

Clinical note

Disseminated bone metastases from occult thyroid cancer effectively treated with debulking surgery and a single dosimetry-guided administration of radioiodine



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ARTICLE INFO

Article history:

Received 6 August 2014

Accepted 30 September 2014

Available online 6 November 2014

Keywords:

Thyroid

Bone metastases

Dosimetry

Surgery

rTSH

ABSTRACT

In this paper we report on a successful management of multiple bone metastases from differentiated thyroid cancer.

In 2007, a 75-year-old female patient, previously referred for thyroidectomy for multinodular goiter, underwent surgical removal of a lumbar mass with histological findings of metastasis from well differentiated thyroid cancer. After surgery, serum thyroglobulin (sTg) was 204.4 ng/mL. A diagnostic/dosimetric ¹²³I WBS was performed, following stimulation by rTSH. Serial WBSs were acquired, along with SPECT/CT and bone scan for localization of lesions. sTg raised to 3.810 ng/mL, and ¹²³I WBS showed thyroid remnants and numerous areas with high iodine-uptake corresponding to skeletal sites, the two largest loading on the skull, with osteolytic pattern. Calculated radiation absorbed dose for skull lesions, determined by mean of MIRD methodology, was 63.5 mGy/MBq.

The patient underwent surgical removal of the two major skull lesions. Successively, 100 mCi ¹³¹I was administered after stimulation by rTSH, with stimulated sTg 297 ng/mL. After 8 months, diagnostic WBS was negative both for remnants and metastases and rTSH-stimulated Tg was 0.6 ng/mL. To date, the patient has maintained sTg values <1 ng/mL during L-T4 suppressive therapy and after rTSH stimulations.

In this unusual case of extensive bone cancerous involvement with high iodine avidity, a multidisciplinary approach based on surgery and dosimetry-guided radiometabolic therapy allowed to accurately assess the patient, execute a small number of treatments and achieve a complete remission of the disease in a very short time, with no additive morbidity.

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Metástasis óseas diseminadas de un carcinoma de tiroides oculto tratado efectivamente con cirugía citorreductora y administración simple de radioyodo rastreado con dosimetría

RESUMEN

En este trabajo presentamos el abordaje adecuado de múltiples metástasis óseas de un cáncer diferenciado de tiroides.

En 2007, una mujer de 75 años previamente remitida para tiroidectomía por bocio multinodular, se sometió a la extirpación quirúrgica de una masa lumbar con resultado histológico de metástasis de cáncer bien diferenciado de tiroides. Tras la cirugía, los niveles séricos de tiroglobulina (Tgs) fueron 204,4 ng/ml. Se realizó un rastreo de cuerpo completo diagnóstico/dosimétrico con ¹²³I después de la estimulación con rTSH. Se adquirieron rastreos seriados junto con SPECT/TC y gammagrafía ósea para la localización de las lesiones. Los niveles de Tgs se elevaron a 3810 ng/ml, y el rastreo de cuerpo completo con ¹²³I demostró captación en restos tiroideos y en numerosas localizaciones esqueléticas, las dos de mayor tamaño en la calota con un patrón osteolítico. La dosis absorbida calculada para las lesiones de calota, determinada mediante metodología MIRD, fue 63,5 mGy/MBq.

Palabras clave:

Tiroides

Metástasis ósea

Dosimetría

Cirugía

rTSH

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Se extirparon mediante cirugía las 2 lesiones de la calota. Posteriormente, se administraron 100 mCi ^{131}I tras la estimulación con rTSH y unos niveles de Tgs 297 ng/ml. Después de 8 meses, el rastreo diagnóstico de cuerpo completo fue negativo tanto para los restos tiroideos como para las metástasis y la Tgs estimulada con rTSH fue 0,6 ng/ml. En la actualidad, la paciente ha mantenido valores de Tgs <1 ng/ml durante la terapia supresora con T4L y después de la estimulación con rTSH.

En este caso poco habitual de extensa afectación metastásica ósea con elevada captación de radioyodo, una estrategia multidisciplinaria basada en cirugía y radioterapia metabólica según dosimetría permitió evaluar con precisión a la paciente, administrar un número pequeño de tratamientos y alcanzar una remisión completa de la enfermedad en muy breve tiempo, sin originar morbilidad adicional.

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Introduction

Although differentiated thyroid cancer (DTC) accounts for only 1–2% of all new malignancies, it is the most common endocrine tumor and its incidence has been constantly rising over the last 20–30 years.¹ Well-established patient-related and tumor-related factors which influence prognosis are age at diagnosis, tumor size and follicular histology. Other unfavorable prognostic factors include the presence of distant metastasis, age at the time of their discovery, their localization (osseous vs. nonosseous) and extension.² The lack of (radio)iodine avidity predicts poor prognosis.³

Bone metastases account for about 2–13% of all DTC distant metastases and are more prevalent in follicular histotype.^{7,8,3} They are predominantly osteolytic, and localized in regions where blood flow is high, such as the axial skeleton red marrow (vertebrae, ribs and hips).^{6,7} Radiometabolic therapy with ^{131}I radioiodine (RAI) remains the prime treatment modality in patients whose bone metastases maintain iodine avidity, possibly associated with local treatments such as external beam radiation therapy or debulking surgery when indicated.^{1–6} The main criteria for therapeutic decisions include: risk of pathologic fracture and neurologic damage from spinal cord compression in the case of vertebral lesions, presence of pain, RAI avidity, and potential bone marrow damage from radiation. The guidelines of the American Thyroid Association recommend complete surgical resection of isolated symptomatic metastases, especially in patients <45 years old with slowly progressive disease. Even though it is defined as “rarely curative”, RAI therapy is nonetheless recommended in patients with multiple iodine-avid bone metastases. RAI activity to be administered can be chosen empirically (100–200 mCi) or determined by dosimetry. In order to optimize the complex management decisions in such patients, multidisciplinary care has been advocated.

We describe here a peculiar case of a patient with extensive, disseminated bone metastases from DTC in whom combined surgery and low RAI treatment following radiodosimetry estimates led to effective, ongoing recovery of the disease.

Case report

In January 2007, a 75-year-old woman was admitted to the Neurosurgery Department due to a swelling in the median thoracolumbar region. The patient had previously undergone thyroidectomy (in 2004) for multinodular goiter and had been subsequently treated with substitutive L-thyroxine (L-T4). The back lesion was not painful, and neurological examination was negative. TC showed a neof ormation with modest contrast enhancement, originating from the spinous process of L1. The initial diagnostic suspicion included possible neoplastic nature or an aneurysmal bone cyst.

A D12-L1 spinolaminectomy was performed, with “en-block” removal of the 6.4 cm × 5 cm × 3.7 cm neoplasm which bled very easily. There was no impairment of the dural sac evident

macroscopically. Conventional Hematoxylin & Eosin (H&E) staining showed diffuse infiltration of the bone by thyroid-like tissue, consisting of follicles of variable size, lined by epithelial cells with occasionally enlarged and clear nuclei (Fig. 1). At immunohistochemistry the neoplastic cells were positive for both thyroglobulin and thyroid transcription factor (TTF-1). The final diagnosis was bone metastasis from well differentiated thyroid carcinoma.

In February 2007, the patient was referred to the Nuclear Medicine Department for comprehensive re-assessment of her thyroid cancer disease. She was asymptomatic and ultrasonography of the neck revealed only minimal post-thyroidectomy fibrous tissue without loco-regional recurrences. Her serum thyroglobulin (sTg) level during substitutive L-T4 therapy was 204.4 ng/mL. A stimulation test with recombinant thyrotropin (rTSH) was then performed, based on sequential sTg measurements and a radioiodine whole-body scan (WBS) for diagnostic and radiodosimetric purposes. A standard dose of 0.9 mg rhTSH (Thyrogen®, Genzyme Transgenics Corp., Cambridge, MA) was injected i.m. on two consecutive days. On the third day, the sTg level reached 3810 ng/mL and the patient experienced clinically obvious painful swelling at the vertex of her skull.

For WBS, ^{123}I sodium iodide (444 MBq, 12 mCi) was administered i.v. on the day after the second rhTSH injection, and serial WBS acquisitions were recorded with a dual-head gamma camera at 6, 24, 30 and 48 h (Fig. 2). A calibrated reference source of ^{123}I (74 MBq, 2 mCi) was included in the field of view. After acquiring the 48-h WBS, $^{99\text{m}}\text{Tc}$ HDP (370 MBq, 10 mCi i.v.) was injected and a simultaneous double-peak whole-body bone scan was acquired 3 h later (Fig. 2). SPECT/CT imaging of the head and neck region was also acquired at 24 h, using a hybrid dual-head SPECT/CT gamma camera (Infinia Hawkeye, GE Healthcare).

^{123}I WBS showed obvious thyroid remnants and more than 30 areas with high radioiodine uptake. The $^{99\text{m}}\text{Tc}$ -HDP bone scan confirmed that all foci of ^{123}I uptake corresponded to skeletal sites, although only few of the metastatic sites exhibited an enhanced uptake of the bone-seeking radiopharmaceutical. SPECT/CT showed that the two largest lesions located in the posterior parietal skull had a prevalent osteolytic pattern.

A diagnostic CT of the skull without contrast described the lesions in the parieto-occipital median region and in the parietal right-paramedian region of the vertex. No intracerebral metastases were detected, whilst impairment of the superior sagittal sinus (SSS) was not assessable without administration of iodinated contrast medium. Additional imaging (chest X-ray and ultrasonography of the abdomen) excluded visceral metastases.

Dosimetric estimates

The absorbed doses in the metastatic lesions were estimated according to MIRD methodology as follows. Selected areas of abnormal radioiodine uptake in the ^{123}I WBS images were evaluated quantitatively, using computerized analysis of regions of interest obtained from conjugate planar views. The masses of the relevant

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