Case 2: 30 yr-old woman with 7 yr history of recurrent kidney stones

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30 yr-old woman with 7 yr history of recurrent kidney stones

Hypercalcemia (11.4 mg/dL)
Increased serum PTH (199 pg/mL)

Diagnostic work-up for suspected primary hyperparathyroidism (performed in a peripheral hospital):
• Normal neck US examination.
• No parathyroid scintigraphy performed.
• Measurement of bone mineral density (DEXA):
  • vertebral BMD 0.8959 gr/cm² (T score -1.2; Z score – 1.1);
  • femoral  BMD 0.656 gr/cm² (T score -1.7; Z score – 1.7).
• 24-hr urinary calcium: 388 mg (100-300).
• No Vitamin D deficiency.
December 2008, Bilateral neck exploration: no evidence of abnormal parathyroid glands; thymectomy performed because of suspected intra-thymic localization □ histology: normal thymic tissue

February 2009 (persistent hyperparathyroidism) Small nodule in thymic region (6×8 mm) detected on neck CT: ectopic parathyroid adenoma?

Preoperative parathyroid localization is crucial in failed parathyroidectomies or in case of recurrent disease
Primary hyperparathyroidism is defined as an excessive PTH secretion despite normal serum calcium levels (inappropriate PTH secretion).

In about 80% of the cases, it is caused by a solitary parathyroid adenoma, in 15%-20% by hyperplasia, and in only 1%-2% of the cases by parathyroid carcinoma.
• Ectopic parathyroid glands (possible site of hyper-functioning adenoma) can be found in 20% of the general population.

• Most common sites of ectopic parathyroid glands:
  • at the angle of the mandible;
  • in the retro-esophageal and pretracheal regions;
  • along the tracheo-esophageal groove;
  • intrathymic;
  • in the pericardium.
All patients with biochemically confirmed primary hyperparathyroidism (PHPT) who have specific symptoms or signs of the disease should undergo surgery.

Results of meta-analysis from Third International Workshop recommends surgery also in asymptomatic PHPT (Udelsman R et al. J Clin Endocrinol Metab. 2009; 94: 366-372):
• Serum calcium 1.0 mg/dL above upper limit of normal (0.25 mmol/liter).
• 24-h urinary calcium not crucial.
• Creatinine clearance (calculated) lower than 60 mL/min.
• BMD: *T-score 2.5 at any site* and/or previous fragility fracture.
• Age <50 yr.
• The conventional surgical approach to primary hyperparathyroidism has, until recently, been represented by bilateral neck exploration (90% success rate).

• The success of minimally invasive parathyroidectomy depends on accurate preoperative localization of the parathyroid lesion(s).
April 2009: Parathyroid scintigraphy dual-phase $^{99m}$Tc-Sestamibi + $^{99m}$Tc-pertechnetate

Washout of $^{99m}$Tc-Sestamibi from the thyroid parenchyma is faster than from abnormal parathyroid tissue. This is related to the presence of oxyphil cells in these lesions, density of mitochondria, regional perfusion, gland size and functional activity, cell cycle phase.
The subtraction method requires administration of either 99mTc-pertechnetate or 123I-iodide, to obtain a purely thyroid image which is subtracted from the 99mTc-Sestamibi image. It is especially helpful in patients with thyroid abnormalities.
Planar imaging 150 min post-injection of $^{99m}$Tc-Sestamibi

150 MBq $^{99m}$Tc-pertechnetate, with planar imaging 15 min p.i.

PHPT sustained by mediastinal parathyroid adenoma, missed at prior surgery because of poor pre-operative imaging characterization (leading to unsuccessful bilateral neck exploration).
250 MBq $^{99m}$Tc-Sestamibi i.v.

Planar imaging and SPECT/CT (parallel-hole collimator) starting 15 min post-injection
- The use of a pin-hole collimator in the neck increases image resolution.
- The chest is best evaluated with a parallel-hole collimator either as a planar image or using SPECT (better topographic correlation).
- SPECT (and especially SPECT/CT) is most helpful in evaluation of the mediastinum as the possible site of ectopic parathyroid glands.
Teaching points

Role of parathyroid scintigraphy in the management of parathyroid adenomas

References