

Original Research Article

Pattern of skeletal metastasis in breast cancer patients of Northern part of Bangladesh

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ABSTRACT

Background: Breast cancer is the most frequent female cancer, especially in 'developed' countries. 30-85% of metastatic breast cancer patients will develop bone metastases during the course of the disease. The study was aimed to evaluate the pattern of skeletal metastasis in breast cancer patients with whole body bone scan using ^{99m}Tc-methyl diphosphonate (^{99m}Tc-MDP).

Methods: This single center based retrospective observational study was conducted among the histopathologically proven breast cancer patients referred to INMAS, Rangpur for ^{99m}Tc-MDP bone scintigraphy between March 2015 and March 2019. Bone scan was done with SPECT digital dual head gamma camera (Siemens S series) 3 hours after intravenous bolus injection of 20 mCi ^{99m}Tc-MDP.

Results: Out of total 300 patients, 120 (40%) patients were found secondaries in bones. Among them 80(66.7%) had only axial skeletal metastases and 15 (12.5%) had appendicular skeletal metastases. Both axial and appendicular skeletal metastases were found in 25 (20.8%) patients.

Conclusion: Thoraco-lumbar spine was the most common site of involvement in our study.

Keywords: Skeletal metastasis, Breast cancer, Northern part

INTRODUCTION

Breast cancer is one of the most common cancers among women, and one of the leading causes of death among females with significant genetic predisposition.¹ The incidence of carcinoma breast increases with age. Bone is the commonest site to which breast cancer metastasizes. Between 30% to 85% of patients with carcinoma breast develop skeletal metastasis during the course of the disease.² In our country, many patients do not visit the doctors at early stage of the disease due to social stigma. When reported to doctors many cases already reach its late stage. So, metastasis is common in breast cancer patients who attend nuclear medicine (NM) departments and we find that bone is a favorable site for metastasis. Usually, the patients present with bone pain in skeletal

metastasis cases.³ Whole body radioisotope bone Scintigraphy is a commonly used and sensitive investigation for detecting skeletal metastasis in breast cancer patients and an excellent modality for staging these group of patients before starting treatment, to assess the ongoing treatment response and for future.

Radioisotopes are accumulated based on the bone vascularity and osteoblastic activity. The sites with metastasis will have more vascularity and osteoblastic activity, so more uptake.⁴ ^{99m}Tc-methyl diphosphonate (^{99m}Tc-MDP) is a common radiopharmaceutical used in this purpose. Aim of this study was to observe the pattern of skeletal metastasis in breast cancer patients in whole body skeletal scintigraphy using ^{99m}Tc-MDP to aid proper diagnosis, staging, management and prognosis.

METHODS

The study was a single center based retrospective observational study. It was based on the findings of whole-body scan of the 300 breast cancer patients referred to institute of nuclear medicine and allied sciences (INMAS), Rangpur from March. 2017 to March 2019. Bone scan was done with intravenous bolus injection of 20mCi (740 MBq) 99m Tc-MDP using SPECT digital dual head gamma camera (Siemens. Symbia S series). Images were taken three hours after injecting the radiotracer and the scan time was about 15 minutes (or for >1.5 million counts). Anterior and posterior projections were obtained in a whole body scan using low energy high resolution parallel-hole collimator, with energy window centered at 1'10 key and window width set at 159,0. Matrix size was 256×256. Skeleton (including shoulder girdle, pelvic girdle and extremities).

RESULTS

In this study, total 300 patients were observed. Out of 120 (40%) skeletal metastasis positive cases (Figure 1).

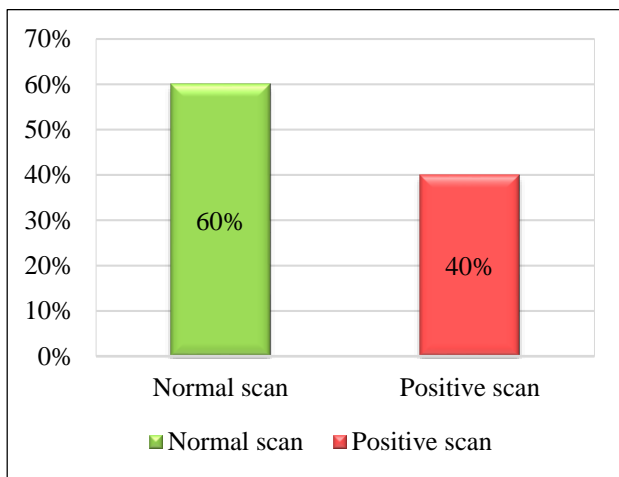


Figure 1: Bone scan findings among the patients, (n=300).

Out of total 120 positive patient of secondaries in bones 80 (66.7%) had only axial skeletal metastases and 15 (12.5%) had appendicular skeletal metastases. Both axial and appendicle skeletal metastases were found in 25 (20.8%) patients.

Out of 80 only axial metastasis patients, highest number was revealed in thoraco-lumber spine (78%). Other sites of axial metastasis were in pelvic bones (12.5%), ribs including sternum and clavicle (5%), cervical spine (2.5%) and skull bone (2%) (Figure 3).

Among 15 appendicular metastasis patients, maximum number was found in upper extremities including scapula (65%). In lower extremities, about 35% involvement was found (Figure 4).

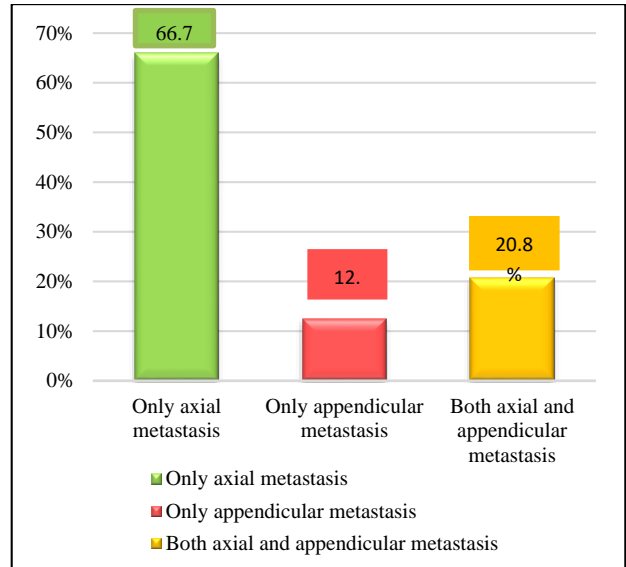


Figure 2: Skeletal metastasis area among positive patients, (n=120).

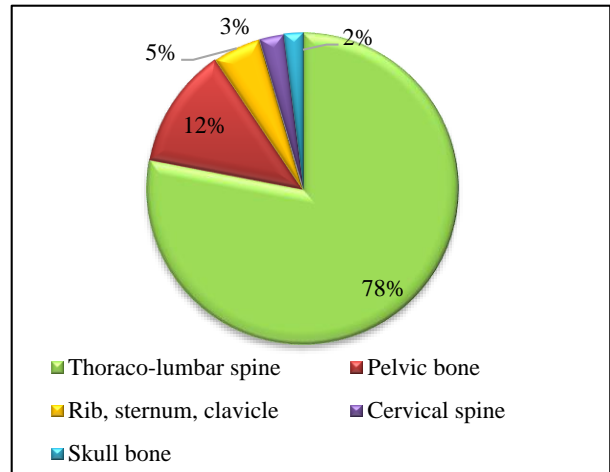


Figure 3: Axial metastasis by anatomical sites, (n=80).

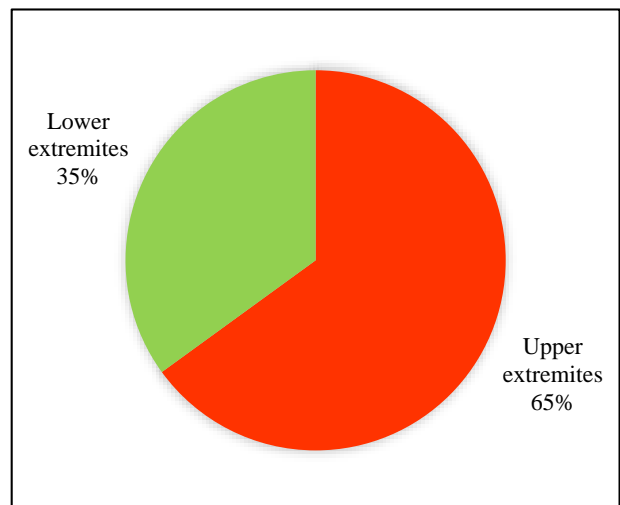


Figure 4: Appendicular metastasis by anatomical sites, (n=15).

Out of 25 both axial and appendicular metastasis patients, highest number was thoraco-lumbar spine with upper extremities (56%). Other sites of metastasis were in pelvic bones with lower extremities (25%), ribs including sternum and clavicle with upper extremities (8%), cervical spine with upper extremities (6%) and skull bone with upper extremities (5%) (Figure 5).

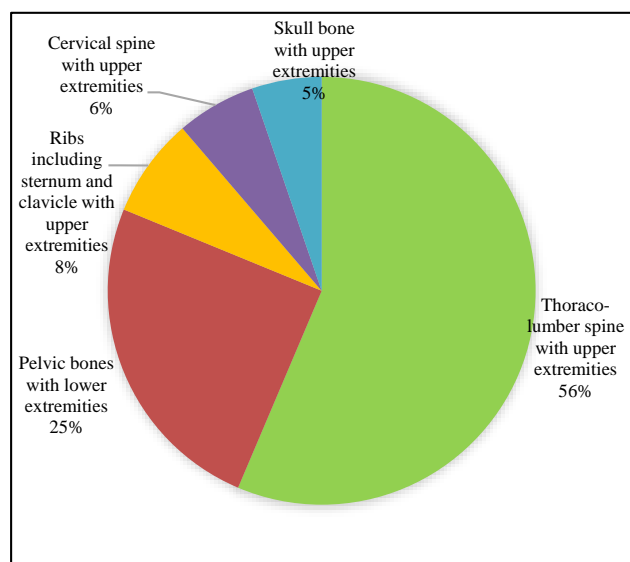


Figure 5: Both axial and appendicular metastasis by anatomical sites, (n=25).

DISCUSSION

Bone is known to be one of the most common sites of metastasis for breast cancer patients. Several imaging modalities, including plain radiography, computed tomography, magnetic resonance imaging, SPECT-bone scan and positron emission tomography are available to detect bone metastasis. Compared to other modalities, bone scan is characteristic by its high sensitivity, easy accessibility, and providing whole-body imaging of bone metabolism.^{5,6} The high sensitivity of this technique is based on physiological basis for preferential uptake of methyl diphosphonate, which identifies as little as 5-15% alteration in local bone turnover. Delineation of a lytic lesion by conventional radiology requires a minimum size of 1cm and a focal loss of at least 50% of bone mineral, while at least 30% increase in bone mineral content is essential to appreciate sclerotic lesion. That's why bone scan may pick up bone metastases up to 18 months earlier than conventional radiology, with an average lead of 4 months. The usual appearance of skeletal metastases on bone scan is focal hot spot; however, rarely focal cold defects are also noted. Therefore, it is more frequently used than the other modalities, and breast cancer patients can benefit from a routine baseline bone scan as well as a regular follow-up.⁷

This study showed, out of total 300 patients, 120 (40%) patients were found metastases positive. Among them 80

(66.7%) had only axial skeletal metastases and appendicular skeletal metastases were observed in 15 (12.5%) patients. Both axial and appendicular skeletal metastases were found in 25 (20.8%) patients. In a similar study, Afzal et al found positive skeletal metastasis in 38% of total breast cancer patients.⁸ About 33.47% positive skeletal metastasis was found in the study by Hosen et al.²

Breast cancer cells spread from primary site of lesion to distant sites either by direct extension, hematogenous spread or lymphatic spread. Bone is the most common site (51%) for metastasis in breast cancer patients.⁹ Metastases to bones usually occur through hematogenous route. Whole body scan with radiopharmaceutical is a fairly' sensitive and cost-effective investigation for detection of the bony metastasis.¹⁰

Sensitivity of whole-body scan for detection of bony metastasis ranges between 62%-100%.¹¹ Though bone scan is not much reliable in detecting metastasis in early stage (Stage-1 and 2) of breast cancer. In clinical stage-1, abnormal bone scan percentage varied from 0%-18% with a mean value of 4.4% and in case of stage-2 this percentage varied from 0%-32% (mean value 7.2%). But the percentage of abnormal bone scans increases with more advanced stage of breast cancer with a mean value of abnormal scans at 27.6%.

Bone metastases may present as osteolytic, osteoblastic or combination of both.⁵

Radiopharmaceuticals deposit to bone tissue on the basis of blood flow and osteogenic activity or bone tumors. So, many benign lesions like osteoarthritis may give false positive results for a bony metastasis.⁶ Invasion of tumor cells to bone depends on adhesion mechanisms, interaction with the extracellular matrix, stromal cells, osteoblasts, osteoclasts, and endothelial cells.⁷

CONCLUSION

Skeletal metastases much more common in multiple sites than solitary lesion in breast cancer patients. In this study, axial skeleton more commonly involved than appendicular skeleton. Both axial and appendicular bone metastasis was also detected at relatively significant proportion. Thoraco-lumbar spine was the most common site of involvement in our study. Whole body scan with ^{99m}Tc-MDP is very cost effective in comparison to other imaging modalities (CT, MRI, and PET-CT) and play a major role in early detection of skeletal metastasis in breast cancer patients.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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