Benign Thyroid Therapy

Susan E M Clarke
Guys and St Thomas’ NHS Foundation Trust
Overview

- Review of pathologies
- Therapeutic options
- Radioiodine methodology
- Dosimetry
- Side effects
- Euthyroid goitre
- Controversies
Benign Thyroid Disease

- Thyrotoxicosis
- Thyroiditis
- Euthyroid goitre
RADIOIODINE THERAPY IN BENIGN THYROID DISEASE

SUITABLE FOR

• Thyrotoxicosis (common aetiologies)
• Euthyroid Goitre
RADIOIODINE THERAPY IN BENIGN THYROID DISEASE

NOT SUITABLE FOR

• Iodine induced thyrotoxicosis
• Sub acute viral thyroiditis
• Hashimotos thyroiditis
• Postpartum thyroiditis
SUB ACUTE VIRAL THYROIDITIS

Acute Phase
Recovery phase
Causes of a high T4 / T3 and a low uptake pattern

- Subacute viral thyroiditis
- Amiodarone
- Kelp
- Contrast media
- Thyroxine medication
THYROTOXICOSIS
Common aetiologies

• Toxic diffuse goitre (Graves’ Disease)
• Toxic nodular goitre (Plummer’s disease)
Grave’s Disease

With patient’s consent
Grave’s Disease

With patient’s consent
Grave’s Pretibial Myxoedema

With patient’s consent
Toxic Multinodular Goitre

With patient’s consent
THERAPEUTIC OPTIONS

• Antithyroid drugs
• Surgery
• Ethanol injections
• Radioiodine
RADIOIODINE THERAPY IN BENIGN THYROID DISEASE

Management of thyrotoxicosis

• Graves’ : Initial course of CBZ/PTU
  54% chance of cure
  RAI / surgery for relapse

• Plummer’s: No cure with CBZ/PTU
  Proceed to RAI
Targets of antithyroid drugs

Wheetman, Lancet, 2001
RADIOIODINE THERAPY IN BENIGN THYROID DISEASE

THYROTOXICOSIS

• Toxic Diffuse Goitre
• Toxic Nodular Goitre
RADIOIODINE THERAPY IN BENIGN THYROID DISEASE

• FACILITIES
• STAFF
• INFORMATION
RADIOIODINE THERAPY IN BENIGN THYROID DISEASE

ABSOLUTE CONTRAINDICATIONS

• Pregnancy
• Breastfeeding
RADIOIODINE THERAPY IN BENIGN THYROID DISEASE

RELATIVE CONTRAINDICATIONS

- Uncontrolled thyrotoxicosis
- Heart failure
- Severe dysthyroid eye disease
- Retrosternal extension
- Children
- Planned pregnancy
Role of RN imaging in patients referred for RAI

- Ensures uptake
- Permits dose calculation
- Aids prognosis
THYROID SCAN

99m Tc Pertechnetate

123I Iodine
Normal 99mTc Thyroid Scan

20 min uptake: 2.89%
Thyrotoxicosis

1) Diagnosis
2) Management Plan
3) Pre-radioiodine
GRAVES’ DISEASE
99m Tc Scan with 20min uptake
Graves disease in a MNG
Cold nodule in Graves’ Disease
Dominant Cold Nodule Graves in MNG
DEVELOPING AUTONOMOUS NODULE
$^{99}$Tc Thyroid scan in Multinodular Goitre

FT4  18.5
TSH  0.9
99m Tc Thyroid scan in MNG

FT4 12.2
TSH 0.8
(FT3 5.0)
Assymetrical Thyroid
RADIOIODINE THERAPY

Precautions

- Pregnancy test
- Discontinue antithyroid drugs >48h
- Child care arrangements
- Follow up arrangements
RADIOIODINE THERAPY
RADIATION PROTECTION
ADVICE

• Customise - national legislation
• Avoid prolonged close contact with small children and pregnant women
• Separate bed to partner
• Public transport < 1h journey
• Work restrictions
RADIOIODINE THERAPY
CONSENT

- Received written information
- Precautions explained
- Pregnancy excluded
- Avoidance of pregnancy
- Possible hypothyroidism
RADIOIODINE THERAPY
PRACTICAL ISSUES

- Administered activity
- Liquid or capsule
CONTROVERSIES
Administered Activity Calculation

• Fixed dose
• Dose adjusted by clinical findings
• Dose adjusted by pathological findings
• Dose calculated by tracer studies
TREATMENT OF TOXIC NODULE

BEFORE

AFTER
TOXIC MULTINODULAR GOITRE

Before Radioiodine

After Radioiodine
OUTCOME
Dosimetry v Fixed dose

Dosimetry
n= 63
86% Euthyroid
9% Hyperthyroid
5% Hypothyroid
Isselt et al, 2001

Fixed Dose
n = 58
100% Euthyroid or hypothyroid
0% Hyperthyroid
Maltby et al, 2007
RADIOIODINE THERAPY IN TOXIC MNG
ISSUES

Subclinical hyperthyroidism
RADIOIODINE THERAPY IN TOXIC MNG

ISSUES

Role of rTSH in large MNG with suppressed TSH

Duick et al, 2003
Lithium and RAI therapy

1972 Lithium inhibits release of 131I
   Robbins et al
2002 Lithium improves ablation of resistant thyrotoxicosis
   Frank et al
THERAPEUTIC OPTIONS
Surgery
Indications

- Compressive symptoms
- Significant mediastinal extension
- Suspicious nodules
THERAPEUTIC OPTIONS
Ethanol Injections

- Used for single toxic nodules
- Not usually effective in toxic MNG
Timing of RAI in Plummer’s Disease

Avoid treating patients when remaining gland not suppressed
RADIOIODINE THERAPY IN
BENIGN THYROID DISEASE
CONTROVERSIES

- Age
- Pre treatment
- Administered dose calculation
- Dysthyroid eye disease
CONTROVESIES

Age

- Women of over child bearing years
- All adults
- All children > 14
- All children
Childhood Graves’
CONTROVERSIES
Pre treatment

• Radioiodine therapy in thyrotoxic patients carries a clinical risk
• Pre treatment may reduce efficacy of radioiodine
CONTROVERSIES
Administered Activity Calculation

- Fixed dose
- Dose adjusted by clinical findings
- Dose adjusted by pathological findings
- Dose calculated by tracer studies
Varying dose regimen for treatment of thyrotoxicosis

Hardisty et al, 1989
Varying dose regimen for treatment of thyrotoxicosis

Hardisty et al, 1989
Varying dose regimen for treatment of thyrotoxicosis

Hardisty et al, 1989
CONTROVERSIES
Radioiodine treatment and dysthyroid eye disease

• Does radioiodine cause dysthyroid eye disease?
• Does radioiodine exacerbate dysthyroid eye disease?
GRAVES’ Thyroid Eye Disease

- Affects 50% of patients with Graves’ disease
- Severity correlates with antibody levels
- TSH receptor Ab better correlate than TPO Ab
- 64kDa protein identified in serum of patients with active dysthyroid eye disease
- G2s - thyroid and eye muscle shared marker
- Self limiting condition
SEVERE DYSTHYROID EYE DISEASE
Clinical Activity Score

- Pain
  - behind orbit
  - on eye movement

- Redness
  - eyelids
  - conjunctiva

- Swelling
  - eyelids
  - chemosis
  - caruncle
  - proptosis > 2mm/month

- Impaired function
  - eye movements
  - visual acuity
TEMPORAL RELATION BETWEEN ONSET OF TED AND HYPERTHYROIDISM

Wiersinga et al, THYROID, 2002
THYROID EYE DISEASE
RISK FACTORS

• Untreated hyperthyroidism
• High antibody levels
• Smoking
• Male
• Radioiodine treatment
• High TSH
Large doses of radioiodine in Graves’ disease: effect on ophthalmopathy and long acting thyroid stimulator

Non ablative doses of radioiodine have varying effects on Graves’ ophthalmopathy

Peqquequat E et al, 1967
Radioiodine and TED

Large randomised controlled trial suggested RAI initiated/exacerbated TED more than anti thyroid drugs

Bartalena et al, 1992
Prospective and controlled study of ophthalmopathy after radioiodine therapy for Graves’ hyperthyroidism

No difference between RAI and control arm

Manso et al, Thyroid, 1998
Does early administration of thyroxine reduce the development of Graves’ ophthalmopathy after radioiodine treatment?

Avoidance of post radioiodine hypothyroidism reduces exacerbation of Graves’ ophthalmopathy

Tallstedt L et al, 1994
THERAPEUTIC OPTIONS
Surgery
Indications

• Large, unsightly
• Compressive symptoms
• Significant mediastinal extension
• Suspicious nodules
THERAPEUTIC OPTIONS
Surgery
Complications

- Transient or permanent hypocalcaemia
- Transient or permanent recurrent laryngeal nerve injury
- Hypothyroidism
- Recurrence if less than total thyroidectomy
RAI and Thyroid Eye Disease

Recommendations

• Prompt, effective control of hyperthyroidism
• Encourage cessation of smoking
• Avoid treating patients when eye disease active
• Cover with high dose steroids if eyes active
• Avoid hypothyroidism post radioiodine
RADIOIODINE FOR NON-TOXIC GOITRE
TREATMENT OF NON TOXIC GOITRE

- Conservative
- Surgery
- Radioiodine
- NOT THYROXINE
## Radioiodine for non-toxic goitre

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>vol</th>
<th>Size ml</th>
<th>Dose mCi/g</th>
<th>mCi</th>
<th>FU (y)</th>
<th>vol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heged</td>
<td>25</td>
<td>US</td>
<td>73</td>
<td>100</td>
<td>15</td>
<td>1</td>
<td>41%</td>
</tr>
<tr>
<td>Nygard</td>
<td>69</td>
<td>US</td>
<td>74</td>
<td>100</td>
<td>15</td>
<td>5</td>
<td>55%</td>
</tr>
<tr>
<td>Huysmann</td>
<td>19</td>
<td>MRI</td>
<td>269</td>
<td>100</td>
<td>71</td>
<td>1</td>
<td>40%</td>
</tr>
<tr>
<td>Wesche</td>
<td>10</td>
<td>US</td>
<td>88</td>
<td>120</td>
<td>20</td>
<td>1</td>
<td>48%</td>
</tr>
<tr>
<td>De Klerk</td>
<td>27</td>
<td>CT</td>
<td>194</td>
<td>90</td>
<td>35</td>
<td>1</td>
<td>34%</td>
</tr>
<tr>
<td>Le Moli</td>
<td>50</td>
<td>US</td>
<td>82</td>
<td>100</td>
<td>27</td>
<td>2</td>
<td>49%</td>
</tr>
<tr>
<td>Bomema</td>
<td>23</td>
<td>MRI</td>
<td>311</td>
<td>150</td>
<td>62</td>
<td>1</td>
<td>34%</td>
</tr>
<tr>
<td>Wesche</td>
<td>29</td>
<td>US</td>
<td>56</td>
<td>120</td>
<td>24</td>
<td>2</td>
<td>44%</td>
</tr>
</tbody>
</table>
Radioiodine for Non-toxic Goitre Adverse Effects

**EARLY**
- Pain
- Thyrotoxicosis
- Compression

**LATE**
- Graves’ (5%)
- Hypothyroidism (20-50%)
RAI for non-toxic goitre
Induction of Graves’ disease

5% of patients with non-toxic goitre treated with RAI develop Graves’
Radioiodine for Non-toxic Goitre
Role of rTSH

• 0.01/0.03 mg rTSH IM 24h prior to RAI
• Reduced activity of RAI
• Reduced dose to non thyroidal tissue

Nieuwlaat et al, JCEM 2003
Radioiodine for Non-toxic Goitre
Role of rTSH

0.45mg rTSH 24h prior to RAI
- Increased pain in thyroid region
- Raised peak T4
- 40% reduction in thyroid volume
- rTSH+RAI > RAI alone

Silva et al, Clin Endocrinl 2004
• “A great many side factors of a particular nature will influence the choice of the initial dose, all of them quite obvious to the clinician when he is presented with a particular patient. It is wise to give the minimum effective dose in a young patient, add a few mCi’s more if the symptoms are severe, double the dose if the heart is badly damaged, subtract a mCi or two if the patient is already overweight, add a couple if the patient lives out of town or if the patient’s doctor is dubious of the value of the treatment”!!

Saed L and Fields T (1953)