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Case Report Open Access

Bone Metastasis from Parathyroid Carcinoma Non-avid for ^{99m}Tc-MIBI, ^{99m}Tc-MDP, and ^{18}F-FDG

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Abstract

Nuclear medicine imaging modalities have been reported to be useful in the diagnosis of parathyroid carcinoma (PC). However, false negative findings of bone metastasis from PC have been rarely reported. Here, we describe a patient undergoing nuclear medicine examinations since he had persistent high calcium and parathyroid hormone levels after resection of parathyroid tumor. ^{99m}Tc-Sestamibi (^{99m}Tc-MIBI) whole body scintigraphy (WBS) and ^{99m}Tc-methylene diphosphonate (^{99m}Tc-MDP) WBS were both negative. ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (^{18}FDG-PET/CT) scan demonstrated osteolytic lesion in the fourth lumbar vertebrae (L_4) on CT image with no obvious ^{18}F-FDG accumulation on PET image. CT-guided fine needle aspiration and pathalogical examinations confirmed bone metastasis from PC.

Keywords: Parathyroid carcinoma; Bone metastasis; ^{99m}Tc-MIBI; ^{18}F-FDG PET/CT; ^{99m}Tc-MDP

Case Report

A 53-year-old man was admitted to a hospital complaining of anergy, right lower extremity muscle weakness, vomiting which became worse after eating. Laboratory data indicated primary hyperparathyroidism with serum calcium 4.10 mmol/L (reference range: 2.08-2.60 mmol/L), phosphorus 1.06 mmol/L (reference range: 0.80-1.60 mmol/L), and pararthyroid hormone 496.20 pg/ml (reference range: 15-65 pg/ml). The enhancement CT indicated that right parathyroid adenoma may exist. The patient underwent right parathyroid resection and the pathological examination showed parathyroid adenoma with masses of neoplastic cells surrounding by collagen fiber hyperplasia (Figure 1). Since high serum calcium and parathyroid hormone levels still existed, the patient was transferred to another hospital for further management. ^{99m}Tc-MIBI WBS showed a normal distribution of the radiotracer (Figure 2). Also the ^{99m}Tc-MDP WBS revealed a normal bone scintigraphy (Figure 3). Subsequently, the patient's condition worsened, and ^{18}F-FDG PET/CT was recommended. CT image revealed an osteolytic lesion in the L_4 with no obvious accumulation of ^{18}F-FDG (Figure 4). To verify the diagnosis, the patient underwent CT-guided fine needle aspiration (FNA) followed by pathological examination, which confirmed bone metastasis from PC in the L_4 with nuclear enlargement and individual abnormal heteronuclear similar to the primary parathyroid lesion (Figures 5A and 5B), supported by PTH protein positive immunolabeling (Figure 5C). So the patient was referred to have radio frequency ablation and percutaneous vertebroplasty surgery which led to normal serum calcium (1.68 mmol/L) and parathyroid hormone (60.58 ng/L).

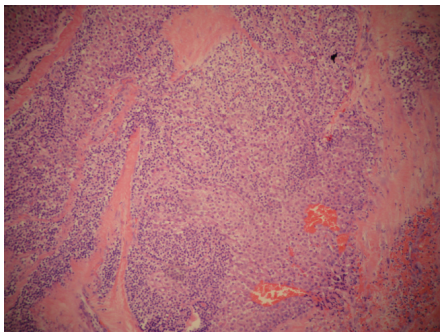

Figure 1: Pathological examination of parathyroid sample showed parathyroid adenoma with masses of neoplastic cells surrounding by collagen fiber hyperplasia.

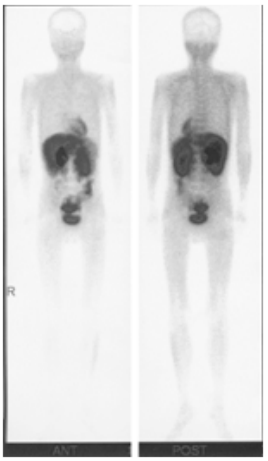

Figure 2: ^{99m}Tc-Sestamibi whole body scintigraphy showed a normal distribution of radiotracer.

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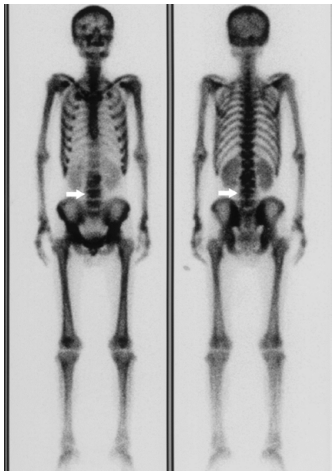

Figure 3: ^{99m}Tc-methylene diphosphonate whole body scintigraphy revealed a normal bone scintigraphy.

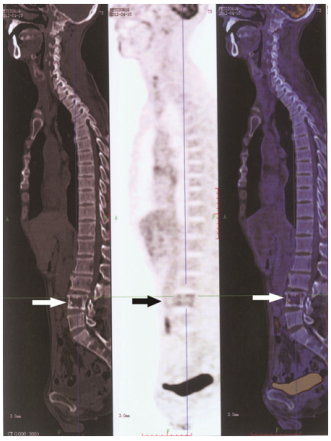

Figure 4: Computed tomography image of ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography revealed an osteolytic lesion in the fourth lumbar vertebrae with no obvious accumulation of ^{18}F-fluorodeoxyglucose.

PC is an uncommon endocrine malignancy which accounting for 0.1% to 5.0% of all cases of primary hyperparathyroidism [1]. Bone metastases from PC are less common, occurring in 7% of cases [2]. At present, it is difficult to distinguish benign disease from malignant disease on clinical grounds, and even the histology of PC can be equivocal or frankly misleading [3,4]. Hence, the diagnosis of PC is commonly made a posteriori, when local recurrence or distant metastases occur [3,5,6].

Nuclear medicine imaging modalities, such as ^{99m}Tc-MIBI WBS, ^{99m}Tc-MDP WBS, ^{18}F-FDG-PET have been reported to be useful in the diagnosis of PC [7-12]. However, the value of these modalities in diagnosis of bone metastasis from PC has not been completely assessed because of the rarity of this disease. Nuclear medicine imaging have been previously reported to be useful in two reports with bone metastasis from PC [13,14]. In 1994, Koyano et al. initially reported that ^{99m}Tc-MIBI scanning revealed bone metastastatic lesions in a 62-year old female patient [13]. In 1995, Okuda et al. evaluated ectopic parathyroid adenoma and bone metastases of parathyroid carcinoma were clearly demonstrated by ^{99m}Tc-MIBI. They drew a conclusion that detectability of MIBI scintigraphy for parathyroid lesions including ectopic and

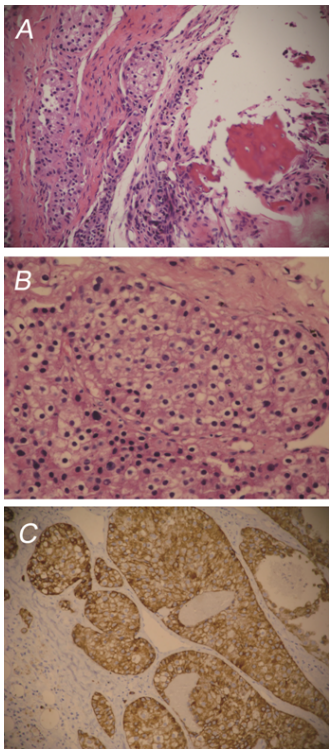

Figure 5: Pathological examination of CT-guided fine needle aspiration confirmed bone metastasis from parathyroid carcinoma in the fourth lumbar vertebrae with nuclear enlargement and individual abnormal heteronuclear similar to the primary parathyroid lesion (A and B), supported by positive parathyroid hormone protein immunolabeling (C).

metastatic lesions was the highest among those of ultrasonography, CT and MRI methods [14].

However, both scans with ^{99m}Tc-MIBI and ^{99m}Tc-MDP in our patient presented false negative findings. The uptake of ^{99m}Tc MIBI may be influenced by a variety of biological factors, including the size of the adenoma, the cell type, the P-glycoprotein expression, Serum Ca levels, and the mitochondrial structure [15]. And it has been reported that ^{99m}Tc-MDP may show false-negative results for osteolytic metastatic bone lesions because of the lack of peripheral osteoblastic reaction [16-18]. F-FDG PET also showed no obvious ^{18}F-FDG activity in the bone metastatic lesion. It is possible that because being a marker of metabolically active lesions that show high grading and low differentiation, FDG is not ideal for this purpose since the majority of endocrine tumors are slow growing and highly differentiated [18]. CT has been demonstrated to be able to provide excellent details on the location of the lesion and its relation to other structures, and may also reveal invasion of surrounding structures and enlarged lymph nodes [19]. The combined whole body imaging modality of ^{18}F-FDG PET/CT provides both anatomic and metabolic information, which may be of incremental value in the detection of metastatic lesions of PC compared with ^{18}F-FDG PET alone.

In conclusion, all scans with ^{99m}Tc-MIBI, ^{99m}Tc-MDP and ^{18}F-FDG may present false negative findings in detecting metastatic bone lesions from PC. CT scan of ^{18}F-FDG PET/CT examination may be helpful in the detection of bone metastases from PC.

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