

Scintimetric Characterization of Skeletal Hotspots by Dr.V.Siva's Retention Ratio in A Diagnostic Referral Center




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Received:  June 25, 2018; Published:  July 16, 2018

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Abstract

Aim: This study aims to document the utility of Scintimetric Characterization of the Skeletal Hot Spots seen in the Bone Scans done in this referral center during 2016-2017, in differentiating metastatic and non-metastatic lesions.

Materials and Method: The study group consists of 59 patients referred for metastatic evaluation and non-specific bone complaints to our center. The whole body bone scan was done 3hrs after the intravenous injection of 15 to 25mCi of Tc99m MDP using GE Millenium Gamma Camera. The 24hr whole body bone scan was repeated in all those who had focal hot spots in their scans and who accepted voluntarily with the consent of the referring physician. The counts in the focal hot spots at 3 and 24hr bone scan images were calculated using the region ratio count protocol. The Dr.V.Siva's Retention Ratio was calculated by dividing the 3hr counts by the 24hr counts in the focal hotspots. The values of metastatic and non-metastatic groups were tabulated and analyzed.

Results: In our series 35/59 (59%) scans were negative and did not show any focal changes. 24/59 (41%) scans showed focal changes in the form of hot spots. Out of the total 69 hot spots analyzed 31 (45%) had the value of 13.07 ± 1.02 indicating metastatic nature and 38 (55%) had the value of 6.07 ± 0.62 confirming the benign nature of the lesions. Thus the metastatic group had the mean value which is almost twice that of the benign group. The statistical evaluation confirmed the significant difference between the two groups.

Conclusion: It can be concluded that the Scintimetric characterization of the focal hot spots by Dr.V.Siva's retention ratio effectively provides useful means to differentiate between the metastatic and non-metastatic lesions in the tertiary referral diagnostic center as well.

Keywords: Scintimetry; Dr.V Siva's Retention Ratio; Skeletal Hot Spot Characterization; Differentiation

Introduction

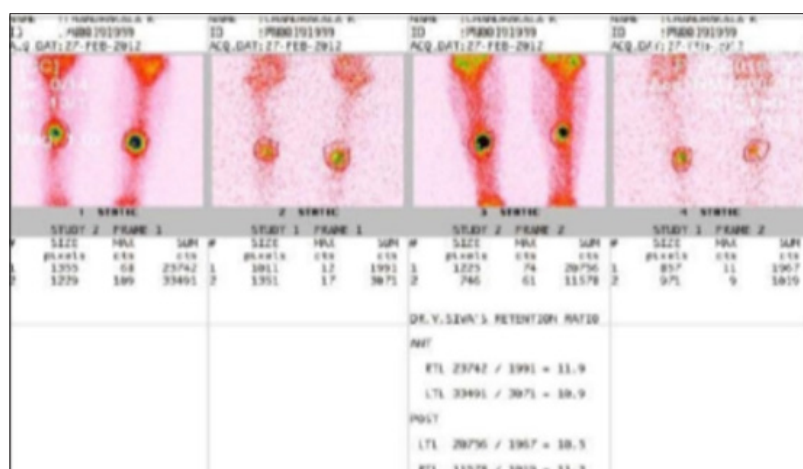


Figure 1: Dr. V. Sivas Retention Ratio Calculation.

The whole-body bone scan is usually asked for the skeletal metastatic involvement in the known and proven cases of Carcinoma

Breast, Carcinoma Prostate and Carcinoma of the Thyroid and lung most of the time and in other tumors as and when indicated. The

normal bones show normal uptake and uniform distribution of the tracer. The abnormal regions usually present as focal hot spots due to increased localization of the tracer in the affected bone. This is common to both the neoplastic and benign etiologies. The metastatic lesions tend to be multiple, asymmetric in distribution and can be single as well. The benign lesions tend to be solitary and if multiple normally show symmetrical distribution of the tracer. The utility of 24hr delayed bone scan in differentiating the benign and neoplastic conditions was first shown by Israel O et al. [1]. The counts at the lesion are divided by the counts at the background at 4hr scan and the 24hr scan. The ratio of the 24hr lesion / nonlesion value divided by the 4hr lesion / nonlesion value was shown to be different in the Malignant and benign bone disorders. This method proved to be of no clinical value as the resultant ratio was in decimal values and no useful cut off could be arrived at. Therefore by taking the counts only in the lesion at 4hr and 24hr Dr. V.Siva's retention ratio was calculated by dividing the 4hr count by 24hr count as shown in Figure 1. A useful cut off could be arrived at using this ratio as it gave full integers rather than decimal values [2,3]. The utility of this method in the evaluation of skeletal hot spots in the

metastatic work up of Carcinoma Prostate had been documented by us [4]. For the first time the scintimetric characterization of the skeletal hot spots was put into use in a tertiary referral diagnostic center at Chennai.

Materials and Methods

The whole-body bone scan was done 3 hours after the intravenous injection of 15 to 25mCi of Tc99m MDP using GE Millenium Gamma Camera. The 24hr whole body bone scan was repeated in all those who had focal hot spots in their scans and who accepted voluntarily with the consent of the referring physician. The study group included 59 patients referred for metastatic evaluation and non-specific bone complaints to our center. The counts in the focal hot spots at 3 and 24hr bone scan images were calculated using the region ratio count protocol and tabulated. The Dr.V.Siva's Retention Ratio was calculated by dividing the 3hr counts by the 24hr counts in the focal hotspots. The values of metastatic and non-metastatic groups were tabulated and analyzed. The values of the malignant and the benign group were shown in Tables 1 & 2 respectively.

Table 1: Malignant group Data.

SITE	4hr Count	24hr Count	Dr. V Sivas Ratio
D5	8295	541	15.3
D6	11244	837	13.4
L1	10929	583	11.5
L2	8291	1139	14.2
D10	15008	1277	13.1
L4	17239	2105	13.4
L5s	19196	1604	9.1
S1	18339	1474	11.4
LTSIJ	18374	645	12.4
Rt Rib	6149	1213	9.5
	15185	604	12.5
Rt	4495	357	11
Scap	3757	461	10.5
rib	4421	438	9.5
RIB	5620	1430	12.8
8thRib	26709	1327	18.6
Rt.Sho	16452	1582	12.3
	21823	190	13.7
D6	4053	204	21.3
RT 4th	2337	545	11.4

Table 2: Benign group Data.

SITEL2	4hr	24hr Count	Dr. V Siva's Ratio
D6	25938	3394	7.6
L2	23345	2655	8.7
Lt SIJ	57560	7713	7.4
D6	18930	4152	4.5
L2	13952	2107	6.6

LT.HIP	46865	5113	9.1
	54889	8272	6.6
	39346	5488	7.1
D8	89315	15214	5.8
	26003	5016	5.1
Lt sca	26253	13843	1.8
Rt Ulna	1607	365	4.4
Lt Ulna	1704	452	3.7
Low Fem	1786	424	4.2
MS FEM	26501	8817	3
RT4RIB	1478	393	3.7
RT5RIB	2516	547	4.5
RT6RIB	2804	629	4.4
LT5RIB	1948	531	3.6
LT8RIB	2116	464	4.5
Lt Ank	2343	522	4.4
	96234	13784	6.9

Results

In this series 35/59 (59%) scans were negative and did not show any focal changes. 24/59 (41%) scans showed focal changes in the form of hot spots. Out of the total 69 hot spots analyzed 31 (45%) had the value of 13.07 ± 1.02 indicating metastatic nature and 38 (55%) had the value of 6.07 ± 0.62 confirming the benign nature of the lesions as per the Dr. V Siva's retention ratio calculation method. Thus the metastatic group had the mean value which is almost twice that of the benign group. The statistical

evaluation confirmed the significant difference between the two groups as shown in Figure 2. The results of an unpaired ttest performed showed $t = 12.3$ and $\text{std dev} = 2.35$, degrees of freedom = 67. The probability of this result, assuming the null hypothesis, is less than .0001. The test of two independent sample analysis by equal variance method showed that Mean a- Mean b is 7.0037 with t of +12.3, df 67 and p value of <0.0001 by both one tailed and two tailed methods. Similarly in the unequal variance method the Mean a- Mean b is 7.0037 with t of 11.88, df 51.05 and p value of <0.0001 by both one tailed and two tailed methods.

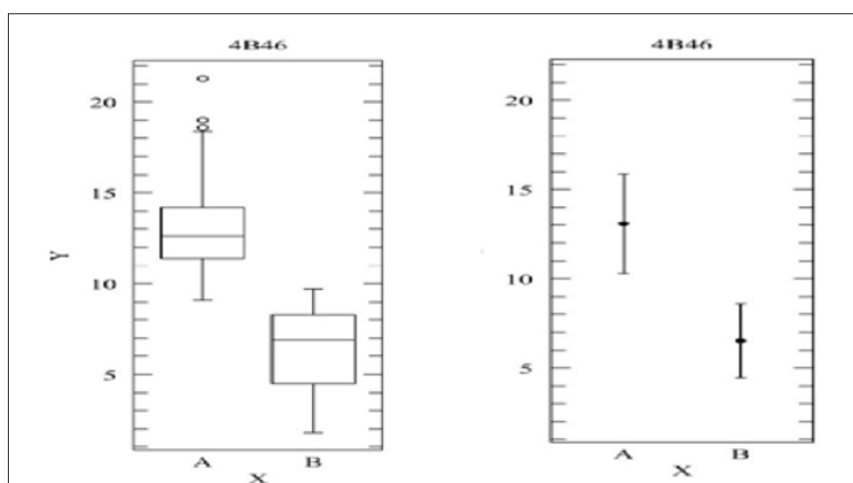


Figure 2: FStudent T test results.

Discussion

The scintimetric characterization of the skeletal hot spots had been shown to be useful in the differentiation of benign and malignant lesions and also in the evaluation of delayed union of fractures as well by us [5]. Afroza Naznin et.al from INMAS, Bangladesh in their study have reported that the Dr. V. Siva's retention ratio protocol applied on a small number of prostate

cancer patients in Bangladesh gave promising results [6]. They had concluded that the inclusion of Dr. V Siva's quantitative parameter in adjunct to conventional bone scintigraphy for the skeletal survey of carcinoma prostate patients can help to narrow down the specificity spectrum of bone scan hot spots being either due to metastasis versus benign disease. A typical method of reporting the scintimetric characterization was introduced in the report of the study as shown in Figure 3.

BONE SCAN REPORT: 3 HRS AND 24 HRS STUDY.
 Scan was carried out following I.V.injection of 21mCi Tc99m-MDP. The images of skeleton was acquired from both anterior and posterior view by whole body mode.

SCAN FINDINGS:
 The Study reveals evidence of focal hot spots in the left side 4th rib anteriorly and the right side 6th and 7th rib posteriorly. Rest of the skeletal tissue show normal uptake and uniform tracer distribution.

The 24 hrs delayed imaging also confirming the above findings.
 The scintimetric evaluation of the hot spots reveals.

Site	3 hr counts	24 hr counts	Dr.V.Siva's Retention ratio
Wb RT 4 th rib	4053	190	21.3
RT 6 th rib	2337	204	11.4
RT 7 th rib	8694	545	15.9
Static view			
6 th rib	3991	209	19.0
7 th rib	11944	782	15.2

(Normal scintimetric values range
 1 – 3 = Benign, 5 – 9 = Degeneration / indeterminate, >10 = Malignant.)

The scintimetric retention of the hot spot by Dr.V.Siva's retention ratio is in the range of 11 to 21 confirming the malignant nature of the lesions.

IMPRESSION
FEATURES SUGGESTIVE OF PROBABLE MULTIPLE METASTATIC INVOLVEMENT.
 For clinical correlation please.

Figure 3: Report Sample.

Conclusion

It can be concluded that the Scintimetric Characterization of the Skeletal Hot spots by Dr.V. Siva's Retention Ratio significantly helps in the proper management of the patients even in a tertiary diagnostic center too. This concept must be put into test in various institutions world over for further authentication.

References

1. Israel O, Front D, Frenkel A, Kleinhaus U (1985) 24 hour / 4 hour ratio of technetium 99m methylene diphosphonate uptake in patients with bone metastases and degenerative bone changes. J Nucl Med 26(3): 237-240.
2. Sivasubramaniyan V, Venkataramaniah K (2015) Scintimetric Characterization of Skeletal Hot Spots in Carcinoma Prostate. I-PET 2015, IAEA-CN-232/136
3. Sivasubramaniyan V, Venkataramaniah K (2016) Temporal Scintimetric Characterization of Skeletal Hotspots in Bone Scan by Dr. V. Siva's Retention Ratio, S.C. Satapathy et al. In: Sivasubramaniyan V, Venkataramaniah K (Eds.), Information Systems Design and Intelligent Applications, Advances in Intelligent Systems and Computing 433: 297-305.
4. Sivasubramaniyan V, Venkataramaniah K (2016) Non-invasive Quantitative Characterization of Skeletal Metastasis in Carcinoma Prostate by Tc99m MDP Bone Scans Using Dr. V. Siva's Retention Ratio in Correlation with Serum PSA Levels. Med Surg Urol 5: 2.
5. Rahul Namdeo, Sivasubramaniyan V, Venkataramaniah K (2015) Scintimetric Evaluation in the Assessment of Delayed Union of Skeletal Fractures. International Journal of Innovative Research & Development 4(8): 362-365.
6. Afroza Naznin, Sadia Sultana, Amrun Nahar, Taslima Sifat, Pupree Mutsuddy (2017) Evaluation of Skeletal Hot Spots in Carcinoma Prostate Patients by Scintimetric Method. Bangladesh J Nucl Med 20(1): 9-13.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2018.06.001420

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