Case 4: Disseminated bone metastases from differentiated follicular thyroid cancer

Giuliano Mariani
Regional Center of Nuclear Medicine, University of Pisa Medical School, Pisa (Italy)
Disseminated bone metastases from differentiated follicular thyroid cancer

- Thyroid carcinoma is the most prevalent endocrine malignancy.
- It accounts for about 1% of all human cancers.
- Approximately 90% of non-medullary thyroid malignancies are well-differentiated and are classified as papillary or follicular.
- Patients with differentiated thyroid carcinoma (DTC) have a high 10-year survival rate (80%–95%), except in the presence of metastatic disease (40% 10-year survival).
• In a review of 13 studies including a total of 1231 patients, 49% of the metastases were in the lung, 25% in the bone, 15% in both lung and bone, and 10% in other soft tissues.

• With bone metastases the overall 10-year survival dropped to between 13% - 21%, depending on the extent of metastases and response to radioactive iodine.

• DTCs are slow growing and are usually efficiently treated with combined surgery, radioiodine ablation, and thyroid stimulating hormone (TSH) suppressive therapy.

• They recur in 20%–40% of patients (still with possible cure).
February 2007:

- A 75-yr old woman, virtually asymptomatic and previously submitted to thyroidectomy because of multinodular goiter (in 2004)

- Referred to Nuclear Medicine after surgical debulking of a lumbar mass whose histology showed metastasis from well-differentiated thyroid cancer.
Rationale for examination

- The osteoblastic reaction accounts for the increased uptake of $^{99m}$Tc-diphosphonates at the site of skeletal metastasis; these agents are therefore most commonly used for localization and staging in patients with bone metastatic disease.

- Tumor cell imaging with $^{131}$I- or $^{123}$I-iodide whole-body scan (WBS) is more specific and sensitive than $^{99m}$Tc-MDP scintigraphy, but only for well differentiated, NIS-positive thyroid tumors (Schirrmeister et al. 2001, de Geus-Oei et al. 2002).
Presentation of clinical data:

• Serum Thyroglobulin 204.4 ng/mL on L-T4 therapy.

Technical parameters of $^{123}$I-WBS and whole-body $^{99m}$Tc-HDP scan:

10 mCi $^{123}$I-iodide was injected after rh-TSH stimulation.
- Image acquisition: planar whole-body scan and SPECT/CT images acquired 24 hr post-injection.
- At 48-hr post-injection of $^{123}$I-iodide: injection of 20 mCi $^{99m}$Tc-HDP, followed by further whole-body acquisition at 4-hr post-injection, with dual-energy peak windowing (140 KeV for $^{99m}$Tc and 159 KeV for $^{123}$I).
Structured approach to image review:
- quality: satisfactory;
- completeness: complete;
- scintigraphic findings and interpretation: see next slides.
$^{123}$I-WBS (planar and SPECT/CT) after rh-TSH (serum Tg: 3810 ng/mL)
Simultaneous whole-body $^{99m}$Tc-HDP scan for better localization of the $^{123}$I-avid lesions
June 2007: surgical debulking of the two major skull lesions.

July 2007:

$^{131}$I-iodide therapy (3.7 GBq, 100 mCi), following rh-TSH stimulation (Tg 297 ng/mL).

Post-therapy $^{131}$I-WBS: multiple bone lesions with high uptake of $^{131}$I-iodide (in addition to important thyroid remnants).
Follow-up

October 2007: serum Tg 0.7 ng/mL (suppressed TSH).

December 2007: serum Tg 0.0 ng/mL (suppressed TSH).

March 2008: serum Tg 0.6 ng/mL under rh-TSh stimulation; negative $^{123}$I-WBS (370 MBq).

September 2008: serum Tg 0.1 ng/ml (suppressed TSH).
TEACHING POINTS

• Occult differentiated thyroid carcinoma (DTC) can be present in multinodular goiter.
• DTCs are slow-growing and are usually treatable by combined surgery of the primary tumor, radio-iodine, and TSH-suppressive therapy.
• Tumor cell imaging with radioiodine ($^{131}$I- or $^{123}$I-iodide) whole-body scan (WBS) is specific and sensitive for well differentiated DTC (especially if combined with TSH-stimulated serum Tg assay).
• In selected instances, surgical debulking of metastatic lesions can be beneficial to patients.
References

