

Interesting Images

Molecular Imaging with ^{18}F -FDG PET/CT and $^{99\text{m}}\text{Tc}$ -MIBI SPECT/CT in Osteitis Fibrosa Cystica Generalisata

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Abstract: Benign so-called “brown tumors” secondary to hyperparathyroidism are a rare diagnostic pitfall due to their impressively malignant-like character in various imaging modalities. We present the case of a 65-year-old male patient with multiple unclear osteolytic lesions on prior imaging suspicious for metastatic malignant disease. Eventually, findings of ^{18}F -FDG PET/CT staging and $^{99\text{m}}\text{Tc}$ -MIBI scintigraphy resulted in revision of the initially suspected malignant diagnosis. This case illustrates how molecular imaging findings non-invasively corroborate the correct diagnosis of osteitis fibrosa cystica generalisata with the formation of multiple benign brown tumors.

Keywords: ^{18}F -FDG PET/CT; $^{99\text{m}}\text{Tc}$ -MIBI SPECT/CT; pitfall; osteitis fibrosa cystica generalisata; brown tumor; parathyroid adenoma



Citation: Holzgreve, A.; Fabritius, M.P.; Knösel, T.; Mittlmeier, L.M.; Rübenthaler, J.; Tiling, R.; Auernhammer, C.J.; Bartenstein, P.; Unterrainer, M. Molecular Imaging with ^{18}F -FDG PET/CT and $^{99\text{m}}\text{Tc}$ -MIBI SPECT/CT in Osteitis Fibrosa Cystica Generalisata. *Diagnostics* **2021**, *11*, 1355. <https://doi.org/10.3390/diagnostics11081355>

Academic Editor: Kalevi Kairemo

Received: 1 July 2021
Accepted: 27 July 2021
Published: 28 July 2021

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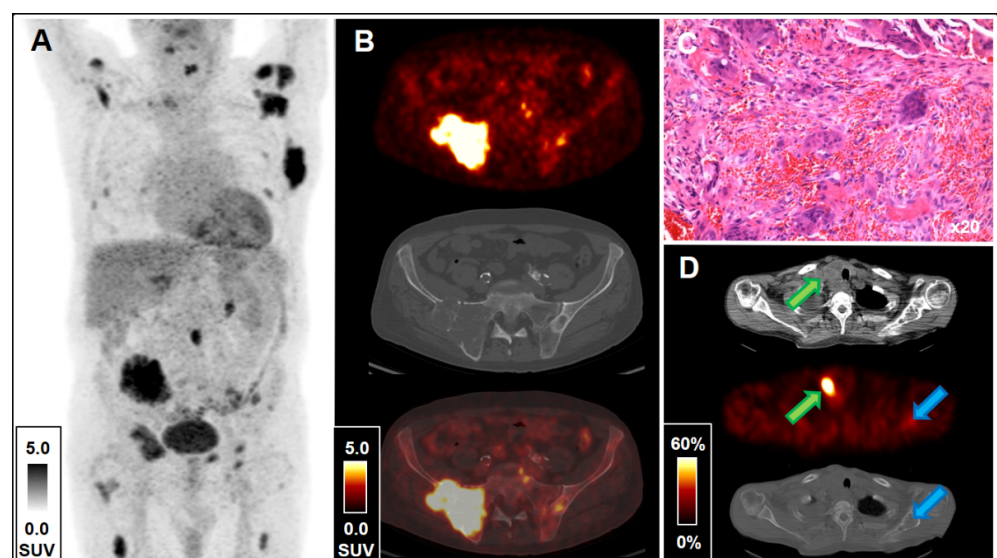


Figure 1. ^{18}F -FDG PET (A), ^{18}F -FDG PET/CT (B), H&E staining (C), $^{99\text{m}}\text{Tc}$ -MIBI SPECT/CT (D). A 65-year-old male patient with multiple unclear osteolytic lesions on CT imaging and suspected metastatic malignant disease of unknown primary presented for ^{18}F -FDG PET/CT staging prior to

biopsy. The patient history included chronic kidney disease (CKD) and pronounced secondary renal hyperparathyroidism on serum biochemistry, as well as COVID-19 one month earlier. Prophylactic shunt placement had previously been performed (Cimino fistula); however, the patient was not on a hemodialysis regimen. At presentation, serum calcium was 2.32 mmol/L (reference range, 2.05–2.65), phosphate 3.7 mg/dL (2.5–4.8), creatinine 3.2 mg/dL (0.7–1.2), glomerular filtration rate (GFR) 19 mL/min (≥ 90), parathormone 752 pg/mL (15.0–65.0) and 25-hydroxyvitamin-D₃ 24.6 ng/mL (20.0–100.0). ¹⁸F-FDG PET/CT imaging with 223 MBq ¹⁸F-FDG and unenhanced CT due to CKD exhibited multifocal osteolytic lesions with highly elevated glucose consumption (see Figure 1A), e.g., a large osteolytic, partly sclerotic lesion in the right ilium and the lateral surface of the right sacrum destroying the sacroiliac joint (SUV_{max} 9.8; mean 45 HU; 7.6 cm × 4.4 cm in transverse planes; see Figure 1B). Additionally, two masses with lower ¹⁸F-FDG uptake adjacent to the right thyroid lobe (SUV_{max} 4.6, 3.0 cm × 2.2 cm in transverse planes), as well as a right intrathyroidal mass with low ¹⁸F-FDG uptake (SUV_{max} 2.0, 3.0 cm × 2.3 cm in transverse planes) were found. There were no further lesions suspicious of malignancy. The presence of a parathyroid lesion with elevated ¹⁸F-FDG uptake is generally suspicious of parathyroid adenoma or carcinoma [1]; however, the low ¹⁸F-FDG uptake, especially compared with the osseous lesions, made a metastatic parathyroid carcinoma or a metastatic thyroid carcinoma rather unlikely [2]. Additionally, a ^{99m}Tc-MIBI scintigraphy with 281 MBq using SPECT/CT imaging and low-dose CT comprised highly elevated tracer retention in good spatial correlation to the previously noted lesion on PET/CT (see the green arrows in Figure 1D), a characteristic finding of parathyroid adenoma. However, no MIBI-avidity of the intrathyroidal lesion was observed, a finding rather untypical for thyroid cancer [3]. A further counter-indicator for a malignant condition was the absent MIBI-avidity of the multiple lytic lesions (see the blue arrows in Figure 1D) [4]. Therefore, contrary to the suspected referral diagnosis of multiple metastatic sites, the most likely diagnosis based on ¹⁸F-FDG PET/CT and ^{99m}Tc-MIBI SPECT/CT imaging was active parathyroid adenoma and secondary osteitis fibrosa cystica generalisata with formation of multiple brown tumors. Histopathological analysis following bone biopsy confirmed the diagnosis of benign, so-called brown tumors: H&E staining exhibited osteoclast-like giant cells (see Figure 1C), and negative G34W staining (monoclonal antibody targeting the G34W mutation in the H3F3A gene of histone H3.3. protein) excluded primary giant cell tumor of the bone; there were no signs of malignancy. Histopathological analysis following right-sided hemi-thyroidectomy confirmed the diagnosis of parathyroid adenoma; there was no evidence of parathyroid or thyroid malignancy. Postoperative serum calcium due to hungry bone syndrome was 1.67 mmol/L (reference range, 2.05–2.65), phosphate 4.5 mg/dL (2.5–4.8), creatinine 3.9 mg/dL (0.7–1.2), GFR 15 mL/min (≥ 90) and parathormone 104 pg/mL (15.0–65.0). Laboratory follow-up gave no signs of tertiary hyperparathyroidism. Brown tumors are a rare pitfall on ¹⁸F-FDG PET/CT reading due to their impressively malignant-like glucose consumption and destructive character [5–7]. This phenomenon has also sporadically been reported with other PET tracers [8,9]. As illustrated by the current case, molecular imaging with ¹⁸F-FDG PET/CT and ^{99m}Tc-MIBI scintigraphy can lead to the correct differential diagnosis of osteitis fibrosa cystica generalisata.

Author Contributions: Conceptualization, A.H. and M.U.; histopathological analyses, T.K.; clinical management, A.H., L.M.M., and C.J.A.; writing—original draft preparation, A.H. and M.U.; writing—review and editing, M.P.F., T.K., L.M.M., J.R., R.T., C.J.A., and P.B.; supervision, M.U.; project administration, A.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The ethics committee approved the publication of this case (21-0457 KB).

Informed Consent Statement: The patient gave written consent prior to PET/CT and scintigraphy exams. The ethics committee waives additional consent for case reports.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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