Hypertrophic osteoarthropathy on bone scan

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Abstract

We present a patient with a history of lung cancer displaying the typical pattern of hypertrophic osteoarthropathy on bone scan. We also discuss other etiologies, pathophysiology and management of this entity.

Case Report

63-year-old man with adenocarcinoma of the right lung presented for evaluation of osseous metastatic disease. Approximately 3 hours following injection of 851 MBq Tc-99m MDP, anterior and posterior whole body bone scans (Figure. 1) were performed with additional spot views of the pelvis, lateral ribs and skull. The bone scan demonstrated mild, diffuse longitudinal increased radiotracer along the cortices of all long bones of the upper extremities and the right lower extremity. We postulate that the unusual asymmetric involvement of the lower extremities (diffusely decreased uptake in the left leg) may be related to patient’s history of chronic peripheral vascular disease seen on CT angiography several years prior. The “railroad tracks” pattern of periosteal uptake is typical for hypertrophic osteoarthropathy. Radiographs of the right ankle (Figure. 2) ordered for the right ankle pain and swelling demonstrated periosteal reaction along the distal diaphysis of the right tibia and fibula.

Discussion

Hypertrophic osteoarthropathy (HOA) is a syndrome characterized by abnormal proliferation of the skin and osseous tissue at the distal parts of the extremities. Clinical features include digital clubbing, periostosis (excessive bone formation or subperiosteal new bone formation) of tubular bones, and synovial effusions. Periostosis is usually accompanied by pain on palpation of the involved area (1).

The primary form of HOA not associated with any other medical disorders, while the secondary form is usually associated with lung cancer, pulmonary infections (abscess, tuberculosis, fungal and pneumocystis), COPD, cystic fibrosis, and right-to-left cardiac shunts, and may be seen less often in other conditions (e.g., Hodgkin lymphoma, sarcoidosis, and cirrhosis). Among patients with lung cancer, HOA is most frequently associated with adenocarcinoma and least frequently with small cell carcinoma (1). Rarely, arterial vascular prosthesis infections may be associated with HOA (2). Bone scintigraphy is a sensitive way to detect involvement.
The exact mechanism of HOA is unclear. Currently there are two pathways known to exist: neurogenic and humoral. In the neurogenic pathway model, diseased organs innervated by the vagus nerve may induce a neural reflex leading to vasodilatation and increased blood flow to the extremities (3).

The humoral pathway involves localized activation of the platelet-endothelial cells, with the subsequent release of fibroblast growth factor(s) (e.g., platelet-derived growth factor) (4). The frequent association with lung disease raises the possibility that circulatory bypass of the lung may play an important role. Another hypothesis involves tumor production and release into the circulation of a factor (one possible candidate is vascular endothelial growth factor [VEGF]) that promotes features of HOA such as vascular proliferation, edema formation, and new bone formation (4).

Treatment with nonsteroidal anti-inflammatories or other analgesics may provide significant relief of symptoms. Removal of lung cancer or treatment of the other causes of HOA results in regression in the clinical manifestations in many patients but is not always effective. In patients with refractory disease, bisphosphonates, including pamidronate(5) and zoledronic acid, have been found to be highly effective.

**Conclusion**

Bone scintigraphy is a sensitive method to detect hypertrophic osteoarthropathy. Tc-99m MDP bone scan typically demonstrates symmetric linear increase in tracer accumulation along diaphyseal and metaphyseal surfaces of long bones ("tram-track" or “double stripe” sign. In addition to diagnosis, radionuclide bone scans can also be used to evaluate therapy response, as scintigraphic findings can resolve after treatment of the underlying secondary cause. On bone scintigraphy, the differential diagnosis of this entity includes normal variant (lateral cortices of the tibiae often appear with a symmetric linear uptake); shin splints can appear similar, but confined to the tibiae; and chronic venous insufficiency that can cause symmetrical periosteal uptake usually confined to the lower extremities below the knees.
References


Anterior (left) and posterior (right) bone scans show increased radiotracer along the cortices of all long bones in the upper and lower extremities (arrows).
Figure 2

Right ankle radiograph demonstrating periosteal reaction along the distal tibial and fibular diaphysis (arrows).