Contemporary Endocrine Imaging

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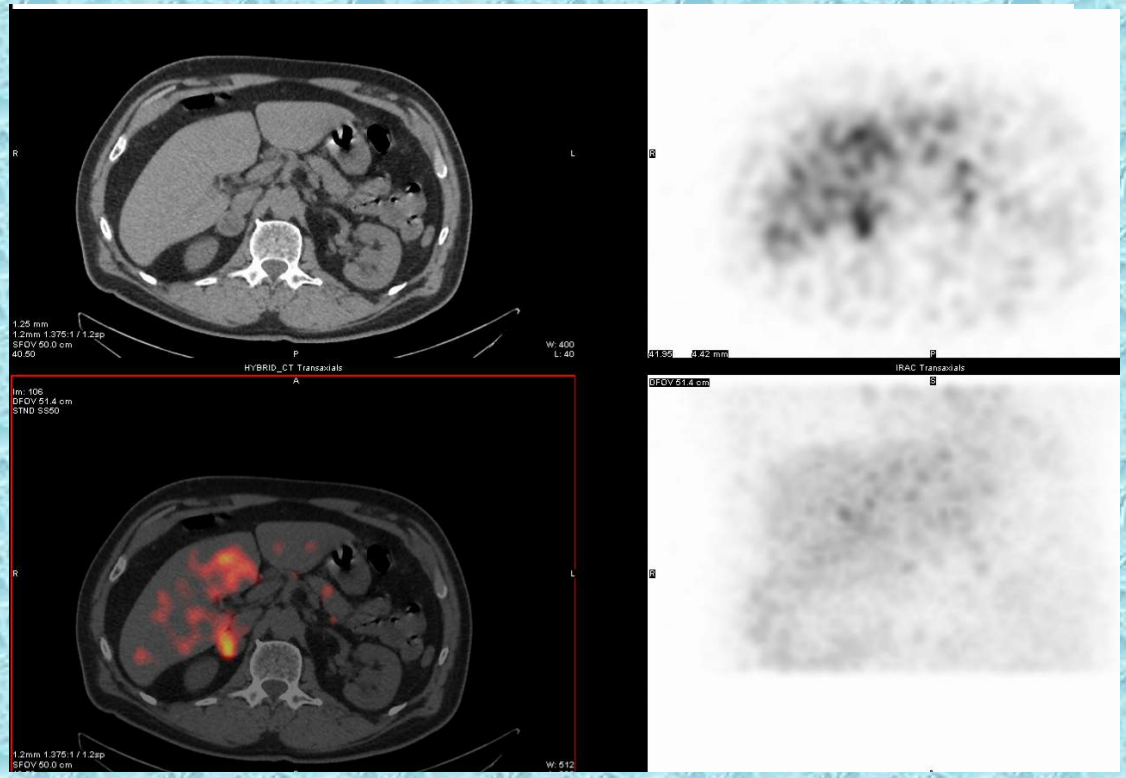
Contemporary Endocrine Imaging

- Ultrasound: B Mode/ Doppler/Elastography
- MDCT
- MRI
- Radionuclide Imaging- SPECT/CT
- PET/CT
  - 18F FDG
  - C11 Methionine
  - 18F Choline
  - 68Ga DOTA

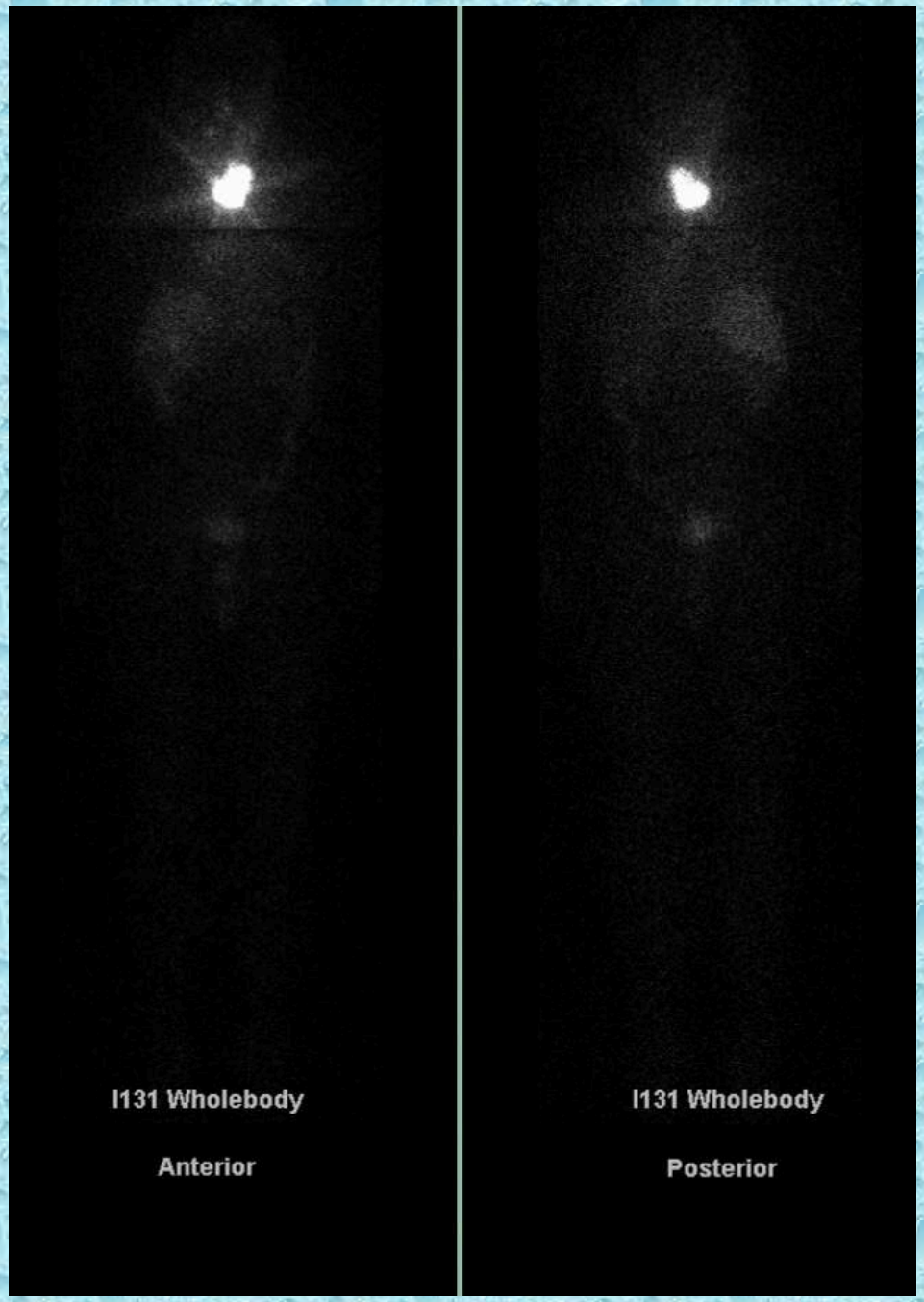
SPECT/CT

- Combines the specificity of functional imaging with the accuracy of anatomical localisation provided by CT.



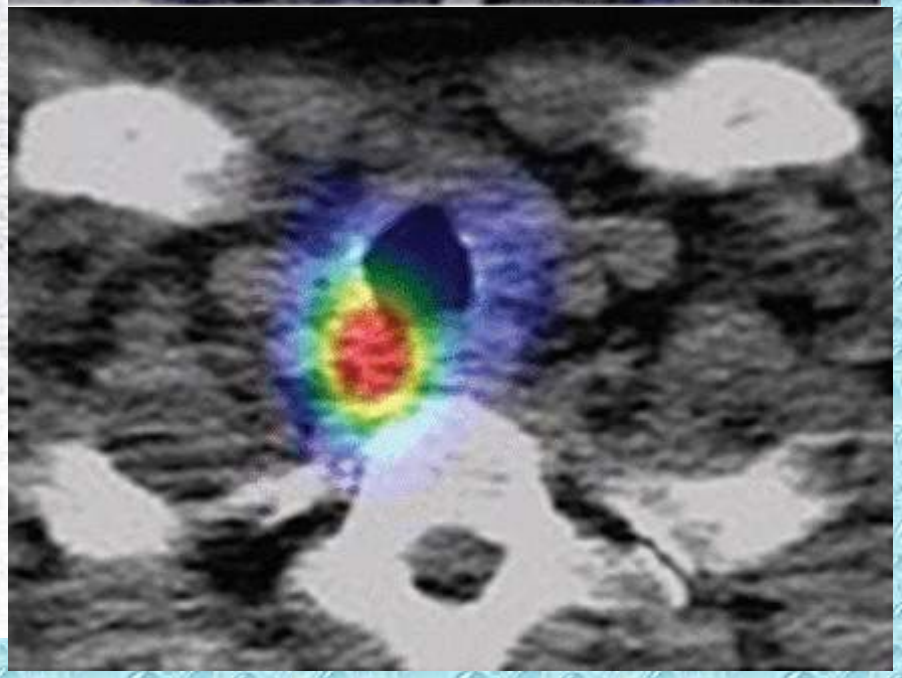
Post Radioiodine Treatment Imaging

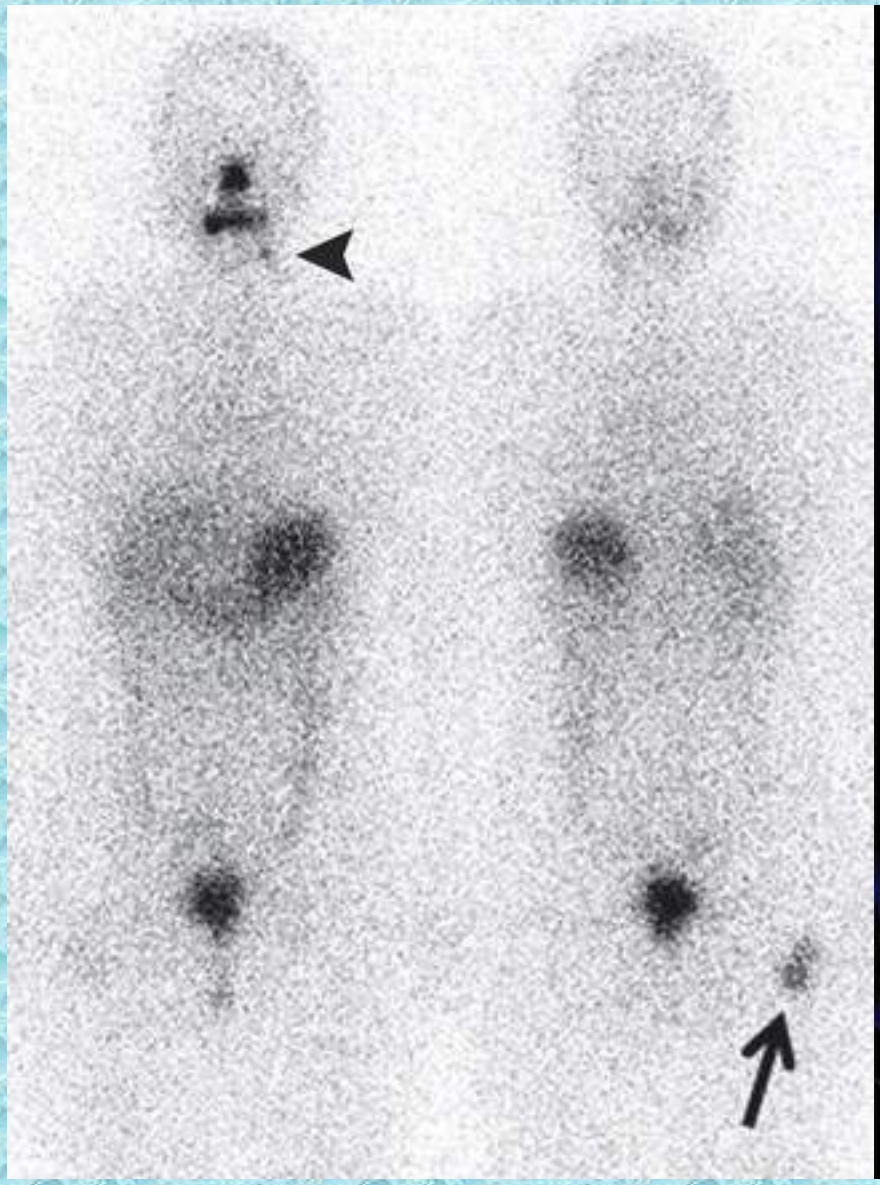
- Conventionally whole body planar imaging 10 days post treatment.
- Can be difficult to interpret:
  - Low resolution
  - Noisy
  - Poor anatomical definition
  - Physiological uptake

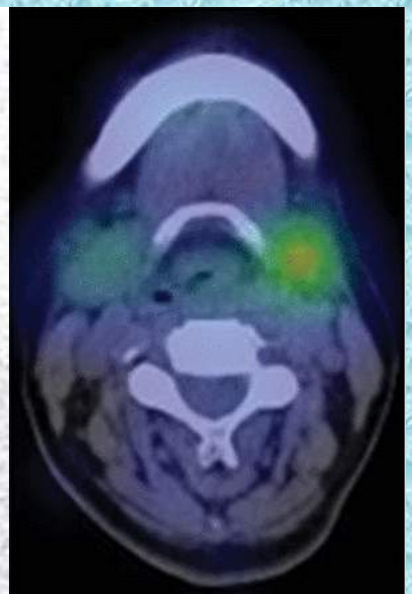

I131 Wholebody
Anterior
I131 Wholebody
Posterior

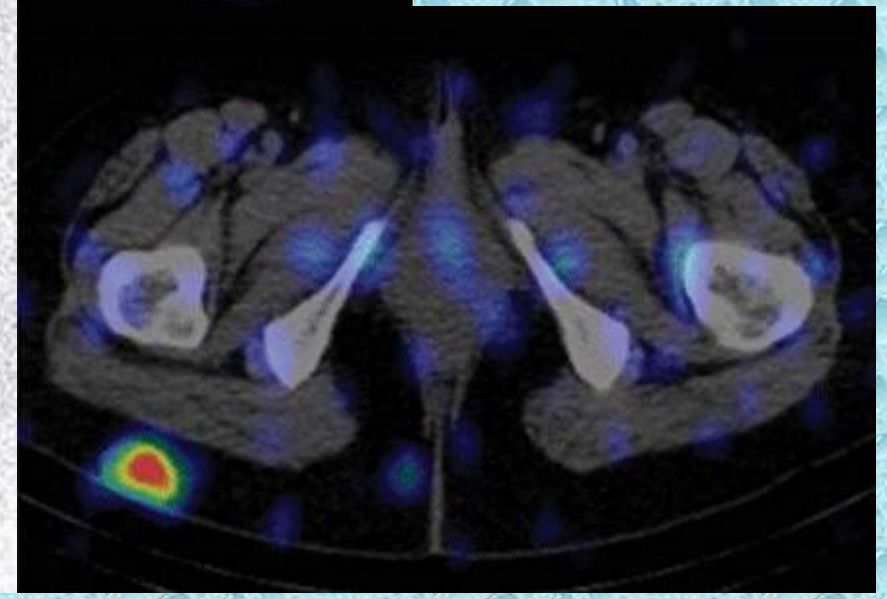
Thyroid: Post 131I Radioiodine Treatment Scans

- Uptake of radioiodine in LN and distant metastases is associated with a favorable prognosis.
- Demonstration of disease is essential to ensure optimum follow up and management







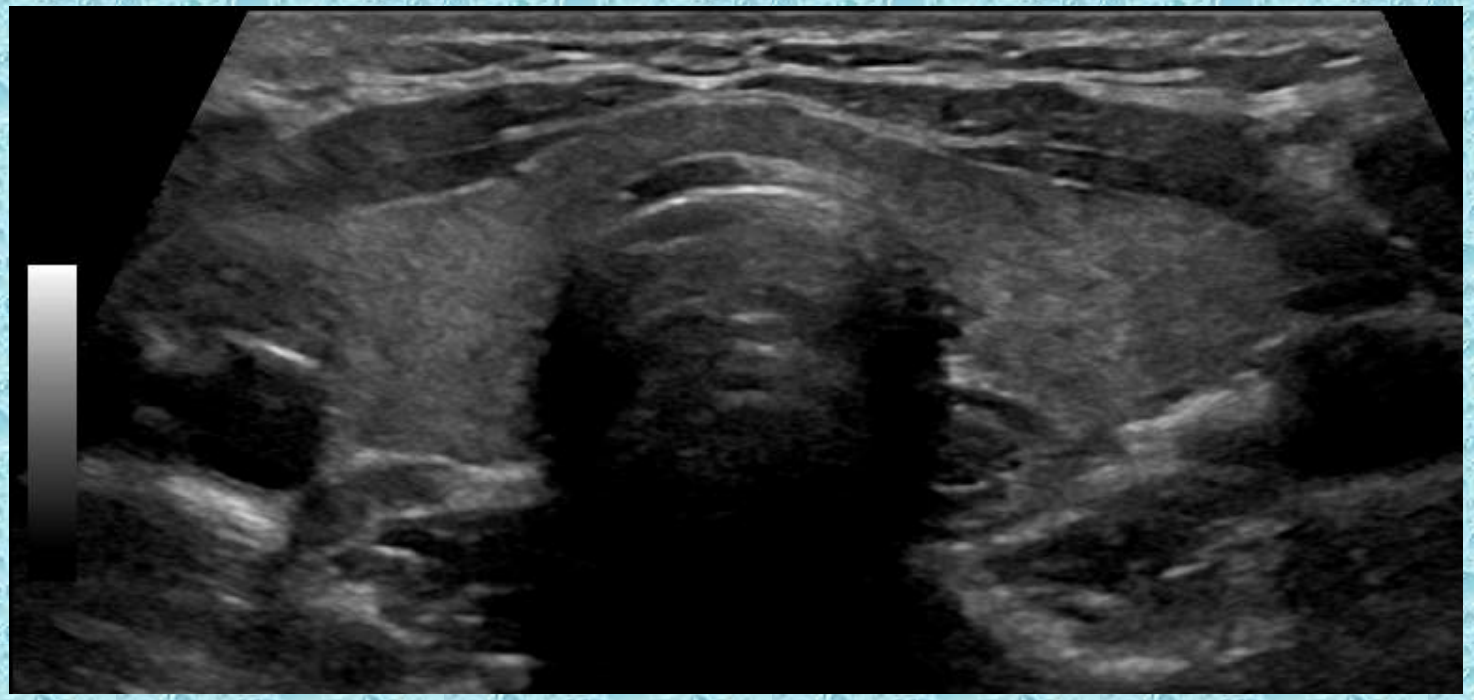


The Organs

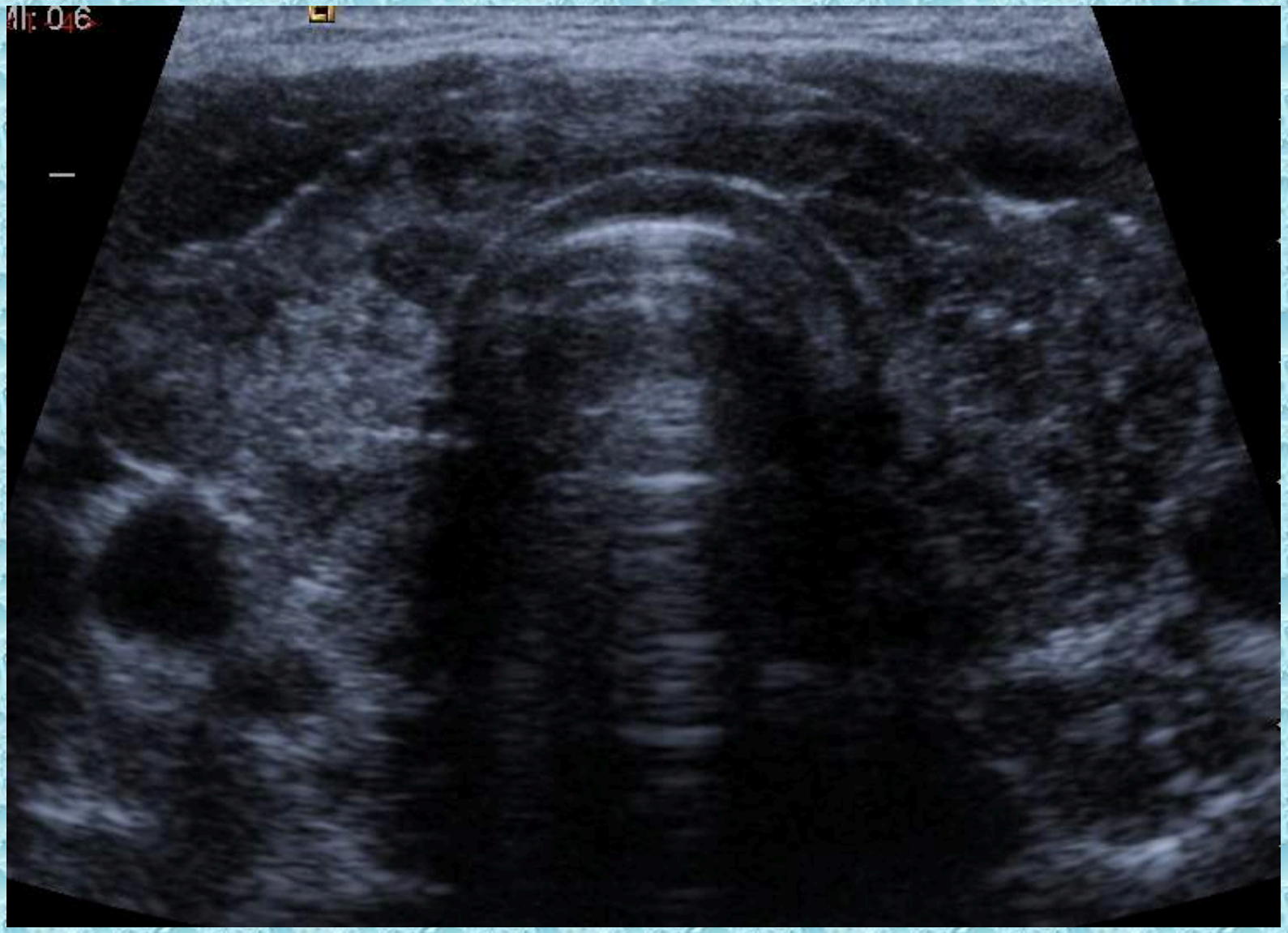
- Thyroid
- Parathyroid
- Adrenal
- NETs

Thyroid: Nodule Assessment

- Ultrasound remains the initial and usually the definitive imaging modality for nodule assessment



Thyroiditis



Thyroid: Nodule Assessment

- Ultrasound remains the initial and usually the definitive imaging modality for nodule assessment
  - B Mode
  - Colour Doppler
- Key imaging challenge:

  Can US accurately characterise the clinically palpable nodule?

Guidelines for the management of thyroid cancer

Third edition

Perros P, Colley S, Boelaert K, Evans C, Evans RM, Gerrard GE, Gilbert JA, Harrison B, Johnson SJ, Giles TE, Moss L, Lewington V, Newbold KL, Taylor J, Thakker RV, Watkinson J, Williams GR

British Thyroid Association

July 2014

Ultrasound: U Classification

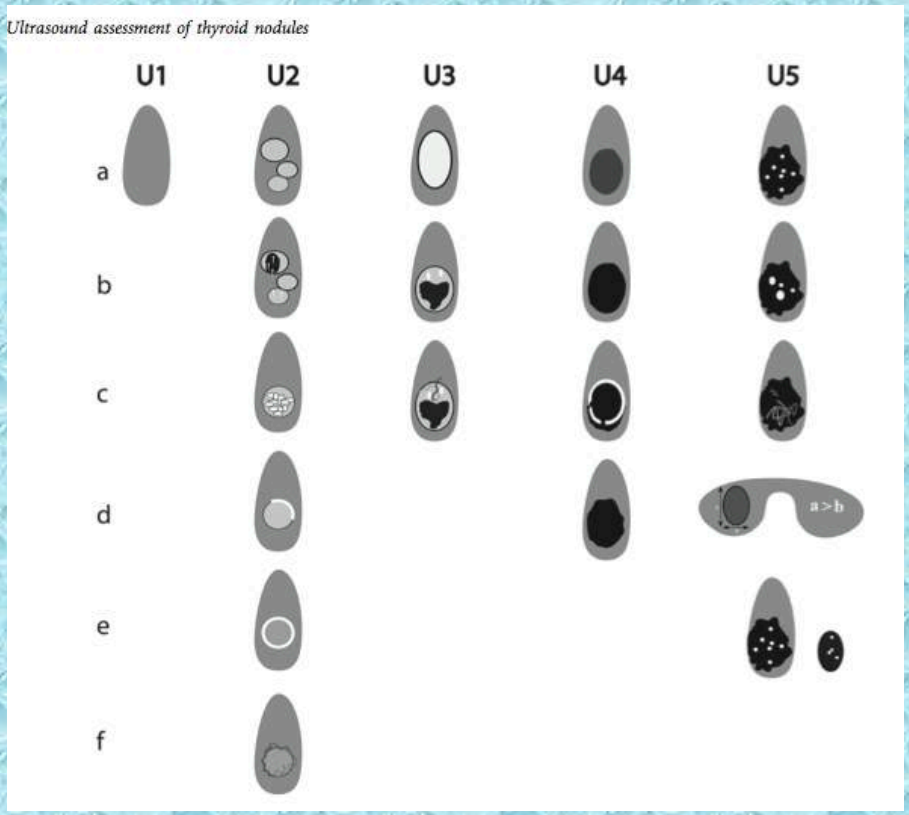
U1. Normal.

U2. Benign:
(a) halo, iso-echoic / mildly hyper-echoic
(b) cystic change +/- ring down sign (colloid)
(c) micro- cystic / spongiform
(d & e) peripheral egg shell calcification
(f) peripheral vascularity.

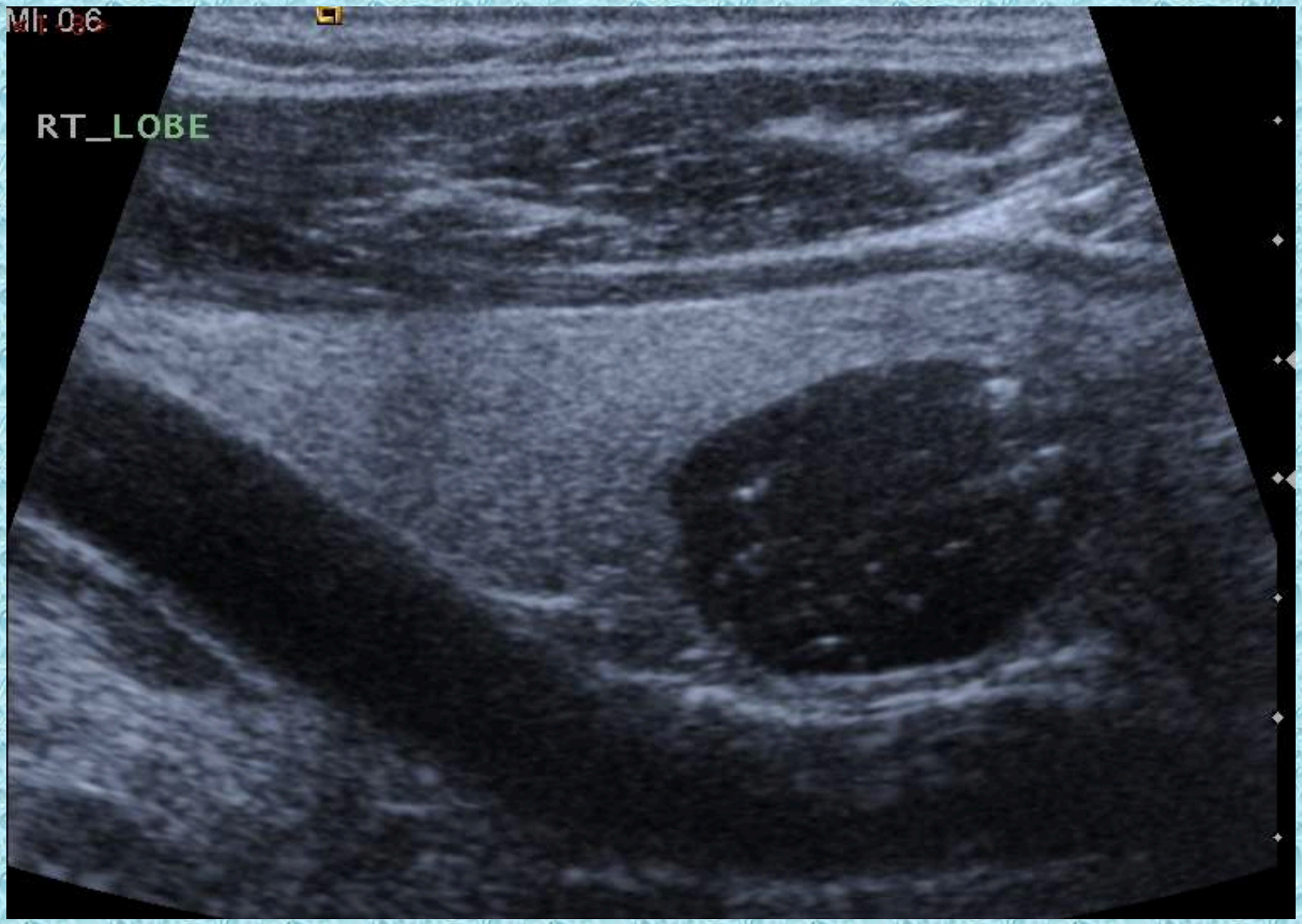
U3. Indeterminate/Equivocal:
(a) homogenous, hyper-echoic (markedly), solid, halo (follicular lesion).
(b) ? hypo-echoic, equivocal echogenic foci, cystic change
(c) mixed/central vascularity.

U4. Suspicious:
(a) solid, hypo-echoic (cf thyroid)
(b) solid, very hypo-echoic (cf strap muscle)
(c) disrupted peripheral calcification, hypo-echoic
(d) lobulated outline

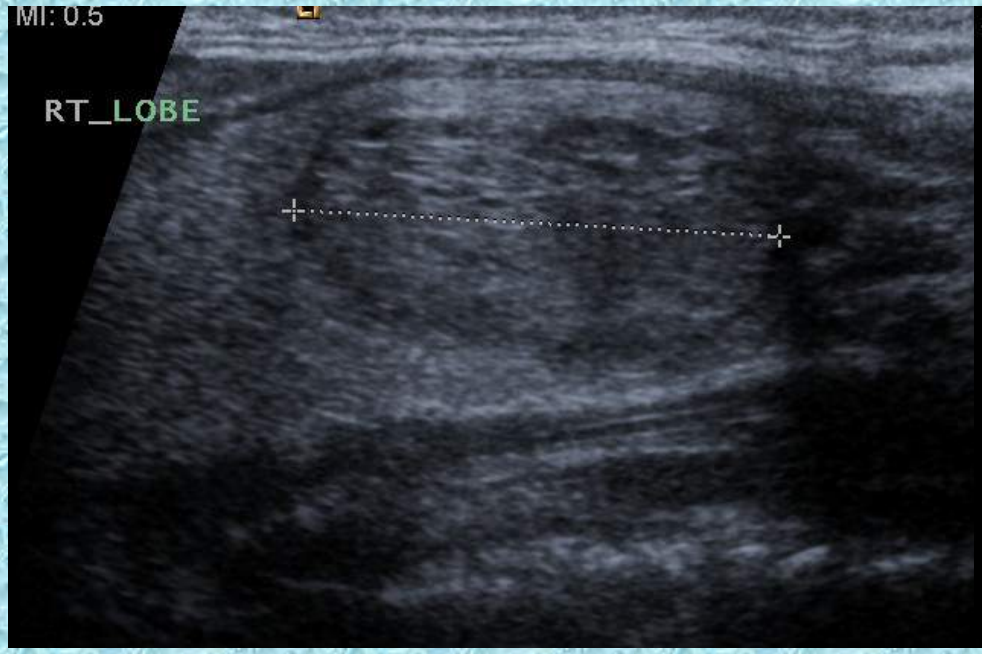
U5. Malignant
(a) solid, hypo-echoic, lobulated / irregular outline, micro-calcification. (? Papillary carcinoma)
(b) solid, hypo-echoic, lobulated/irregular outline, globular calcification (? Medullary carcinoma)
(c) intra-nodular vascularity
(d) shape (taller >wide) (AP>TR)
(e) characteristic associated lymphadenopathy

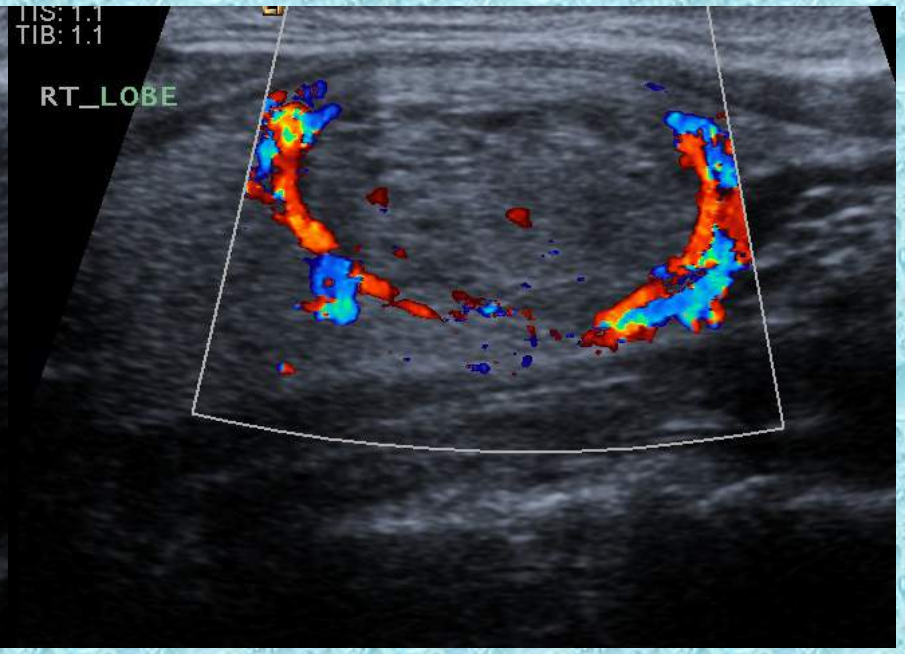


U2:Colloid cyst

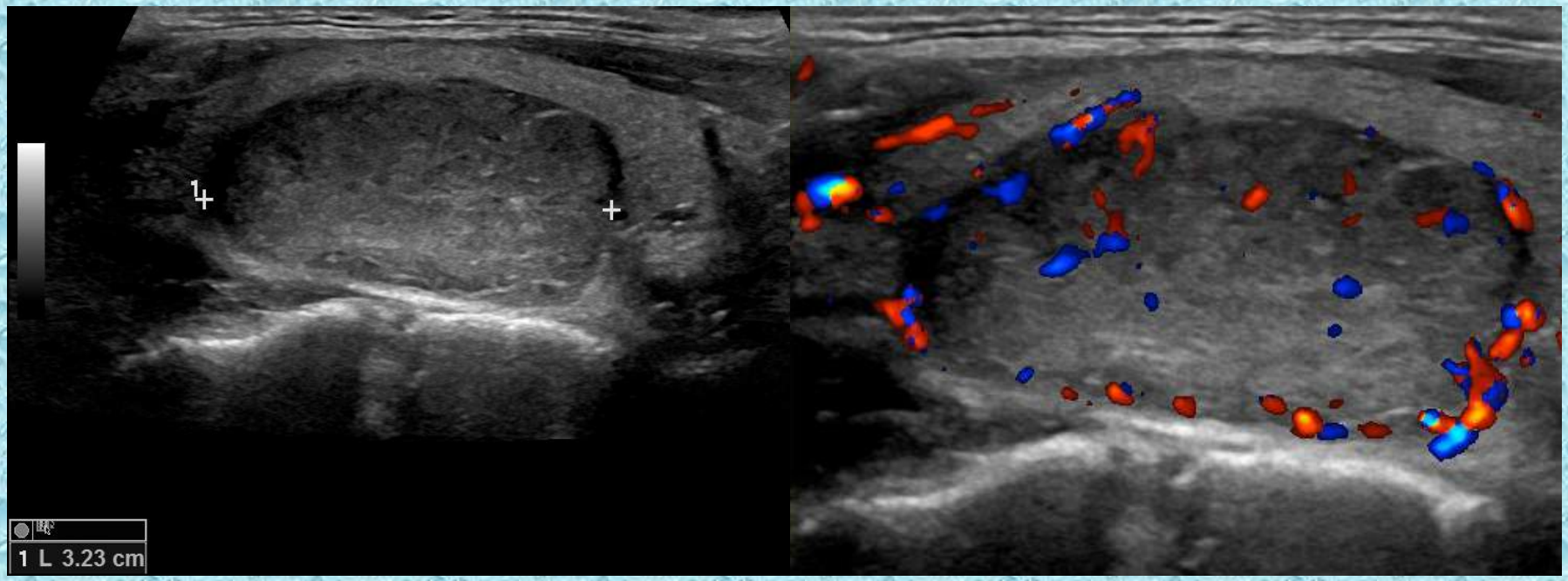


U2: Hyperplastic nodule

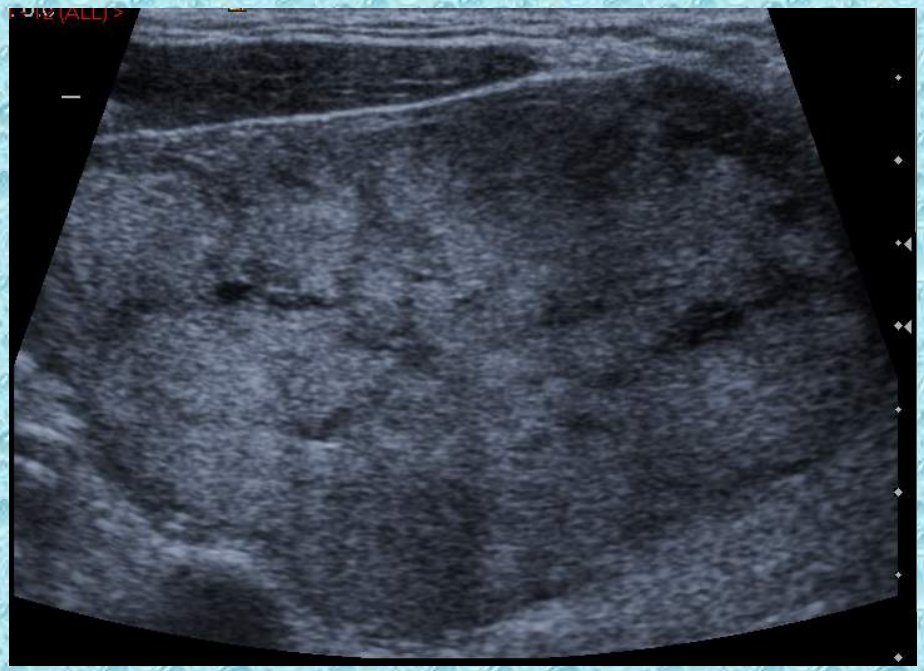


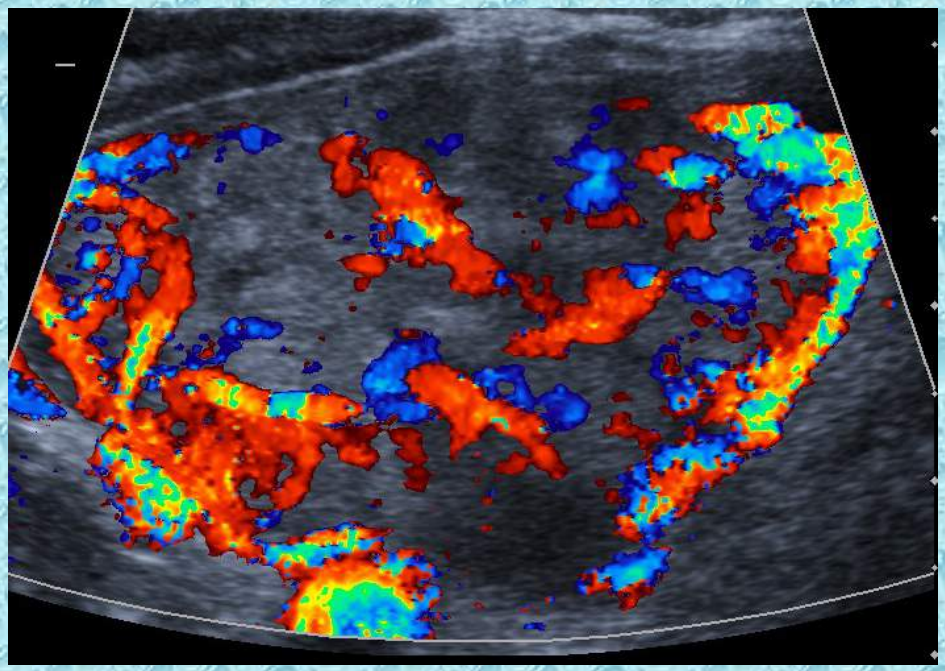


U4: Suspected Malignant Nodule

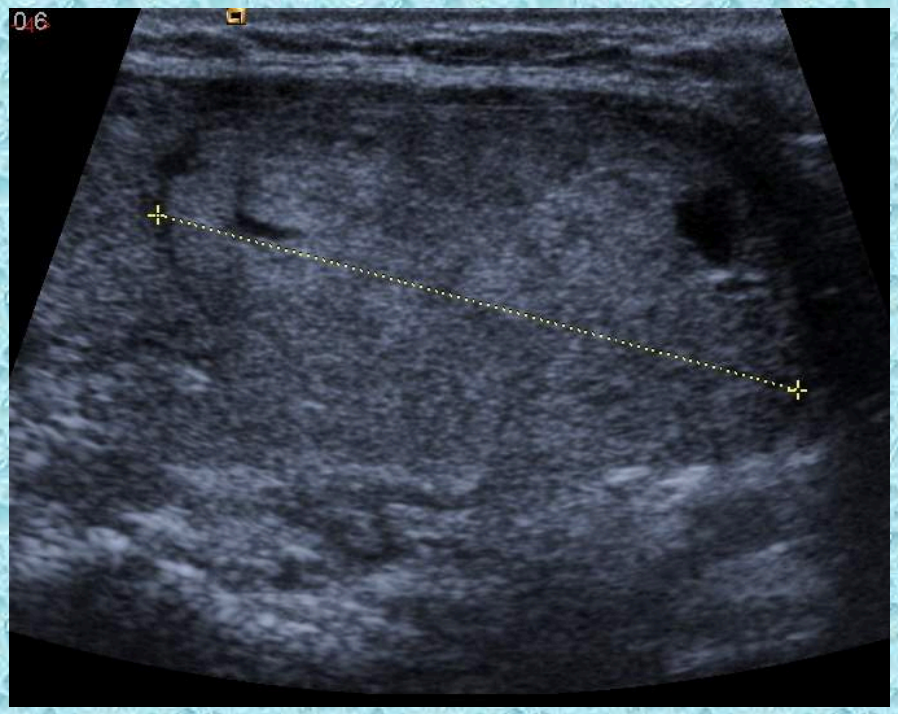


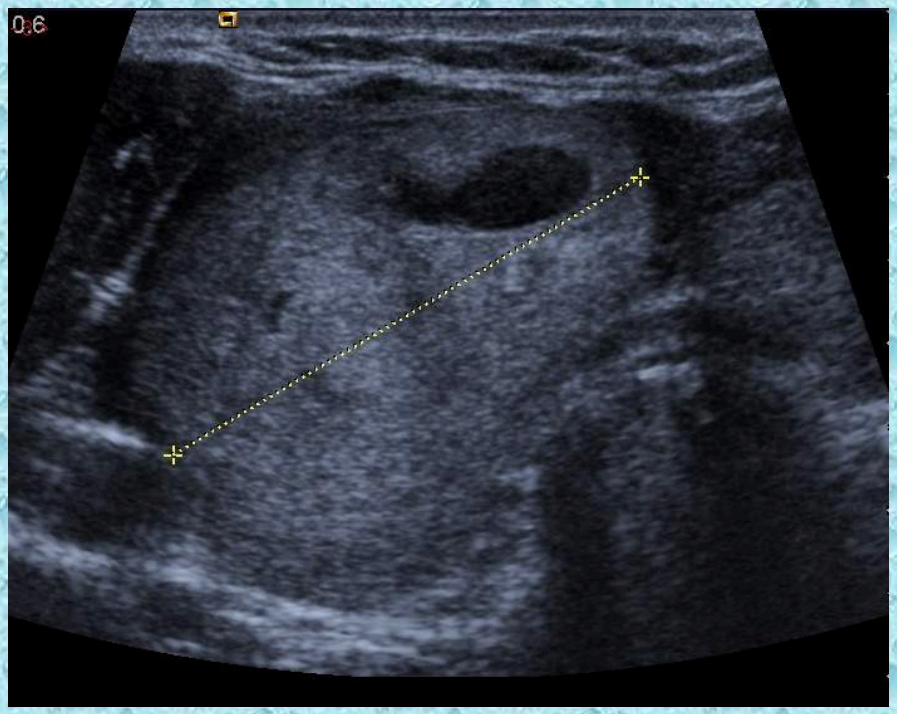
U5: Papillary Carcinoma





U3:?Hyperplastic ?Follicular tumour





i US appearances that are indicative of a benign nodule (U1–U2) should be regarded as reassuring not requiring fine needle aspiration cytology (FNAC), unless the patient has a statistically high risk of malignancy (Chapter 3.7) (**2++, B**).

IMPLICATION: CLINICIANS WILL REFER PATIENTS WITH A THYROID NODULE FOR ULTRASOUND BEFORE PERFORMING FNA

Impact of U Reporting

- Reporting Radiologist/Sonographer required to give an opinion rather than a descriptive report.
- Increased clinician confidence.
- Facilitates different operators following up individual patients.
- Risk of increased number of U3 categorisation.

Elastography

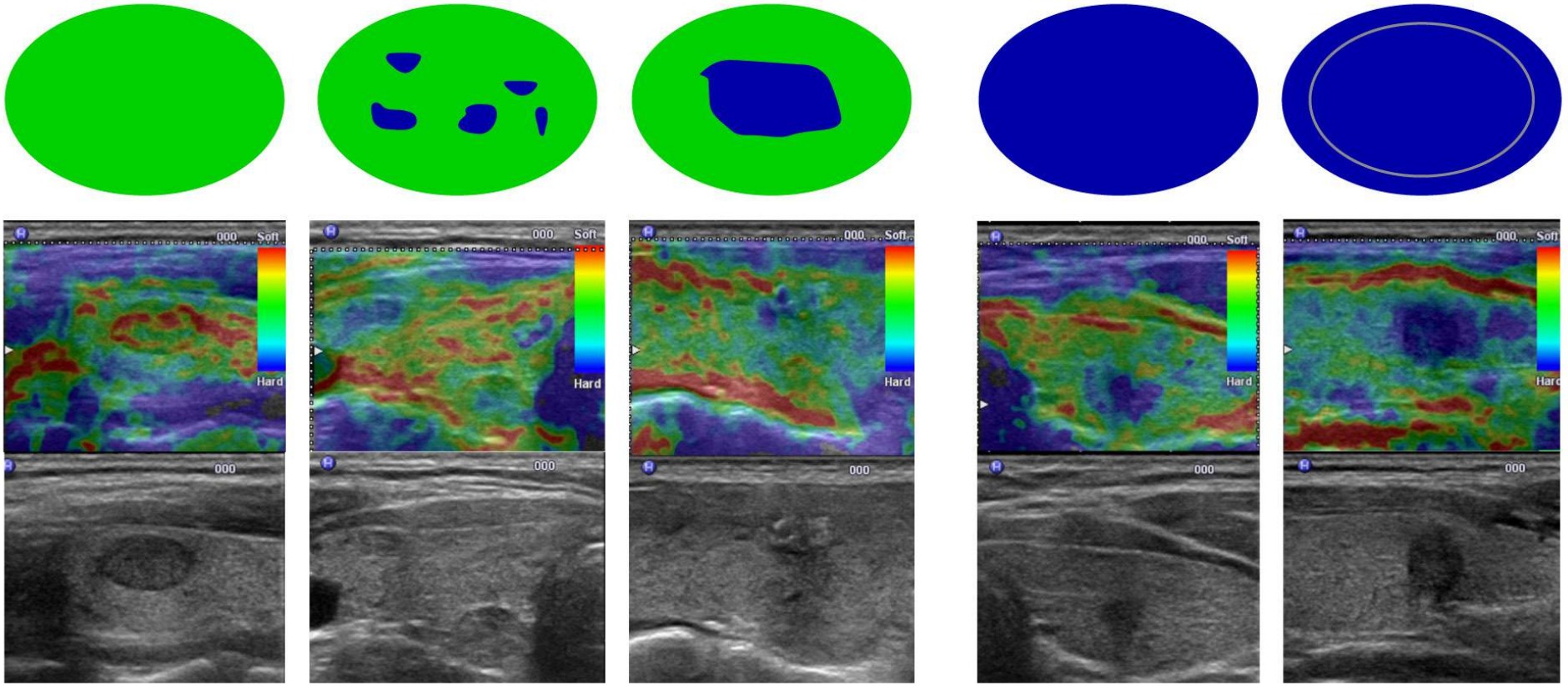
- Ultrasonic assessment of tissue stiffness
- Malignant nodules tend to be hard.

Elastography

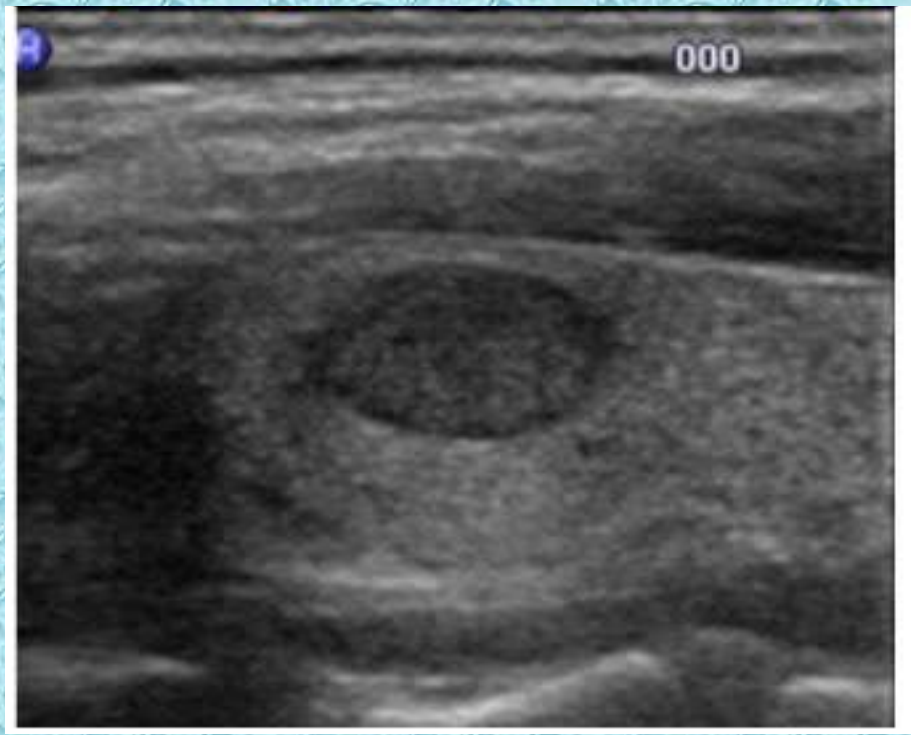
- Encompasses a number of different techniques
- Strain elastography
- Shear wave elastography
- Acoustic Radiation Force Impulse Imaging

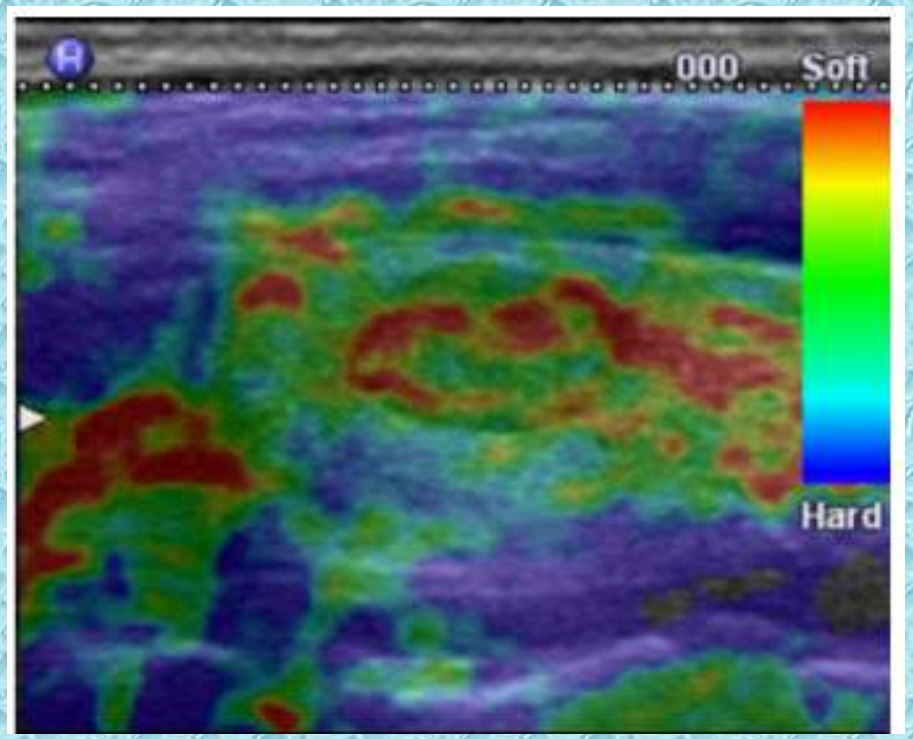
Strain Elastography

- External palpation with probe – results in axial displacement of tissue by mechanical stress
- Tissue deformation from the stress is measured.
- Elastic image is superimposed on the B mode image
- Tissue stiffness displayed as a continuum of colours (Red to Blue)
- Elasticity assessed by:
  - Visual colour scoring
  - Strain Ratio

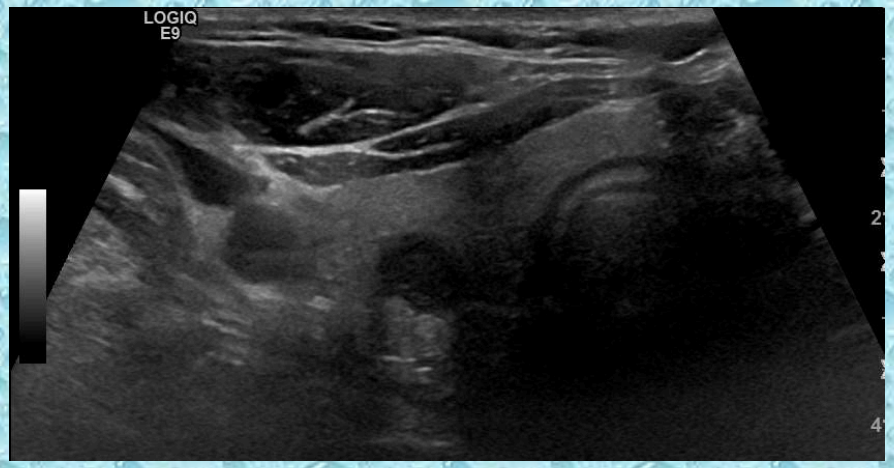

Soft
Hard
Score 1
Score 2
Score 3
Score 4
Score 5

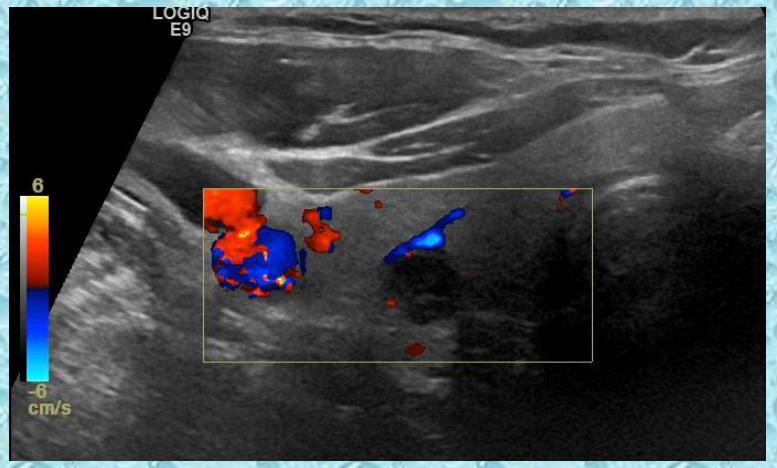
Elastography: Benign

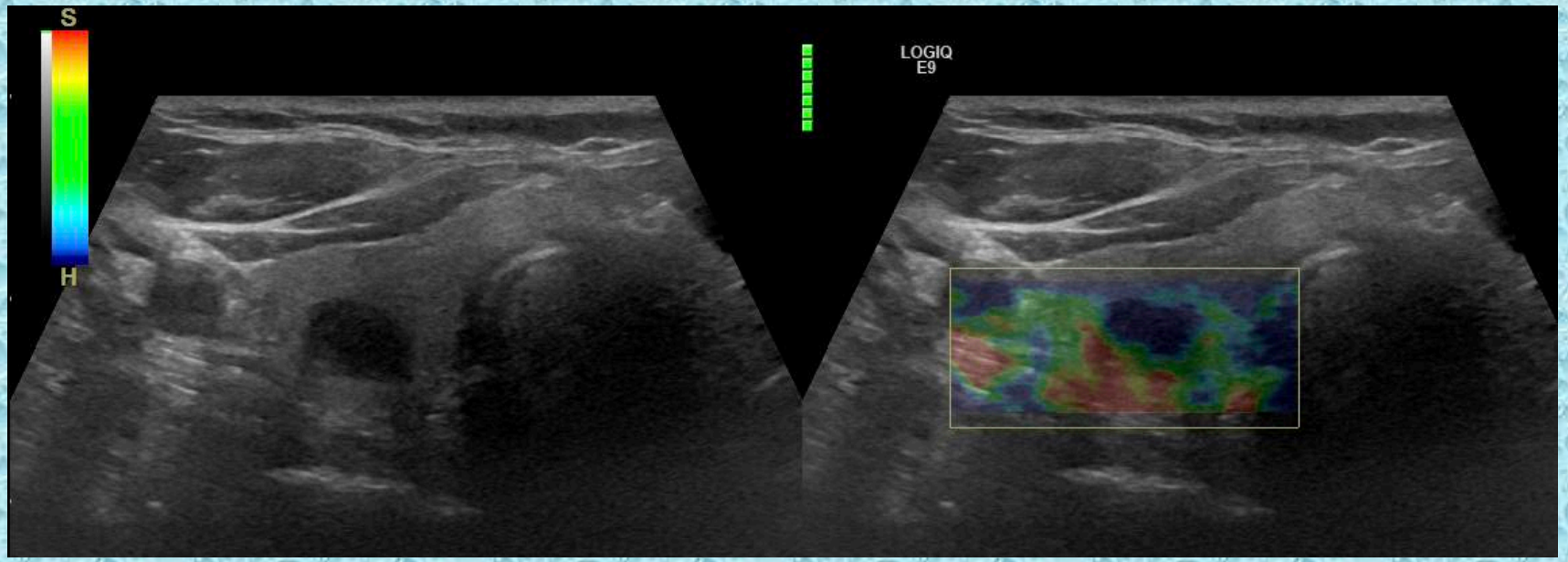




Papillary Carcinoma







Elastography: Potential Advantages

- Additional criterion to aid nodule categorisation.
- Reduce the number of FNAs.
- Target specific areas within a nodule to biopsy.

Elastography: Is it useful?

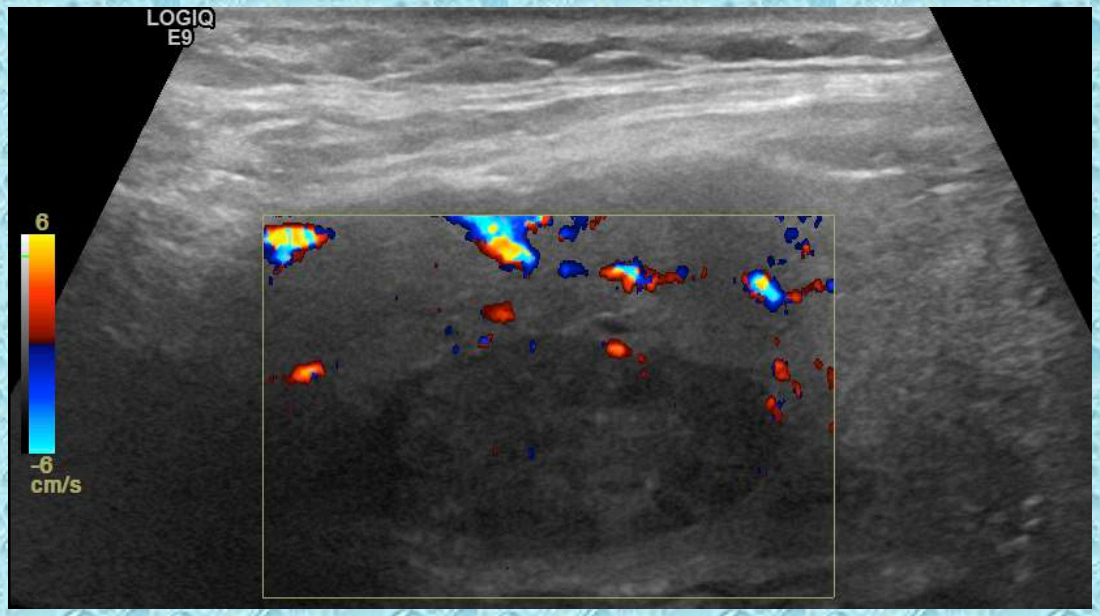
- Elastography as a stand alone tool is inferior to conventional ultrasound.
- Sensitivity/Specificity for detecting malignancy based on elastography score 2-3: 86%/66.7%
- High negative predictive value- sensitivity 98% for benign nodules based on elastography score 1-2

Ghajarzadeh et al. AJR (2014) Diagnostic accuracy of sonoelastography in detecting malignant thyroid nodules: a systematic review and meta-analysis.

NHS
National Institute for Health Research

The Efficacy and Cost effectiveness of Real Time Ultrasound Elastography in The Investigation Of Thyroid Nodules and the diagnosis of thyroid cancer.

ElaTION


LOGIQ
E9
6
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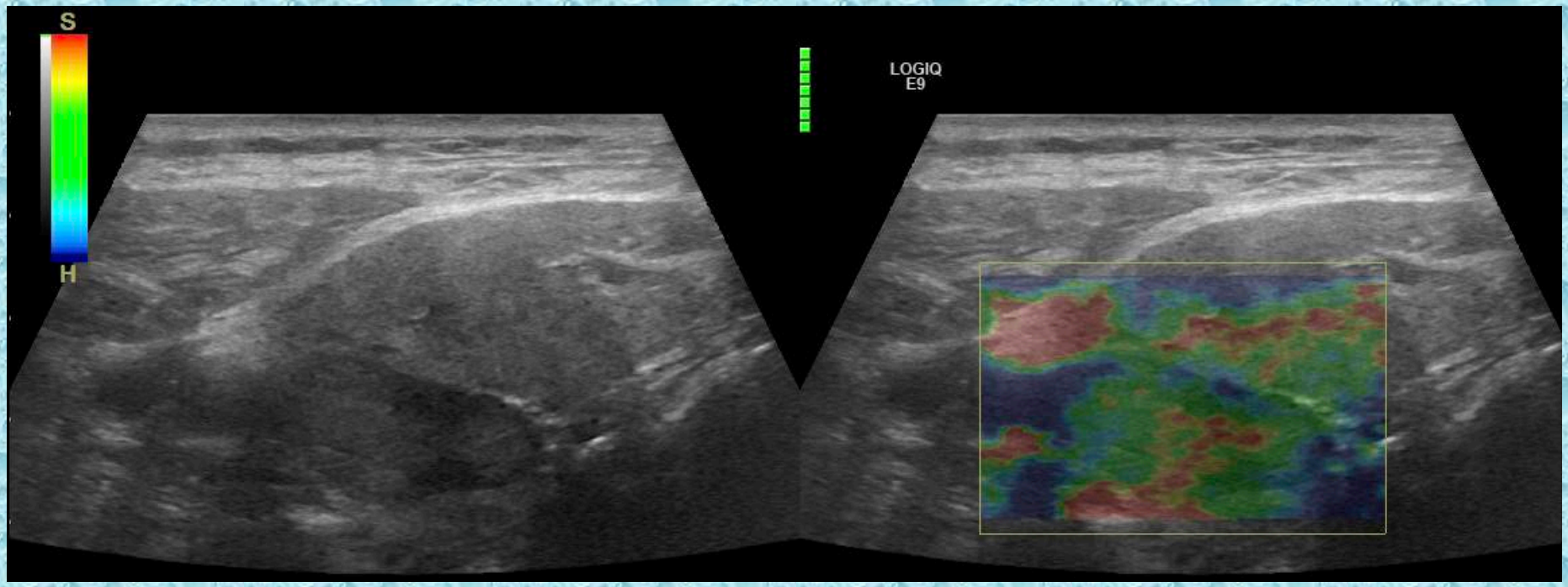
cm/s


S
H
LOGIQ
E9

Parathyroid Adenoma Localisation

- "The only localisation required for a patient with primary hyperparathyroidism is the localisation of an experienced endocrine surgeon"

Doppman J. Reoperative parathyroid surgery; localisation procedures. Prog Surg. 1986;18:117-132

Preoperative localisation: Disadvantages

- High non localisation failure rates.
- Expense.
- Radiation exposure.
- Increased time taken to surgery.

Preoperative Localisation: Advantages

- Minimally invasive parathyroidectomy.
- Local anaesthesia vs GA
- Shorter operative times.
- Reduced complication rates.
- Shorter hospital stays.
- Higher localisation rates

Primary Hyperparathyroidism With Negative Imaging

A Significant Clinical Problem

Heather Wachtel, MD, Edmund K. Bartlett, MD, Rachel R. Kelz, MD, Isadora Cerullo, BA, Giorgos C. Karakousis, MD, and Douglas L. Fraker, MD

(*Ann Surg* 2014;260:474–482)

- Retrospective study (2002-2014)
- 2185 patients
- Non localisation in 836 pts (38.3%)
- Intraoperative success rate (93.9% vs 95.6%)
- Cure rate (96.2% vs 97.7%)
- Increased incidence of parathyroid hyperplasia and reduced incidence of single adenoma.

Parathyroid Adenoma Localisation

- Ultrasound
- 99mTc Sestamibi
- Multiphasic contrast enhanced CT (4D CT)
- (PET imaging)

Parathyroid Localisation

- Primary hyperparathyroidism (De novo)
- Recurrent Primary hyperparathyroidism
- PHT (As part of MEN syndrome)

Parathyroid Localisation: Ultrasound

- Initial imaging investigation of choice.
- Sensitivity for single adenoma: Upto 80%

Ultrasound: Parathyroid Adenoma

99mTc Sestamibi

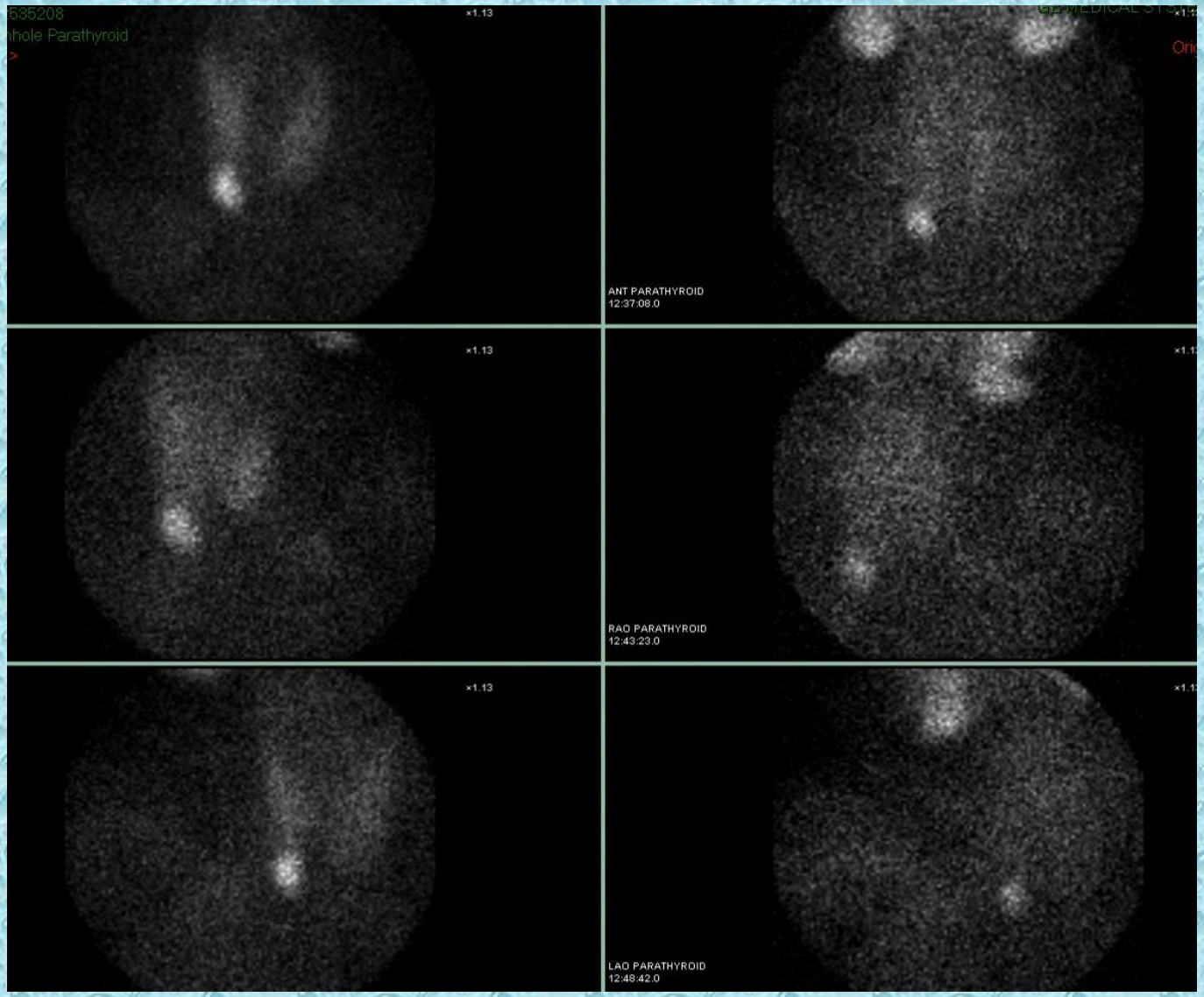
- PHT: Patients with negative or equivocal U/S
- All patients with recurrent PHT even if U/S identifies an adenoma
- All patients with PHT as part of MEN syndrome

99mTc Sestamibi

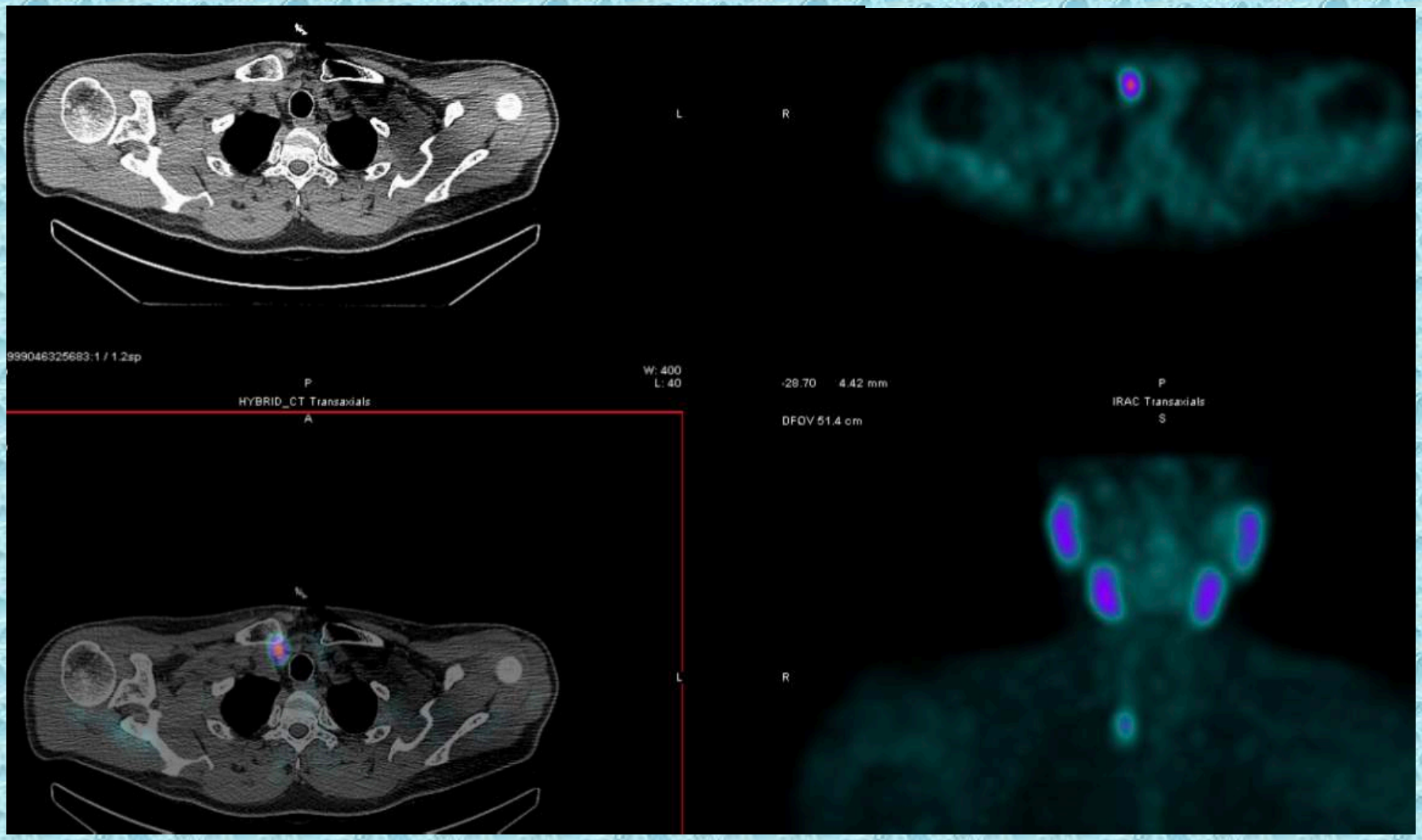
- Planar
- SPECT/CT

- Sensitivity 88% (Upto 95% when combined with preoperative ultrasound)

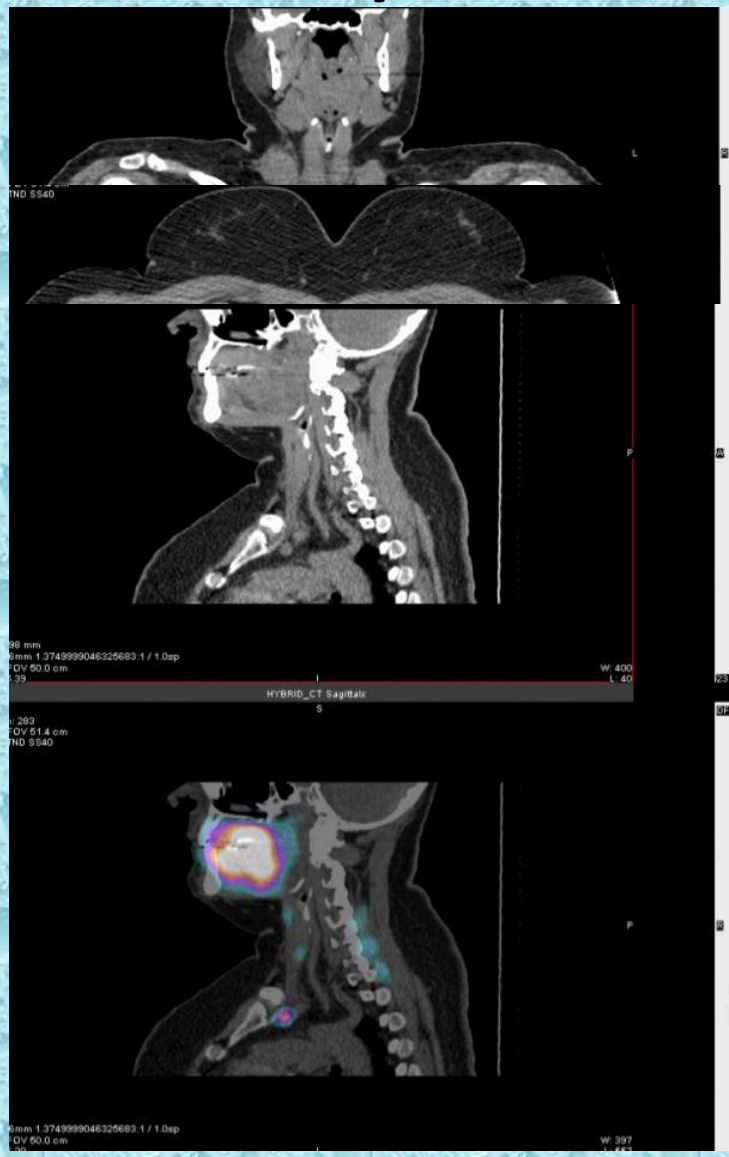
Sestamibi: Planar



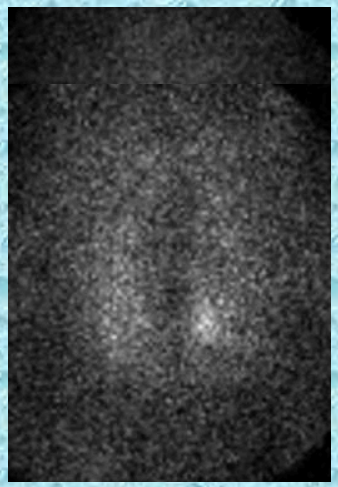
Sestamibi: Planar and SPECT

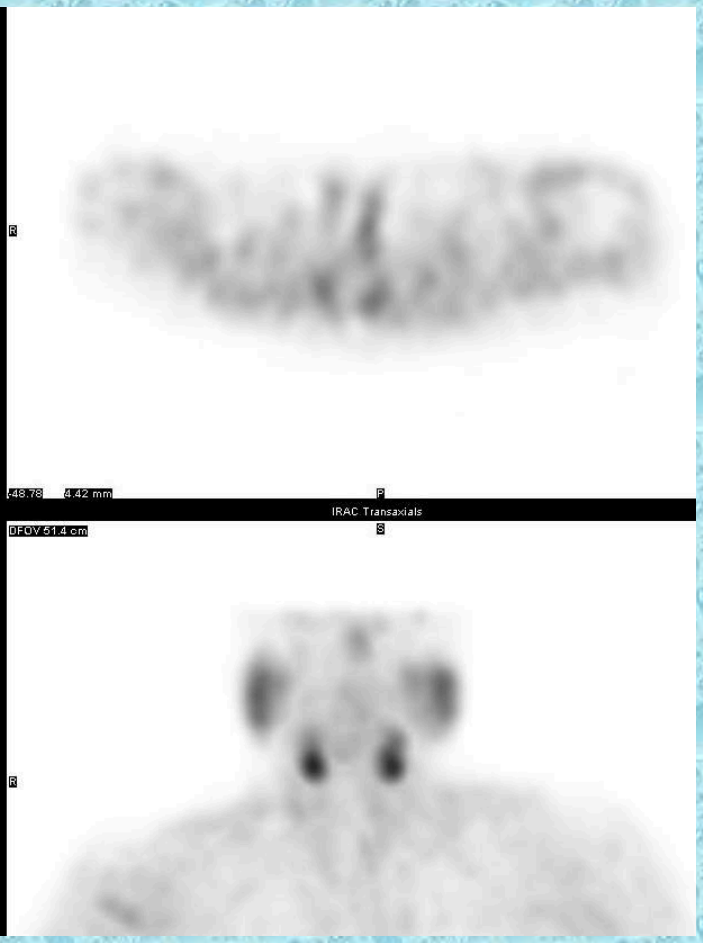


Ectopic Parathyroid Adenoma



Parathyroid: SPECT/CT

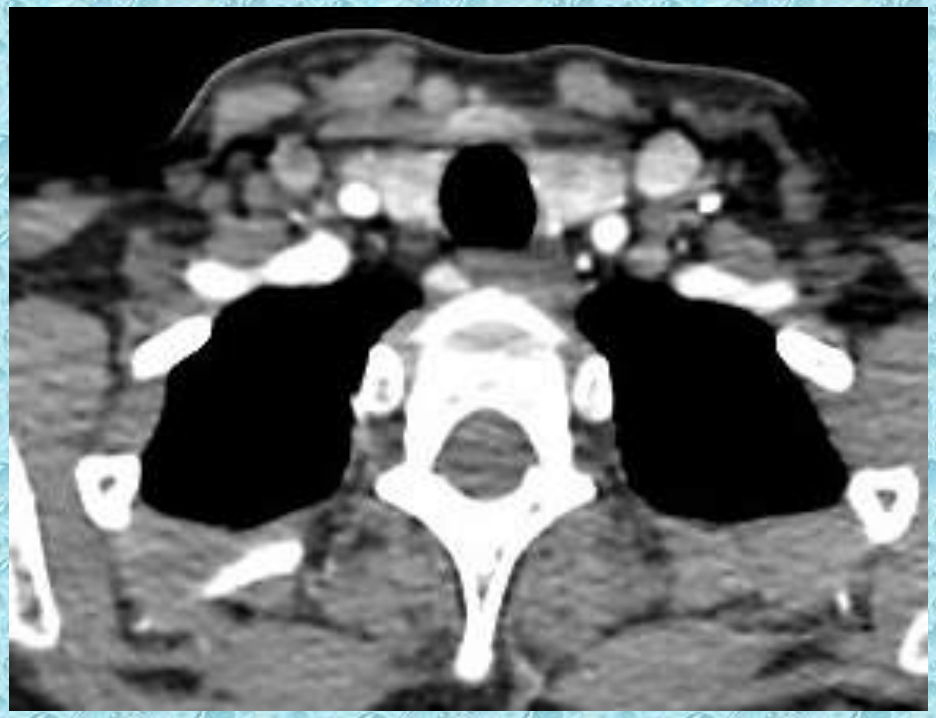


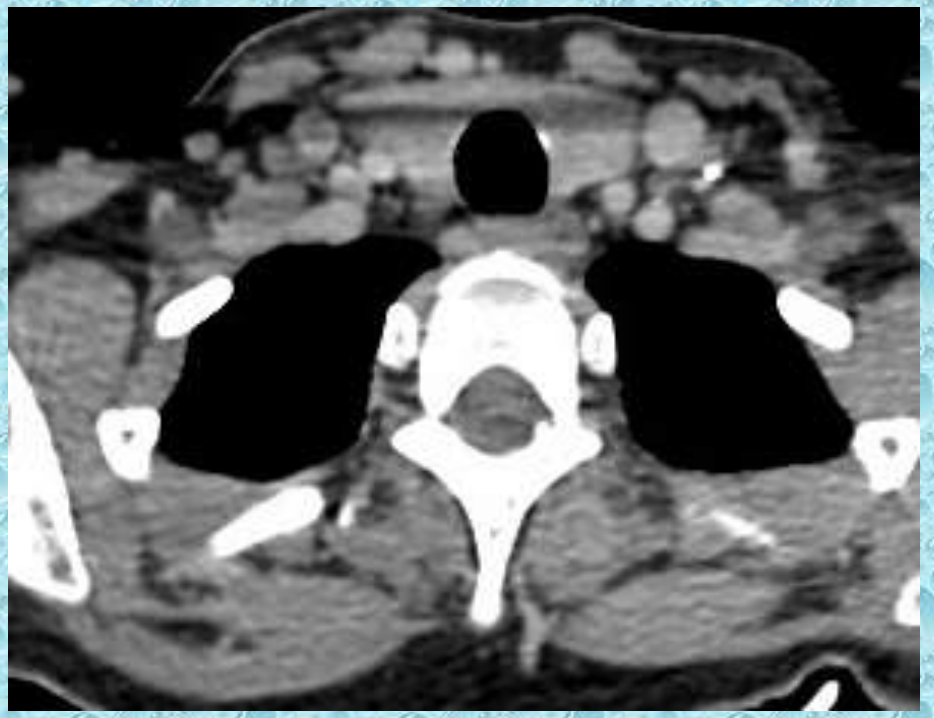


4D CT

- Indication: All patients with negative US & negative/equivocal SPECT.
- Contrast enhanced CT (Arterial, Venous)
- Parathyroid adenoma identified as an arterially enhancing nodule with venous washout.

4D Parathyroid CT





4D CT: How does it shape up?

- Limited data
- Difficult to interpret
- Sensitivity 80-90%

- How useful is it when ultrasound and sestamibi are negative?

Sensitivity 89% in 26 patients with PHT who were operated on who had negative ultrasound and sestamibi scans. Day et al. Surgery 2015.

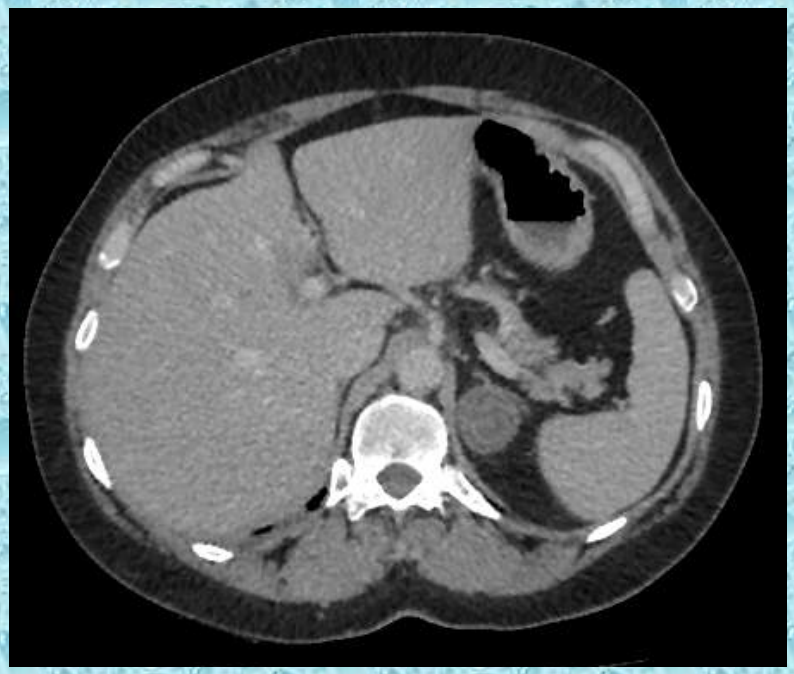
Parathyroid localisation: Negative U/S, Sestamibi and 4D CT

- Interval follow up imaging.
- Venous sampling
- Intraoperative gamma probe following sestamibi injection
- Bilateral neck exploration

- PET imaging

Adrenal Incidentaloma

- Adrenal mass > 1cm discovered incidentally on a cross sectional examination performed for another reason.



Adrenal Incidentaloma

- Radiological “pain in the neck”
  - 5% of CT scans in patients with no known history of malignancy.

Adrenal Incidentaloma

- Part of the incidentaloma epidemic.
- Driven by the relentless increase in the use of cross sectional imaging.
- Investigation and follow up is driven by the fear of missing a serious diagnosis.
- Clinician/Radiology led.

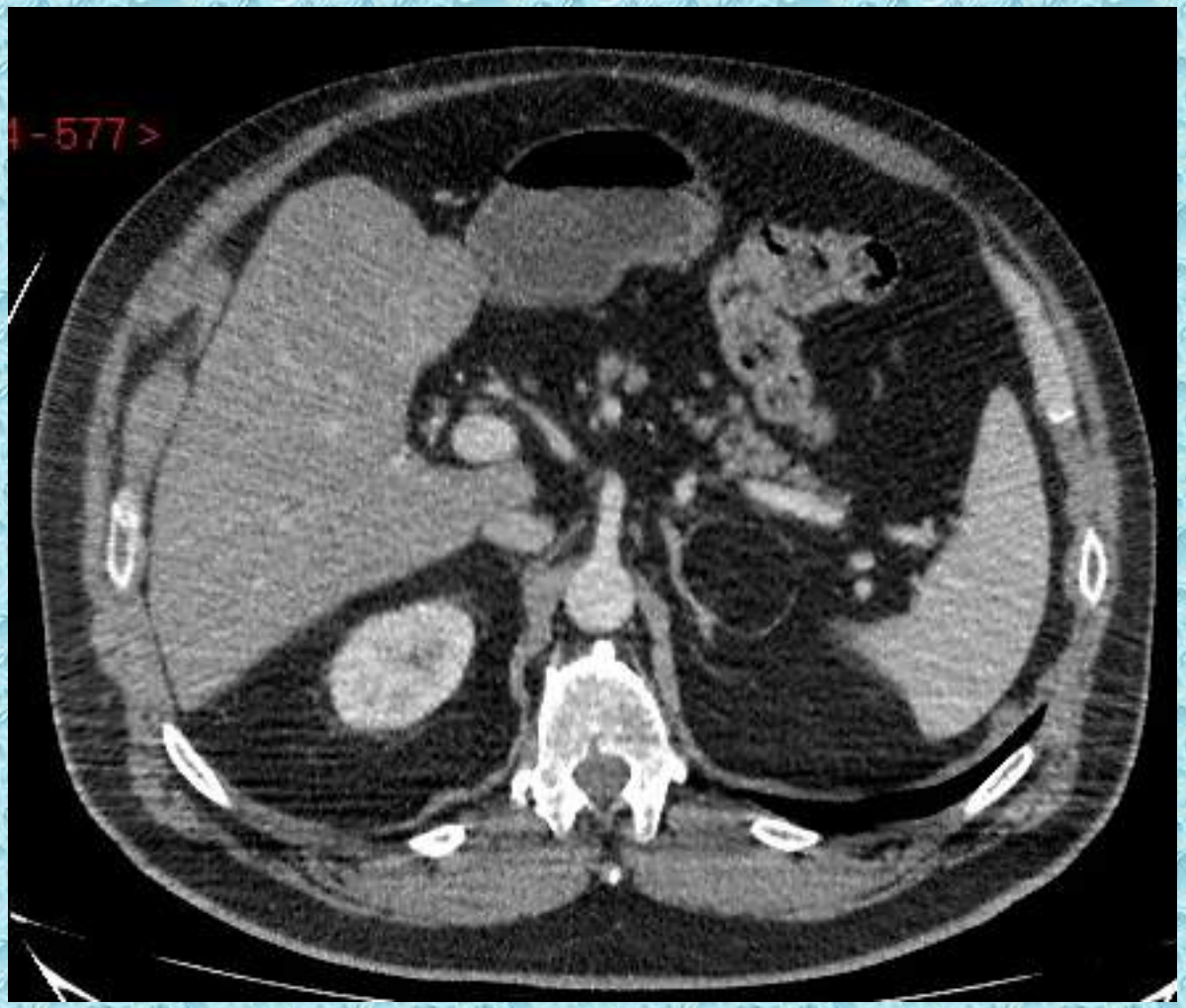
Adrenal Incidentaloma

- How to characterise?
- Who to image?
- Who to follow up?

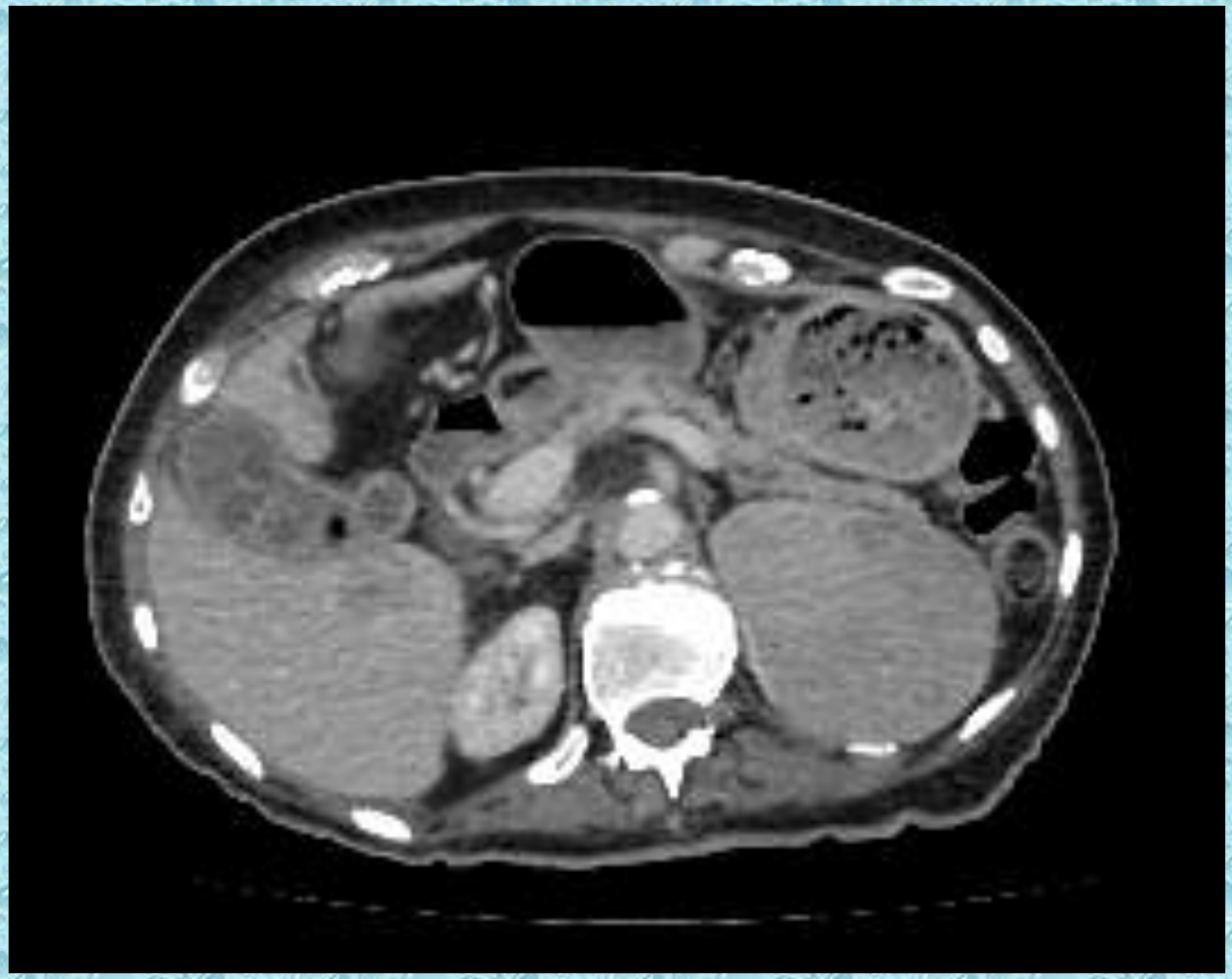
- Are these functional?

Adrenal Cyst

Adrenal myelolipoma



Adrenal carcinoma



How to image?

- Easiest question of the 3 to answer
- Aim: To differentiate the benign adenoma from other lesions requiring further management.
- MRI vs CT
  - Demonstration of intracytoplasmic lipid
  - Malignant adrenal lesions contain fat extremely rarely

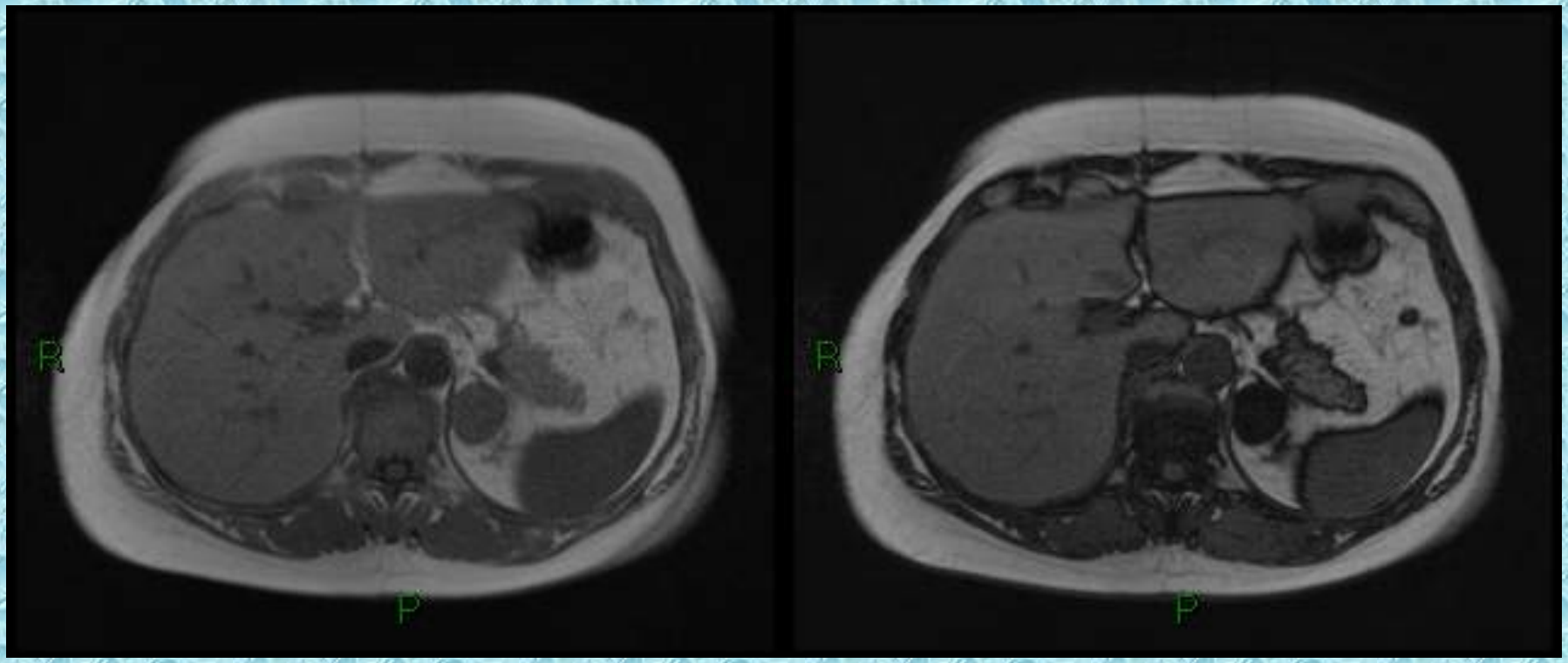
How to image?

- MRI
  - Chemical shift imaging
- CT
  - Precontrast
  - Contrast washout: Relative/Absolute

Chemical Shift Imaging

- T1 dual gradient echo sequence
- In and out of phase images
- Perfect registration

Adrenal Adenoma: CSI MRI



- Sensitivity (81-100%). Specificity (94-100%)

CSI: Pitfalls

- India ink artefact can mimic signal loss in small adenomas
- Other fat containing adrenal lesions
  - RCC and HCC metastases
  - Phaeochromocytoma
  - Adrenal carcinoma
  - Myelolipoma
  - Collision metastasis within a preexisting adenoma

CSI: Pitfalls

- The lipid poor adenoma

Adenoma NECT	% SIGNAL DROP OUT CSI
10-30 HU	89%
>30 HU	13%

Haider et al. Chemical shift MR imaging of hyperattenuating (>10 HU) adrenal masses: does it still have a role?
Radiology 2004;231:711-16

Adrenal CT

- Pre contrast
  - <10 HU: STOP

  - HU >43 : Increased risk of malignancy irrespective of washout characteristics. Blake et al. Radiology 2005.

Adrenal CT

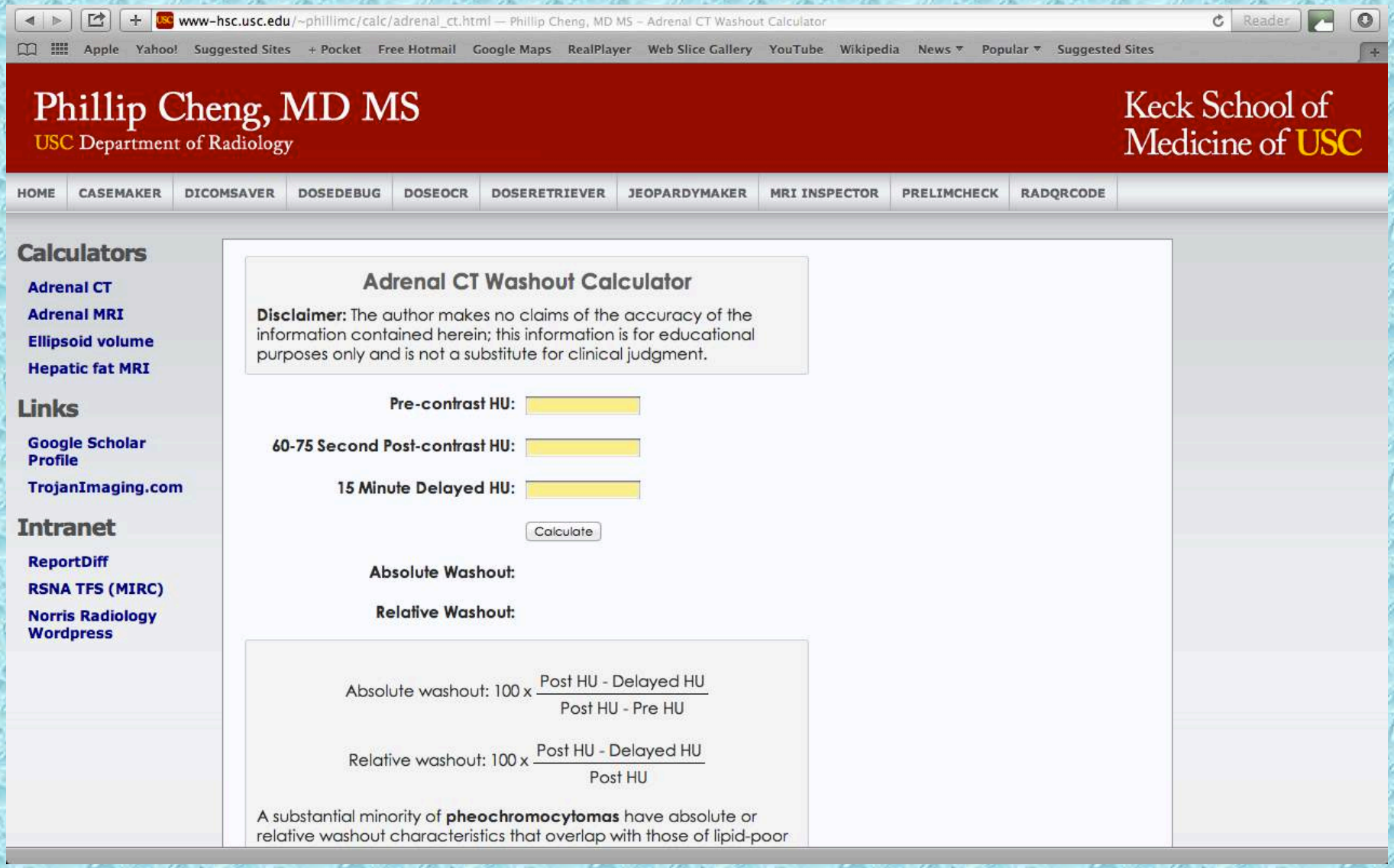
- Pre contrast
  - <10 HU: STOP
- Post contrast (60s and 15m)
  - Absolute washout (>60%)
  - Relative washout (40%)
- Nodules >10 HU: Sensitivity/Specificity 100/80% cf 76/60% for CSI.

Seo et al. Characterisation of lipid poor adrenal adenoma: chemical shift MRI and washout CT. AJR 2014;202:1043-50

Adrenal washout equations

$$\text{Absolute washout: } 100 \times \frac{\text{Post HU - Delayed HU}}{\text{Post HU - Pre HU}}$$

$$\text{Relative washout: } 100 \times \frac{\text{Post HU - Delayed HU}}{\text{Post HU}}$$


www-hsc.usc.edu/~phillimc/calc/adrenal_ct.html — Phillip Cheng, MD MS – Adrenal CT Washout Calculator
Reader
Apple Yahoo! Suggested Sites + Pocket Free Hotmail Google Maps RealPlayer Web Slice Gallery YouTube Wikipedia News Popular Suggested Sites
Phillip Cheng, MD MS
USC Department of Radiology
Keck School of Medicine of USC
HOME CASEMAKER DICOMSAVER DOSEDEBUG DOSEOCR DOSERETRIEVER JEOPARDYMAKER MRI INSPECTOR PRELIMCHECK RADQRCODE
Calculators
Adrenal CT
Adrenal MRI
Ellipsoid volume
Hepatic fat MRI
Links
Google Scholar Profile
TrojanImaging.com
Intranet
ReportDiff
RSNA TFS (MIRC)
Norris Radiology Wordpress
Adrenal CT Washout Calculator
Disclaimer: The author makes no claims of the accuracy of the information contained herein; this information is for educational purposes only and is not a substitute for clinical judgment.
Pre-contrast HU:
60-75 Second Post-contrast HU:
15 Minute Delayed HU:
Calculate
Absolute Washout:
Relative Washout:
Absolute washout: 100 x (Post HU - Delayed HU) / (Post HU - Pre HU)
Relative washout: 100 x (Post HU - Delayed HU) / Post HU
A substantial minority of pheochromocytomas have absolute or relative washout characteristics that overlap with those of lipid-poor

Adrenal adenoma: Relative contrast washout 55%

80HU 44HU

Adrenal Incidentaloma: Which nodules to investigate/follow up?

- Guidelines
  - Numerous
  - Not consistent

NIH State-of-the-Science Statement on

Management of the Clinically Inapparent Adrenal Mass ("Incidentaloma")

NIH Consensus and State-of-the-Science Statements

Volume 19, Number 2
February 4–6, 2002

NATIONAL INSTITUTES OF HEALTH
Office of the Director

- Recommendations for surgery based upon tumor size are derived from studies not standardized for inclusion criteria, length of followup, or methods of estimating the risk of carcinoma. Nevertheless, patients with tumors greater than 6 cm usually are treated surgically, while those with tumors less than 4 cm are generally monitored. In patients with tumors between 4 and 6 cm, criteria in addition to size should be considered in making the decision to monitor or proceed to adrenalectomy.
- The literature on adrenal incidentaloma has proliferated in the last several years. Unfortunately, the lack of controlled studies makes formulating diagnostic and treatment strategies difficult. Because of the complexity of the problem, the management of patients with adrenal incidentalomas will be optimized by a multidisciplinary team approach involving physicians with expertise in endocrinology, radiology, surgery, and pathology. The paucity of evidence-based data highlights the need for well-designed prospective studies.
- Either open or laparoscopic adrenalectomy is an acceptable procedure for resection of an adrenal mass. The choice of procedure will depend upon the likelihood of an invasive adrenal cortical carcinoma, technical issues, and the experience of the surgical team.
- In patients with tumors that remain stable on two imaging studies carried out at least 6 months apart and do not exhibit hormonal hypersecretion over 4 years, further followup may not be warranted.

GUIDELINES FOR THE SURGICAL MANAGEMENT OF ENDOCRINE DISEASE AND TRAINING REQUIREMENTS FOR ENDOCRINE SURGERY

THE BRITISH ASSOCIATION OF ENDOCRINE SURGEONS

BAETS Guidelines 2003

- Non functioning nodules <3cm: Can be safely observed with repeat CT scanning
- >3cm or rapidly growing: Surgical resection
- Needle biopsy: Only indicated to confirm metastatic disease in a patient with primary malignancy elsewhere but no evidence of metastases elsewhere.

- Interval imaging @6, 12 & 24 months.
- Yearly biochemical testing for 4 years**

- ***Based on 2 reports of development of Cushing's syndrome in previously non functioning nodule!*

AACE/AAES Guidelines

AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS AND AMERICAN ASSOCIATION OF ENDOCRINE SURGEONS MEDICAL GUIDELINES FOR THE MANAGEMENT OF ADRENAL INCIDENTALOMAS

Martha A. Zeiger, MD, FACS, FACE; Geoffrey B. Thompson, MD, FACS, FACE; Quan-Yang Duh, MD, FACS; Amir H. Hamrahian, MD, FACE; Peter Angelos, MD, PhD, FACS, FACE; Dina Elaraj, MD; Elliot Fishman, MD; Julia Kharlip, MD

AACE/AAES Adrenal Incidentaloma Guidelines, *Endocr Pract.* 2009;15(Suppl 1) 3

RECOMMENDATIONS

- **R1.** Patients with an adrenal incidentaloma should undergo evaluation clinically, biochemically, and radiographically for signs and symptoms of hypercortisolism, aldosteronism (if hypertensive), the presence of a pheochromocytoma, or a malignant tumor **(Grade C; BEL 3)**.

- **R2.** Patients with adrenal incidentalomas who do not fulfill the criteria for surgical resection need to have radiographic reevaluation at 3 to 6 months and then annually for 1 to 2 years. For all adrenal tumors, hormonal evaluation should be performed at the time of diagnosis and then annually for 5 years **(Grade C; BEL 3)**.

Managing Incidental Findings on Abdominal CT: White Paper of the ACR Incidental Findings Committee

Lincoln L. Berland, MD[a], Stuart G. Silverman, MD[b], Richard M. Gore, MD[c], William W. Mayo-Smith, MD[d], Alec J. Megibow, MD, MPH[e], Judy Yee, MD[f], James A. Brink, MD[g], Mark E. Baker, MD[h], Michael P. Federle, MD[i], W. Dennis Foley, MD[j], Isaac R. Francis, MD[k], Brian R. Herts, MD[h], Gary M. Israel, MD[g], Glenn Krinsky, MD[l], Joel F. Platt, MD[k], William P. Shuman, MD[m], Andrew J. Taylor, MD[n]

J Am Coll Radiol 2010;7:754-773.

Adrenal nodule FU- ACR

- <1cm benign appearances (IGNORE)
  - Smooth
  - Homogenous
  - Low attenuation

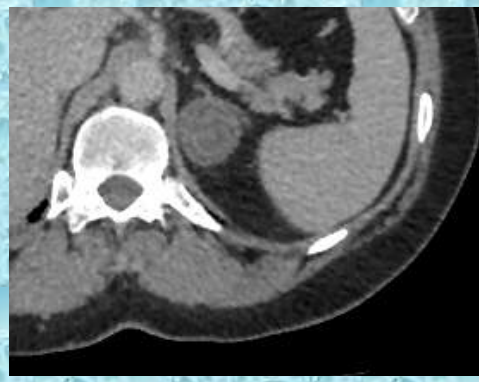
Functional adrenocortical tumours can be very small!

Conn's tumour

Adrenal nodule FU- ACR

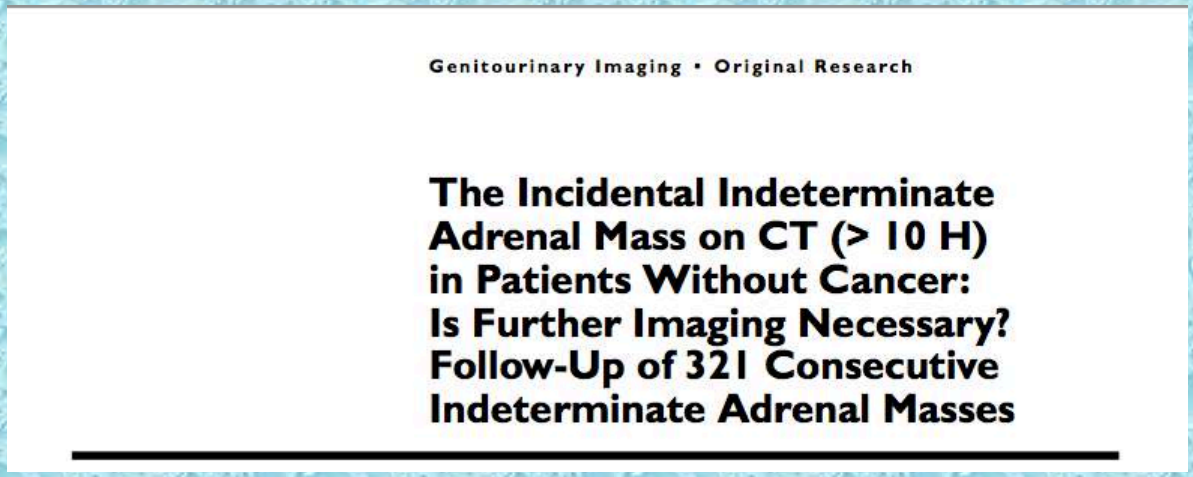
- <1cm benign appearances (IGNORE)
  - Smooth
  - Homogenous
  - Low attenuation
- 1-4cm

  - Benign appearances (12m FU scan)



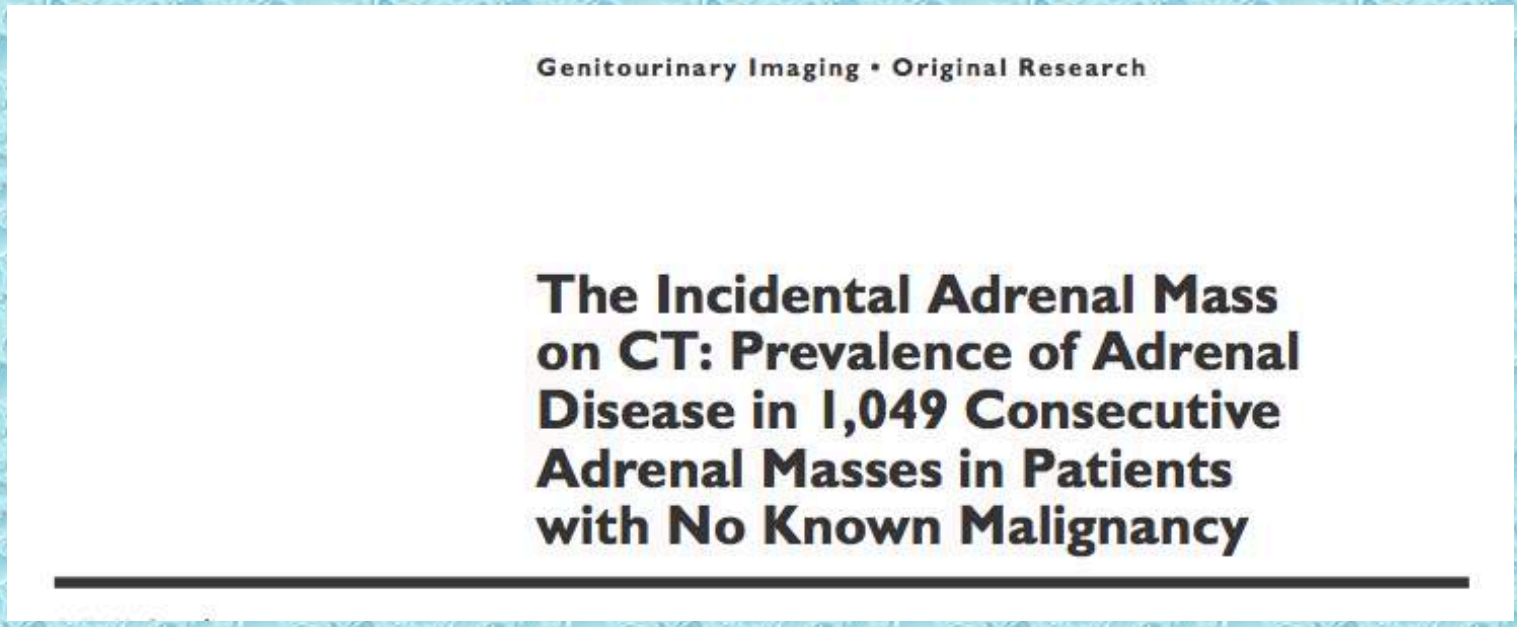
Adrenal nodule FU- ACR

- <1cm benign appearances (IGNORE)
  - Smooth
  - Homogenous
  - Low attenuation
- 1-4cm
  - Benign appearances(12m FU scan)
  - Suspicious appearances (characterise)
- >4cm
  - Characterise/PET/Biopsy/Resect



Song et al. AJR 2007; 189:1119–1123

- No malignant nodules
- Vast majority non functioning adenomata
- 3 pts. – functioning lesions

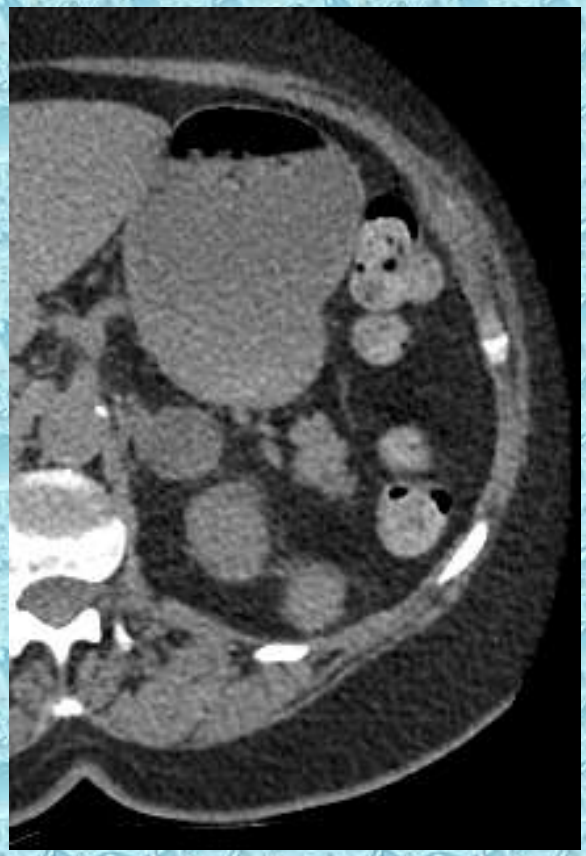


Song et al. AJR 2008;190:1163–1168

- No cases of malignancy
- 75% adenomata
- 6% myelolipomata

Incidental benign adenoma

APR 2013

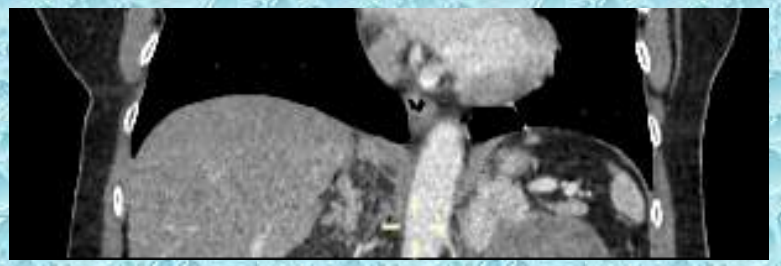


NOV 2015

Adrenal haemorrhage

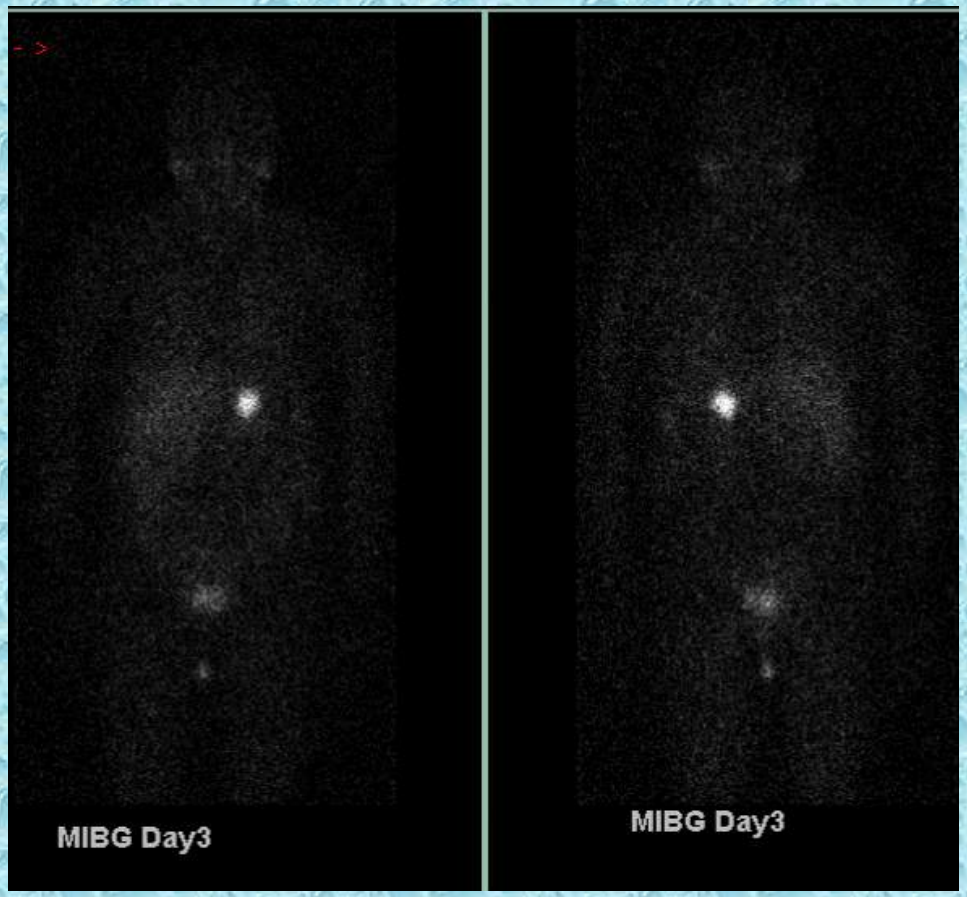
- Spontaneous vs traumatic.
- Beware the underlying mass lesion.
- Imaging follow up mandatory

Adrenal haemorrhage: Phaeochromocytoma

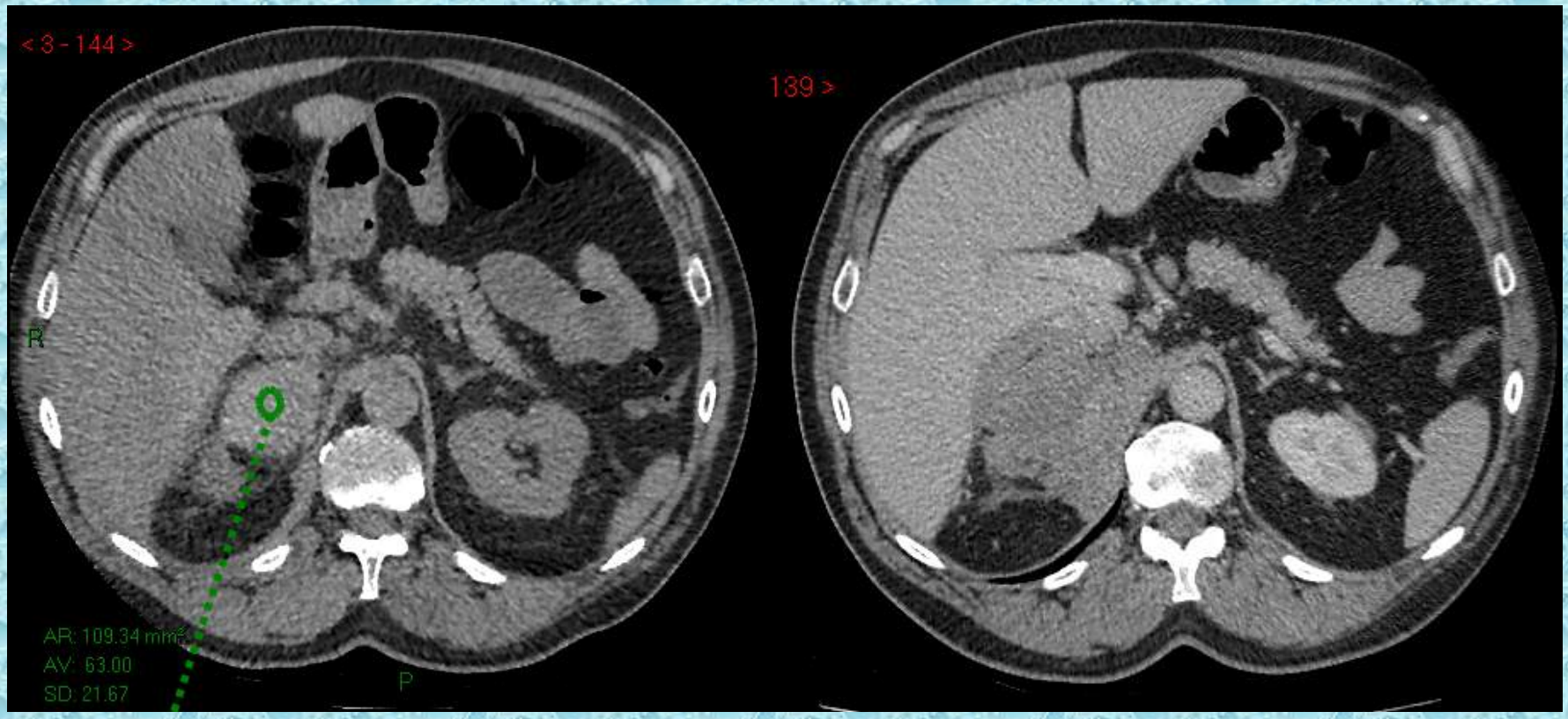


6 weeks later

Adrenal haemorrhage: Phaeochromocytoma



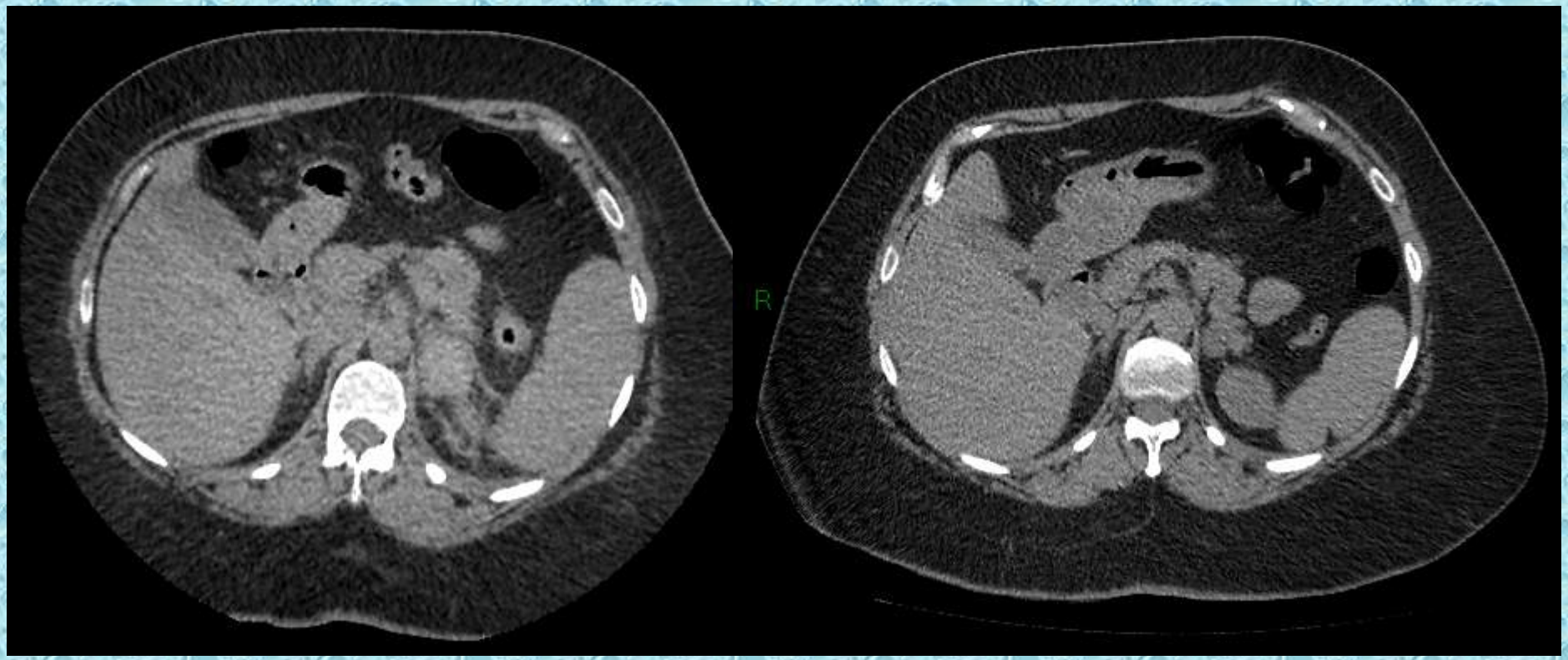
Adrenal haemorrhage: Metastasis



April 2014

May 2014

Adrenal haemorrhage: Adenoma



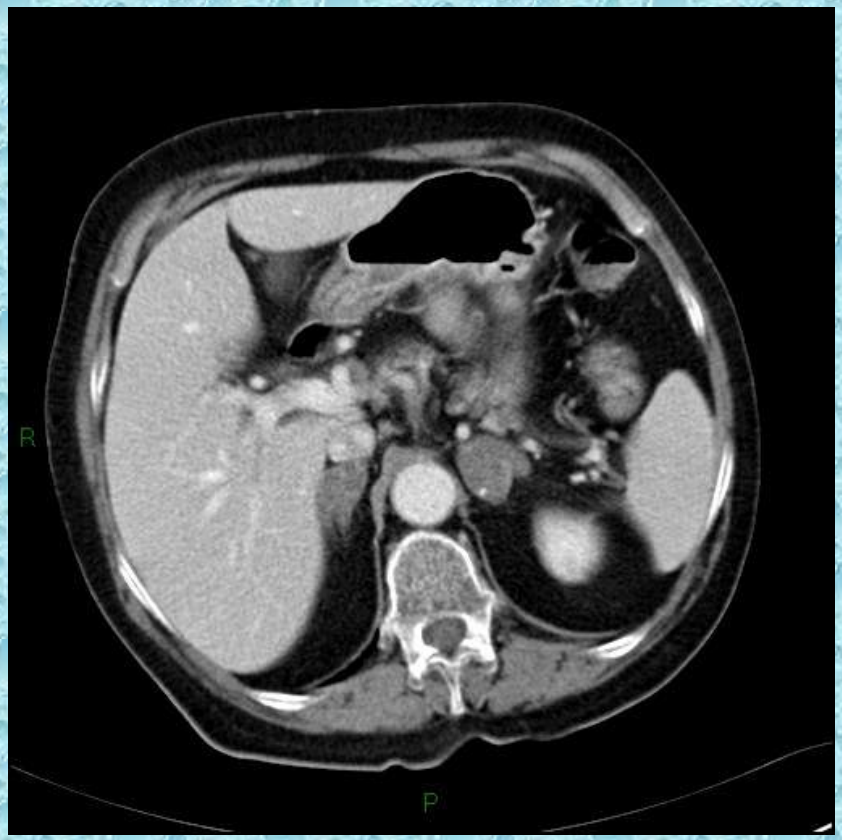
2012

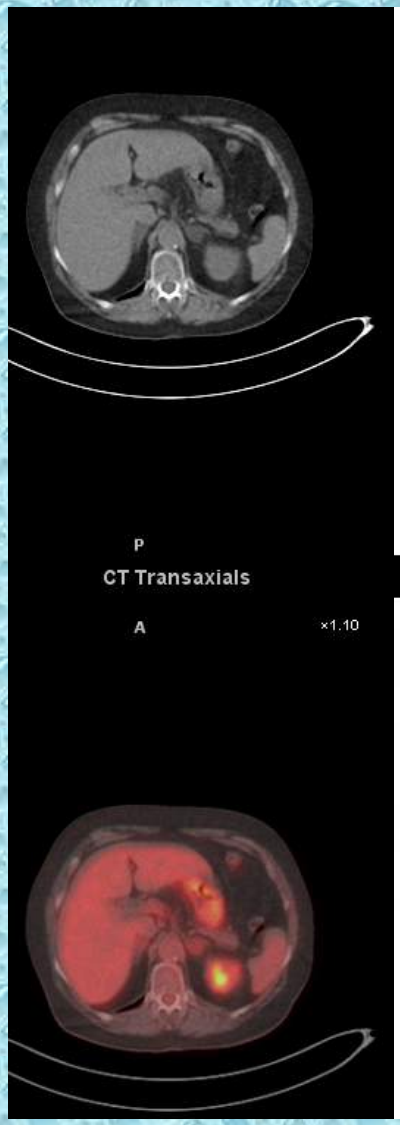
2014

Solitary/bilateral adrenal nodule(s) in the patient with malignancy at initial staging

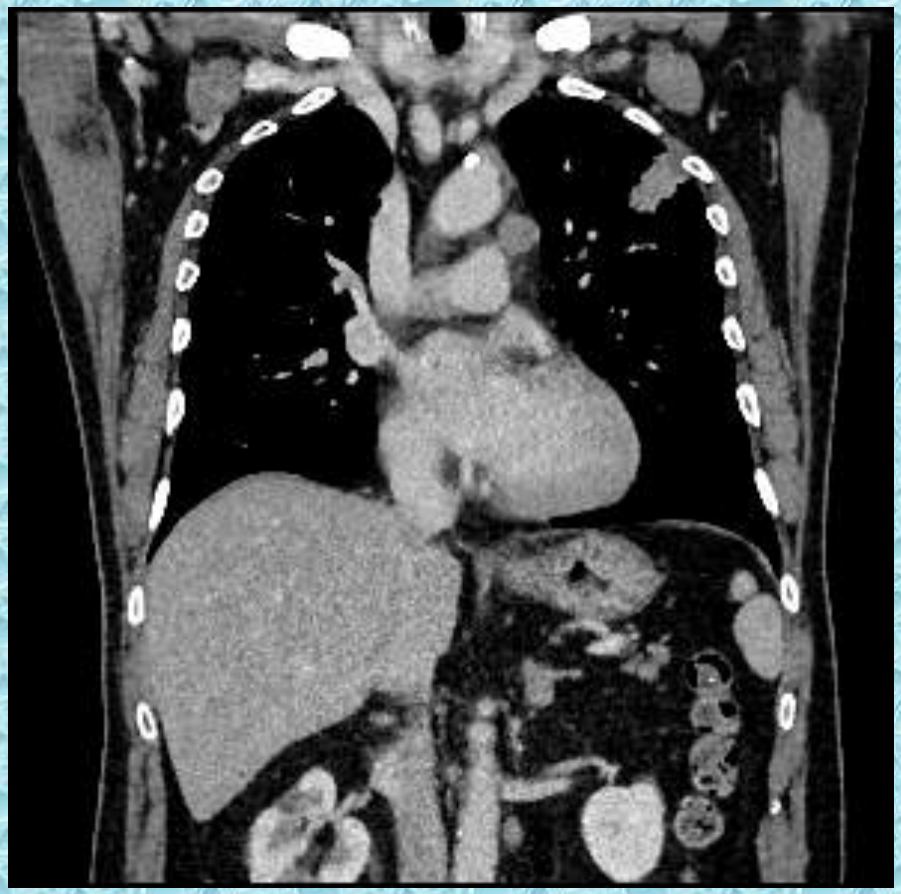
- Investigation of choice is 18F FDG PET/CT
- Solitary vs multiple metastases.

Adrenal adenoma(ta)



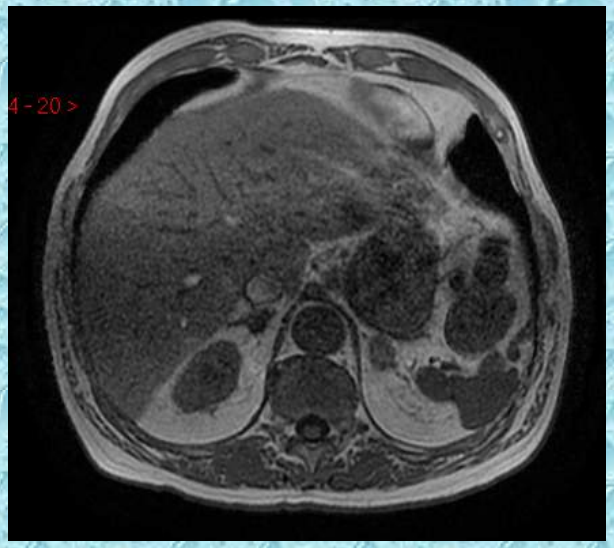


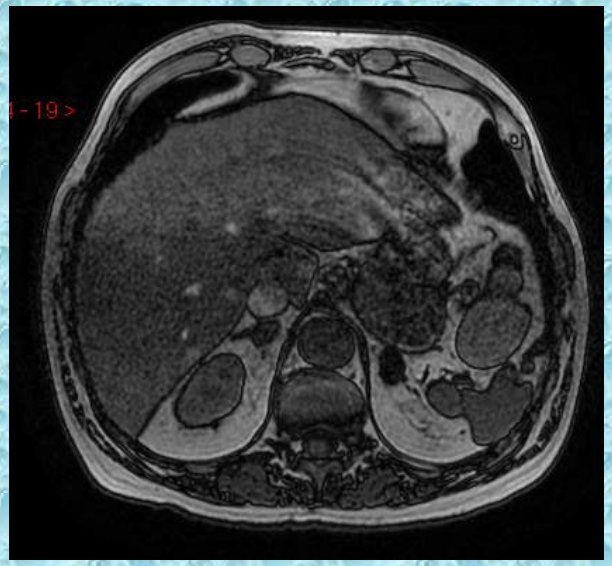
Adrenal metastasis

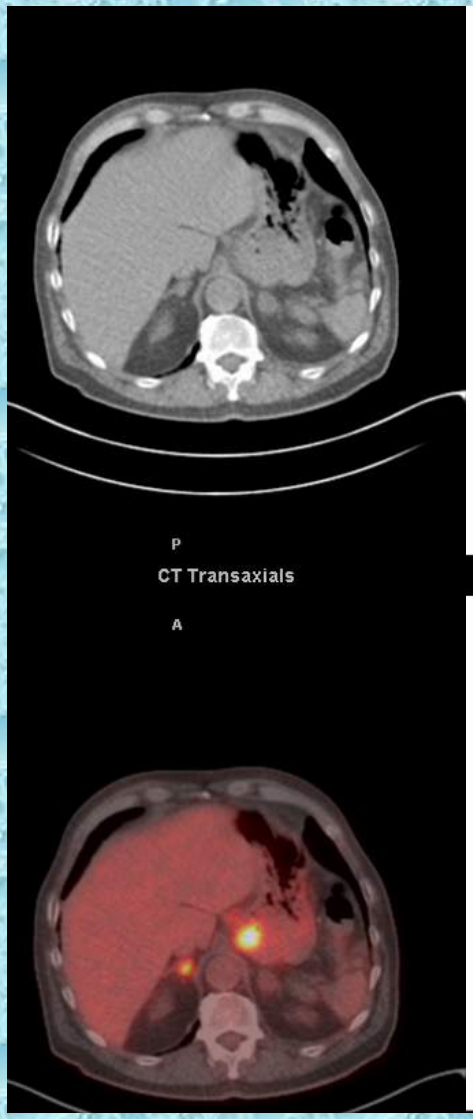


Adrenal adenoma and metastasis

Adrenal adenoma and metastasis







Reported Results of PET or PET-CT in Differentiating Metastatic Adrenal Lesions from Benign Adrenal Lesions in Oncologic Patients

Study/Year	Diagnostic Criteria	No. of Lesions	Sensitivity (%)*	Specificity (%)*	Accuracy (%)*
Erasmus et al (15)/1997	>background activity	33	100 (23/23)	80 (8/10)	94 (31/33)
Maurea et al (16)/1999	>background activity	27	100 (13/13)	93 (13/14)	96 (26/27)
Yun et al (17)/2001	≥hepatic uptake	50	100 (18/18)	94 (30/32)	96 (48/50)
Gupta et al (18)/2001	≥background liver activity	30	100 (12/12)	100 (16/16)	100 (28/28)
Kumar et al (19)/2004	≥hepatic uptake	113	93 (67/72)	90 (37/41)	92 (104/113)
Jana et al (20)/2006	≥hepatic uptake	80	93 (28/30)	96 (48/50)	95 (76/80)
Blake et al (21)/2006	≥hepatic uptake	41	100 (9/9)	94 (30/32)	95 (39/41)
Metser et al (22)/2006	≥hepatic uptake	175	100 (68/68)	98 (105/107)	99 (173/175)

False +ve rate: Up to 12%
High negative predictive value (>90%)
False –ve: Lesions < 10mm/tumour type

PET/CT

- 18F FDG
- C11 Methionine
- 18F Choline
- 68Ga DOTA

18F FDG

Thyroid carcinoma

- Assessment of patients with elevated thyroglobulin levels and negative iodine scintigraphy with suspected recurrent disease.
- To evaluate disease in treated medullary thyroid carcinoma associated with elevated calcitonin levels with equivocal or normal cross-sectional imaging, bone and octreotide scintigraphy.

Evidence-based indications for the use of PET-CT in the UK 2013

18F FDG

Neuroendocrine tumours.

- Staging or restaging of selected patients with poorly differentiated neuroendocrine tumours prior to treatment with negative or normal metaiodobenzylguanidine (MIBG) and octreotide scans.
- Assessment of possible multifocal disease in patients with paraganglioma considered for surgery.

Evidence-based indications for the use of PET-CT in the UK 2013

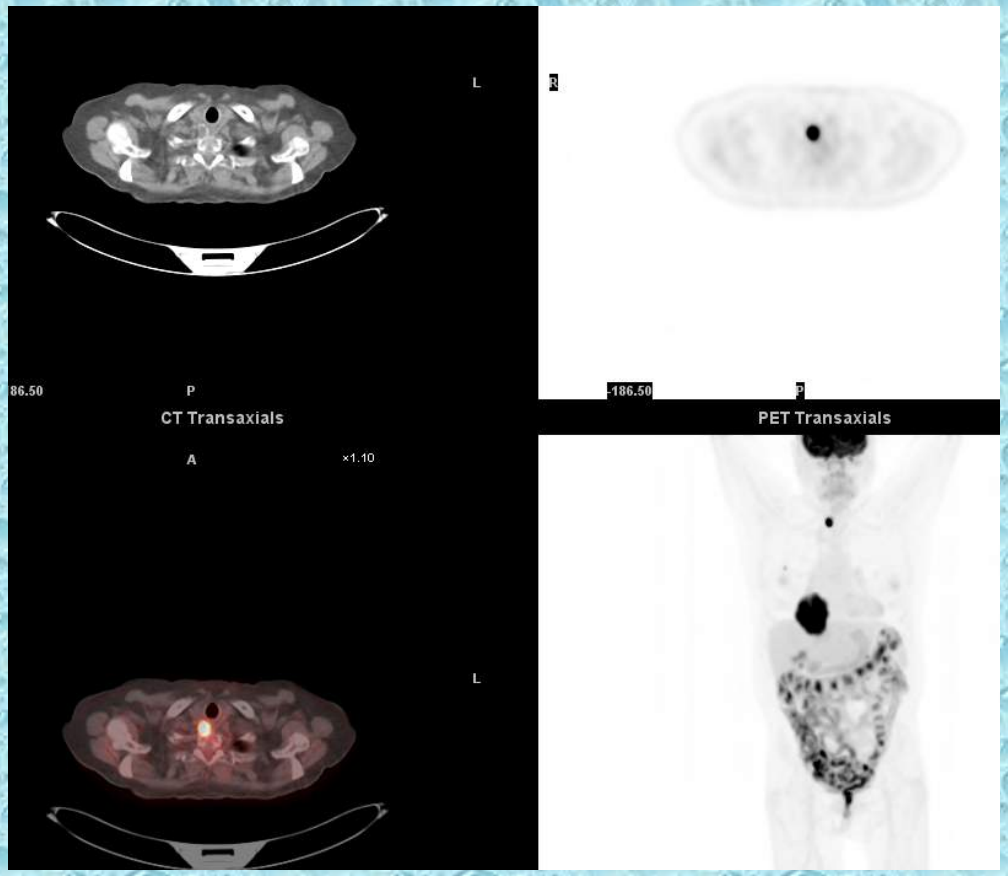
Incidental FDG Thyroid Uptake

- Focal uptake:
  Toxic adenoma
  Hyperplastic nodule
  Malignancy

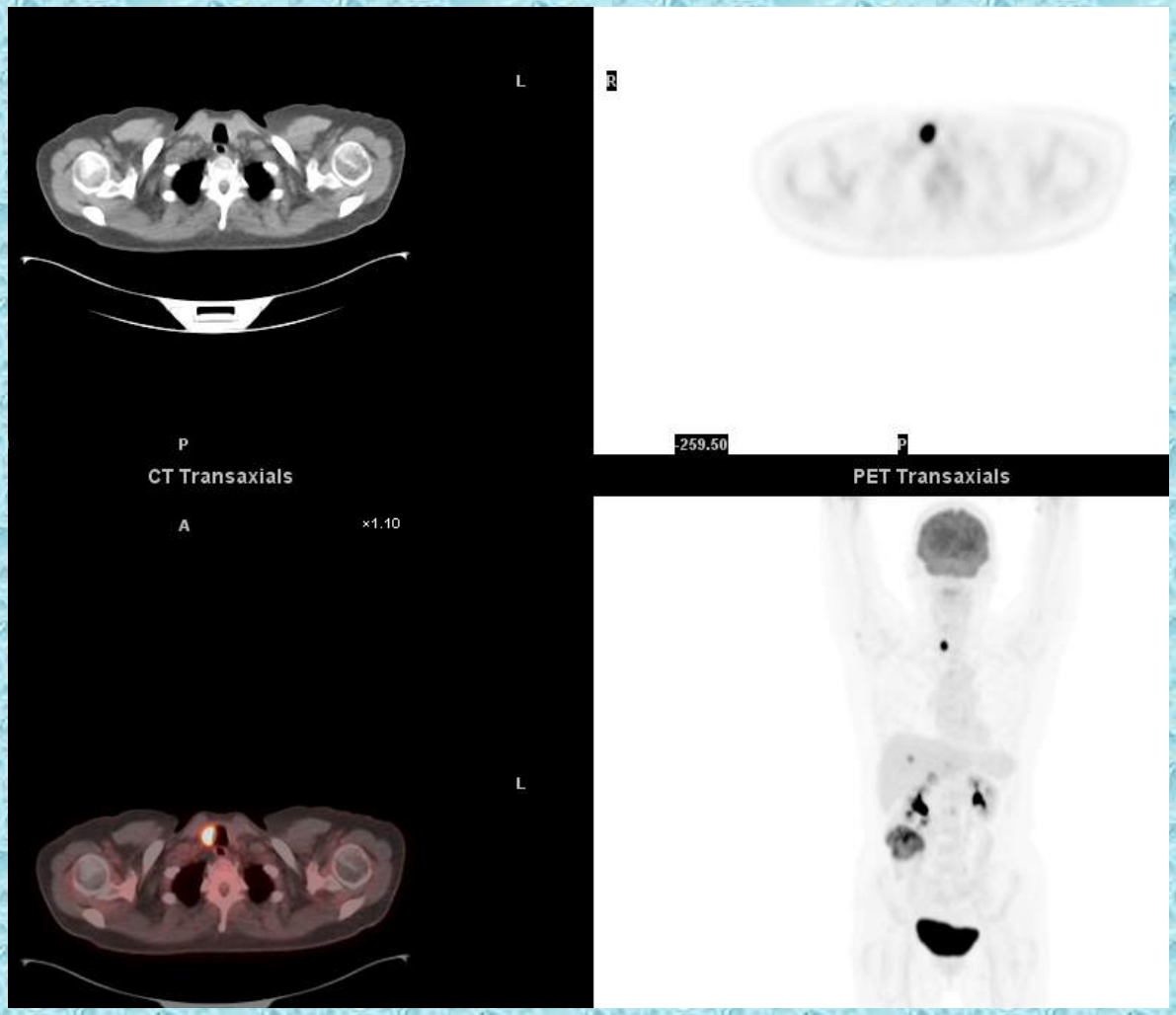
- Up to 60% are malignant

Thyroid Incidentalomas Identified by 18F-FDG PET: Sonographic Correlation. Kwak et al. AJR 2008; 191:598–603

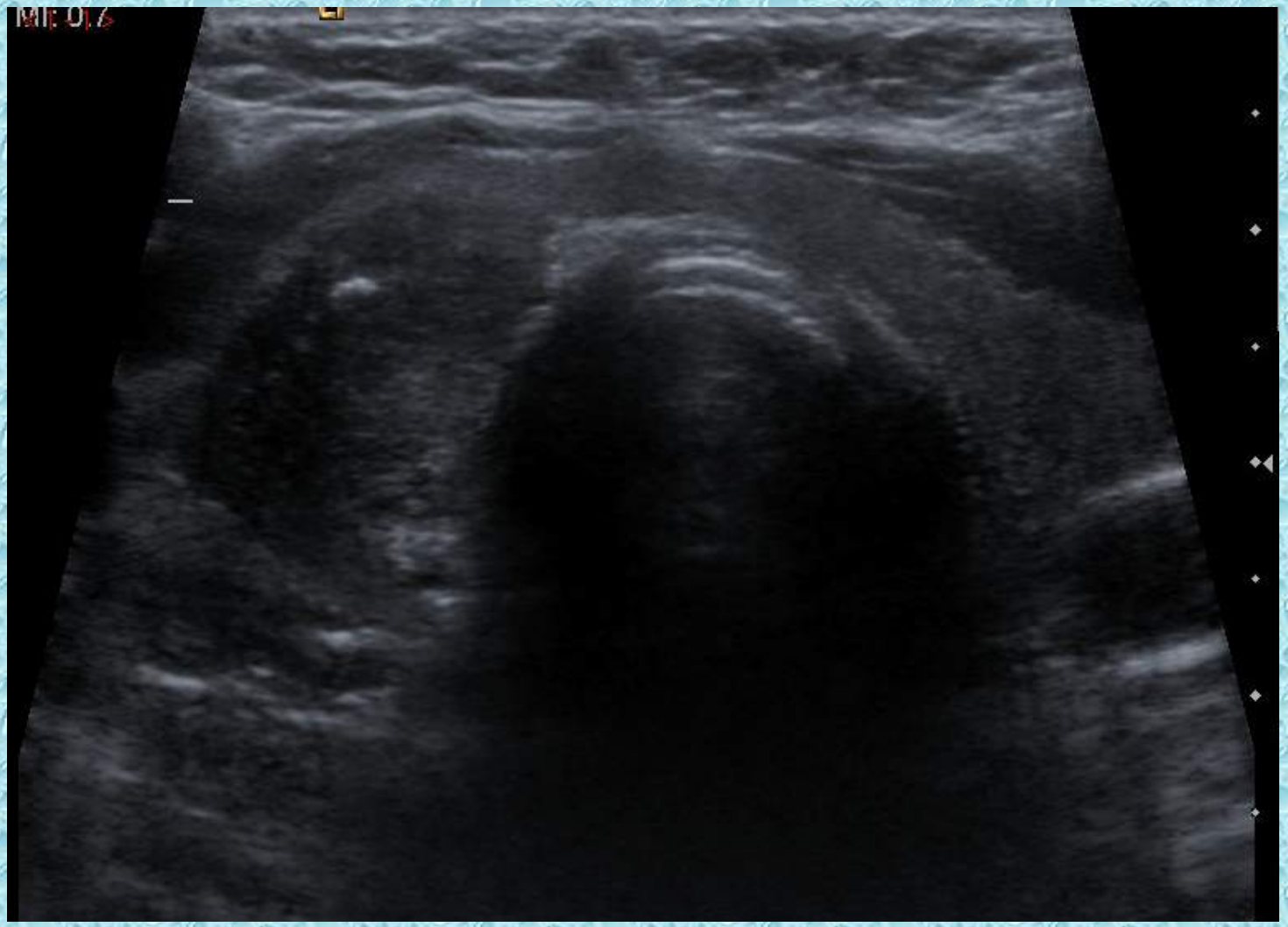
Focal thyroid uptake: Hyperplastic nodule



Focal thyroid uptake: Follicular carcinoma



Focal thyroid uptake: Follicular carcinoma



Parathyroid localisation: PET imaging

- C11 Methionine PET/CT
- 18F Fluorocholine

Parathyroid localisation: C11 Methionine

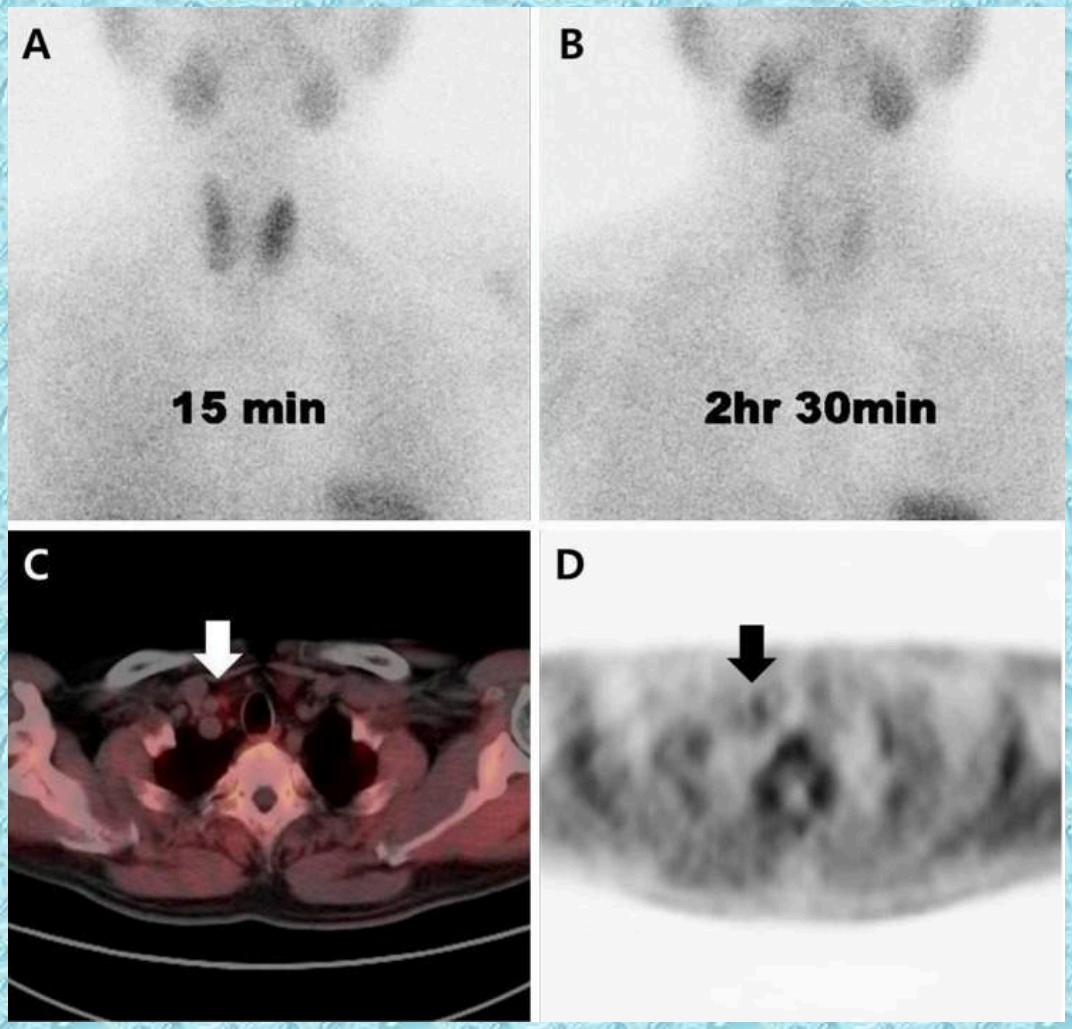
- Sensitivity 85% for detection of single gland disease
- Limited data that it may be useful in detecting adenomata in sestamibi negative patients.

C11 Methionine PET detected a single adenoma in 5/6patients with PHT in whom US/Sestamibi were negative.
Lenschow et al. World J Surg. 2015; 39: 1750-7

.

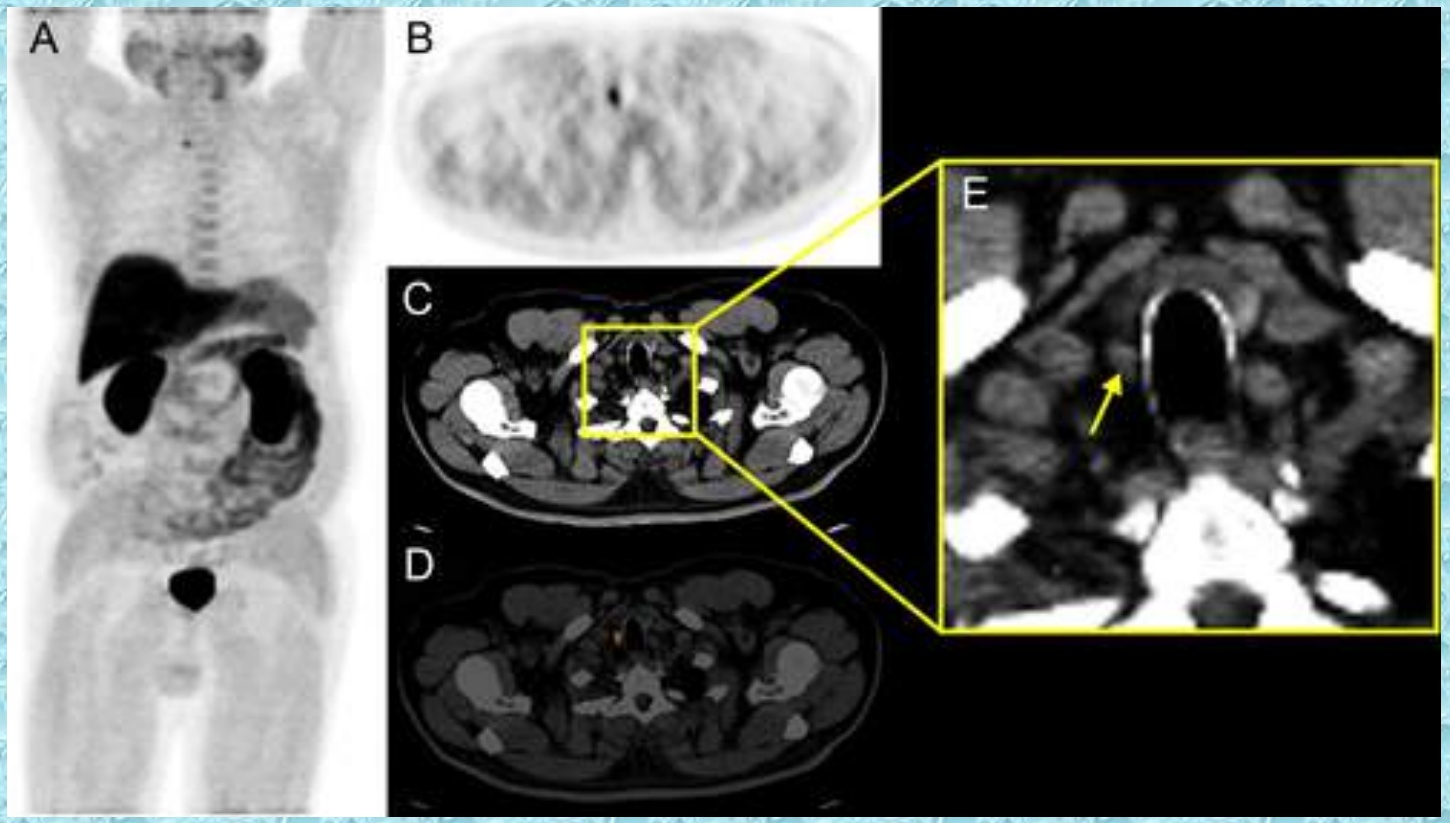
- Limited data- may be useful in detecting hyperplastic glands in pts. with CRF related hyperparathyroidism.

C11 Methionine PET/CT



Chun et al.Nucl Med Mol Imaging 2013.

Parathyroid localisation: 18F Choline



J Clin Endocrinol Metab, August 2013, 98(8):3111–3112

Parathyroid localisation: 18F Choline

- Emerging data from small studies that 18F Choline may be comparable to 99mTc Sestamibi and may be of value in localising parathyroid adenomata when US and sestamibi are discordant.

Primary Hyperaldosteronism (PHA)

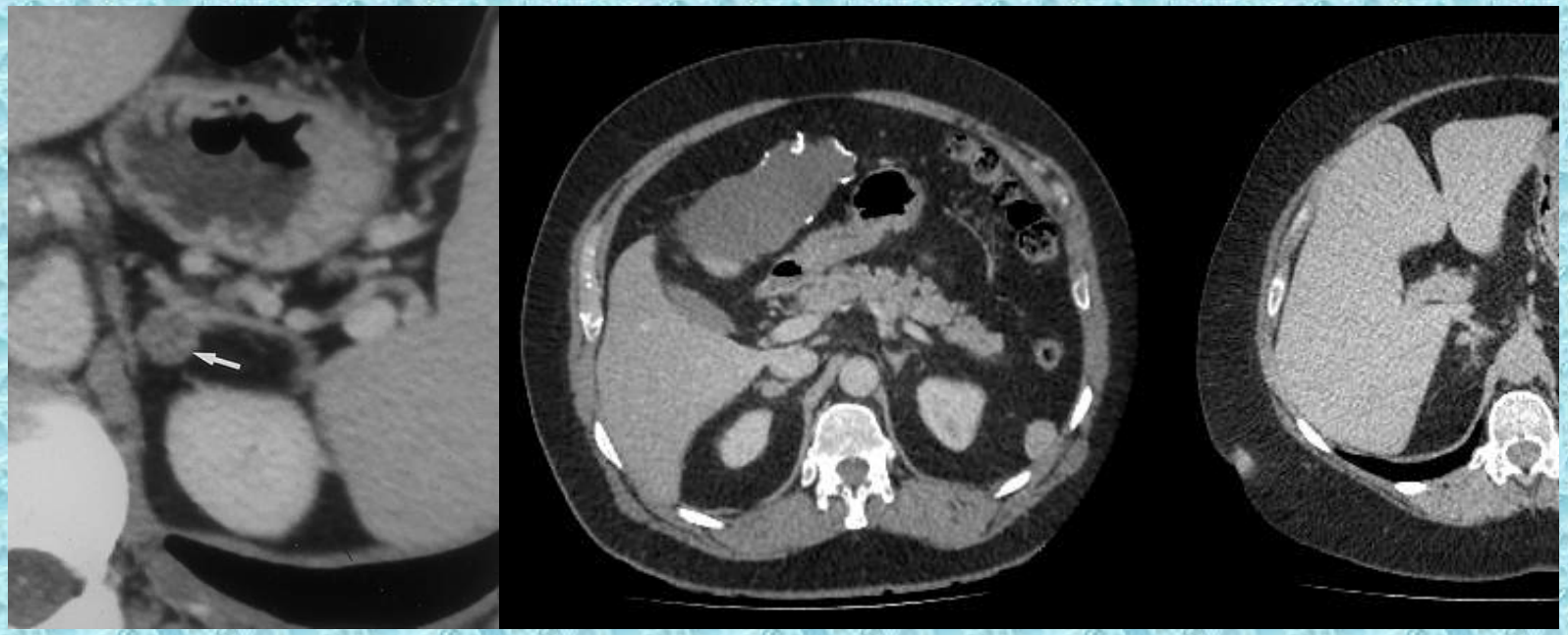
Challenge:

- To distinguish bilateral adrenal hyperplasia from unilateral adenoma/hyperplasia

Primary Hyperaldosteronism (PHA)

CT

- Variable performance (based on older scanner technology)
- Conn's adenomata can be very small
- Unilateral nodules noted at CT may not be functional



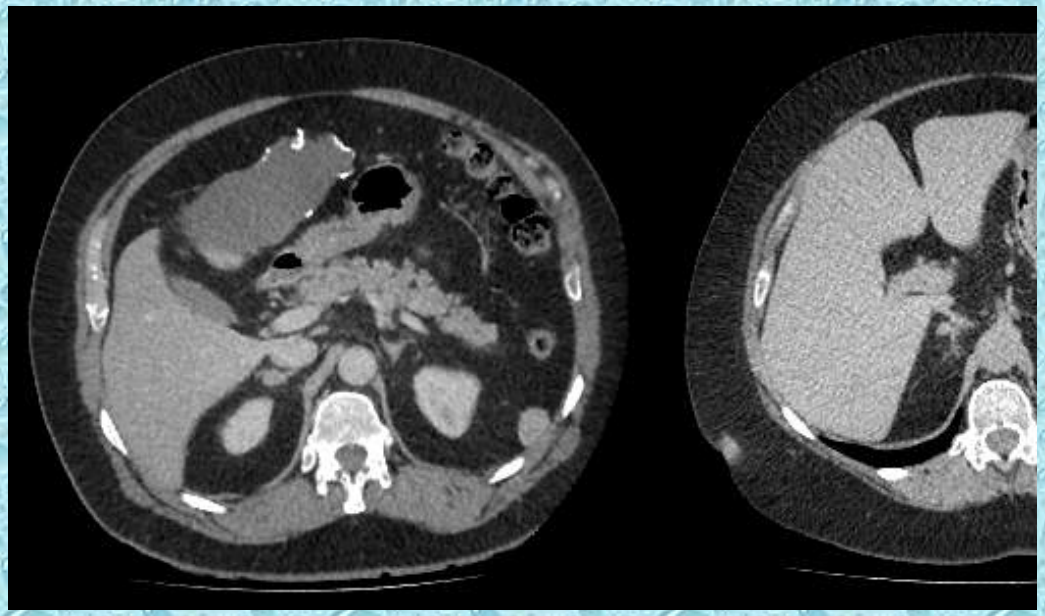
Primary Hyperaldosteronism (PHA)

AVS

- Considered the localisation gold standard
- Technically demanding
- Operator dependent
- Cost
- Radiation
- Morbidity

PHA

- Is a positive CT sufficient for localisation?
- Should all patients undergo AVS irrespective of the CT findings?
- What is the role of functional imaging?



PHA: 11C Metomidate PET/CT

- Promising non invasive localisation technique
- May obviate the need for AVS

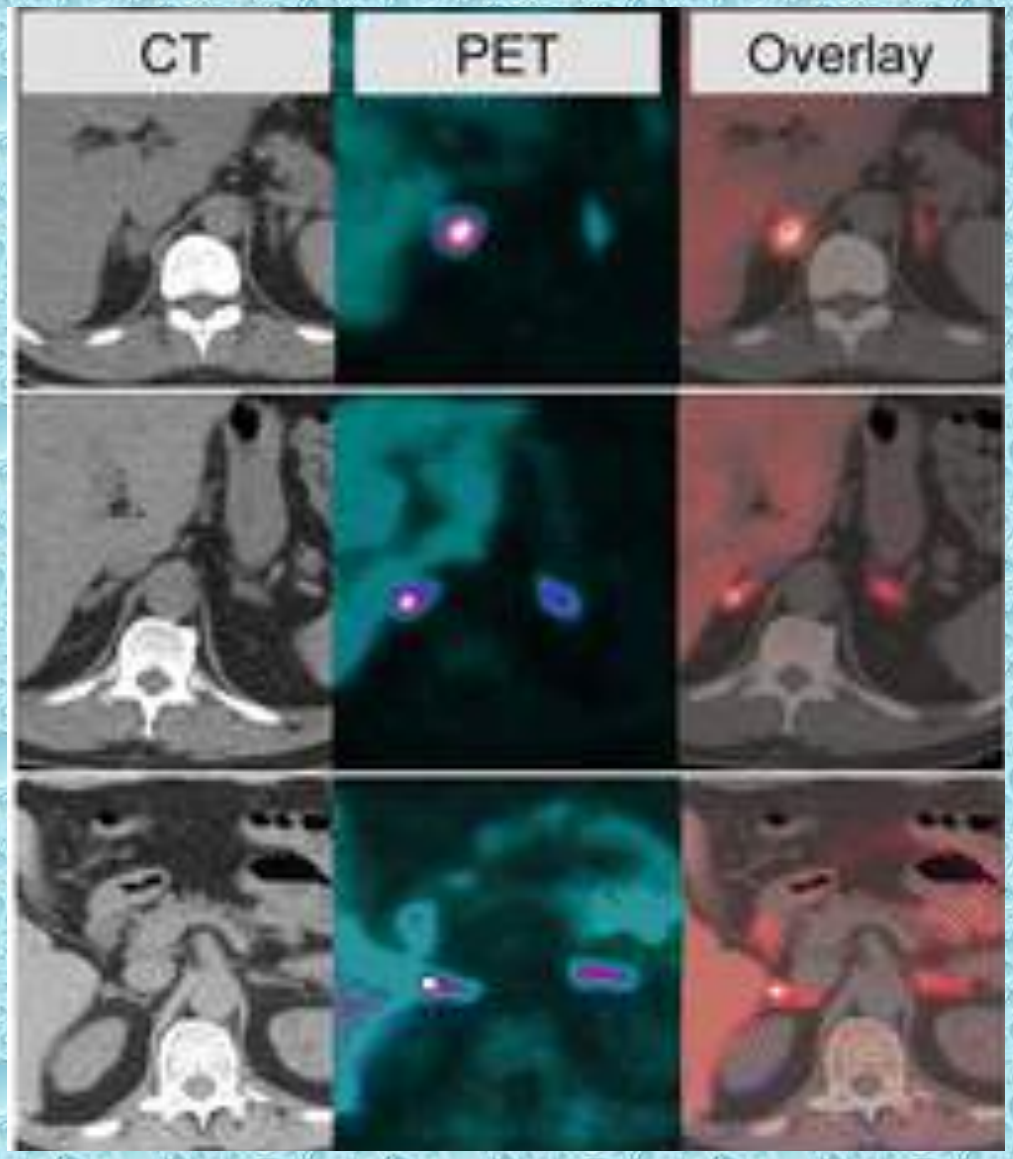
- Metomidate- 11β hydroxylase and aldosteronase inhibitor.
- Taken up selectively by Conn's adenomata.
- 11C cyclotron produced isotope
- Half life 20mins

C11 Metomidate

- C11 Metomidate vs. AVS
- 39pts with PHA
- Sensitivity 76% Specificity 87% (SUV ratio>1.25)
- Specificity 100% if combined with SUV max >17)

Burton et al. J Clint Endocrinol Metab 2012

C11 Metomidate



NET imaging

- Pancreatic
- GI
- (Pulmonary)

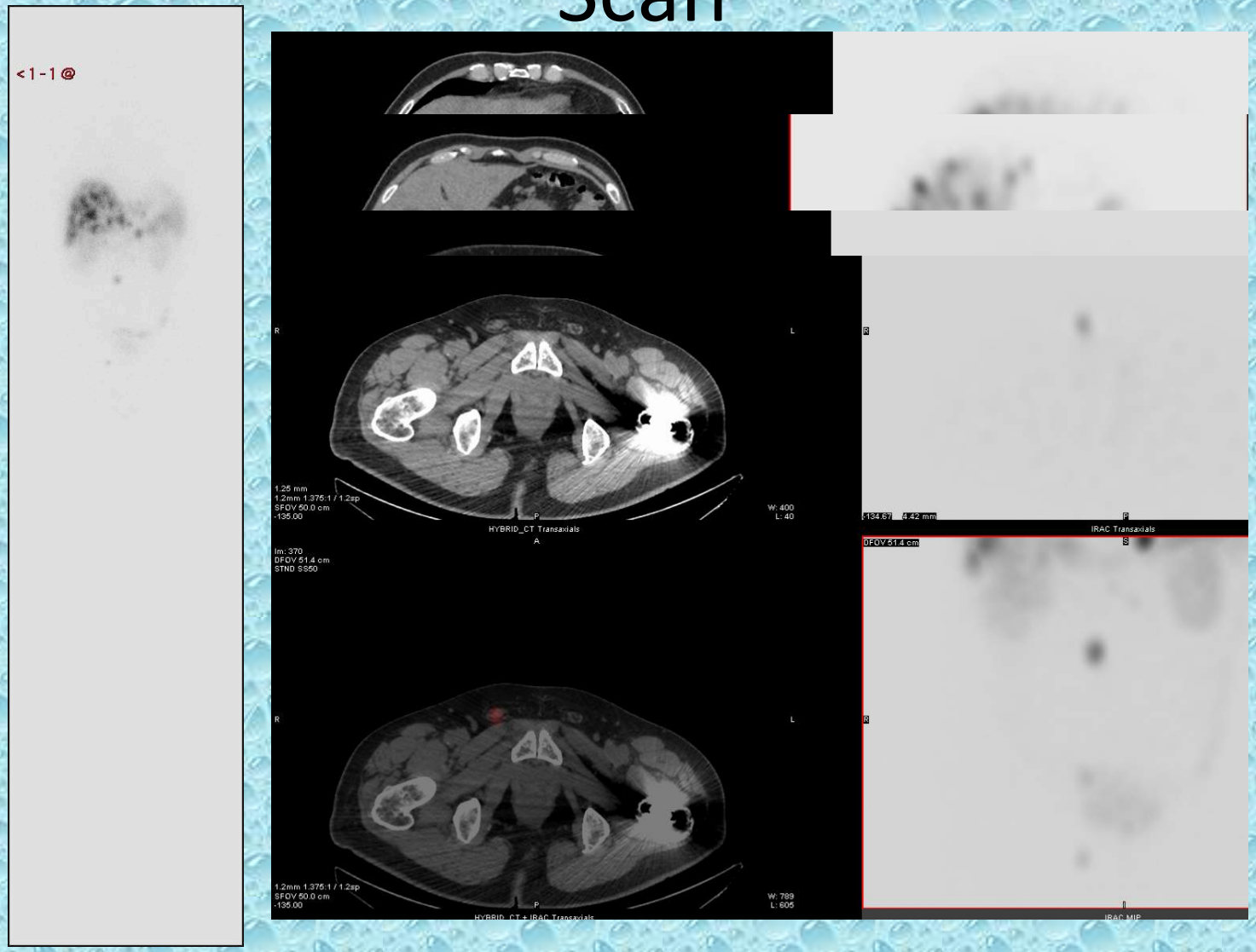
NET imaging

- CT/MRI- initial imaging modalities for characterisation and staging.
- EUS- important modality for further characterisation and obtaining histology for pancreatic NETs in particular.
- Functional imaging
  - 111In Octreotide
  - 123I MIBG

111In Octreotide

- 111In Octreotide is currently the radionuclide imaging investigation of choice to detect metastatic disease.
- 111In Octreotide binds to type II and V SST receptors.
- Can also be used to predict response to somatostatin analogue therapy.
- Sensitivity increased with SPECT/CT.

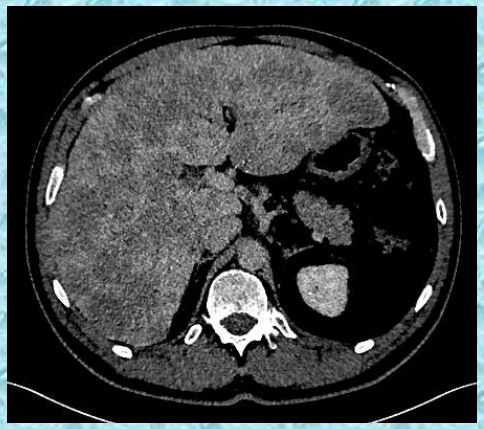
Metastatic Pancreatic NET: Octreotide Scan

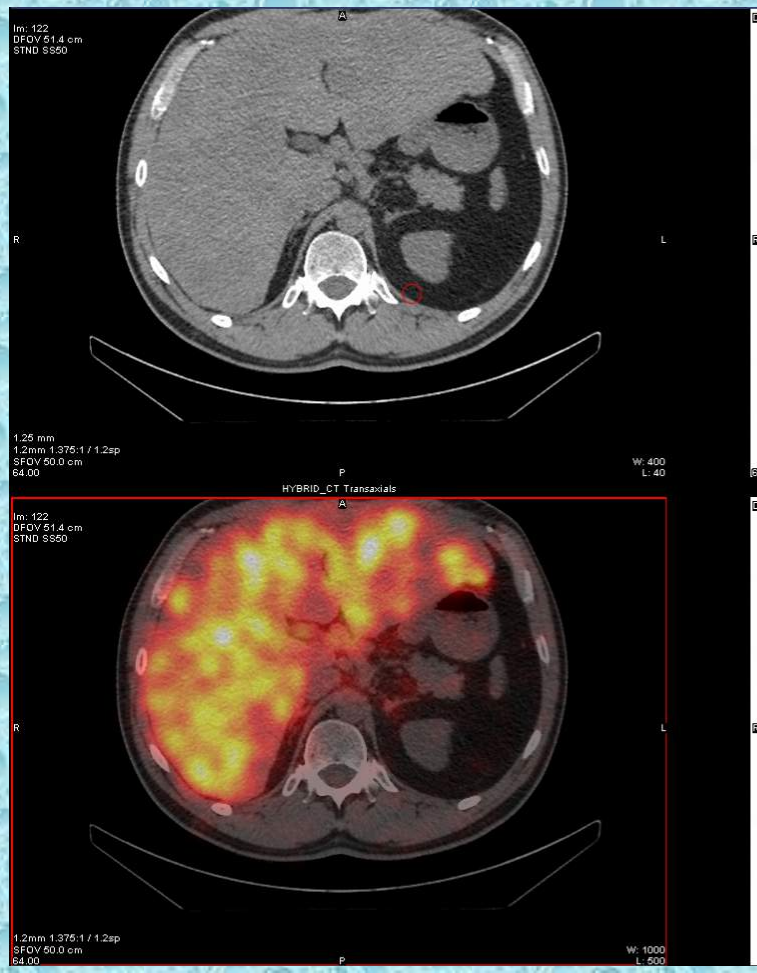


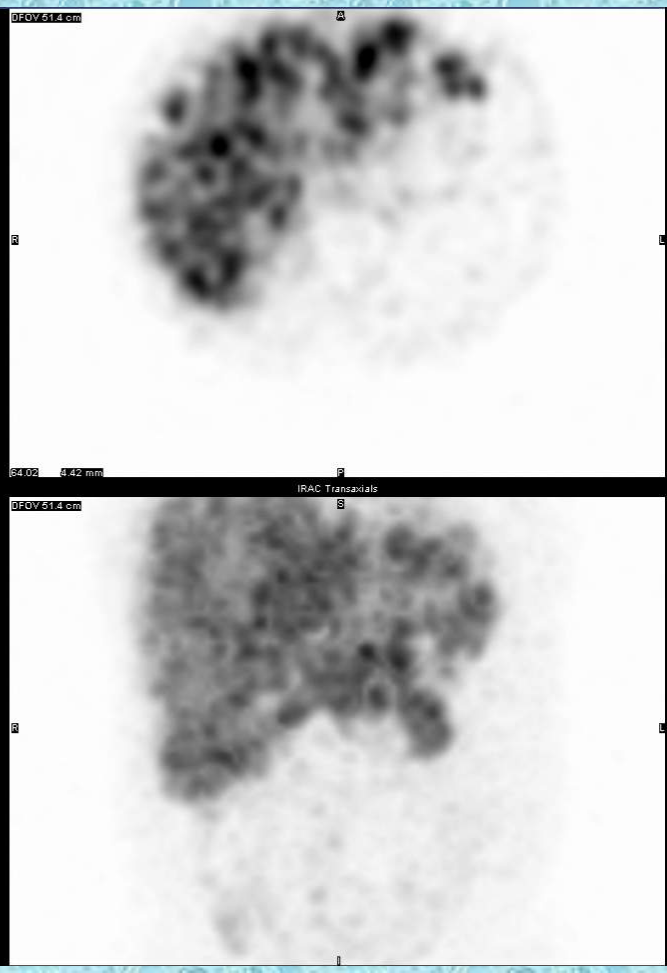
123I MIBG

- 123I MIBG imaging typically reserved for those patients being considered for 131I MIBG therapy.
- Also used for the diagnosis and staging of phaeochromocytoma
- Increased sensitivity with SPECT/CT

MIBG avid metastatic disease.







NET: PET imaging

- 18F FDG
- 18F DOPA
- 68Ga DOTA imaging

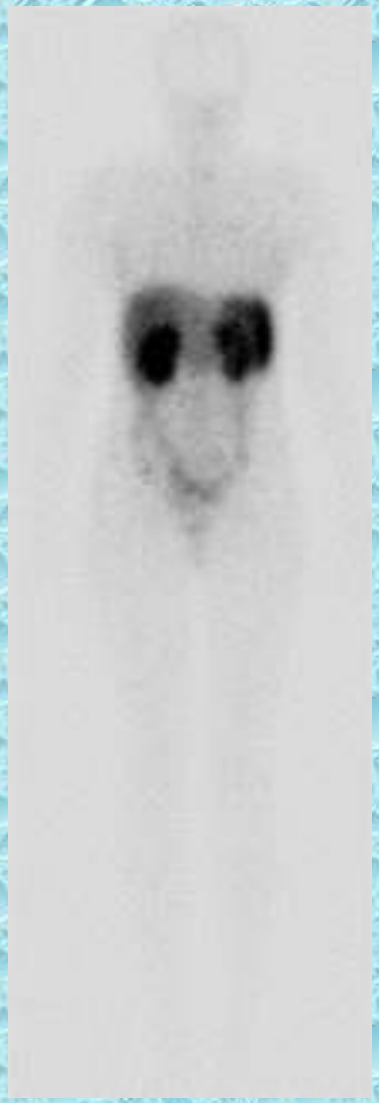
18F DOPA

- F18 DOPA/DOPAMINE concentrated by NETs by an amino acid transport mechanism which is upregulated in tumour cells.
- Both agents have been shown to have increased sensitivity and specificity for carcinoid tumours and phaeochromocytoma in particular compared to other imaging techniques.
- The accuracy for pancreatic NETS is not as great.

68Ga DOTA

- 68Ga produced by a generator rather than by a cyclotron potentially making this isotope more widely available.
- The different ligands have differing SST receptor avidity with DOTATATE>DOTATOC>DOTANOC.
- Increased sensitivity and specificity compared to 111In octreotide SPECT and SPECT/CT (90% vs 55%)

DOTA positive disease



Conclusion

- Endocrine imaging has the potential to exploit the potential of high resolution anatomical imaging combined with functional/molecular imaging.
- Image WISELY…….