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CASE REPORT

Subtle [^{99m}Tc]Tc-HYNIC-PSMA-11 uptake in a frontal sinus osteoma: Insights from dual bone and PSMA imaging in prostate cancer

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ABSTRACT

Osteomas are benign, slow-growing bone tumors, most frequently found in the nose and paranasal sinuses. We report the case of a 69-year-old male with a history of low-risk prostate adenocarcinoma who was under active surveillance. He was referred for [^{99m}Tc]Tc-MDP bone scintigraphy and [^{99m}Tc]Tc-HYNIC-PSMA-11 imaging due to a rising PSA level. Incidentally, an osteoma was identified in the left frontal sinus, demonstrating intense uptake on the bone scan and faint uptake on PSMA imaging. This case highlights the potential for PSMA ligand uptake in benign osseous lesions and underscores the importance of correlating functional and anatomical imaging to avoid misinterpretation and ensure accurate diagnosis and appropriate patient management.

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INTRODUCTION

Osteomas are benign, slow-growing osseous tumors that most frequently involve the paranasal sinuses and are typically discovered incidentally on imaging, as they are often asymptomatic. Differential diagnoses include osteoblastoma, ossifying fibroma, fibrous dysplasia, and osteosarcoma. CT imaging is particularly effective in diagnosing osteomas and distinguishing them from other conditions [1-4]. Prostate-specific membrane antigen (PSMA) imaging, a valuable tool in the staging and restaging of prostate cancer, may occasionally demonstrate uptake in benign lesions, potentially leading to diagnostic confusion [5]. We present a rare case of a frontal sinus osteoma in a patient with prostate cancer, characterized by intense uptake on bone scintigraphy and faint uptake on PSMA-targeted imaging.

CASE PRESENTATION

A 69-year-old male with a history of prostate adenocarcinoma (Gleason score 3+3=6, with 3 of 14 biopsy cores positive), managed under active surveillance, was referred for bone and PSMA imaging due to a rising PSA level from 7 to 12 ng/mL. Planar whole-body bone scintigraphy in anterior and posterior views, followed by SPECT/CT, was performed three hours after intravenous administration of 20 mCi (740 MBq) of [^{99m}Tc]Tc-MDP. The planar imaging revealed a focal area of intense tracer uptake in the left frontal bone, which was confirmed on corresponding SPECT and SPECT/CT images. CT imaging in axial and coronal planes demonstrated a hyperdense, rounded, and well-circumscribed osseous lesion within the left frontal sinus, without cortical disruption or periosteal reaction, consistent with an osteoma (Figure 1). The patient was asymptomatic, with no complaints of swelling, headache, or sinus-related symptoms. On a separate day, planar whole-body imaging and SPECT/CT were performed three hours after intravenous injection of 20 mCi (740 MBq) of [^{99m}Tc]Tc-HYNIC-PSMA-11. These images revealed faint tracer uptake corresponding to the previously identified osteoma in the left frontal sinus as visualized on CT (Figure 2).

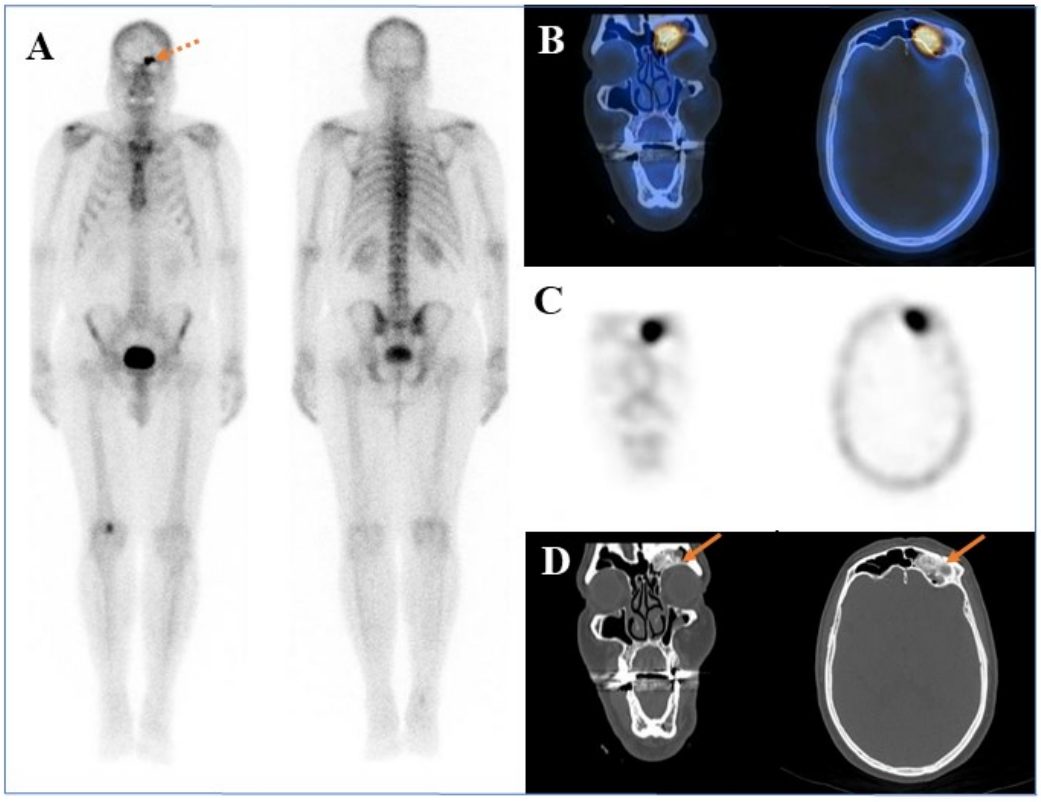

Figure 1. Incidental focal tracer uptake in the left frontal bone on planar bone scan (A, dotted arrow) was confirmed by subsequent SPECT/CT and SPECT imaging (B, C) and identified as a well-defined osteoma in the left frontal sinus on CT (D, arrows)

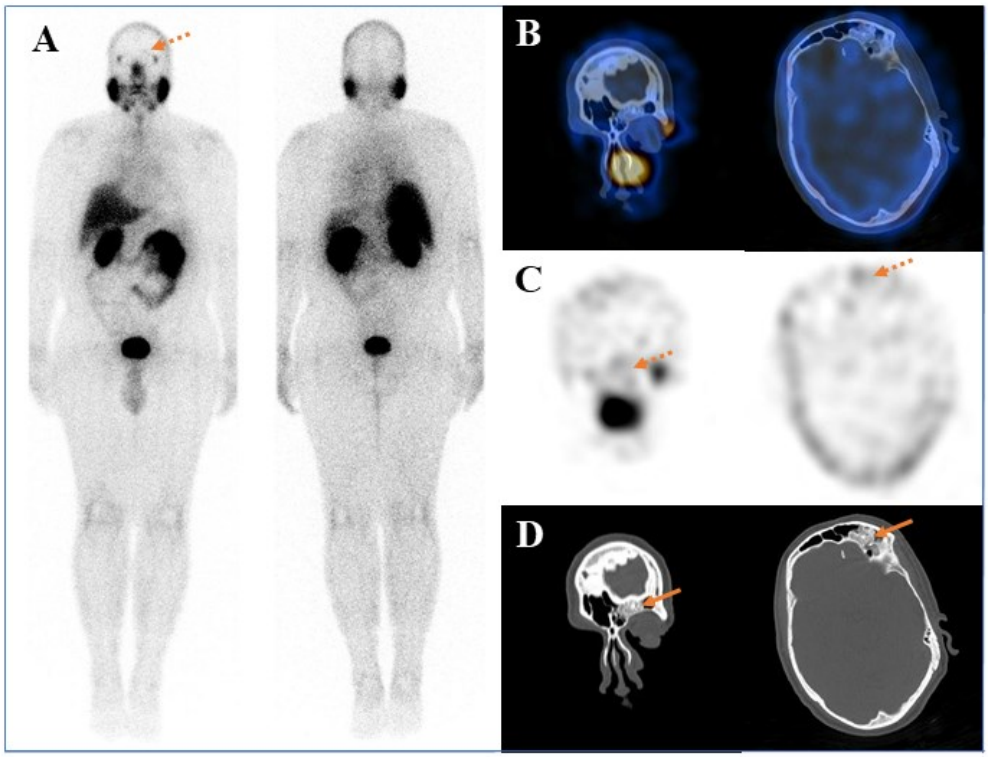

Figure 2. Planar whole-body PSMA imaging (A) and SPECT/CT images (B, C) demonstrated faint tracer uptake (dotted arrows) corresponding to a left frontal sinus osteoma identified on CT (D, arrows)

DISCUSSION

Cone beam CT is the optimal imaging modality for assessing the relationship between osteomas and adjacent structures, as well as for surgical planning [4]. Bone scintigraphy, which revealed intense uptake in this case, remains a valuable modality for detecting osteomas, particularly in the context of syndromic associations such as Gardner syndrome, where multiple lesions may be present. The addition of SPECT/CT fusion imaging significantly enhances diagnostic accuracy by enabling precise anatomical localization and characterization of lesions, thereby facilitating the distinction between benign and malignant osseous findings [6-10]. Osteomas that are asymptomatic, as in this case, typically do not require surgical intervention. Instead, they are managed with a “watch-and-wait” approach, guided by clinical evaluation and radiological follow-up. Surgery is reserved for cases in which symptoms develop or clinical progression occurs [3, 4]. While bone is a common site for prostate cancer metastasis, brain involvement is exceedingly rare, with an estimated incidence of only 0.16%. Isolated cranial metastases are even less common and typically occur alongside widespread skeletal involvement. In this case, despite the patient’s low-risk profile for skull metastasis, the focal intense uptake in the frontal sinus on bone scintigraphy warranted further evaluation. Correlation with CT imaging and the low uptake observed on PSMA imaging enabled accurate characterization, as tracer accumulation in prostate cancer metastases is typically higher than in benign or false-positive lesions, thus obviating the need for further investigations [5]. Accurate recognition of non-prostatic etiologies is therefore essential to avoid misinterpretation and overtreatment [11]. Importantly, PSMA uptake is not exclusive to prostate cancer and has been reported in a range of benign and malignant conditions. These include inflammatory and infectious processes, as well as benign bone lesions such as hemangiomas [12], fractures [13], subchondral cysts [14], osteodegenerative changes, Paget’s disease, fibrous dysplasia, osteochondromas, multiple myeloma [5], and osteosarcoma [15]. Craniofacial lesions with PSMA avidity have also been described, including nasal angiofibroma [16], adenoid cystic carcinoma [17], meningioma [18], glioma, head and neck squamous cell carcinoma [5], osteoid osteoma [19], and fibrous tumors [20]. Low-level PSMA expression in benign osseous lesions may be influenced by reactive changes and the vascular supply necessary for bone growth and remodeling. Although osteomas are not inherently neovascular or inflammatory lesions, limited vascularization within the lesion could still permit radiotracer

accumulation. In addition, osteoblastic activity—an essential feature of osteoma growth—may contribute to focal uptake, as suggested in prior reports describing PSMA avidity in osteoid osteomas [5, 19].

CONCLUSION

This case presents faint PSMA uptake in a frontal sinus osteoma in a patient with prostate cancer, underscoring the importance of recognizing benign causes of tracer avidity that may mimic metastatic disease. SPECT/CT fusion imaging serves as a critical tool in differentiating benign osseous lesions from true metastases, thereby enhancing diagnostic accuracy and minimizing the potential for misinterpretation.

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