

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/mjafi

Original Article

To study the efficacy of thallium-201 as tumor seeking agent and to study its role in therapeutic response



Gp Capt A.V.S. Anil Kumar^{a,*}, Col P.G. Kumar^b, Wg Cdr Sangeetha Sampath^c, Lt Col V. Suhag^d

^a Senior Adviser (Medicine & Nuclear Medicine), Command Hospital (Southern Command), Pune 411040, India

^b Senior Adviser (Medicine & Nuclear Medicine), Command Hospital (Southern Command), Pune 411040, India

^c Assistant Professor, Department of Biochemistry, Armed Forces Medical College, Pune 411040, India

^d Classified Specialist (Radiotherapy), Army Hospital (R&R), New Delhi, India

ARTICLE INFO

Article history:

Received 17 March 2016

Accepted 3 January 2017

Available online 16 February 2017

Keywords:

Thallium

T/B ratio

Scintigraphy

ABSTRACT

Background: Tumour seeking characteristics of TL-201 have been underutilized. The study was undertaken to evaluate the role of TL-201 scintigraphy in tumour imaging.

Methods: A total of 50 cases were studied over a period of 18 months (13 lymphomas, 11 breast carcinoma, 10 lung cancer, 6 of soft tissue sarcoma, 2 bone tumours and 4 cases each of thyroid and brain tumours). Thallium-201 chloride was injected IV in the dose range of 3–5 mCi. Imaging was done using Siemen's ECAM dual headed gamma camera. Mean tumour to background ratio (T/B ratio) was calculated for all the positive cases. Descriptive statistical analysis was carried out.

Results: Findings revealed a sensitivity of 94.12%, specificity 87.5%, PPV 94.12%, NPV 87.50% and accuracy of 92% for TL-201 tumour imaging. The mean T/B ratio for the true positive cases at 10 min and at 3 h was 1.81 and 1.99 respectively, the difference being 0.18 ($P < 0.001$). Amongst them, the mean T/B ratios for low-grade tumours were 1.45 ± 0.32 at 10 min and 1.63 ± 0.38 after 3 h with difference of 0.176 ($P < 0.001$). For the high-grade tumours the ratios were 2.08 ± 0.35 and 2.26 ± 0.41 respectively with a difference of 0.186 ($P < 0.001$).

Conclusion: Thallium-201 scintigraphy is a useful tumour imaging modality in cases of thyroid, breast, brain, lung, soft tissue and bone tumours and lymphomas. A T/B ratio of 1.63 ± 0.38 in 3 h-delayed imaging is suggestive of low-grade tumours. For high-grade tumours a ratio of 2.26 ± 0.41 should be considered significant.

© 2017 Published by Elsevier B.V. on behalf of Director General, Armed Forces Medical Services.

* Corresponding author.

E-mail address: avsanil2002@yahoo.com (A.V.S. Anil Kumar).

<http://dx.doi.org/10.1016/j.mjafi.2017.01.001>

0377-1237/© 2017 Published by Elsevier B.V. on behalf of Director General, Armed Forces Medical Services.

Introduction

Thallium-201 is a mono-valent radioisotope and has biological properties very similar to potassium.^{1,2} The major role of thallium in nuclear medicine has been in myocardial perfusion imaging, parathyroid imaging and in assessment of viability post myocardial infarction. It was used for tumour imaging in late 1980s and early 1990s. However with the approval of FDG-PET in the imaging world, ²⁰¹Tl took a backseat due to the better biological distribution and resolution of F-18 FDG. However, it continued to have its role in intracranial brain tumours as FDG has physiologically high uptake in brain leading to poor tumour to background ratio (T/B ratio).

There is however enough literature suggesting that ²⁰¹Tl has a clinically relevant role in the oncology patient population. ²⁰¹Tl in many tumour types is an excellent radiopharmaceutical for evaluating the extent of the tumour, response of the tumour to therapy and distinguishing benign from malignant lesions.³ Rapid development of research using ²⁰¹Tl in different tumours had taken place during 1990s. The techniques for using ²⁰¹Tl in tumour imaging have also been modified using SPECT and various tumour to non-tumour uptake ratios.^{4,5}

Thallium still has the problems of poor resolution, however despite this it is currently being used to differentiate malignant from inflammatory lesions, to help in guiding biopsy accurately to malignant tissue,⁶⁻¹⁰ to differentiate kaposi sarcoma from inflammatory lesions in AIDS, to determine the grade of the tumour,^{11,12} to evaluate the response of pre-operative chemotherapy or radiotherapy to determine the presence of residual tumour or tumour recurrence,^{7,13} and to differentiate post-therapy tissue necrosis from local recurrence.¹⁴⁻¹⁶

There are studies which show that ²⁰¹Tl better delineates viable tumour as compared to CT scan and Tc-99m HMPAO after radiotherapy.¹⁷ Thallium-201 SPECT has been found to be useful in differentiating benign from malignant breast masses especially in patients with dense breasts who have indeterminate mammograms.¹⁸ It has been found useful, even when compared with mammography in patients with normal breast density.¹⁹ The viable tumour burden in primary brain tumours is indicated better by thallium-201 scans as compared to other radionuclide studies. Steroid administration has lesser effect on TL-201 uptake and it complements well with the CT scan data (anatomical information).²⁰ PET facility is not available in all centres and we feel TL-201 has been under-utilized in tumour imaging. Also there are not enough Indian studies which lay down the various T/B ratios of malignant tumours using ²⁰¹Tl for diagnosing and grading malignancy. Hence this study was undertaken to study and revisit the role of thallium in tumour imaging.

Material and methods

1. A total of 50 cases who were referred from the oncology ward/OPD and who were willing to undergo thallium scanning were imaged with TL-201 in the Department of

Nuclear Medicine, over a period of 18 months. Written consent was taken for the procedure from all the patients. The study group consisted of patients in pre-treatment group referred for diagnostic workup and those in post-treatment group referred for either ruling out recurrence or to assess treatment response.

2. Thallium-201 chloride was injected IV in the dose range of 3-5 mCi. Imaging was done at 10 min and 180 min post injection using Siemen's ECAM dual headed gamma camera with energy centred on 80 keV and 160 keV with window widths of 20% and 15% respectively using low energy all purpose collimators. Static imaging was done for 5 min each time followed by whole body imaging with a speed of 8 cm/min.
3. T/B ratio was calculated for both 10 min and 3 h image. Region ratio protocol in the Siemen's software was used to calculate the ratio. Tumour ROI (region of interest) was drawn on the tumour over the pixels showing the maximum uptake and background ROI was drawn on the contra-lateral side in the same region. The images were studied and reported by two nuclear medicine physicians independently without the knowledge of histopathology report.
4. Mean T/B ratio was calculated for all the positive cases. Mean difference in the T/B ratio from early (scan at 10 min post injection) to late (scan at 180 min post injection) was calculated and the mean difference in ratio between high-grade and low-grade tumours was calculated. Any uptake seen with ratio more than 1 was considered positive scan and below 1 was considered negative scan.
5. Histopathology was used as gold standard for pretreatment cases and conventional imaging/histopathology for all the post treatment cases. Sensitivity, specificity, NPV and PPV was accordingly calculated.

To estimate sensitivity of thallium scan to detect malignancy as compared to gold standard with 10% absolute precision and 95% confidence interval, sensitivity considered from previous review as 90%,^{3,4,21} the minimum required sample size was 34 subjects with disease. We studied 50 consecutive cases out of which 34 had active disease. Descriptive statistical analysis was carried out. Results on continuous measurements were presented as mean \pm SD (Min-Max) and results on categorical measurements were presented as number (%). Significance was assessed at 5% level. Between TB ratio early and late, Student's t test (paired) was used and between low grade and high grade, Student's t test (unpaired) was used to find out statistical significance. +Suggestive significance (P value: 0.05 < P < 0.10); *Moderately significant (P value: 0.01 < P \leq 0.05); **Strongly significant (P value: P \leq 0.01). The statistical software SPSS 15.0 was used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables etc.

Results

A total of 50 cases were studied over a period of one and half years. The mean age of patients studied was 50.2 years. There were 30 males and 20 females. 13 cases were of lymphomas, 11 cases of breast carcinoma, 10 cases of lung cancer, 6 cases of

Download English Version:

<https://daneshyari.com/en/article/5642160>

Download Persian Version:

<https://daneshyari.com/article/5642160>

[Daneshyari.com](https://daneshyari.com)