Thyroid & Parathyroid Scans

What is it?

Technetium and iodine are taken up by the thyroid gland physiologically. While technetium play no further part in thyroid metabolism, iodine is organified and is ultimately complexed with tyrosine residues to form the various thyroid hormones. Bound to thyroglobulin, these hormones can be stored for release at a later stage when needed by the cells of the body. The uptake of isomers of technetium (the radioactive 99m isomer) and of iodine (the radioactive 123 and 131 isomers) can all be imaged and measured and aids in the diagnosis of various thyroid related pathologies.

The iodine whole body scan can also be utilized to stage for iodine avid metastases in thyroid cancer patients.

Non-thyroidal tissue should not accumulate pertechnetate or iodine. Cystic structures should also not accumulate pertechnetate or iodine or any other tracer for that matter, whereas tumours (benign and malignant) by virtue of their high cellular activity or mitochondrial concentration can accumulate tumoral agents such as ^{201}Thallium and ^{99m}Tc-Sestamibi, respectively. This forms the basis for dual tracer imaging when assessing for neoplastic lesions visualized on thyroid ultrasound or other imaging modality.

The same principle can be applied in the presence of primary hypercalcemia and raised parathyroid hormone to confirm and localize a hyperfunctioning parathyroid gland or confirm parathyroid hyperplasia.

Furthermore, subtraction of the pertechnetate data from the ^{99m}Tc-Sestmibi or ^{201}Tl data can more definitively reveal the culprit parathyroid adenoma.

Dual phase imaging also allows for greater sensitivity. The patient is imaged over three hours. A tumour (benign or malignant) should demonstrate progressive accumulation of ^{99m}Tc-Sestamibi unless there is over expression of the gene coding for P-glycoprotein – in the case of malignancy this may infer resistance to chemotherapy (useful especially in scintomammography).

What are the indications for thyroid and parathyroid Scintigraphy and uptake?

Thyroid Scintigraphy and uptake:

- Differential diagnosis for thyrotoxicosis:
    - Increased uptake:
        - Graves
        - Multinodular goitre
        - Acute Hashitoxicosis
        - Central hypothyroidism
        - Hydatiform mole, trophoblastic tumours, choriocarcinoma
        - Metastatic thyroid cancer (if functional)
    - Decreased uptake:
        - Subacute thyroiditis
            - Granulomatous thyroiditis (de Quervains)
            - Silent thyroiditis
            - Post-partum thyroiditis
        - Iodine induced thyrotoxicosis (Jod-Basedow)
        - Amiodarone-induced thyrotoxicosis
        - Thyrotoxicosis factitia
        - Struma ovarii
        - Iodine induced blockade of uptake (Wolff Chaikoff)
- Estimate I-131 therapy dose for Graves, toxic nodule(s) and cancer
- Estimate residual thyroid post-surgery (with whole-body imaging)
- Predict I-131 effectiveness (response)
- Follow-up for recurrence

Parathyroid Scintigraphy:

- To assess for parathyroid adenoma/hyperparathyroidism in proven hypercalcemia and raised PTH
- To allow for intra-operative localization using a gamma probe (less invasive)

What does the patient need to know?

Thyroid imaging:

- The scan consists of injecting a low-dose radiotracer, which will get taken up by the thyroid gland, and any thyroidal tissue.
- The various studies can last the following:
- Pertechnetate scan: 1 hour
- I-123 whole body: 30 minutes at 24 hours
- I-131 whole body: 30 minutes at 48 hours
- Sestamibi scan: Up to 4 hours
- Cessation of treatment interfering with thyroid uptake is required.
- Cessation of thyroxine for 4-6 weeks and T3 for 2 weeks to achieve a TSH > 30 IU. Recombinant TSH may be considered 2 days before whole body scan.

Parathyroid imaging: No preparation

In general:

- No contrast enhanced radiological examinations in the preceding 4 weeks
- The radiation risks are significantly less than conventional radiological procedures.
- The patient should please inform us if pregnant or suspicious that she may be or if breastfeeding.

Please refer your patient to theramednuclear.co.za for detailed information regarding the scan, preparation therefor, radiation safety et cetera.

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