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Case Report

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Abstract

Brown tumors are uncommon manifestations of hyperparathyroidism (HPT) that without awareness are easily misdiagnosed as metastases. This short report highlights the importance of clinical context and clear communication between medical specialties when interpreting complex radiologic findings.

Keywords

brown tumor, radionuclide studies, SPECT, parathyroid, biopsy

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Introduction

Skeletal abnormalities are frequent among patients with untreated HPT. They are identified based on specific radiographic features and will, importantly, resolve when the HPT is treated. Brown tumors represent the terminal stages of bone remodeling in HPT and are rarely observed nowadays.[1] The disease can occur in both primary HPT and secondary HPT as solitary or multiple lesions in any bone; most common sites of involvement are pelvis, ribs, clavicle, and the extremities.[2,3]

Here, we present a case with multifocal brown tumors caused by primary HPT and an incidental finding of papillary microcarcinoma. It illustrates the importance of integrating medical history, biochemical screening, and radiologic imaging to differentiate between brown tumors and malignant metastases, which necessitate a multidisciplinary approach.

Case history

A 30-year-old woman was referred to the emergency department by her general practitioner due to swelling of the lower extremities and hypercalcemia. Here, blood tests showed hypercalcemia with an albumin corrected calcium of 3.50 nmol/L, phosphate of 0.52 mmol/L, and a high alkaline phosphatase concentration of 1163 U/L. She was admitted to the endocrinology department and diagnosed with severe hyperparathyroidism with a high parathyroid hormone (PTH) concentration of 92.9 pmol/L and referred for surgical intervention. Parathyroid imaging with preoperative ultrasound and dual phase technetium sestamibi ([^{99m}Tc] MIBI) with single-photon emission computed tomography/low dose computed tomography (SPECT/ldCT) indicated a parathyroid adenoma located paratracheally at the inferior pole of the right thyroid lobe. In addition, the SPECT/ldCT revealed multiple expansive osteolytic lesions characterized by [^{99m}Tc] MIBI-uptake and located in the bone marrow of the left humeral head, the spine of scapula bilaterally, the ramus of the mandible, the left costa 4, and the left clavicula (Figure 1(a)–(f)). Based on the radiographic features, these lesions—in combination with the known primary HPT—led to a tentative diagnosis of brown tumors (osteoclastomas).

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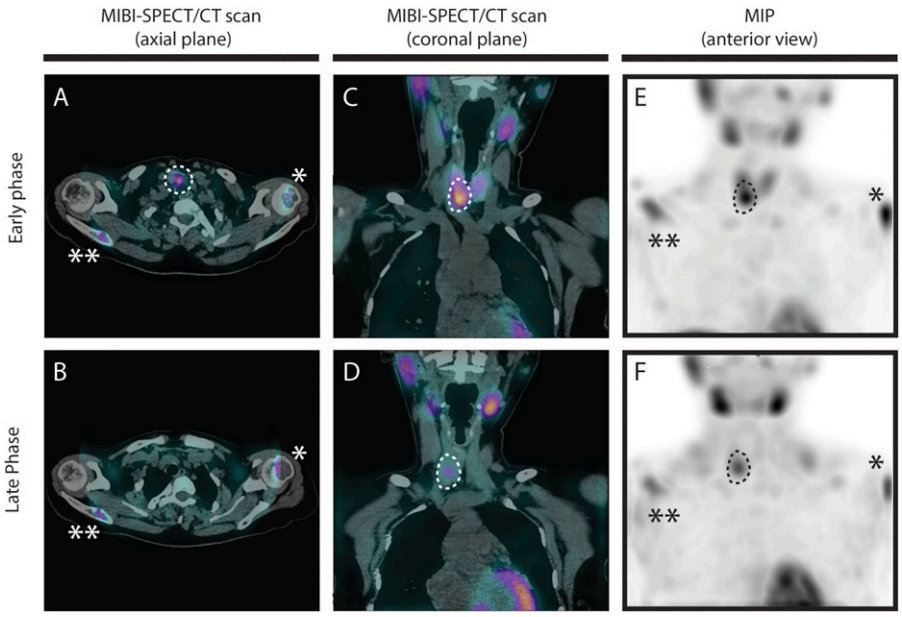

Figure 1. Dual-phase [^{99m}Tc] sestamibi scintigraphy (MIBI SPECT-CT scan) performed to localize parathyroid adenomas, early and late phases (5 and 120 min after injection) (a–d). Pre-operative maximum intensity projection (MIP) (e–f). Osteolytic skeletal abnormalities, characterized by high metabolic activity as indicated by [^{99m}Tc] MIBI-uptake, are evident in the left humeral head (marked by *), and in the right scapula (marked by **). The SPECT/CT is shown with optimal visualization of the bone lesions. The parathyroid adenoma was located paratracheally at the inferior pole of the right thyroid lobe and is marked by the dotted line.

Minimally invasive surgery was planned to remove the parathyroid gland, but instead a right hemithyroidectomy was performed since the parathyroid adenoma could not be separated from the thyroid lobe. Perioperative microscopy confirmed complete surgical removal of the parathyroid adenoma, and a satisfying drop in PTH was observed. The final histopathological examination of the removed surgical specimen revealed a parathyroid adenoma (1277 mg) as well as an incidental papillary thyroid microcarcinoma (PTMC) (1 mm) in the thyroid lobe.

Post-operative computed tomography (CT) scan of the thorax, abdomen, and pelvis requested by the surgical department revealed skeletal abnormalities in the left humeral head and the left costa 4. Further investigations were suggested to exclude possible metastases or alternatively Paget's disease of bone. Magnetic resonance imaging (MRI) scan of the affected skeletal structures was inconclusive (results not shown) and positron emission tomography (PET)/CT scan with 2-[fluorine-18] fluoro-2-deoxy-D-glucose (FDG) was suggested. However, after medical consultation, a whole-body bone scintigraphy with additionally SPECT/ldCT of the thorax and femur was performed instead. This revealed intense focal uptake of [^{99m}Tc] bisphosphonate in the known skeletal lesions and additionally in the left femur, indicative of increased osteoblastic activity (Figure 2(g)). Additionally, scintigraphy demonstrated high bone to soft tissue ratios in the entire skeleton with marked increases in the skull throughout the calvarium, and in the mandible. These changes are pathognomic for severe HPT (2). When comparing the pre- and post-operative CT scans, remineralization of the lesions was evident (Figure 2(a), (b), (d) and (e)). At the 4-month out-patient follow-up, the patient had regained appetite and muscle strength, and former skeletal pain had remitted. All blood tests were normalized: PTH 3.6 pmol/L, albumin corrected calcium 2.4 nmol/L, phosphate 1.2 mmol/L, and alkaline phosphatase 103 U/L. The genetic screening for germline-mutations was negative.

A control CT scan was performed 1 year after surgery. It revealed further remineralization and remodeling of the skeletal abnormalities (Figure 2(c) and (f)).

Discussion

Nowadays, brown tumors are uncommon manifestations of primary HPT and rarely considered when CT scans reveal osteolytic lesions. Therefore, brown tumors are at risk of being misdiagnosed as osteolytic metastases. Differentiation is difficult due to several common features. Clinically both are characterized by skeletal pain, biochemically by a high level of serum calcium due to a high turnover of bone, radiologically by osteolytic lesions, and pathologically by the presence of giant cells.[1] Differentiation is possible with brown tumors never penetrating bone cortex, while they biochemically differ from osteolytic cancer metastases in a high level of PTH concurrent with a high serum calcium.[3]

In the presented case history, the osteolytic lesions were initially correctly interpreted as brown tumors, but the

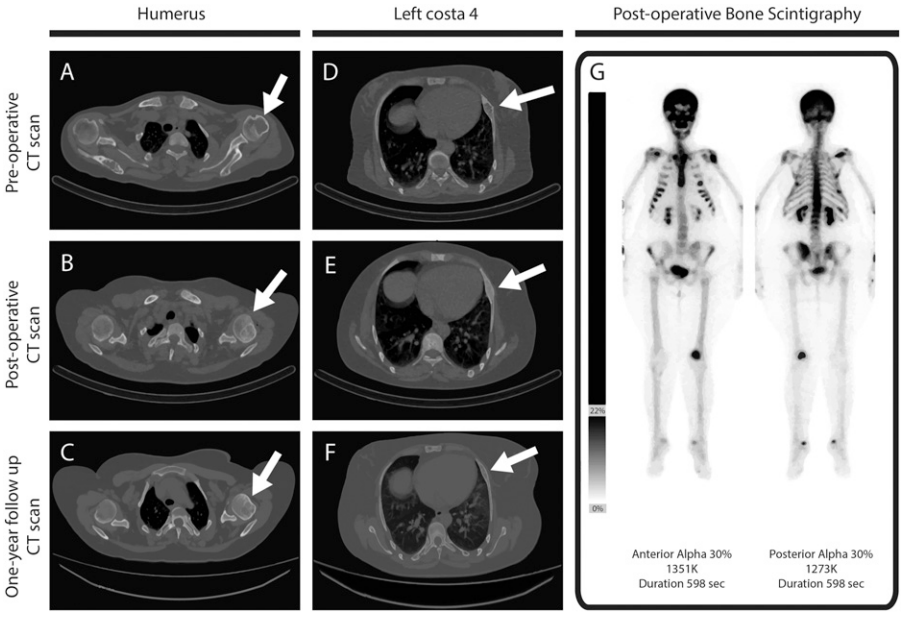

Figure 2. Left: Computed tomography (CT) performed pre-operatively (a and d), and 2.5 months and 1 year after surgery (b and e; c and f) of the left humeral head and the left costa 4. Right: Post-operative bone scintigraphy performed 2.5 months after surgery (g). (a and d): Pre-operative low dose CT scan showing osteolytic skeletal abnormalities in the left humeral head and the left costa 4 (white arrows). (b and e): Post-operative diagnostic CT scan showing partial remineralization of skeletal abnormalities in the left humeral head and the left costa 4 (white arrows). (c and f): One-year follow-up CT scan showing almost complete remineralization and remodeling of skeletal abnormalities in the left humeral head and the left costa 4 (white arrows). (g): Post-operative bone scintigraphy showing intense uptake in areas with high bone metabolism.

diagnostic focus shifted due to the early post-operative CT scan where osteolytic cancer metastases were suggested. Incidental thyroid carcinomas are not uncommon among patients with primary HTP, but PTMC rarely spread beyond cervical lymph nodes, and screening for distant metastases is not recommended in the standard follow-up.[4,5]

In conclusion, the presented case draws the attention and interest of head and neck surgeons and radiologists who prescribe and interpret imaging. It highlights the importance of clinical context in the interpretation of imaging findings and of good communication in a multidisciplinary setting to avoid excessive diagnostic procedures and interventions.

Declaration of Conflicting Interests

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Patient consent

Written informed consent was obtained from the patient for publication of this case report.

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