
PATTERN OF METASTATIC DEPOSIT IN BONES

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ABSTRACT

To detect the pattern of bony involvement of various malignant diseases by planar bone scanning.

Methods : 99m Tc-MDP was injected four and three phases bone scan performed in some circumstances. After 2 hrs static acquisition done. After four injection, sequential images were taken for 30 seconds, blood pool images at 1 minute, static views were taken after 2 hours. Diagnosis was made in all cases histologically.

Results : In the years of 1999-2000, only 76 patients, where as in the year of 2001-2002, 236 patients were referred to NMC, Rangpur for bone scan to detect metastatic deposition in bones. Among these (236), 81 patients with Ca (Ca-Carcinoma) breast, metastatic deposit found in 31 patients (38.27%), metastatic deposit found in Ca prostate patients 66.66%, in Ca-lung, secondaries found in bone 58.33%, metastatic deposit in renal Ca 60% and in Urinary Bladder malignancy 33.33%. In Hodgkin's lymphoma (HL) and Non-Hodgkin's lymphoma (NHL) bony metastasis found 33.33% and 40% respectively. Clinically most of the referred patients were of suspected bone metastasis.

Conclusion : Accurate bone scan diagnosis depends on high quality image. Specific advantages of SPECT in identifying and localizing skeletal pathology have already been established. But planar scintigraphy in diagnostic application for skeletal oncology not lagging behind. SPECT supplements but does not replace planar bone scanning. However, programme should be taken to aware the referring physician to detect bony involvement earlier by isotope scan than radiograph which will help to palliate or, cure the patients.

Key words = Bone, Metastasis, MDP.

INTRODUCTION

Cancer incidence and death rates continue to fall in the USA;¹ but day to day malignancy of various human organs are increasing in many other parts of the world. Cancer is a multistage disease, not a single event and doctors should emphasize cancer prevention in addition to cancer treatment

and cure. Chemoprevention with naturally occurring (many dietary) and synthetic agents shows promise for preventing, arresting and reversing cancer development.² Most human cancers are caused by genotoxic carcinogens. However, we should search for the causes of

malignancies. Also search for how to control the malignant diseases, which will minimize the incidence of malignancy. For example to prevent Ca. stomach we should take more vegetables, fruits, vit. C, vit. E. Less intake of salt, alcohol, tobacco etc. Red wine is also a factor in the causation of Ca. stomach.

Excess egg ingestion is a risk factor for Ca. rectum, colon. Radiation can cause malignancy anywhere in the body. Vit-D3 can prevent invasive breast cancer. Oral contraceptive increases the incidence of Ca. cervix. In USA, diuretics play an important role in the incidence of renal cell cancer among female. Geographical distribution, occupational and nutritional factors are also some important causes for malignancy.

Malignancy is the first cause of death (35-45%) in the developed and developing countries. Bone scan is currently accepted as a powerful investigational tool in the evaluation of patients with both benign and malignant skeletal disease. The commonest indication being the detection of occult metastasis, for which purpose the entire skeleton should be imaged. Bone scintigraphy is directed towards identifying sites of skeletal metabolism and abnormal foci of calcium phosphate deposition.

INDICATIONS FOR BONE SCANNING

1. Identification of bone pain of unknown origin.
2. Screening of patients with suspected malignancy.
3. Pre-operative staging for Ca. breast, Ca. bronchus and Ca. prostate.
4. Planning of radiotherapy.
5. Selection of sites for bone biopsy.
6. Detection and follow-up of primary bone disease.
7. Early identification of soft tissue lung mets from primary bone tumour.
8. Assessment of trauma to the skeleton.

9. Differential diagnosis of compression fracture in the spine.
10. Localization of inflammatory bone disease.
11. Localization of sites of Paget's involvement.
12. Detection of soft tissue calcification.

The ^{99m}Tc labeled phosphate are believed to undergo chemisorption-tracer adsorbed on to the surface of calcium hydroxy-apatite crystal and then passes in to the interior of the bone crystal.³ Deposition of tracer occur in the areas of new bone formation of any aetiology. Tracer deposition also depends on blood flow to a given area not to the bone mass. Bone scan quality depend on state of hydration, renal function, obesity, distance of detector from patient, quality of radiopharmaceutical, age of patient, scan interval, any systemic therapy like chemotherapy, steroids etc. The characteristic appearances of metastasis on the bone scan is thus a hot spot. In extensive metastasis, the bone scan may resemble the superscan appearance of metabolic bone disease.

AIM & OBJECTIVE

Role of scintillation gamma camera in the diagnosis of bone metastasis. Also to find out the causes and how to control malignant diseases.

MATERIALS & METHODS

Scintillation gamma camera (Siemens, made in Germany). bone kits (Amersham-MDP; Mallinckrodt-HDP), isotope ^{99m}Tc -combinedly allow clear visualization of the skeleton and to produce the bone scan that we are familiar with today. Immediately after IV bolus injection of radionuclide, 15 mCi ^{99m}Tc -MDP scintiphotos were obtained, 2 sec interval for 30 sec to see the regional blood flow followed by static images at 1 min to see the blood pool phase. Delayed imaging at 2 hrs. post-injection reflects osseous activity. Static images were taken both in supine and prone position of the major body regions. All

patients were well hydrated prior to isotope bone scan in order to enhance the excretion of tracer from soft tissue and vessel via the urinary tract. Patient Urinary Bladder was made empty before scanning to make a good scan of pelvic bones also to reduce the radiation dose to the bladder.

RESULT

In this study 236 cases have been included, among these 76 (32.20%) patients found with

positive bone scan. Histologically almost all cases were malignant. Age range were 0.5 to 80 years. Sex ratio between male and female 1:1.31. Total male and female patients in different age groups shown in Table 1 The percentage of bone metastasis of various malignant diseases shown in Table 2. In Ca. cervix, bone metastasis found in 66.66% and in Hodgkin’s lymphoma (HL) 33%. These results are a bit higher than usual. Probably the cases were referred to NMC, Rangpur in the late stage.

Table 1 Age-Sex distribution

| Age in Years | Male | Female |
|--------------|-------------|-------------|
| 0.5-15 | 03 patients | 05 patients |
| 16-30 | 13 patients | 17 patients |
| 31-45 | 25 patients | 60 patients |
| 46-60 | 32 patients | 40 patients |
| 61-75 | 26 patients | 12 patients |
| Above 75 | 03 patients | 00 patients |
| Total-236 | 102 | 134 |

Table 2 Top 10 primary malignancies with bone metastasis.

| Primary sites | Mets present | Mets absent |
|---------------------------|--------------|-------------|
| Breast 81 cases | 31 (38.27%) | 50 (61.73%) |
| Lung 24 cases | 14 (58.33%) | 10 (41.67%) |
| Bone tumour 17 cases | 08 (47.05%) | 09 (52.95%) |
| Alimentary canal 15 cases | 04 (26.66%) | 11 (73.34%) |
| NHL 10 cases | 04 (44.44%) | 06 (55.56%) |
| Prostate 06 cases | 04 (66.66%) | 02 (33.34%) |
| Cervix 06 cases | 04 (66.66%) | 02 (33.34%) |
| HL 06 cases | 02 (33.33%) | 04 (66.67%) |
| Renal 05 cases | 03 (60 %) | 02 (40 %) |
| M.Myeloma 02 cases | 02 (100 %) | 00 (00 %) |
| Total 172 | 76 | 96 |

Sixteen patients out of 236 were referred for bone scan due to malignancy of various

organs-e.g Ca. thyroid gland, salivary gland, testes, tongue etc, none had bone metastasis.

DISCUSSION

In our study we have observed the increased percentage of bone metastasis of various malignant diseases. It could be due to two reasons. One, not all patients who were suffering from malignant diseases were referred to our NMC, Rangpur. Only the suspected patients with bony metastasis were referred. Two, in the northern zone of Bangladesh, patients are not much aware about health, all patients consulted their physicians in the late stage of the malignant process. On the other hand, we didn't take 24 hrs scan for spinal metastasis. So, we may have missed few of them as false negative. Metastasis in spine take more tracer at 24 hrs. scan. In 4 hrs. scan benign and malignant lesion of spine, no significant change of tracer distribution. In our study most of the cases had multiple hot spots. because the number of lesions on a bone scan may provide some guide as to the likely cause. Around 7% of patients with metastasis will present with single lesion on the bone scan.⁴ Another series study showed 55% of the solitary scan abnormalities were due to neoplastic disease. The remainder were due to trauma (25%), infection (10%) and miscellaneous causes (10%). The location and distribution of multiple bone scan lesions help in the determination of their natures. Linear lesion in the ribs is probably due to trauma.⁵ Elongated rib lesion is likely to be malignant, while focal rib lesion is often due to fracture.⁶ We observed, in our study, the sites of metastatic deposit were found mostly in the thoracic and lumbar vertebrae, ribs. Long bones involvement were minimum. Shape of the hot spots were focal, rounded.

In case of metastatic lesion from breast and lung cancer, thoracic spine or, rib lesion are common (>80%) and limbs sites are uncommon (15%).⁷ Solitary rib lesions are malignant in 1-17%, while around 80% of vertebral lesions are malignant. Isolated joint abnormalities are likely

to be due to arthritis.⁸

Breast cancer is the most common cause of cancer death in women at the age range from 15-75 years of age. In this study we found metastatic deposit in bones from Ca. breast 38.27%. There are reports of Ca. breast metastasis in bones 4.4% and 7.2% in stage I, stage II respectively. This wide discrepancy may be due to bone scan was made in late stages of Ca. breast.

In more advance diseases at presentation, the pick-up rate of metastasis is high with a mean figure of 28%.⁹

We have 54% of bone metastasis in a selected Ca. lung patients. Studies on unselected patients with bronchial carcinoma showed a frequency of abnormal bone scan 31%.¹⁰ Another study showed 33% bone metastasis in Ca. lung.¹¹ Possibly due to bone scan done in advanced stages of Ca. lung. Levenson et al studied 119 patients with small cell carcinoma of the lung and reported that 49 patients (41%) had positive bone scan before having treatment.¹²

In our study, we have observed 60% metastatic deposit in bone from prostatic cancer, the highest incidence of metastasis at presentation, more than in breast cancer which is around 38% or more in more advanced disease.⁸ Johansson et al reported that bone scanning detected skeletal metastasis in 24% of patients with prostatic carcinoma at the time of presentation.¹³

CONCLUSION

Accurate bone scan diagnosis depends on high quality imaging. Specific advantages of SPECT in identifying and localising skeletal pathology have already been established. But planar scintigraphy in diagnostic application for

Another group of patients, 28 in number, performed bone scan not due to malignant disease rather than due to some non-specific causes like PUO, H/O fall, unconsciousness, generalized bodyache, thigh mass etc. One patient had bone marrow infiltration. All these patients were normal in bone scan.

PUO = Pyrexia of Unknown Origin

H/O fall = Home Outside fall

Ten patients of Ca. gall bladder were referred for bone scan, none had bone metastasis.

Six patients with Ca. ovaries came for bone scan, all had normal findings.

Three patients with Ca. urinary bladder but none of them had bone metastasis.

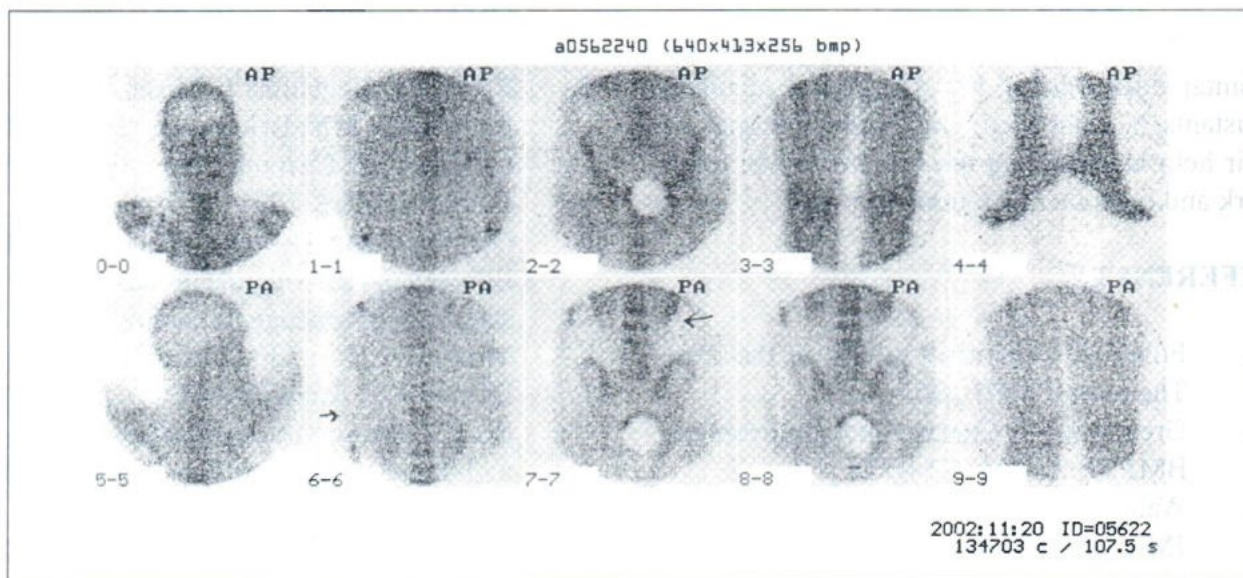


Fig. 1 Metastatic deposit in lumbar vertebrae.

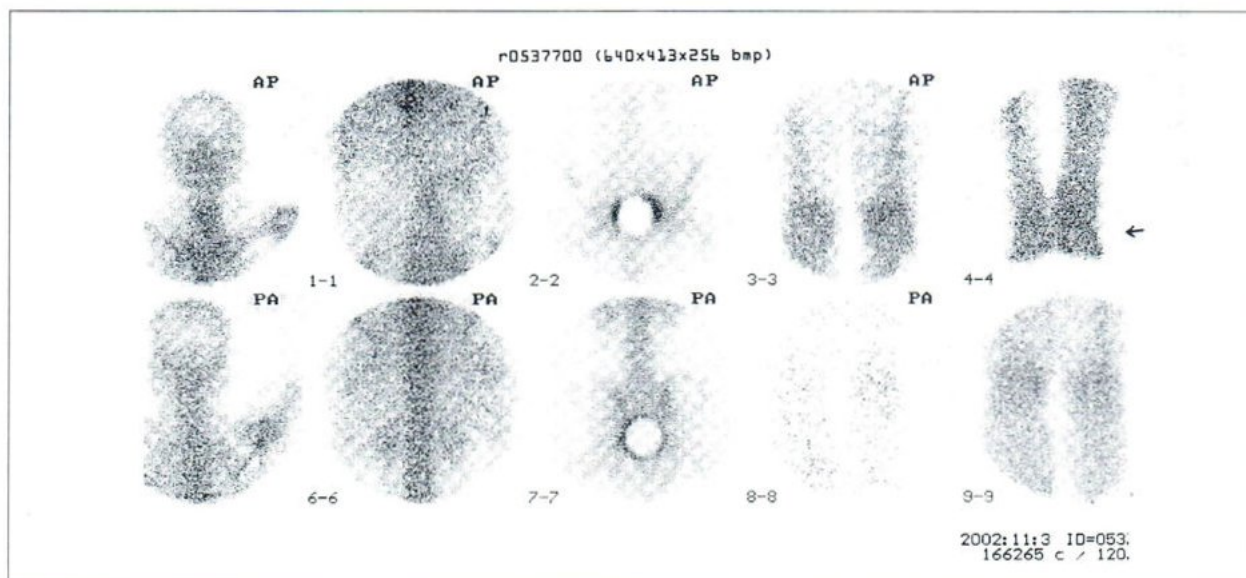


Fig. 2 Metastatic deposit in left ankle

skeletal oncology is not lagging behind. SPECT supplements but does not replace planar bone scanning. However, programme should be taken to aware the referring physician to detect bony involvement earlier by isotopic scanning rather than by radiography alone which will help to palliate or cure the patients more effectively.

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