Research Article

Journal of Bone Biology and Osteoporosis

Young Population Attending for Whole Body Technetium 99MDP Bone Scintigraphy: A Single Institution Experience

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Received date: July 07, 2018; Accepted date: Aug 21, 2018; Published date: Aug 26, 2018

Abstract

Objective: Radionuclide isotope scanning is a sensitive scanning procedure for the detecting of bone pathology. This article focuses on an institution experience bone Scintigraphy applications in patients below 25 years.

Patients and methods: This study is a retrospective descriptive study that analyzed the handwritten medical records of patients younger than 25 years old referred for Technetium bone scan in Mansoura University Hospital, Nuclear Medicine Unit from August 2011 to October 2015.

Results: Seventy-six patients younger than 25 years old were referred for bone scan. The main cause of referral was metastatic work up. Osteosarcomas and Ewing tumors constituted together the commonest malignant tumors referred while osteochondromas were the commonest benign tumors. The area around the knee was the commonest affected area in the primary bone neoplasm's while the vertebrae and the pelvis were the commonest sites of distant metastasis. No recorded complications existed secondary to the injection of the radioactive material. The commonest defect was lack of documentation of the family history.

Conclusion: This study helped to elucidate the extent of medical support that our nuclear medicine unit can give to other pediatric and adolescent medical specialties. It demonstrates also the wise selection of the cases to be referred for bone scan. To maximize the benefit from our bone scan service, analysis of differences between our unit and older larger units in the country is needed as regard policy decisions and financing. Digital reporting will put an end to mistakes in handwritten patient records.

Keyword: Technetium 99MDP bone scan, Young population

Introduction

Radionuclide isotope scanning is a sensitive scanning procedure for the detecting of bone pathology. A bone scan images the metabolic activity of the skeleton. This has traditionally been accomplished by imaging a radionuclide whose physiology closely mimics a metabolic process within bone. Nuclear Scintigraphy of the bone commonly utilizes the radio-nuclides technetium-99m (Tc-99m) or fluoride-18 (F-18). Tc-99m is usually attached to Medronic acid (Tc-99m

MDP) and F-18 incorporated into sodium fluoride (F-18 NaF). These molecules are injected intravenously, and a nuclear camera that contains a salt crystal captures the decay of photons from the radioisotope. This is achieved through the process of scintillation or fluorescence that occurs when the photon emitted by the radionuclide hits the salt crystal within the nuclear camera. The scintillations are then digitized and converted to images for interpretation by a nuclear medicine physician [1].

This article focuses on an institutional experience in planar bone Scintigraphy and its applications in young patients below 25 years.

Patients and Methods

This study is a retrospective descriptive study that analyzed the handwritten medical records of patients younger than 25 years old referred for Technetium bone scan in Mansoura University Hospital, Nuclear Medicine Unit from August 2011 to October 2015. Epidemiological data, investigations done for every patient other than the bone scan, the therapeutic history and bone scan reporting were all documented. Planer skeletal scintigraphy was performed at 3 h following intravenous administration of 750 MBq of Tc 99m methylene diphosphonate (MDP) using dual detector gamma camera (Philips) No cases was examined by Single Photon Emission Tomography (SPECT) due to lack of experience in its application.

The study was approved by the institutional Ethical Committee.

Results

Seventy-six patients younger than 25 years old were referred for bone scan in Mansoura University Hospital, Nuclear Medicine unit from August 2011 to October 2015. The mean age was 16 years and the age range was (1-24 years). The majority of the patients were males. Seventy-two patients (95%) were living in rural areas (Table 1).

Table 1: Patient characteristics.

Sex Distribution	No	%
Male	46	60.5
Female	30	39.5
Age		
< 15 years	27	35.5
≥ 15 years	49	64.5
Diagnosis		
Primary bone tumor	32	42.1
Metastatic	24	31.6
No defined diagnosis	20	26.3
Place of Residence		
City	4	5
Rural areas	72	95

All the cases were referred by a specialized physician or a consultant. The main cause of referral was metastatic work up in patients with a high suspicion or confirmed

diagnosis of malignancy (Table 2).

It was found that the reporting of each scan was done by at least 2 consultants. On analyzing the reporting, agreement between the consultants as regard diagnosis was found and no consultation of a higher specialized center was needed.

Table 2: Causes of referral for bone scan.

Cause	Patients Number	Percentage
Exploring the whole skeleton in existence of a provisional diagnosis of a benign bone lesion	18	24%
Metastatic work up in existence of a primary tumor highly suspicious of malignancy or proved to be malignant	56	74%
Exploring the whole skeleton in existence of delayed milestones	1	1.30%
Unexplained generalized bone aches	1	1.30%

Osteosarcomas and Ewing tumors constituted together the commonest of the malignant tumors referred while osteochondromas were the commonest benign tumors (Table 3).

In one osteochondroma case, the bone scan discovered extra lesions in the skeleton that were diagnosed neither clinically nor by plain X ray films. None of the osteochondroma patients had lesions that raised the suspicion of malignant transformation.

The area around the knee was the commonest affected area in the primary bone neoplasm's (Table 4). On the other hand, the vertebrae and the pelvis were the commonest sites (97%) of distant metastasis. No case of super scan was reported. There were no cases of intestinal uptake of Tc-MDP on bone scans. No recorded complications existed secondary to the injection of the radioactive material. The different defects in the patient records are shown in table 5. The commonest defect was lack of documentation of the family history.

Discussion

Bone Scintigraphy is a famous method for imaging wide variations of benign or malignant skeletal abnormalities

Table 3: Different types of diagnosis at attendance for bone scan.

Diagnosis type	Male	Female
No defined diagnosis	13	7
Osteosarcoma	5	2
Ewing	4	2
Mediastinal sarcoma	1	0
Round cell tumor	2	0
Rhabdomyosarcoma	1	0
Synovial sarcoma	1	0
Malignant fibrous histocytosis	1	0
Osteochondromas	7	2
Giant cell tumor	1	2
Enchondroma	1	0
Osteoid osteoma	3	0
Chondroblastoma	1	1
Neuro fibroma	0	1
Malignant peripheral nerve sheath tumor	0	1
Nasopharyngeal carcinoma	1	0
Acute lymphatic leukemia	0	1
Neuroblastoma	1	2
Thyroid cancer	1	3
Breast cancer	0	3
Histocytosis x	1	0
Metastasis of unknown origin	2	2
Total	46	30

Table 4: Bone sites affected in primary bone tumors.

Tumor type	Around Knee	Humerus	Iliac bone	Femur	Foot	Tibia	Paraspinal
Osteochondroma	5	2	2	0	0	0	0
Osteosarcoma	6	0	1	0	0	1	0
Giant cell tumor	3	0	0	0	0	0	0
Osteoid osteoma	0	0	0	2	1	0	0
Ewing sarcoma	1	1	1	1	0	0	2

[2].

Although bone metastasis is uncommon among children with cancer [3], the main cause of referral was metastatic work up. This is attributed to the fact that skeletal-related events affects the disease future [3].

Coinciding with the literature [4], the axial skeleton was the commonest site of bone metastasis. MRI is better than skeletal scintigraphy regarding the sensitivity, specificity and clarifying of the metastasis extent [5]. However, cost issues still prevent the total dependence on total body MRI

and PET scan or both together in initial diagnosis of bone metastasis in our locality.

Going in harmony with literature [6-10], our work revealed that osteosarcoma incidence was higher in young males with more predilections to the area around the knee. On the other hand, osteochondromas were the commonest benign bone tumor with also a higher incidence in young males.

Factors as chronic osteomyelitis, bone infarction, insertion of metallic prostheses, previous exposure

Table 5: Defects of the medical records and the final reporting.

Defect	Number of Encountered Defects
Absent family history	65
Non direct mentioning of the cause of referral for bone scan in the request.	6
Non reporting of vital signs as blood pressure, pulse or non reporting of weight and height	5
Non detailed documentation of the symptoms at presentation	5
Reports of the other radiology investigations exist without images.	25
The final report did not stat frankly the agreement or contradiction between the bone scan and the previously done radiology	10
Non documentation of requiring sedation or particular narcotic analgesia during the imaging process	2

to ionizing irradiation and receiving alkylating agents are known predisposing factors in osteosarcoma [11]. However, none of them seems to be a predisposing factor in our cases. This could be explained by the small number of patients.

In spite of the reported occasional existence of osteosarcomas and osteochondromas both together in the same patient [11], it was not reported in our cases.

Although osteochondromas could be hereditary [12], the hereditary stat of our osteochonroma cases was not clearly documented due to the defective family history in the patient's files.

Referring osteochondromas for bone scan to detect precisely their number in the skeleton is a reported indication [13], however in only one of our cases, one extra site was diagnosed. No autism among our osteochondroma case was reported although occasionally both may exist together [14][15].

The abnormal bone geometry related to Turner Syndrome [16] is being further investigated in the Pediatric Department of our University Hospital. However one case has been referred to our Nuclear Medicine till the time of presenting this study.

No cases of osteomyelitis was referred, this may be due to the satisfactory increasing role of MRI in its diagnosis [17].

There are indications of bone scan in the literature that were not reported during this study period for example the follow up of autologous bone graft of sarcomas [18]

and diagnosing a vascular bone necrosis after allogeneic hematopoietic cell transplant [19].

Super scan in a child or an adolescent is probably due to osteomalacia [20]. Due to better family awareness in the recent years, osteomalacia is not a common health problem and so no super scans were diagnosed.

The incidence of intestinal uptake in Tc MDP bone scan is 1% [21] and this may explain why it was not found in our reports.

Among the positive aspects found in this study is that the referred cases were well selected and referred in the proper time of their medical history which makes the scan procedure cost-effective? On the contrary, the absent experience in applying SPECT technology in our unit till now is a strong drawback that will be resolved in the nearest future. Digital patient records will not allow mistakes reported in the manually written records anymore and can help creating more integration between the medical departments.

Conclusion

In spite of being a small study, it helped to elucidate the extent of medical support that our nuclear medicine unit can give to other pediatric and adolescent specialties. It demonstrates also the wise selection of the cases to be referred for bone scan. To maximize the benefit from our bone scan service, analysis of differences between our unit and older larger units in the country is needed as regard policy decisions and financing. Digital reporting will put an end to mistakes in handwritten patient records.

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