CASE REPORT

'Sub-superscan' in Bone Scan – An Important Feature of Extensive Bone Metastases

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ABSTRACT

A Superscan is described as a 'beautiful bone scan'. In a superscan, the uptake of ^{99m}Tc-Methelene Diphosphonate (MDP) is prominent in the skeleton relative to soft tissue with absent or faint visualisation of the kidneys. This finding could be misinterpreted as a normal bone scan. A 'Sub-superscan' is a term used for scan findings in which the uptake is atypical of a superscan, but the patient has extensive bone metastases, as presented in our case report.

Keywords: Superscan, Bone scintigraphy, Diffuse bone metastasis, ^{99m}Tc- HMDP, Marrow infiltration

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INTRODUCTION

A superscan is defined as a bone scan which demonstrates prominent uptake of bone radiotracer in the skeleton relative to soft tissue with absent or faint visualisation of the kidneys. Diffuse bone metastases and metabolic bone diseases are the differential diagnoses of a superscan. The pattern of a superscan from bone metastasis differs from the metabolic bone disease by the distribution and patterns of the uptake. In bone metastases, the distribution of intense uptake is in the axial skeleton and proximal portion of long bones, compared to the metabolic bone diseases where the intense uptake is in the whole axial and distributed evenly in the long bones.

Our patient had evidence of extensive bone metastases on CT scan. Her bone scan showed increase tracer uptake in the skull, sternum, the whole spine, ribs, pelvis, proximal femura and humeri but no tracer uptake is seen in the distal 1/3 of femura as well as bilateral tibias and fibulas. There was good soft tissue visualisation. This is a rare bone scan finding in cases of extensive bone metastases and can be described as a 'sub-superscan'.

CASE REPORT

A 50-year-old lady presented with a left breast lump for one year and severe back pain. Her full blood count (FBC) result was relatively normal except for slightly increased haemoglobin level (15.1 g/L). Renal profile was normal. Bone profile revealed high calcium level (2.84 mmol/L). Other than that, her liver profile was within normal range except for low albumin, high globulin and high alanine transferase (ALT). Histopathological examination from the left breast lump confirmed the diagnosis of breast carcinoma. Her thoracic vertebrae x-ray is as shown in Figure 1.

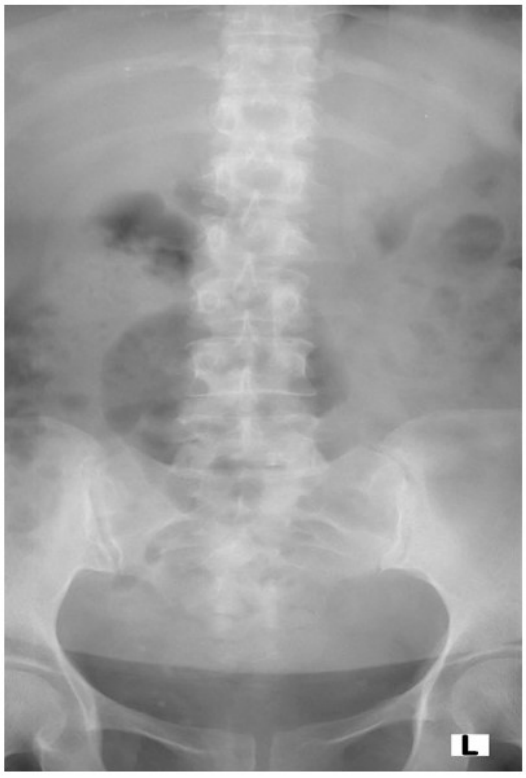

Figure 1: Normal lumbo-sacral x ray in anterior view

Bone scan was done to rule out bone metastasis in view of severe back pain. Scan findings revealed increased uptake in the skull, sternum, the whole spine, ribs, pelvis and proximal bilateral femura and humeri. No tracer uptake is seen in the distal 1/3 of bilateral femura as well as bilateral tibias and fibulas. Uptake in the soft tissues (bilateral breasts and both kidneys) were clearly visualised (Figure 2). Selected computed tomography (CT) scan of thoracolumbar spine and sternum showed extensive lytic and sclerotic lesions in the visualised bones (Figure 3). The patient was started on palliative chemotherapy. Unfortunately, she succumbed to the disease and died within one month of the diagnosis.

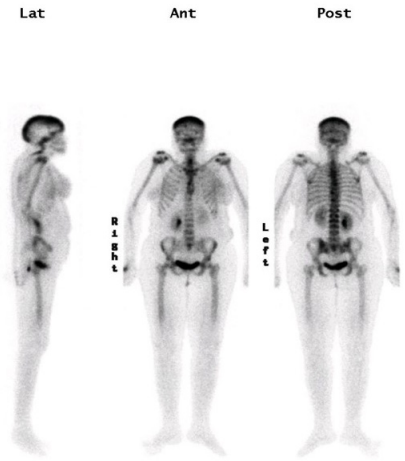

Figure 2: Whole body planar bone scan (lateral, anterior and posterior views) with increase uptake in the skull, sternum, the whole spine, ribs, pelvis, humeri and proximal 2/3 of femura. No tracer uptake is seen in the distal 1/3 of femura as well as bilateral tibias and fibulas. Uptake in the soft tissues (bilateral breasts and both kidneys) were clearly visualised

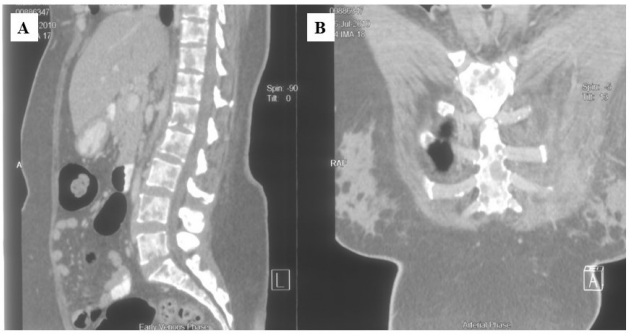

Figure 3: (A) CT scan of thoraco-lumbar vertebrae (sagittal view). (B) Coronal view of sternum. Both images show extensive lytic and sclerotic lesion suggestive of bone metastases

DISCUSSION

A superscan is defined as diffuse symmetric skeletal uptake of radiopharmaceutical such as ^{99m}Tc-MDP in the skeleton with absent or faint visualisation of the kidneys. A normal absorption of ^{99m}Tc-MDP is less than 40% by the bone and the remainder is excreted by the kidneys (1) . In a case of extensive bone metastases, there is greater absorption of radiopharmaceutical by the bone relative to the soft tissue and kidneys which cause consequent loss of signal from the kidneys (1).

Although the classic super scan is described as absent or faint visualisation of kidneys, there are cases where kidney is visualised in a diffuse bone metastasis, as described by Shanti L. Lunia et al (2). The uptake in both kidneys can be explained if the patient had kidney impairment or recent chemotherapy. In our case, the kidney function is normal, and the patient did not have any recent chemotherapy to explain the uptake in both kidneys.

Although there are extensive bone metastases as evidence by the CT scan (Figure 3A and 3B), the bone scan finding is atypical of a superscan. This finding can be considered as sub-super scan. This term was used in a case report by Seo et al where there were extensive bone metastases with evidence of marrow involvement (3). In their case, the FBC is already abnormal with pancytopaenia, hence the suspicion of marrow metastases. They have done both bone scan and bone marrow scan using ^{111}In-chloride to show that the bone scan finding is associated with bone marrow metastases.

In our case, the full blood count is almost normal, compared to the case presented above (3). The disappearance of distal 1/3 of femora and bilateral tibias and fibulas in the bone scan has not been published before. A superscan represent diffuse high bone turnover rate and it is due to diffuse infiltrating marrow metastasis. A possible explanation is that our patient might had bone marrow metastases as well as extensive bone metastases. Bone marrow and bone are the environment with abundant blood flow and growth factors. Once the tumour successfully metastasizes to the bone marrow, it will trigger a complicated interactions that are regulated by osteoclasts and osteoblasts (4).Osteoclasts are highly specialised multinucleated cells which are responsible of bone resorption hence the appearance of lytic lesions in the CT/MRI scan. Breast carcinoma is known to have both lytic and sclerotic components in bone metastases, as in this case, it is predominantly lytic.

Bone scan is more sensitive in the detection of bone formation than bone destruction because the principal of bone scan is the chemisorption of ^{99m}Tc-MDP into the calcium hydroxyapatite in the bone which occurs during bone formation. It is possible that due to predominance of lytic component in this case that the bone scan appearance is not typical of a superscan despite extensive bone metastases. To overcome this, ^{18}F-NaF PET/CT is a better alternative as it is more sensitive than ^{99m}Tc-MDP to look for lytic bone metastases (5).

Ideally, bone marrow metastases should be confirmed by bone marrow biopsy. It could also be detected by imaging such as bone marrow scan, ^{18}F-FDG PET/CT as

well as MRI. ^{18}F-FDG PET/CT is highly sensitive mainly in diagnosis of early metastatic disease, which may still be confined to the bone marrow, and for the detection of lytic bone metastases.

This case demonstrates that extensive bone metastases from breast carcinoma does not always show up on bone scan as superscan. A 'sub-superscan' does not indicate early stage of bone metastases but possibly the opposite as demonstrated in this case.

CONCLUSION

In conclusion, the absence of a superscan finding in bone scans does not rule out extensive bone metastases. A 'sub-superscan' bone scan can also be seen in a patient with extensive bone metastases. Therefore, correlation with other imaging techniques and bone marrow HPE need to be done to confirm the diagnosis.

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