

Imaging: Standards or at Your own Choice

Christian Pirich

Department of Nuclear Medicine &
Endocrinology

Paracelsus Private Medical University
Salzburg, Austria

Imaging of Thyroid Cancer

- **Ultrasonography (US)**
- **F-18 FDG PET-(CT)**
- MRI
- radioiodine: diagnostic – post-therapy
- bone scanning
- CT (RECIST)
- Tc-99m MIBI, tetrofosmin
- radiolabelled somatostatin analogues

Preoperative Imaging

Postoperative Imaging

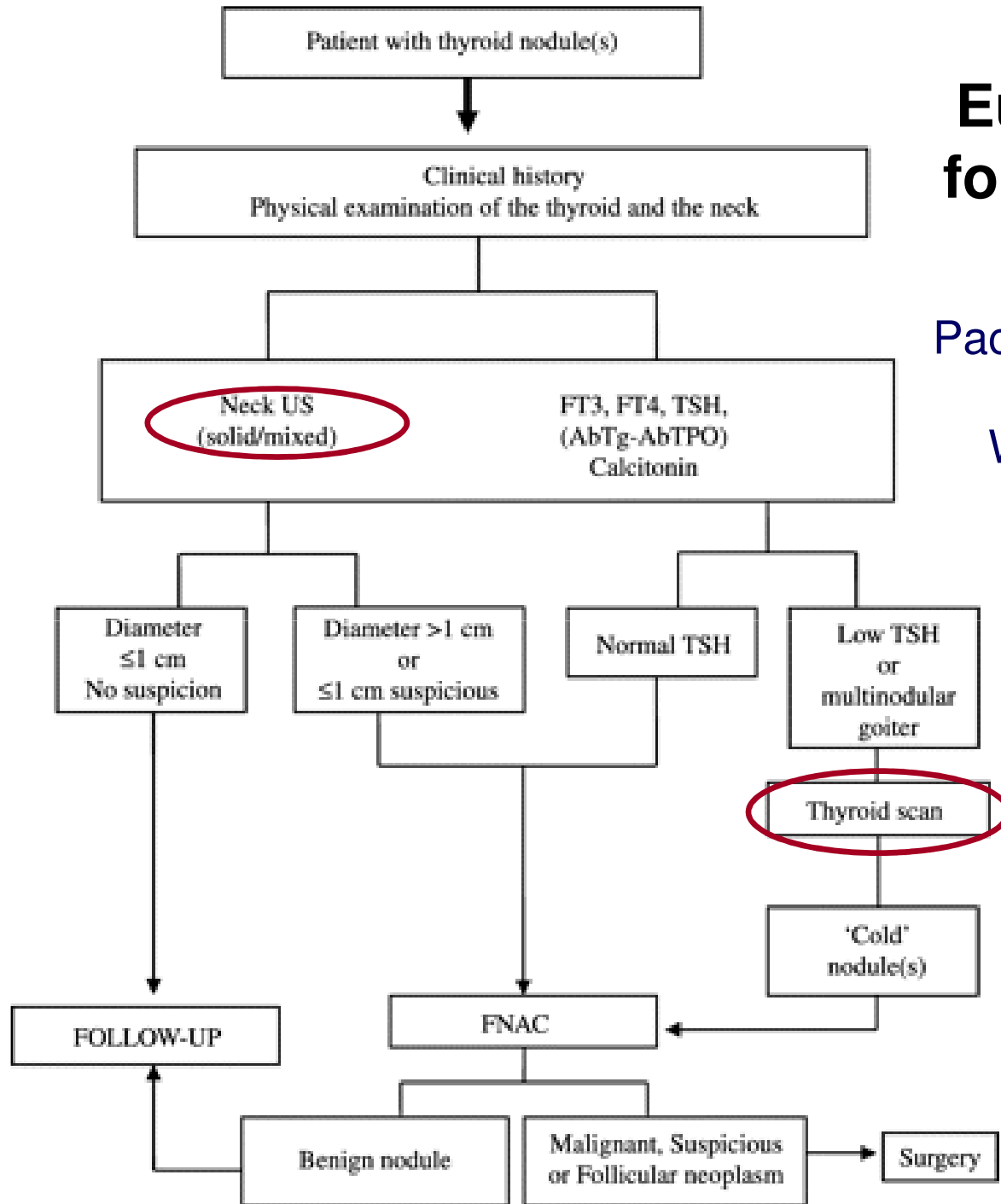
Purpose of Preoperative Imaging

- to guide the management of patients with nodules of cytologically indeterminate dignity (follicular neoplasia)
- to detect and localize lymph node metastasis or soft tissue invasion
- to adapt the surgical strategy

Is there any Standard for
Preoperative Imaging?

European Consensus for the Management of Patients with DTC

Pacini F, Schlumberger S, Dralle
H, Elisei R, Smit JWA,
Wiersinga W the European
Thyroid Cancer Taskforce

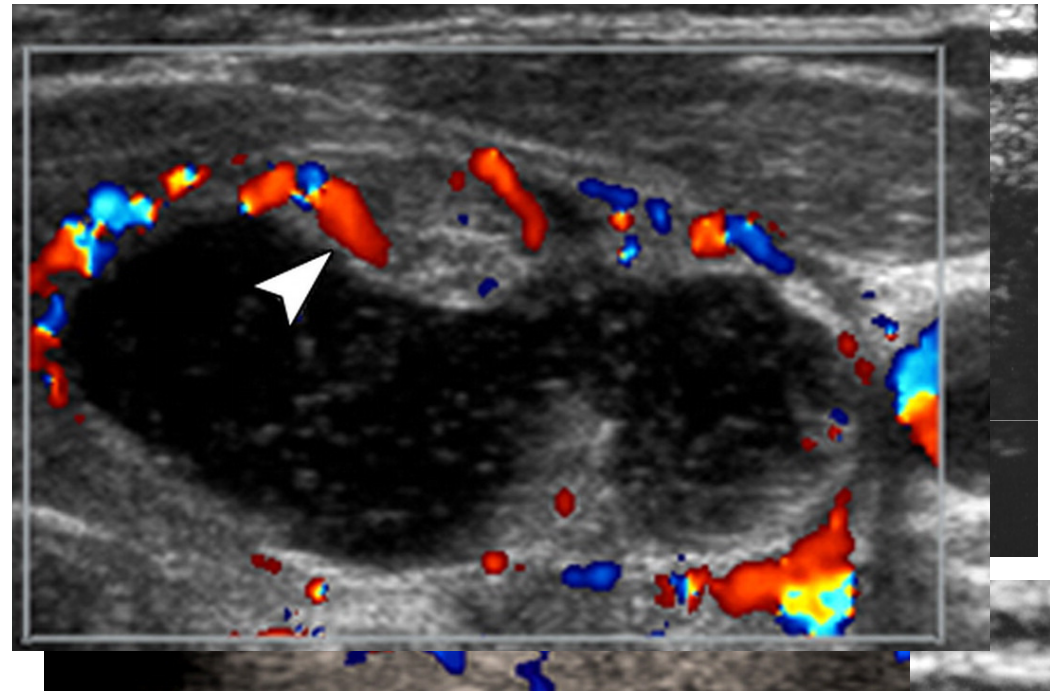


US/Scintigraphy in the Work up of Thyroid Nodules

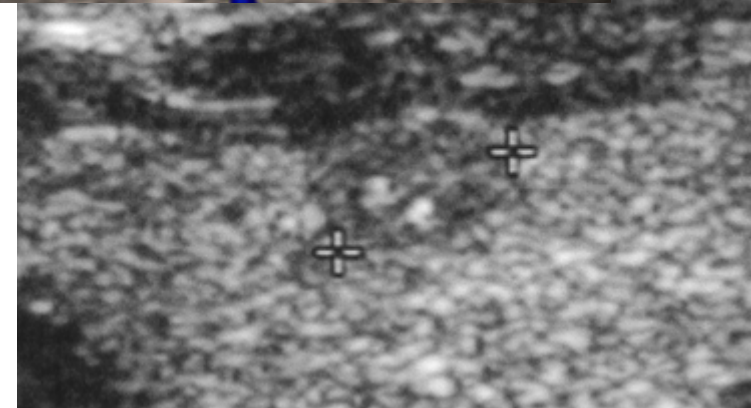
	solitary nodule(s)	multiple nodule(s)	
Scan		66	Europe
US 80		84	
Scan		23	USA
US 34	59		

Ultrasonographic Indicators of Malignancy

- increase in size
- shape (round)
- hypoechogenicity
- irregular outline
- central hyperperfusion
- microcalcification



any single sign is unspecific



Differences in US Criteria to Define LN Metastasis

- height > 0.5 cm
 - height/width ratio > 0.5
 - irregular spiculated outline
 - cystic changes
 - the absence of hilum
 - microcalcification
 - chaotic capsular blood flow
-
- minor axis greater than 10 mm
 - minor axis greater than 50% of major axis
 - or hypodensity with or without microcalcifications

American Joint Committee on Cancer Staging. 2002 Manual for staging of cancer, 6th ed. J.B. Lippincott, Philadelphia, PA.
Senchenkov Surgical Clinics of North America 2004

Identification of Nonpalpable Lymph Node Metastasis in PTC

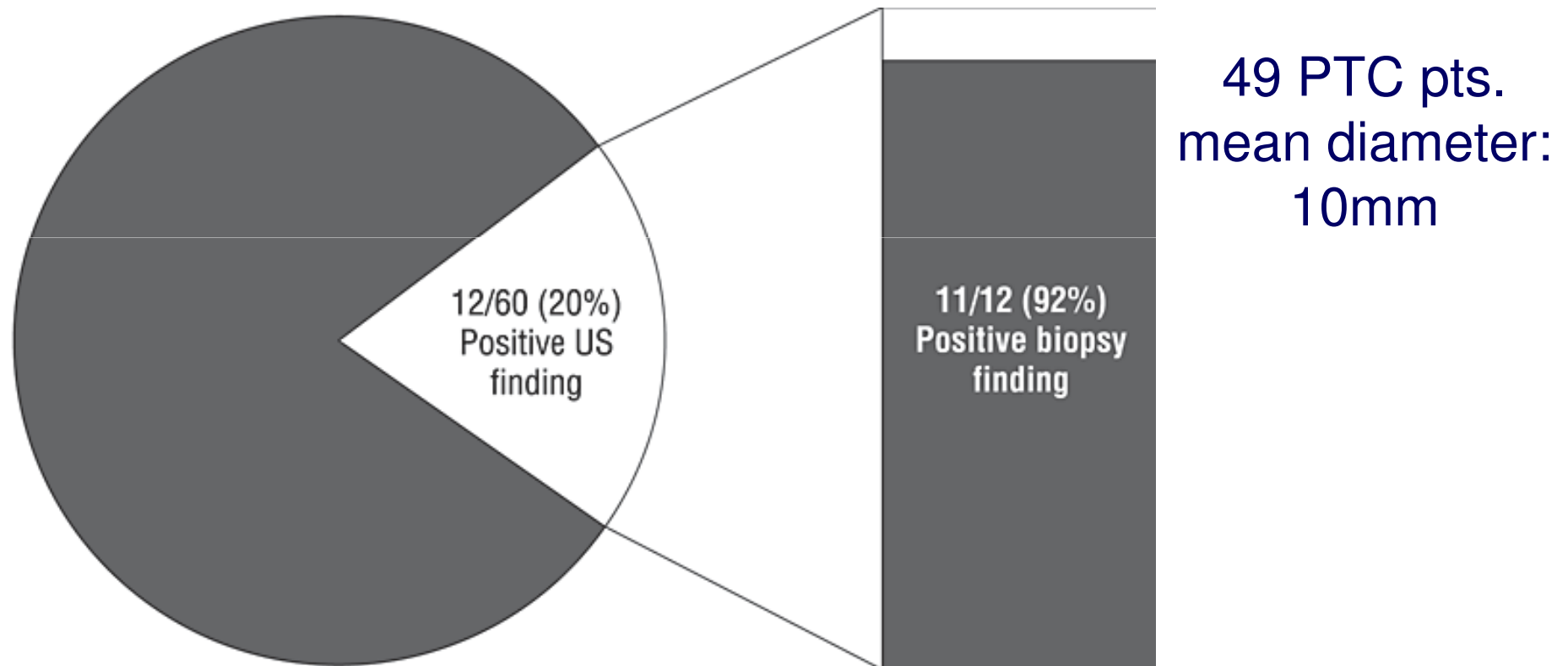


Table 3. Neck Level Localization of Metastasis by US Finding

Neck Level	Positive Pathological/ Positive US Findings (%)^a	Positive Pathological/ Negative US Findings (%)^b
IIa	1/1 (100)	NA
III	3/3 (100)	NA
IV	5/5 (100)	NA
Vb	1/1 (100)	NA
VI	8/9 (89)	1/9 (11)

Do US Findings Change Surgical Strategies?

n	histology	detection of unknown tumor (LN/soft tissue) %	change in management %	author
212	DTC, MTC	34 (DTC)	21 (DTC)	Kouvaraki, Surgery 2002
770	DTC (1st or reoperation)	14 (nonpalp) 7 (palpable)	41	Stulak, Arch Surg 2006
49	PTC	20	22	Gonzalez, Arch Otol Head Neck Surg 2007

Pro and Contra for Extended Lymph Node Imaging by the Use of US

pro:

- less residual tumor tissue – increased efficacy of RAI131
- lower recurrence rate
- less follow up procedures and (costs?)

contra:

- higher morbidity
- no effects on prognosis

prerequisites:

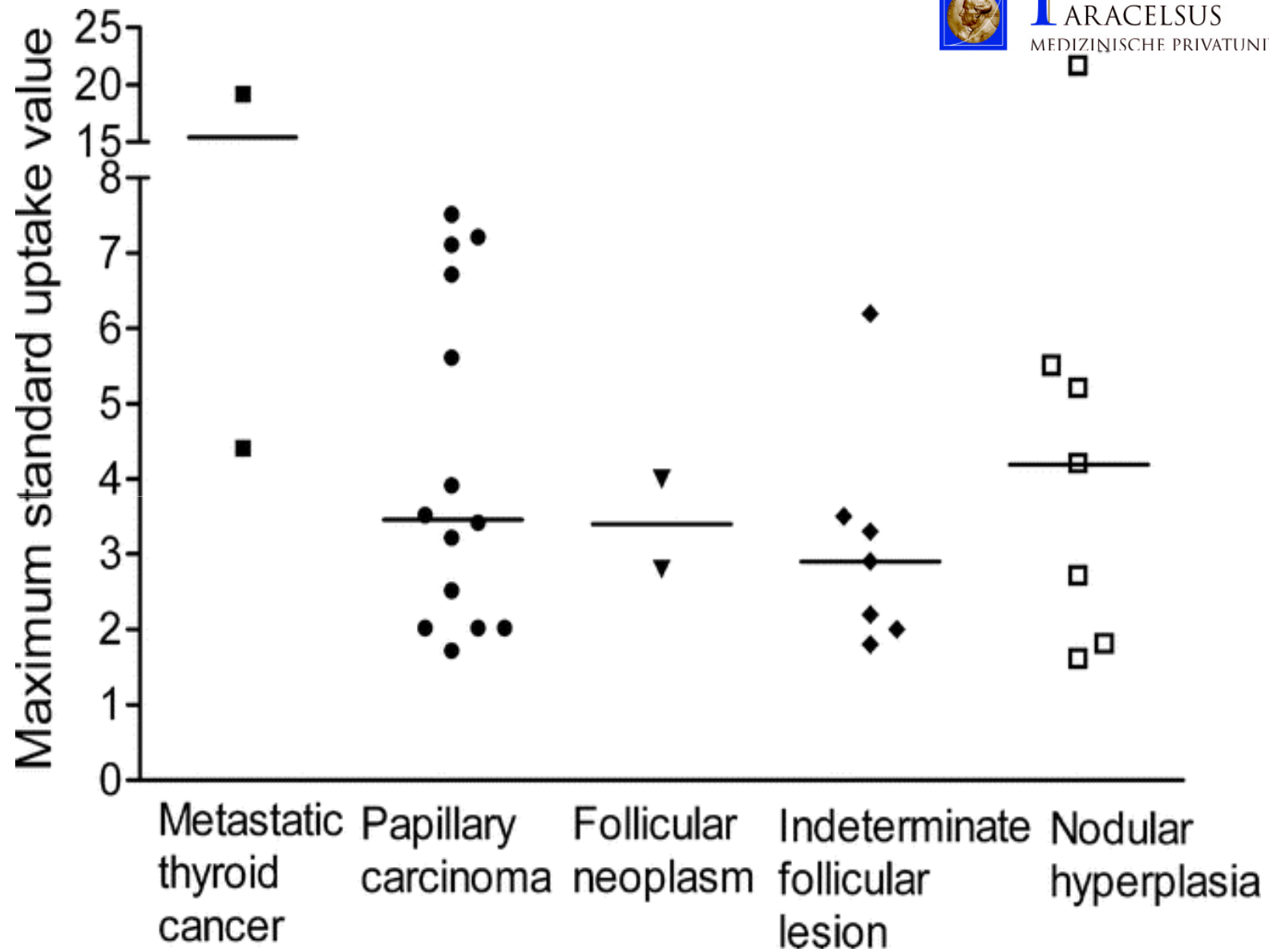
expertise, experience and collaboration

Diagnostic Performance of FDG PET in DTC

Thyroid Cancer Presenting as Incidentaloma

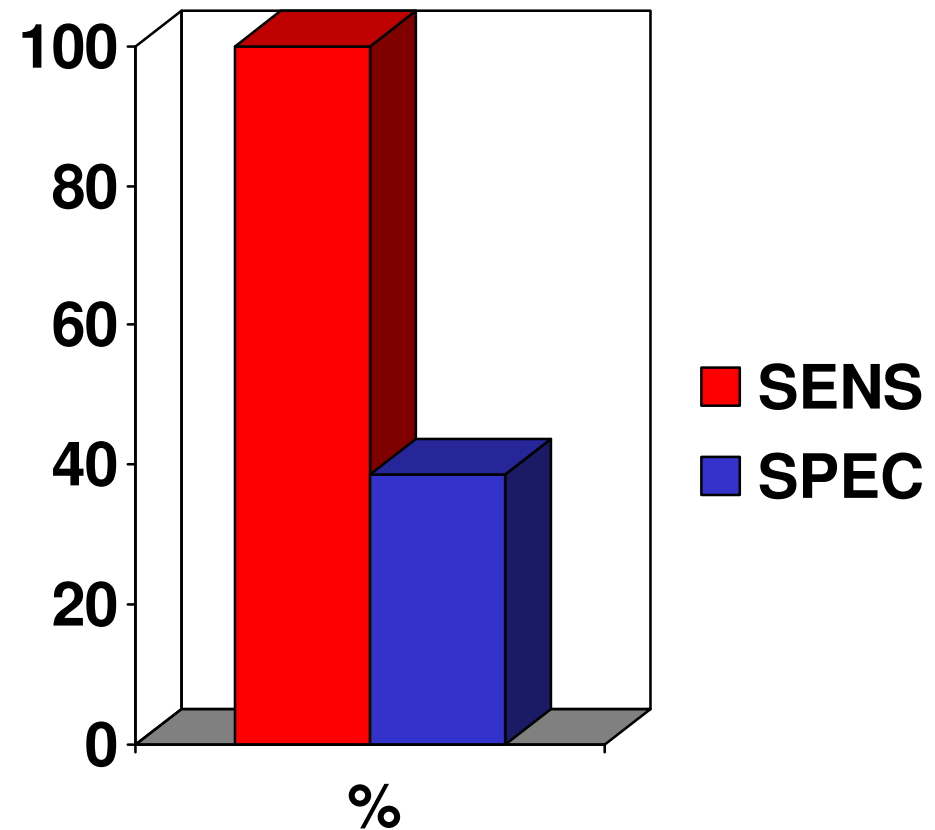
Subjects	Prevalence	lesion diameter	SUV	author
1330 p	0.03 % (4)		16.5 ± 4.7	Kang, JCEM 2003
4803 h	0.15 % (7)		6.8+/-3.7	Chen, Anticancer Res 2005
4136 p	0.34 % (14)	0.6–6.9	1.9-20	KIM, Laryngoskope 2005
140 lc	2.9 % (4)	0.8-2.5	3.0-32.9	Yi, Radiology 2005

h: healthy subjects, p: pt. w. suspected cancer, l.c. lung cancer



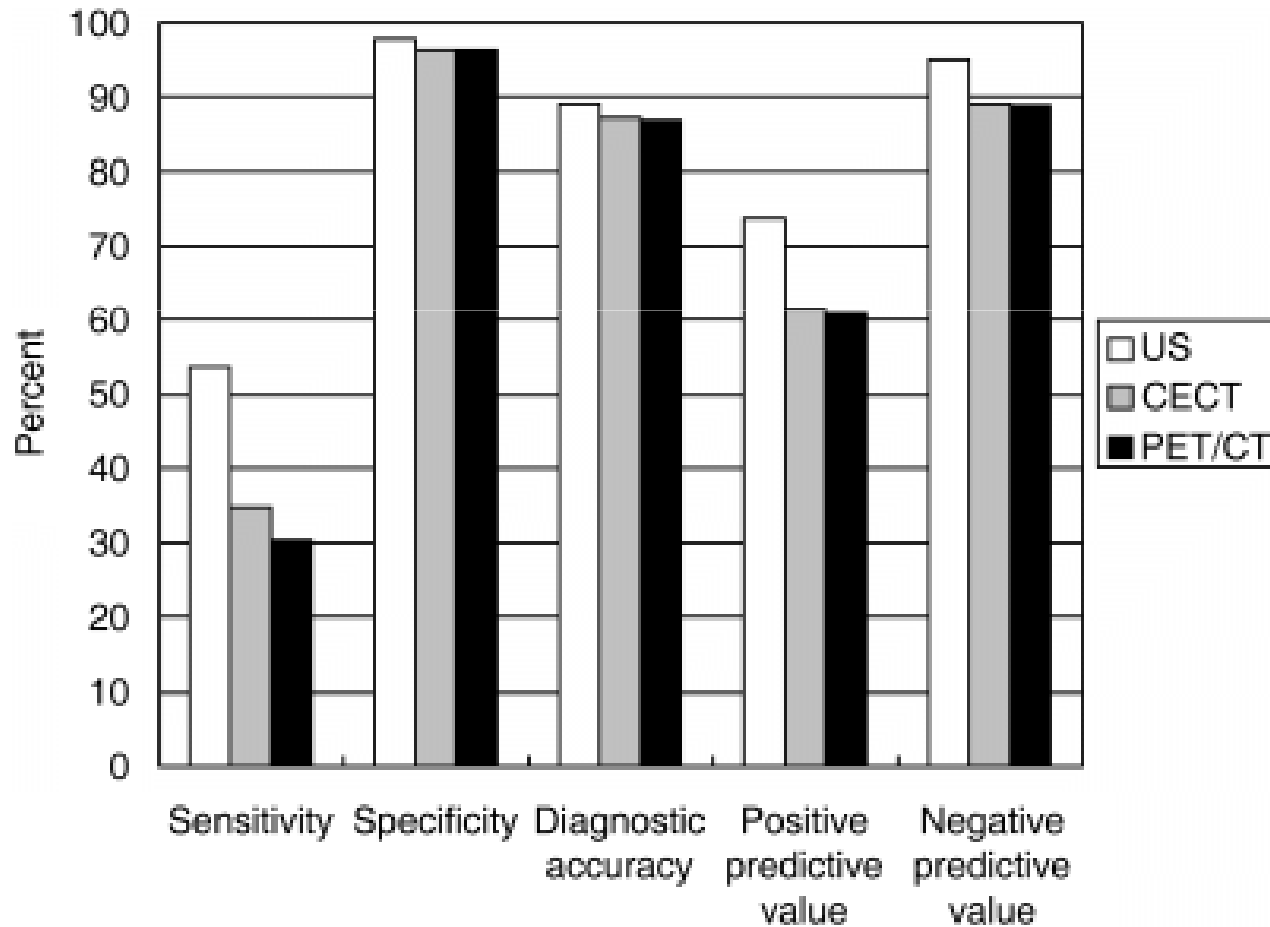
Preoperative Imaging of Nodules with Indeterminate Dignity in FNA using FDG PET

- 42 pts.
- fokal uptake in all cancers
- no relation between size and SUV
- no predictive value of SUV
- reduction of unnecessary thyroidectomy in 39 %



%
Sebastianes, JCEM 2007

Staging of DTC: Diagnostic Value of US, CE-CT and PET-CT for Preoperative Evaluation of Lymph Nodes in all Levels



Characterisation of Tumor Biology in DTC by FDG PET and RAI Imaging

RAI

FDG

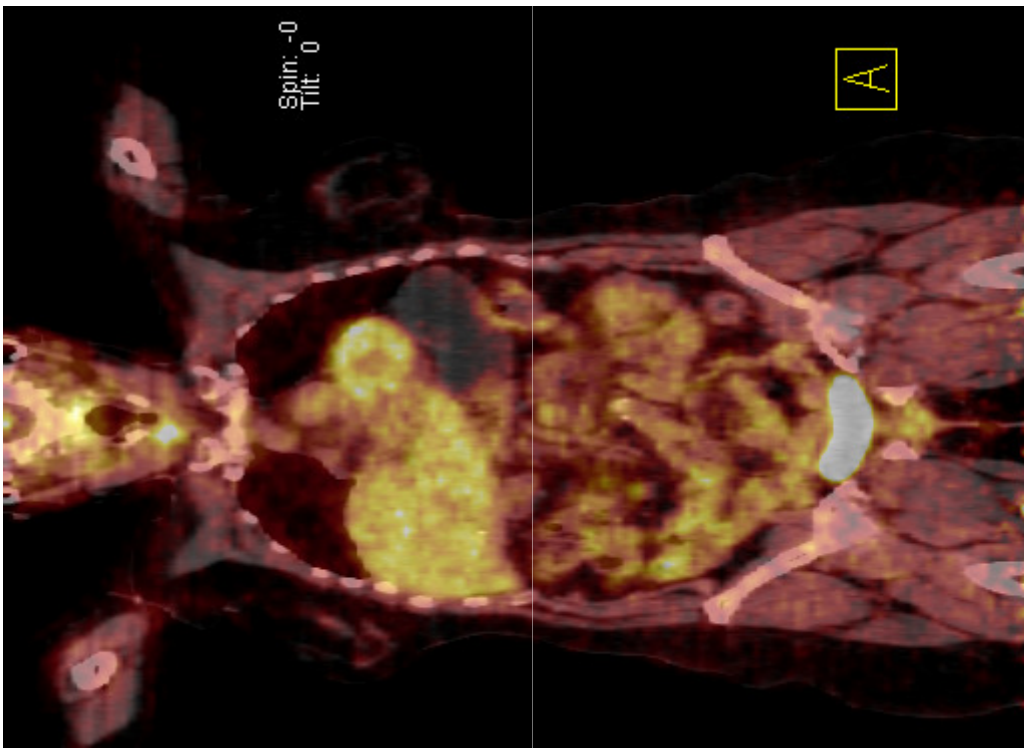
+

-

-

+

Flip Flop Pattern in > 90 % (41 DTC pts)



R
Posterior 64K Dauer:1260sec 256x1024
Pix:2.4mm 131-Iodine

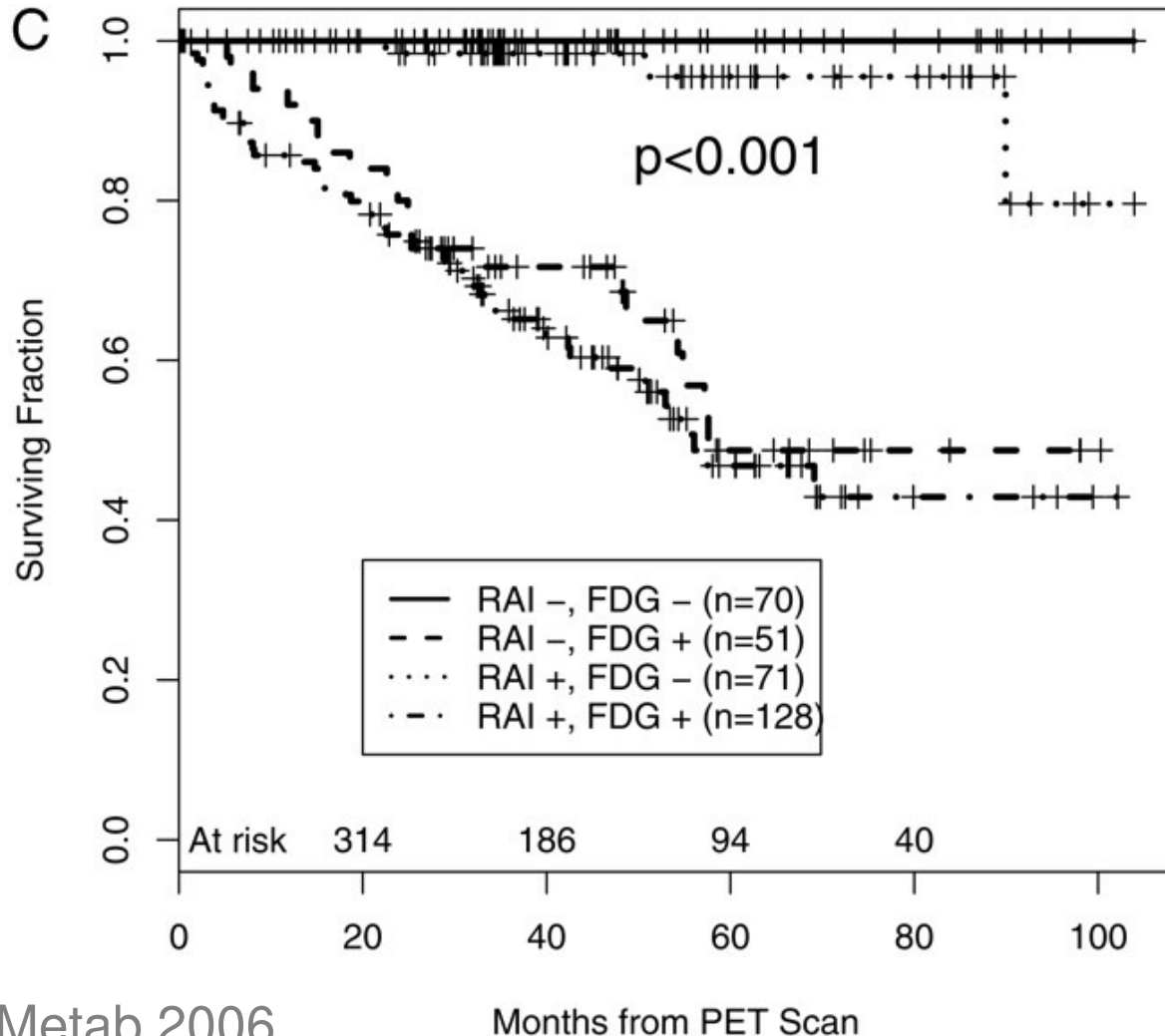


L
Anterior 75K Dauer:1260sec 256x1024
Pix:2.4mm 131-Iodine

Diagnostic Performance of FDG PET in RAI-negative, Patients with DTC and Elevated TG Levels

n	Sens	Spec	Author
37	70	77	Wang JCEM 1999
166	85	90	Grünwald EJNM 1999
24	95	26	Frilling Surgery 2000
22	80	83	Yeo Head Neck 2001
64	69	42	Schluter JNM 2001
35	92	80	Plotkin Thyroid 2002
	88.5	78.5	

Survival of TC patients based on radioactive iodine scanning and FDG-PET scanning



Conclusion

Neck US:

- first tool in pre- and postoperative state
- examination of 1) thyroid and 2) cervical lymph nodes (central and lateral compartments)
- highly sensitive and specific
- requires expertise, experience and collaboration

FDG PET-CT:

- no screening tool for TC
- of diagnostic and prognostic value in patients with increasing thyroglobulin, but negative RAI scan or suspected distant metastasis