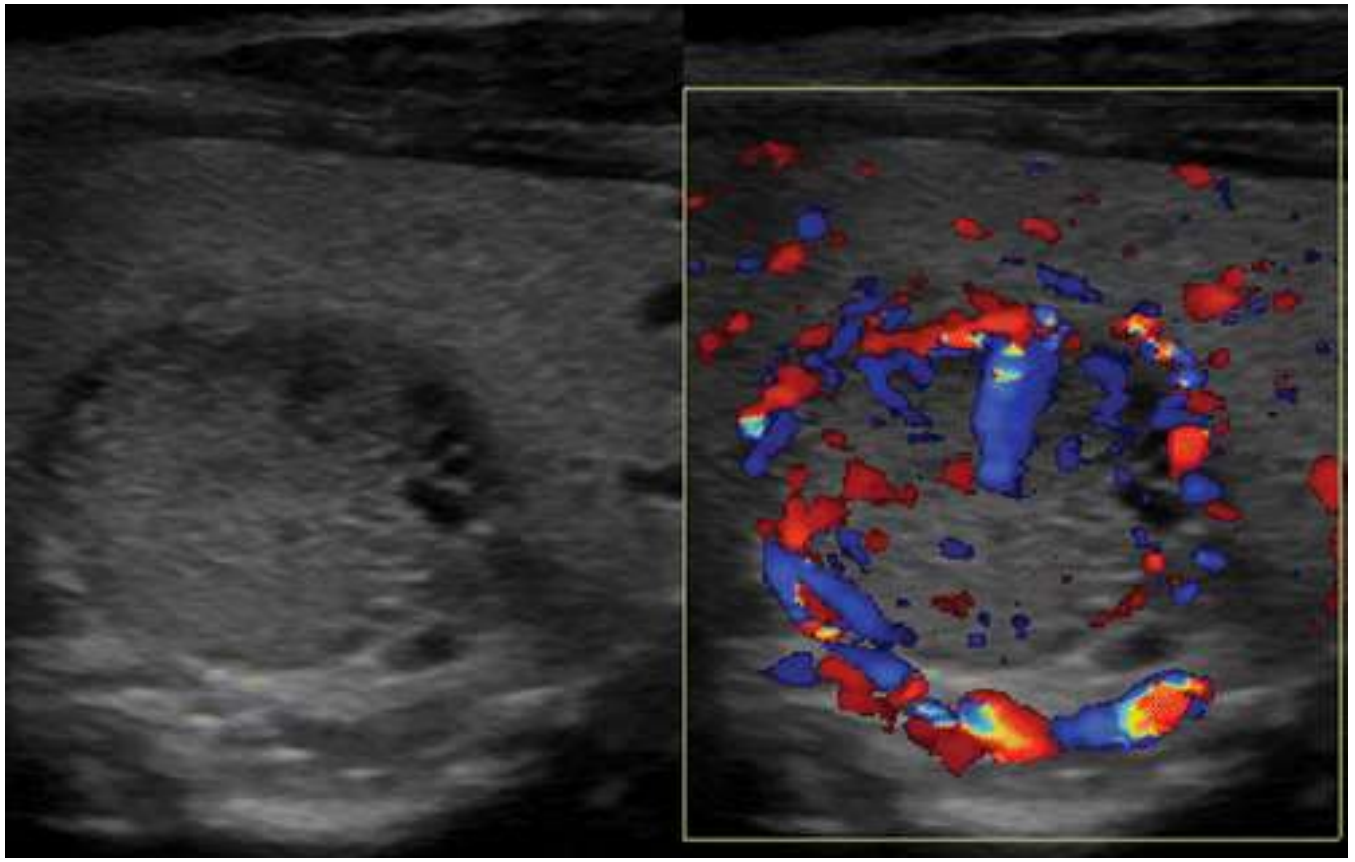
- May identify a parathyroid lesion in SPECT-CT negative patients
- Role in pregnant patients
- Help differentiate between thyroid nodules and intra-thyroidal parathyroids
- Evaluates the thyroid for concurrent pathology
  - 3.5% overall incidence of thyroid cancer in surgical primary hyperparathyroidism patients

Intra-thyroidal parathyroids



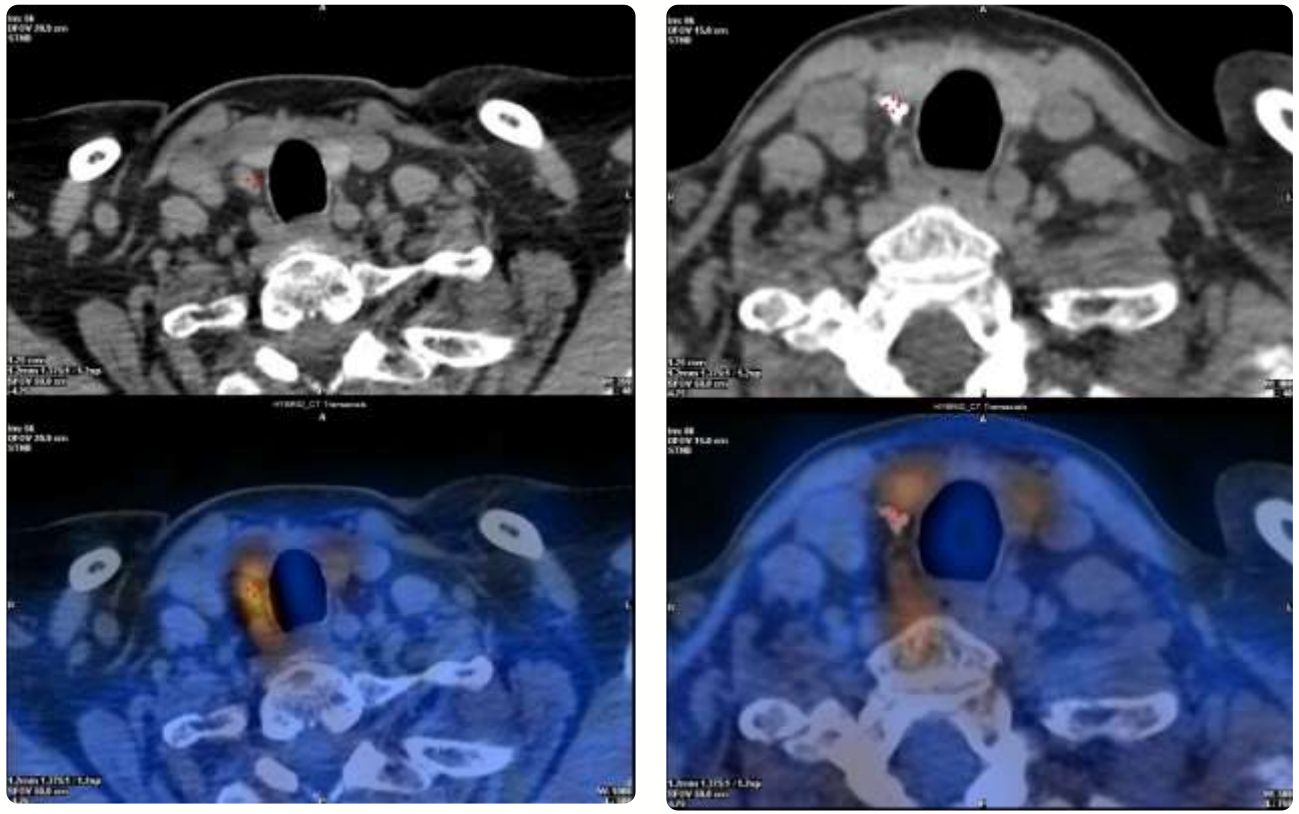
Negative imaging in PHPT

- Hyperplasia/MGD
- Multinodular goitre
- Vitamin D deficiency
- Small gland size/cystic change
- Juxta-/intra-thyroidal
- Technical
- Wrong diagnosis



Persistent disease

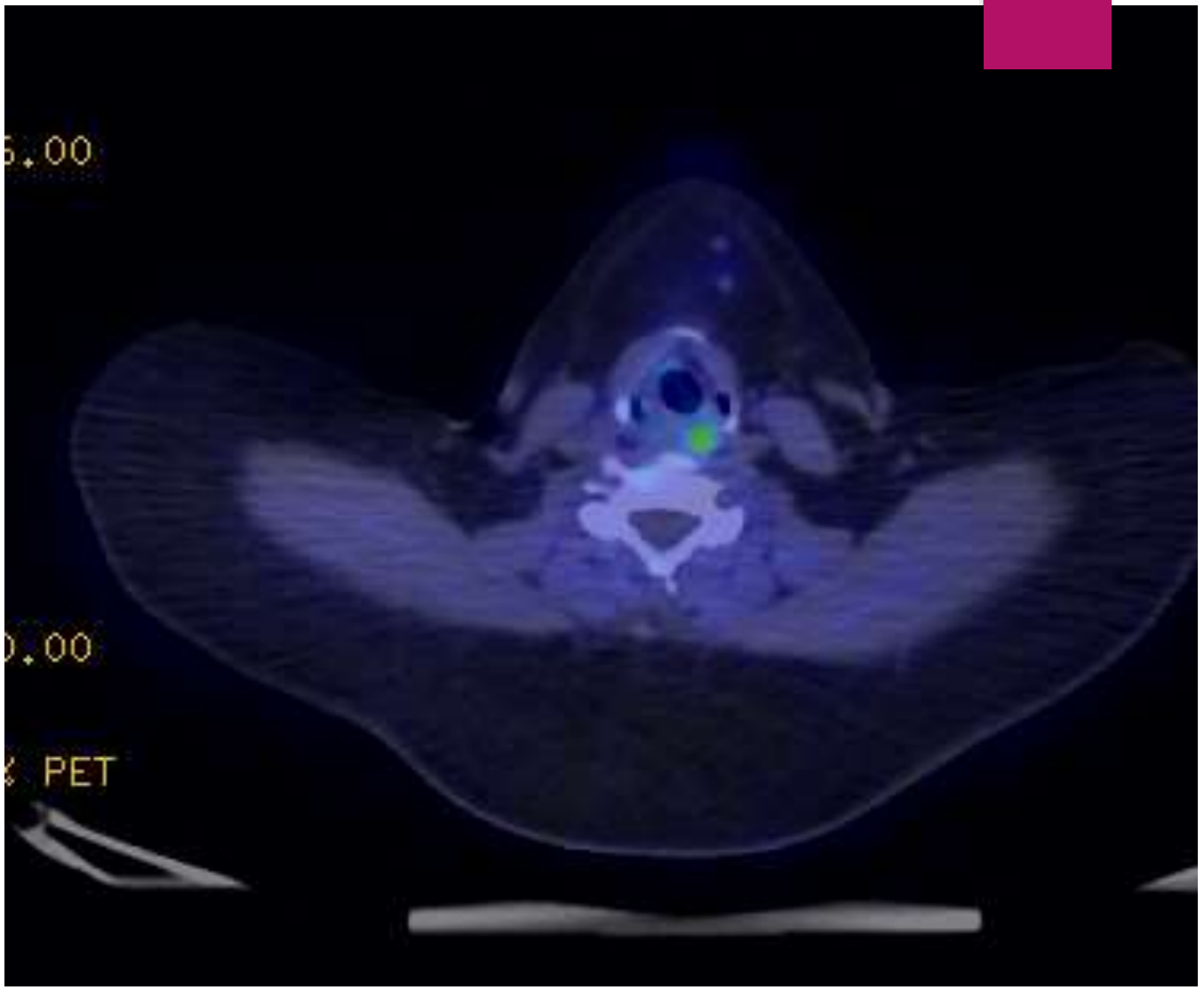
- 1-3% patients not cured post operatively
- Parathyroids may not be found during surgery
- Multigland disease or double adenoma missed
- Genetic cause not considered pre-operatively

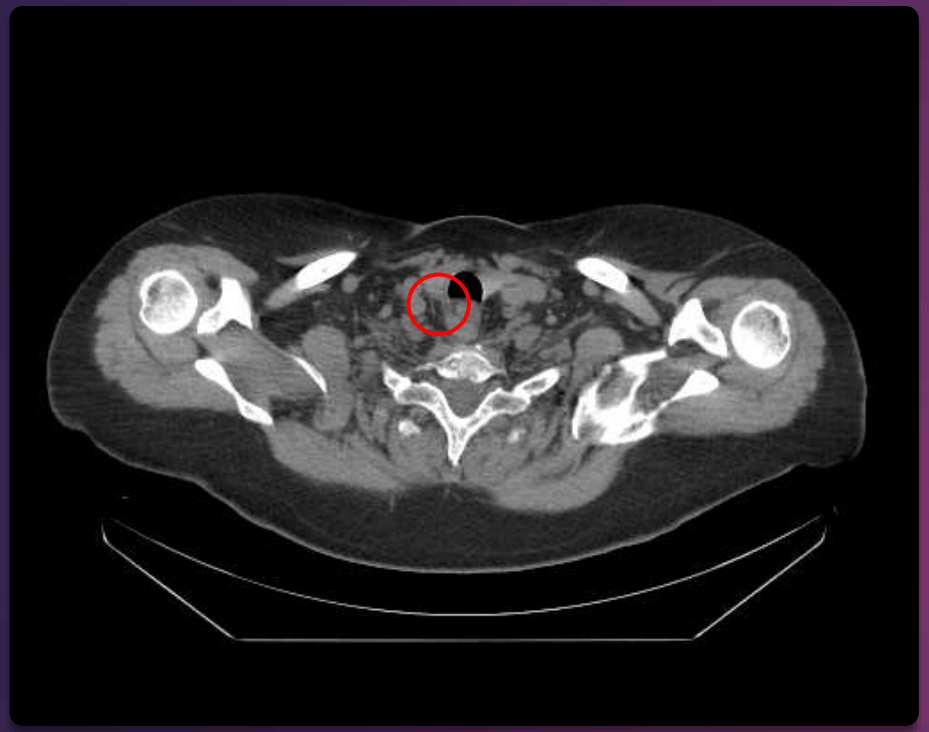


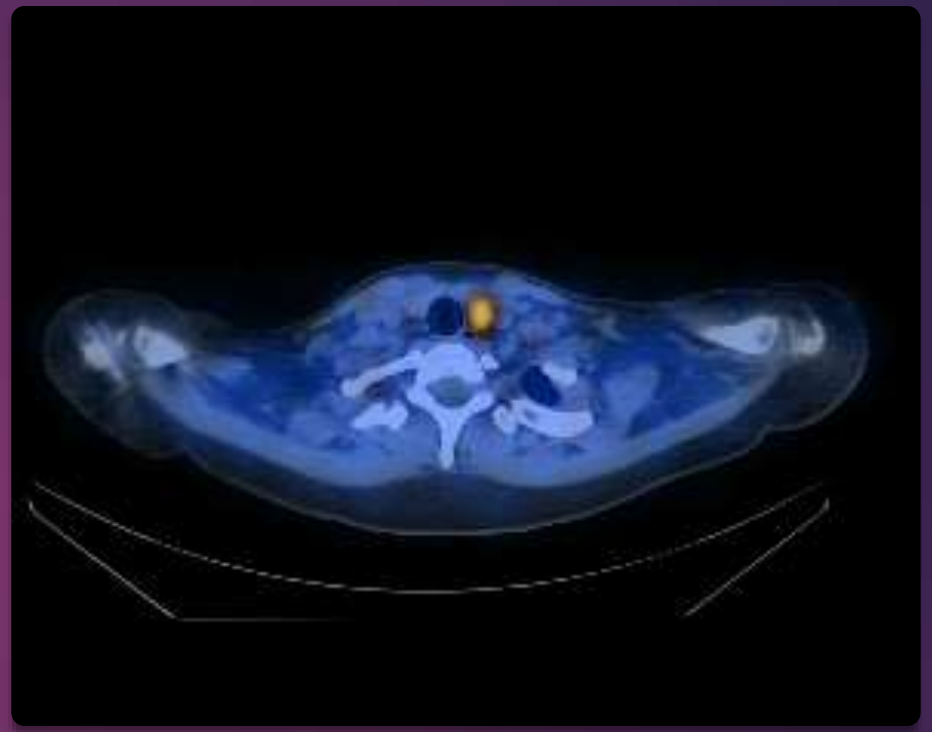
Missed double adenoma

Persistent disease

- Imaging is essential if considering redo surgery
- Risks of operating significantly increased
- Only operate if there is a target
- Repeat USS and SPECT-CT
- If negative – Choline PET-CT
- Review scans with radiologists





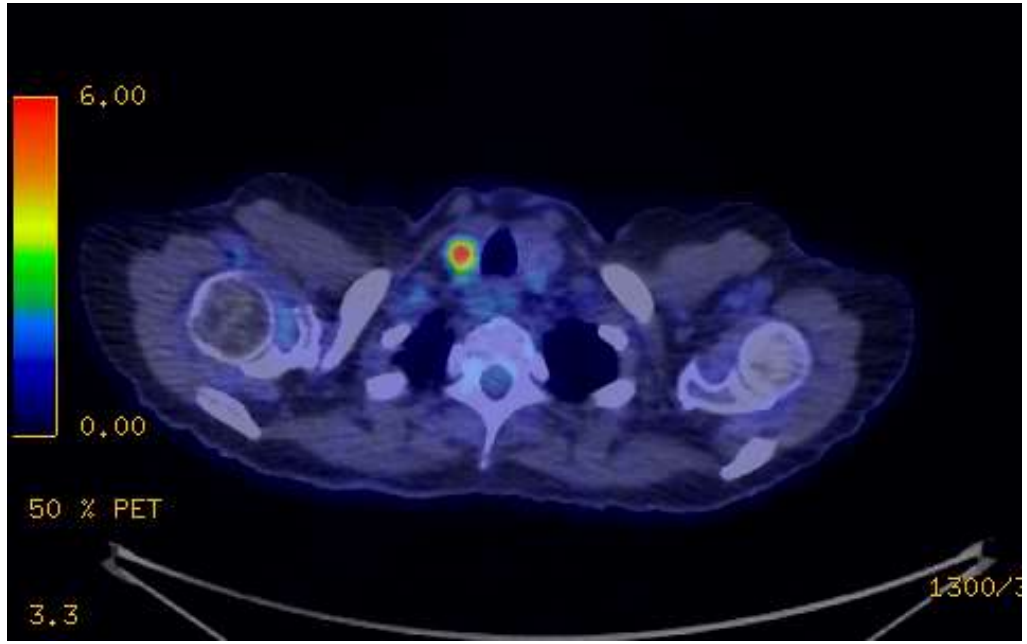


Read the report…review the scans

Thyroid nodule referrals

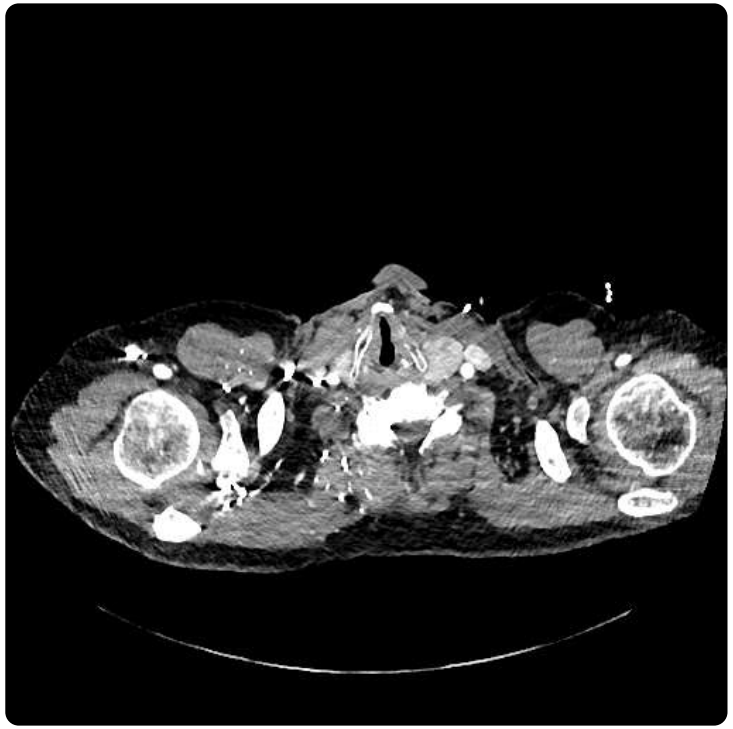
- Direct GP referral to ultrasound
- Incidental finding on imaging – CT / MRI / PET-CT

- One stop clinic with ultrasound support



Reports that help surgeons

- Size of thyroid
- Classification of thyroid nodules (BTA / TIRADS)
- FNA performed
- Lymph node assessment (central and lateral)
- Any suggestion of a retrosternal goitre
- Any other concerning features in the neck



Retrosternal goitres

Ultrasound in thyroid cancer

- First line imaging modality
- Evidence of extra-thyroidal extension
- Bilateral disease
- Lymph node involvement
- Any indication tracheo-oesophageal involvement

Why ultrasound helps

- Concurrent FNA
- Further imaging prior to surgery
  - MRI
  - CT
- Surgical planning
  - Thyroid cancer subtypes

Summary

- Close collaboration between radiology and surgical teams is vital
- Anatomical information on reports is very helpful
- Opinions also valuable!