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Estimation of Radionuclide Dose for Patients undergoing Bone Scan

Osama O. Ali, Mohamed E. M. Gar-Elnabi
Sudan University of Science and Technology College of Medical Radiologic Science, P.O. Box 1908, Khartoum, Sudan
Corresponding Author : Osama Ali

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ABSTRACT:
nuclear medicine involves the administration of radiopharmaceuticals that expose the patient to ionizing radiation. The aim of this study to estimate of patient's dose for patients are referred to nuclear medicine departments for bone scan. The descriptive statistics for all patients during bone scan the total number of patients was 102, were the data presented as mean, standard deviation, minimum and maximum. For age the mean ± STD was 57.32 ± 14.48, for patient's height, weight and BMI was 160.99 ± 11.08, 67.37 ± 12.41 and 25.89 ± 4.88 respectively, for patients' dose was 19.28 ± 3.12. analysis of variance for patients' dose with patients age and body mass index during bone scan, were the p.value showed there is no significant difference between the patient's dose with age and body mass index were the p.value was 0.095 and 0.141 respectively. compare between the present study with other studies, were the present study show the lowest value of dose form all others studies for bone scan. The study concluded that the relationship between administered activity and patient size and weight needs to be better understood.

Keywords: Nuclear Medicine, Activity, bone Scan, Radionuclide

I. INTRODUCTION:

Nuclear medicine is a medical specialty using radioisotopes astracers to diagnose diseases or for therapy. These tracers areusually attached to chemical compounds that are attracted toorgans of interest such as bones or thyroid gland. Afteradministration into the body, tracers emit characteristic radiations. Special electronic instruments, such as scintillationdetector or a gamma camera, displays the recorded emissions as images. The images yield information about the anatomyor the functional state of the organ being imaged.

In clinical applications of nuclear medicine, the amount ofadministered activity is low such that its correspondingabsorbed dose to imaged and non-imaged tissues are typicallyvery low and thus stochastic effect are outweighed by thediagnostic benefit of the imaging process [1].

Bone scintigraphy with technetium-99m–labeled diphosphonates isone of the most frequently performed of all radionuclide procedures.Radionuclide bone imaging is not specific, but its excellent sensitivitymakes it useful in screening for many pathologic conditions. Moreover,some conditions that are not clearly depicted on anatomic images canbe diagnosed with bone scintigraphy. Bone metastases usually appearas multiple foci of increased activity, although they occasionally manifest as areas of decreased uptake. The application of scintigraphy studies in nuclear medicine was developed in the last years with the use of many techniques and a variety of radioisotopes. However, one of the most used radionuclides in nuclear medicine routine is the technetium-99m (99mTc) [2,3].

Image quantification in nuclear medicine isused, among other options, to estimate activity in human subjects for the calculation of radiation dose in individuals undergoing radionuclide therapy and to study pharmacokinetics for approval of new radiopharmaceuticals [4,5].

The objective of this study is to estimate of patient's radiation dose during bone scan in nuclear medicine departments in Sudan.

II. METHODOLOGY:

Gamma camera: Khartoum Oncology Hospital: Model: Nucline Spirit, Royal Care International Hospital: Model: Nucline Spirit, Alnelain Medical Diagnostic Center: MiE medical imaging electronics (single head gamma camera), Model DRBITER Digi37 WB.

Dose calibrator: Alnelain Medical Diagnostic Center: Model: CRC-25R, SN: 250418, Khartoum Oncology Hospital: Model: 0202020023, Royal Care International Hospital: Atmolab 400 Dose Calibrator (BIOTEX) Model: 086-335.

The study was conducted atRadiationandIsotopeCenter in sudan in tht

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follwing hospital: RadiationandIsotopeCenter of Khartoum, RoyalCareInternationalHospital, AlnilainDiagnostic Center, NationalCancerInstitute, AlmakNimer Hospital, in period from Feb 2018- Aug 2021**, were** the study includes all patientsreferred tothese centers for Nuclear Medicine Exams duringthestudyperiod.(i.e.diagnosticand therapeuticprocedures)withdiggrentagebutwithcons tantrangeof weight60to80Kg.

Bone Scan:
Radionuclide: 99mTC t 1\2: 6 hours, Energies: 140 Kev, Type: IT. y. generator
Radiopharmaceutical: MDP (methylene diphosphonate), HDP (hydraxymethylene diphosphonate)

Localization: Chemisorption; chemically bonds on surface of hydroxyapatite crystals. These hydrolyze and bind normally to bone as tin oxide and/or Tc02 and present as prominent focal areas during the process of osteoblastic activity of bone repair.Quality Control: No 0 2 in kit. Chromatography. >95% tagging. Use MDP within 6 hours and HDP within 8 hours.Adult Dose Range : 20-30 mCi (740-1110 MBq). pediatrics by weight. Method of Administration: intravenous: Straight stick, butterfly or existing IV catheter with saline flush. Flow requires fast bolus injection.

III. RESULTS:

Estimation of effective dose for patient underwent nuclear medicine exam for bone scan in Sudanwhere the number of patients was 102patient's male and females were the mean of age for all patients was57.32 years and the standard deviation was 14.48 as presented in tables below:

Table 1. show descriptive statistic for all patients during Bone Scan: 102

variables	Mean	Std. Dev	Min	Max
Age	57.32	14.484	18	97
Height	160.99	11.078	130	183
Weight	67.37	12.411	18	91
BMI	25.8946	4.88912	16.33	45.23
Dose	19.284	3.1162	5.0	26.0

Table 2. show group statistic for all patients according to their gender:

	Gender	Mean	Std. Deviation	Std. Error Mean
Age	Female	52.767	13.9349	1.7990
	Male	63.619	13.6238	2.1022
Height	Female	157.583	10.2035	1.3173
	Male	165.857	10.5474	1.6275
Weight	Female	67.583	12.9632	1.6735
	Male	67.071	11.7253	1.8093
Dose	Female	18.783	2.7745	.3582
	Male	20.000	3.4571	.5334

Table 3. show correlation between the BMI and dose with patients age groups:

Age Group	Body Max Index		Dose	
	Mean	STD	Mean	STD
18-29	23.82	1.23	16.75	1.25
30-39	23.56	3.06	19	2.64
40-49	26.33	5.11	19.16	2.43
50-59	24.59	4.49	20.12	2.67
60-69	27.49	5.54	19.107	3.68
70-79	26.36	4.54	18.78	3.69
80-89	21.29	2.58	21.33	2.30
90-100	25.4600	0.00	20	0.00

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Table 4. show analysis of variance for patients' dose with age and body mass index:

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Age	Between Groups	3713.376	11	337.580	1.664	.095
	Within Groups	18262.977	90	202.922		
	Total	21976.353	101			
BMI	Between Groups	376.217	11	34.202	1.511	.141
	Within Groups	2037.636	90	22.640		
	Total	2413.853	101			

Table 5. compare between the present study with international studies:

Studies	Bone
Present study	19.28
Malaysia 2013	832
Australia 2008	900
Ireland 2004	800
Japan 2015	950
Lithuania 2012	517

IV. DISCUSSIONS:

Table 1. show descriptive statistics for all patients during bone scan the total number of patients was 102, were the data presented as mean, standard deviation, minimum and maximum. For age the mean ± STD was 57.32 ± 14.48, for patient's height, weight and BMI was 160.99 ± 11.08, 67.37 ± 12.41 and 25.89 ± 4.88 respectively, for patients' dose was 19.28 ± 3.12.

Table 2. show group statistics for patients during bone scan, for patients age the mean ± standard deviation for female was 52.77 ± 13.93 and for male was 63.62 ± 13.62, for patient's height the female was 157.58 ± 10.20 and for male 165.86 ± 10.55, for weight the female 67.58 ± 12.96 and for male 67.07 ± 11.72, for patient's dose female was 18.78 ± 2.77 and for male 20 ± 3.46.

Table 3. show correlation between the BMI and dose with patients age groups, were the patients age divided to eight groups, for age group 18-29 years the mean ± STD for body mass index and dose was 23.82 ±1.23 and 16.75± 1.25, for age group 30-39 was 23.56 ± 0.06 and 19 ± 2.64, for age group 40-49 years 26.33 ± 5.11 and 19.16 ± 2.43, for age group 50-59 the BMI and dose was 24.59 ± 4.49 and 20.12 ± 2.67, for age group 60-69 years was 27.49 ± 5.54, for age group 70-79 years was 26.36 ± 4.54 and 18.78 ±3.69, for age group 80-89 years was 21.29 ± 2.58 and 21.33± 2.30, for age group 90-100 years the body mass index and patients dose was 25.46 ± 0.00 and 20 ± 0.00.

Table 4. show analysis of variance for patients' dose with patients age and body mass index during bone scan, were the p.value showed there is no significant difference between the patient's dose with age and body mass index were the p.value was 0.095 and 0.141 respectively.

compare between the present study with other studies, were the present study show the lowest value of dose form all others studies for bone scan.

V. CONCLUSION:

Estimation of patient's dose during bone scan in nuclear medicine departments in Sudan, where the descriptive statistics for all patients during bone scan the total number of patients was 102, were the data presented as mean, standard deviation, minimum and maximum. For age the mean ± STD was 57.32 ± 14.48, for patient's height, weight and BMI was 160.99 ± 11.08, 67.37 ± 12.41 and 25.89 ± 4.88 respectively, for patients' dose was 19.28 ± 3.12. analysis of variance for patients' dose with patients age and body mass index during bone scan, were the p.value showed there is no significant difference between the patient's dose with age and body mass index were the p.value was 0.095 and 0.141 respectively. compare between the present study with other studies, were the present study show the lowest value of dose form all others studies for bone scan.

REFERENCES:

[1]. Bolch, W., & Fahey, F. (2013). The management of imagingprocedure dose. Nuclear Medicine, 2. https://www.aapm.org/meetings/2013AM/PRAbs.asp?mid¼477&aid¼22648.

[2]. AMATO, E., A. CAMPENNÌ, A. HERBERG, F. MINUTOLI, S. BALDARI, Internal radiation dosimetry: Models and applications, 12 chapters on nuclear medicine, Ali Gholamrezanezhad, IntechOpen, 2011, Available from: https://www.intechopen.com/books/12-chapters-onnuclear-medicine/internal-radiation-dosimetry-models-and-applications.

[3]. BERTELLI, L., D.R. MELO, J. LIPSZTEIN, R. CRUZ-SUAREZ, AIDE: internal dosimetry software, Radiat. Prot. Dosimetry, 2008, 130, 358−367.+

[4]. Pereira, J. M., Stabin, M. G., Lima, F. R. A., Guimar~ aes, M. I. C. C., &Forrester, J. W. (2010). Image quantification for radiation dosecalculations limitations and uncertainties. Health Physics,99(5), 688e701.

[5]. Sgouros, G., et al. (2003). Patient-specific, 3-dimensionaldosimetry in non-Hodgkin's lymphoma patients treated with131I-anti-B1 antibody: assessment of tumor doseeresponse.Journal of Nuclear Medicine, 44(2), 260e268.