Evaluation of skeletal metastatic pattern by ^{99m}Tc- Methylene diphosphonate in prostatic carcinoma patients

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ABSTRACT

Objective: **The objective of this study was to find out the pattern of skeletal metastasis in-patient with prostatic carcinoma by using ^{99m}Technetium-Methylene diphosphonate (^{99m}Tc MDP).**

Methods: **This retrospective study was carried out at the National Institute of Nuclear Medicine and Allied Sciences (NINMAS) from January 2014 to December 2014. The study included 65 histologically proven prostatic carcinoma patients. They were divided into three groups according to their age. Whole body bone scintigraphy was performed with ^{99m}Tc MDP and was interpreted by expert nuclear medicine physicians as negative or positive for skeletal metastases.**

Results: **Bone scan was done on 65 prostate cancer patients. They were divided into three groups according to their age. In this series, the lowest age of patients were 50 years and highest 85 years with a mean ± SD was 65.80 ± 10.11 years. Group A comprised of 14 subjects age ranged 50 to 59 years. Out of them 8 (57%) were positive for skeletal metastasis. Group B comprised of 25 subjects and age range from 60 to 69 years. Out of them 18(72%) were positive for skeletal metastasis. Third group C comprised of 26 subjects and age ranged from 70-80+ years of age. Out of 26 subjects 22(84%) were positive for skeletal metastasis. The most common site involved was dorsal vertebrae in which 60% secondaries were isolated. Sacroiliac joint 39% and ribs 33% were the second and third most common affected areas respectively. Other involved sites were skull, sacrum, lumbar vertebrae, ileum, mandible, femur, sternum, cervical vertebrae, iliac crest, scapula, hip joint, tibia and pelvis.**

Conclusion: **This retrospective study focused on the pattern of skeletal metastasis in various bony sites due to prostate carcinoma, which might be helpful for the oncologist and clinician in further treatment planning.**

Key words: **Bone scan, Prostate cancer, Bone metastases.**

INTRODUCTION

The introduction of ^{99m}Tc-based scan agents was started approximately 25 years ago, the radioisotope bone scan had been the standard method for detection of skeletal metastases. Isotope scanning is more sensitive than radiography for detection of most skeletal metastases. Tracer accumulates in the reactive new bone that is formed in response to the lesion. Thus, although most metastatic lesions are "hot". Cold lesions are due to complete absence of reactive bone, which may represent particularly aggressive metastases. In addition, the amount of accumulation of Technetium ^{99m}Tc-Methylene diphosphonate (^{99m}Tc-MDP) tracer is sensitive to the level of blood flow. Diffuse accumulation of tracer throughout the skeleton due to disseminated skeletal disease (super scan) may lead to the false impression of a normal scan. Carcinoma prostate is the most common malignancy in males older than 50 years of age (1). The exact incidence and distribution of cancer in Bangladesh is still undetermined due to lack of cancer registries, the importance of which in epidemiological point of view is unrecognized in our country till today (2). In a 5 years study in Dhaka Medical College & Hospital (DMCH) shows the incidence of carcinoma of male genital system is about 2.19% among them prostate is 0.70% (3). Bone metastases are a frequent complication of cancer, occurring in up to 70% patients with advanced prostate cancer (4). The consequences of bone metastases are often devastating. The bone scan is an important modality to evaluate skeletal pathological condition and is of utmost prognostic significance. Because of its sensitivity and the ability to examine the whole skeleton in a single examination, it still remains the most important investigation in the evaluation of skeletal metastases from prostate cancer in clinical practice. This study was focused to determine the pattern of bone secondaries in prostate

carcinoma patients and the common sites of involvement.

PATIENTS AND METHODS

We performed a retrospective study of diagnosed prostatic adenocarcinoma patients referred to NINMAS for whole body bone scintigraphy from January 2014 to December 2014. The study included 65 subjects. Bone scan reports of all these patients were then retrospectively reviewed, and confirmation of bone metastases was determined by consideration of all available clinical information. The bone scan were performed with ^{99m}Tc MDP as bone seeking agent, given intravenously as a dose of 18-20 mCi. Imaging was done 2-4 hours after tracer injection by a SPECT system single head Gamma Camera. Images were processed and displayed for analysis in different sections of anterior and posterior views. The subjects were divided into three groups according to their age. Sixty five patients are further subdivided into two groups according to bone scan findings i.e. 48 patients with bone metastases, termed bone scan – "positive" and 17 patients with no bone metastases, termed bone scan-"negative". Bone scan images were interpreted and the findings (areas of increased or decreased tracer localization) were recorded according to the number anatomical location, distribution (focal versus diffuse) and the shape (round, fusiform linear etc.) and reported as negative or positive for skeletal metastases.

RESULTS

The age range of 65 patients was 50 to 85 years mean ± SD was 65.80 ± 10.11 years. The subjects were divided into three groups according to their age. Findings of bone Scintigraphy in different age groups of patients is shown in Table I. The most common area of skeletal involvement was elicited by this study. According to our data the most primarily and frequently involved area were dorsal vertebrae in which 29 (60%) secondaries were seen. Sacroiliac joint was the second frequently involved area in which 19 (30%) secondaries were present followed by ribs showing 16 (33%) secondaries. Distribution of patients by site of metastasis in bone scintigraphy was shown in Table II. Patients with bone scintigraphy results were divided in four groups. Among all patients 17(27%) patients had no skeletal involvement (M0). Eighteen (28%) patients had 1-5 bony lesions and was classified M1 group. M2 group comprised 26 (40%) patients those represented presence of bony lesions in ≥ 6 sites and finally M3 group classified as presence of super scan of malignancy and was comprised 4(6%) patients. This result is shown in Table III. Well-differentiated adenocarcinoma was observed in 34 cases and shows mostly M1 group of skeletal metastasis (Figure-1). While moderately differentiated adenocarcinoma were found in 15 cases and correlated most with M2 metastases (Figure 2). Poorly differentiated adenocarcinoma were found in 16 patients and correlated with M2 and M3 groups. Other sites involved were skull, sacrum, lumbar vertebrae, ileum, mandible, femur, sternum, cervical vertebrae, iliac crest, scapula, hip joint, tibia, pelvis, ischium, pubic, knee joint and clavicle.

DISCUSSION

Metastatic prostate cancer is a leading cause of illness and death among men in the United States and Western Europe (5). The high rate of mortality from prostate cancer may be due to late detection. Thus, prostate cancer is also a major cause of suffering and of health care expenditures (6, 7). In this retrospective study, incidence of prostate cancer was highest (n=28, 44%) in the age group of 60 - 70 years, consistent with other published literature (8,9). Skeletal metastases of prostate cancer was found in 48 (73%) patients that was consistent with other published literature (10) and somehow more than others Scaffer and Pollen (11,12). Chybowski FM and Huncharek et al., (8, 9) described about 38% of metastasis at presentation, which is consistent with this study. We found that bony

were more common in axial skeleton specially in dorsal vertebra, ribs, skull , sacroiliac joint and pelvis corresponding to findings of the study by Lee et al., (13) but somehow inconsistent with Scaffer (11). Awal et al., (14) worked with bone scintigraphy in carcinoma prostate patients in another institute about 10 years back and showed almost similar results, which prove that the pattern of distribution of skeletal metastasis remained the same.

Table I: Findings of bone Scintigraphy in different age group of patients

	Age range	n = 65(100%)	Positive bone scan	Negative bone scan
Group A	50-59 yrs.	12(18%)	08(66%)	04(34%)
Group B	60-69 yrs.	28(44%)	18(64%)	10(36%)
Group C	70-80+ yrs.	25(38%)	22(88%)	03(12%)
		Total = 65 (100%)	Total = 48(73%)	Total=17(27%)

Table II: Pattern of bone involvement in skeletal metastasis

Site of metastasis	No of patients	Percentage
Dorsal vertebra	29	60%
Sacroiliac joint	19	39%
Rib	16	33%
Long bone	10	20%
Skull	06	12%
Shoulder joint	04	08%

Table III: Extent of skeletal metastasis, based on different categories

Extent of metastasis	No of patients	Percentage
M0 (No skeletal involvement)	17	26%
M1 (1-5 lesions)	18	28%
M2 (> 6 lesions)	26	40%
M3 (super scan)	04	06%
Total	65	100%

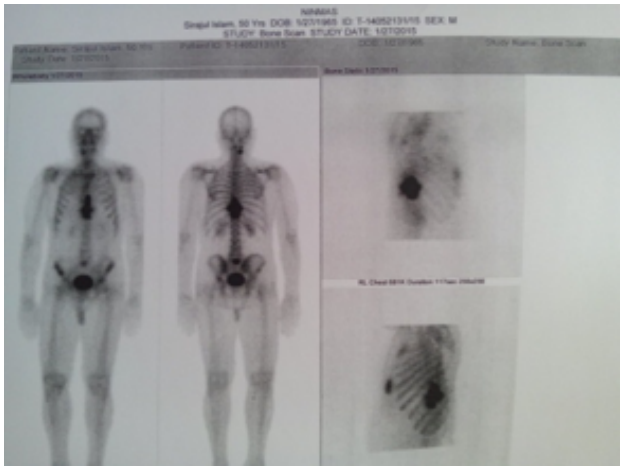

Figure 1: M1 category of skeletal metastasis involvement.

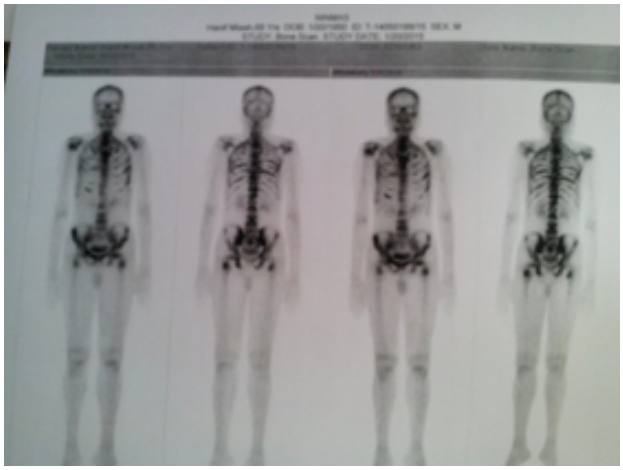

Figure 2: M2 category of skeletal metastasis involvement.

CONCLUSION

This retrospective study focused on the pattern of skeletal metastasis in various bony sites due to prostate carcinoma and most common sites of bony involvement were dorsal vertebra and sacroiliac joints.

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