SPECT CT in Thyroid Cancer

Val Lewington
Guy’s and St Thomas’ Hospital, London

Tara Barwick Ranju Dhawan Fahim-Ul Hassan

Thyroid Cancer

0.6 - 1.5% of all cancer
Incidence per 10^5  Male 37  Female 112

% Papillary 70-85 Locally invasive/ regional nodes
Follicular 10-20 Angioinvasive/distant metastasis
Medullary 5 Lymphatic & angioinvasive
Anaplastic <5

Initial management

- Diagnosis  FNA
- Surgery  total thyroidectomy
- 131I thyroid remnant ablation
\[1^{31}\text{I} \text{ ablation rationale}\]

- Selective uptake (NIS)
- Remove all thyroid tissue – local control
- ↑ Thyroglobulin specificity
- Enhance metastatic uptake
- Post treatment Whole Body Scan (WBS)

\[\text{Post ablation imaging}\]

Low risk
- Papillary / minimally invasive follicular
- Near total thyroidectomy
- \[1^{31}\text{I}\] uptake confined to thyroid bed
- Undetectable Tg/sTg
- Tg antibodies absent

High risk
- Elderly
- Male
- Histology - Poorly differentiated
  - PTC variants
  - multifocal
- incomplete surgery
- N1b / M1 disease
- anti Tg antibodies
Prognosis

- PTC 80% 10 year survival Goldman 1996
- FTC 60% Geopfert 1994
- MTC 75% Sporadic
  40% MEN2B

Life time follow up
- 43% of all relapses in 1st year
- 23% within 2-5 yrs
- 9% > 10 years

NM Imaging timepoints

- Post ¹³¹I ablation
- Low risk follow up:
  Selected subset  e.g. +ve anti Tg antibodies
- High risk follow up:
  Post ¹³¹I therapy
  Detectable thyroglobulin
  +ve anti Tg antibodies

Post ¹³¹I ablation

- WB imaging as standard
  Activity ~ 800 MBq ¹³¹I at discharge
  
  Leitha T Nuklearmedizin 2003
  59% required additional investigation

- SPECT few anatomical/physiological landmarks
  Barwick T Eur J Endocrinol 2010
Post $^{131}$I ablation

SPECT CT: Precise localisation and staging
  • Physiological vs pathological discrimination

• Thyroid bed vs cervical node
Post $^{131}$I ablation

SPECT CT: Precise localisation and staging

- Physiological vs pathological discrimination
- Thyroid bed vs cervical node
- Metastatic localisation

Post $^{131}$I ablation

SPECT CT: Precise localisation and staging

- Physiological vs pathological discrimination
- Thyroid bed vs cervical node
- Metastatic localisation – guide further Rx
SPECT CT - local disease

- Inconclusive studies from 29 to 7%  
  Aide N J Clin Endocrinol Metab 2009  n=55
- Improved node staging in 25 – 35%  
  Mustafa M Eur J Nucl Med Mol Imaging 2010  n=155
  Schmidt D JNM 2009  n=57

SPECT CT - M staging

M stage change 21%  Management change 74%  
Kohlfuerst S Eur J Nucl Med Mol Imaging 2009  n=41

Follow up 123I or 131I

- Detectable Tg / sTg
- Anti-thyroid antibodies

SPECT CT: Additional diagnostic information in 42%  
Barwick T Eur J Endocrinol 2010  n=85

Guides neck US / MRI  
99m Tc MDP Bone scintigraphy  
TSH stimulated PET CT

SPECT CT - metastatic disease
**SPECT CT – metastatic disease**

- Occult metastasis
- Synchronous 2nd primary

**SPECT CT – incidental finding**

- Occult metastasis
- Synchronous 2nd primary

**Medullary thyroid cancer**

- Parafollicular C cells
- Non iodine avid
- $^{123}$I mIBG
- $^{111}$In radiopeptide
- $^{99m}$Tc DMSA (V)

**Indications:**
- Rising marker (calcitonin/CEA)
- Guide further Rx
- Select for targeted radionuclide Rx
Controversies

- Is SPECT CT mandatory?
- Area of interest:
  - determined by planar imaging?
  - wider FOV in high risk disease?
- Time / dose constraints

Summary

SPECT CT in DTC

- Improves diagnostic accuracy
- Guides further Rx
- Additional clinical information