Scintimetric Evaluation of the Rheumatoid Arthritis Involvement by Dr. V. Siva’s Retention Ratio-(Preliminary Report)

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Abstract

Aim: This study aims to propose the utility of Scintimetric Characterization of the tracer activity uptake in the joints afflicted by Rheumatoid arthritis in the bone scans.

Materials and method: Three out of five patients of confirmed Rheumatoid arthritis who had bone scans for Bone and joint pains showed presence of skeletal hot spots in various joints. They were subjected to the scintimetric evaluation of the skeletal hot spots by Dr. V. Siva’s retention ratio by repeating the 24 hr delayed bone scans. The 58 skeletal hotspots seen in various joint spaces were subjected to the calculation of maximum counts in 3 hr and 24 hr bone scans. They were tabulated and 3/24 hr Dr. V. Siva’s Retention Ratio was calculated and analysed.

Results: They showed a mean of 5.91 ± 0.35 and standard error of means as 0.3496. The estimated variance was 8.8408 and the estimated standard deviation was 2.9734. For this sample size the estimated variance was 6.6306 and estimated standard deviation was 2.575 by HOJO’s modification. This was unavoidable due to very small size of the Sample population.

Conclusion: Thus this study had shown that the scintimetric evaluation of the skeletal hotspots in the Rheumatoid Arthritis Patients showed a definitive benign value. This could provide a firm base line value to assess the response to treatment and progression as well.

Keywords: Rheumatoid arthritis; Skeletal hotspots; Scintimetric evaluation; Dr. V. Siva’s retention ratio

Introduction

The utility of Tc99m MDP bone scans in the successful elimination of Rheumatoid Arthritis in 87% of cases and fruitful confirmation in 80% cases in a study of 139 bone scans in Rheumatoid Arthritis is reported by Duncan et al. [1]. Vos et al. has reported the comprehensive utility and role of various scintigraphic techniques in comparison with other radiological imaging methods [2]. Since the nuclear medicine studies lacked specificity quantitative evaluation methods are attempted. In their study of 69 patients with Reflux Sym pathetic disorder after stroke the quantitative valuation of Triple Phase Bone Scan is reported to be non-contributory by Zyluk et al. [3]. Park et al. have shown that the combination of individual phases of the Triple Phase Bone Scan can improve the diagnostic accuracy in patients after stroke [4]. The quantitative evaluation of three phases of the Triple phase bone scan findings into Minimal uptake group and Moderate uptake group has been reported to be useful in classifying patients with reference to time course in stroke patients by Park et al. [5]. The utility of Tc99m Human Immuno Globulin (HIG) in the identification of inflammatory process even in the sero-negative Rheumatoid Arthritis patients had been reported by Gerasimou et al. [6]. A simpler regional scintimetric evaluation of the complex regional pain syndrome by calculating the Asymmetry Score in quantitative triple phase bone scans has been reported by Santhosh et al. [7]. A new Temporal Scintimetric Characterization of the skeletal hot spots by Dr. V. Siva’s Retention Ratio has been devised and reported by us [8]. The utility of Dr. V. Siva’s Retention Ratio in the non-invasive characterization of skeletal metastasis in correlation with serum PSA levels and in the evaluation of delayed union of skeletal fractures had been documented by us [9,10]. Hence the same principle was selected for application in the Rheumatoid arthritis patients as well.

Materials and Methods

All the five patients referred by the Rheumatologist for bone pain evaluation underwent Triple Phase Bone scan, 3 h Whole body Bone scan after the intravenous injection of 20 to 25 mCi of Tc99m MDP. The Millennium SPECT gamma camera was used for acquiring the images as per the Xeleris Software specifications.

The 24 h delayed static imaging of the hand followed by the 24 h whole body bone scan were acquired in Three out of Five patients who had focal hot spots in their skeletal tissue. The maximum counts at the 58 skeletal hot spots in the 3 h and 24 h images were calculated using region ratio estimation protocol, tabulated and analyzed. Representative image taken for analysis shown in (Figures 1 and 2).

Results

The maximum counts encountered in the skeletal spots of the Rheumatoid patients in the 3 h and 24 h images and the corresponding 4/24 h ratio were depicted in Table 1.
They showed a mean of $5.91 \pm 0.35$ and standard error of means as 0.3496. The estimated variance was 8.8408 and the estimated standard deviation was 2.9734. For this sample size the estimated variance was 6.6306 and estimated standard deviation was 2.575 by HOJO's modification. This was unavoidable due to very small size of the sample population.

|                  | 3 h  | 24 h | 3/24 h | site | 3 h  | 24 h | 3/24 h |
|------------------|------|------|--------|------|------|------|--------|
| RT 5IPJ          | 519  | 100  | 5.1    | Frontal | 8554 | 1622 | 5.2    |
| RT3IPJ           | 502  | 91   | 5.5    | RT3IPJ | 5846 | 3630 | 1.6    |
| RT2IPJ           | 504  | 111  | 4.5    | RT5IPJ | 6231 | 3796 | 1.6    |
| RT1IPJ           | 504  | 135  | 3.7    | LT2IPJ | 21224 | 7668 | 2.7    |
| RT5MPJ           | 828  | 237  | 3.4    | L4    | 34820 | 4798 | 7.2    |
| RT4MPJ           | 1179 | 267  | 4.4    | RT4IPJ | 23512 | 34964 | 6.7   |
| RT3MPJ           | 1615 | 377  | 4.2    | RT2IPJ | 147315 | 19018 | 7.7   |
| RT2MPJ           | 1134 | 317  | 3.5    | D2    | 25729 | 2895 | 8.8    |
| RT1MPJ           | 1085 | 307  | 3.5    | RT3IPJ | 47875 | 4119 | 11.6   |
| RT4IPJ           | 427  | 179  | 2.3    | RT5IPJ | 280348 | 28339 | 9.8   |
| LT3IPJ           | 651  | 212  | 3      | LT3IPJ | 159525 | 16220 | 9.8   |
| LT2IPJ           | 465  | 181  | 2.5    | D2    | 3777 | 2610 | 1.4    |
| LT1IPJ           | 513  | 167  | 3      | L4    | 38067 | 3320 | 11     |
| LT5MPJ           | 465  | 210  | 2.2    | RTHP  | 333083 | 33492 | 9.9   |
| LT4MPJ           | 1192 | 315  | 3.7    | LTHP  | 198902 | 16954 | 11.7  |
| LT3MPJ           | 1713 | 366  | 4.6    | D2    | 25729 | 2895 | 8.8    |
| LT2MPJ           | 1375 | 325  | 4.2    | L4    | 47875 | 4119 | 11.6   |
| LT1MPJ           | 1054 | 301  | 3.5    | RTHP  | 280348 | 28339 | 9.8   |
| RTCPMPJ          | 5699 | 1282 | 4.4    | LTHP  | 159525 | 16220 | 9.8   |
| RTWJ             | 6827 | 1208 | 5.6    | RTILIUM | 11540 | 1458 | 7.91   |
| LTCPMPJ          | 6673 | 1230 | 5.4    | LTFOOT | 47717 | 5524 | 8.63   |
| RTCPMPJ          | 8164 | 1483 | 5.5    | L5    | 17308 | 2681 | 6.45   |
| Frontal          | 4852 | 879  | 5.5    | D10   | 10980 | 1566 | 7.01   |
| Frontal          | 4299 | 928  | 4.63   | D11   | 28649 | 4119 | 6.95   |
| Frontal          | 13039| 3027 | 4.3    | L3    | 30317 | 3789 | 8      |
| Frontal          | 17873| 3498 | 5.1    | L4    | 37496 | 4883 | 7.67   |
| Frontal          | 31367| 6610 | 4.7    | L5    | 32010 | 4064 | 7.87   |

Table 1: Scintimetric evaluation of Rheumatoid Arthritis skeletal hot spots.

Discussion

All the other quantitative parameters reported were relying on the changes expected out of inflammatory reaction leading to changes in the blood flow and uptake. Both were bound to vary from patient to patient and from one lesion to the other. But the scintimetric characterization of the Skeletal hot spots by Dr. V. Siva's Retention Ratio was found to be successful in variety of clinical conditions resulting in bone changes because of the fact that the metabolic turnover occurring at the hot spot with reference to the time was the basis for interpretation rather than indirect effects.

Conclusion

From the proven utility of the scintimetric characterization of the Skeletal hot spots by Dr.V.Siva's Retention Ratio in Carcinoma prostate and pathological fracture, it can be inferred that the extension of the above application in the joints where active Rheumatoid Arthritis is afflicted is justifiable and appropriate. We hope to extend this to the future cases of Rheumatoid Arthritis patients referred to us to consolidate the findings and present a solid report in the future. Technical collaboration with the institutions actively pursuing Rheumatoid Arthritis will throw much light on this approach.

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