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CASE REPORT

Incidental detection of bridging ribs on whole-body bone scan in a patient with prostate cancer: Case report of a rare congenital anomaly

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ABSTRACT

A 71-year-old man with prostate adenocarcinoma underwent [^{99m}Tc]Tc-MDP whole body and SPECT/CT scans for primary staging, which revealed unexpected vertical linear uptake in the intercostal spaces. Subsequent evaluation with [^{99m}Tc]Tc-PSMA scintigraphy revealed no uptake in these areas, and physical examination revealed no tenderness or cutaneous changes. Further investigation led to the diagnosis of bridging rib, a rare congenital anomaly occurring in less than 0.5% of the population, characterized by developmental fusion between two or more ribs. This case underscores the significance of considering rare anatomical variants in the interpretation of imaging studies, as it can affect the accuracy of diagnoses, and provides a review of the differential diagnoses that may be mistaken for one another when interpreting bone agent uptake in the ribs.

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INTRODUCTION

This case report describes a 71-year-old male patient with a diagnosis of prostate adenocarcinoma, characterized by a Gleason score of 3+4 and a serum prostate-specific antigen (PSA) level of 37 ng/dl, who underwent primary staging following a trans-rectal ultrasound (TRUS) biopsy prompted by obstructive lower urinary tract symptoms and a rising serum PSA level. Notably, subsequent whole-body bone scan and SPECT/CT images revealed an unusual radiologic finding, which highlights the importance of considering normal variants in the interpretation of bone scintigraphic results.

CASE PRESENTATION

A 71-year-old man with a diagnosis of prostate adenocarcinoma, characterized by a Gleason score of 3+4 and a serum prostate-specific antigen (PSA) level of 37 ng/dl, was referred for primary staging. The initial diagnosis was established through a trans-rectal ultrasound (TRUS) biopsy, which was performed due to obstructive lower urinary tract symptoms and a rising serum PSA level. Initially, he underwent imaging assessments, including a Technetium-99m methylene diphosphonate ([^{99m}Tc]Tc-MDP) whole-body and SPECT/CT scans. The whole-body bone scan revealed a notable finding: a vertical linear intercostal uptake in each hemi-thorax, which drew attention (Figure 1A). Due to the absence of prior chest X-rays or CT scans, SPECT/CT imaging was conducted to elucidate the nature of the intercostal uptakes. Interestingly, the SPECT/CT images localized these uptakes to two accessory bony connections between the posterior aspects of the ribs, one connection in the right 7th and 8th intercostal spaces and another in the left 6th intercostal space (Figure 1B). The accessory bones originating from the right 8th rib, extend bidirectionally toward the right 7th and 8th intercostal spaces, exhibiting incomplete fusion with the 7th and 9th ribs and displaying a pseudo-articulation pattern. In contrast, the accessory bone on the left side demonstrated complete fusion between the 6th and 7th ribs. Furthermore, a reduction in kyphosis of the thoracic spine was also observed, with no evidence of scoliosis. No skeletal metastases were identified on his bone scintigraphy. The patient reported no history of trauma or rib fractures, and physical examination revealed no tenderness or cutaneous changes in the posterior wall of the thorax. On further evaluation with Technetium-99m prostate-specific membrane antigen ([^{99m}Tc]Tc-PSMA) scintigraphy, no [^{99m}Tc]Tc-PSMA uptake was observed corresponding to the rib bony fusions on the whole-body scan or in the SPECT/CT images (not shown), with the scintigraphy revealing only a few pelvic lymph node metastases.

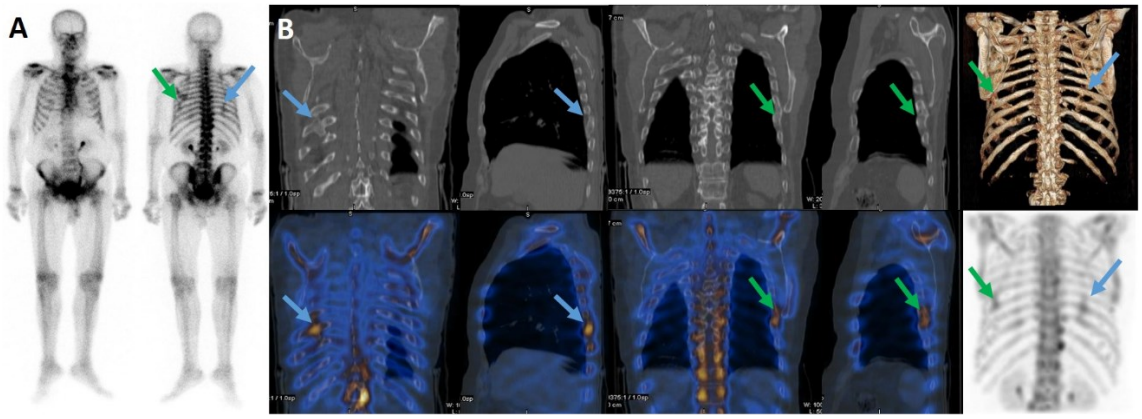

Figure 1. A: Whole-body bone scan demonstrating bilateral vertical linear intercostal uptake in each hemithorax (green and blue arrows). B: SPECT/CT images revealing two accessory bony connections between the posterior aspects of the ribs: one bridging the right 7th and 8th intercostal spaces (blue arrow) and another in the left 6th intercostal space (green arrow), confirming the presence of congenital rib fusion

DISCUSSION

Bridging rib is a rare congenital anomaly, characterized by developmental fusion between two or more ribs, affecting less than 0.5% of the population [1, 2]. The ribs exhibit a wide range of normal congenital variations, as well as pathologic radiographic appearances. Congenital anomalies of the ribs, such as supernumerary or accessory ribs, vestigial anterior ribs, bifid ribs, and bridging ribs, must be distinguished from traumatic and pathologic conditions on bone scintigraphy [3, 4]. Recent reports indicate that bridging rib lesions can

be associated with pain in certain cases. For instance, Yosef et al. documented a case involving a young man with fusion between the left 7th and 8th ribs, which resulted in pain and necessitated surgical intervention [2]. Another study conducted by Ghorbanlou et al. evaluated the frequency of rib anomalies in 400 chest CT scans and identified four cases of bridging ribs, all of which had involved the left first and second ribs [5].

Other differential diagnoses to consider for bone agent uptake in rib include fractures, mal-union with heterotopic ossification, rib metastasis, primary osseous neoplasms (such as osteosarcoma, chondrosarcoma, Ewing sarcoma, Langerhans cell histiocytosis, and osteochondroma), fibrous dysplasia, and Paget disease [3, 6]. It is worth noting that metastatic carcinoma of the rib can occur as a result of various primary cancers, including lung cancer, liver cancer, multiple myeloma, breast cancer, and prostate cancer [7]. Although seemingly straightforward, misinterpretation of rib fusion can have far-reaching consequences, leading to incorrect diagnoses of metastasis or fracture, which in turn can significantly impact treatment approaches and forensic investigations, ultimately affecting the accuracy of wergild assessments. It is essential to be aware of the typical radiologic appearance of the normal variants, as this knowledge can help avoid misinterpretation of the bone scintigraphic findings as metastases [3, 8]. Moreover, in the era of rapidly evolving artificial intelligence (AI) applications in disease diagnosis, accurate interpretation of radiologic findings is crucial to ensure reliable AI-driven diagnoses. Recently, AI-based approaches have been explored for the detection of rib fractures and thoracic cage metastases. Considering our experience in this case, bridging rib is a potential pitfall that can confound AI algorithms [9].

CONCLUSION

Accurate interpretation of rib cage findings relies on consideration of normal variants, which can help reduce the need for additional SPECT/CT imaging and avoid misinterpretation.

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