

## Multiple brown tumors in a patient with parathyroid adenoma depicting affinity for both $^{99m}\text{Tc}$ -pertechnetate and $^{99m}\text{Tc}$ -MIBI: Evaluation with hybrid SPECT/CT

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(Received 27 February 2012, Revised 19 July 2012, Accepted 22 July 2012)

### ABSTRACT

Parathyroid adenoma involving a single parathyroid gland is the underlying cause of 80-85% of primary hyperparathyroidism (PHPT). Skeletal system is significantly affected by PHPT. Brown tumors are known to have affinity for  $^{99m}\text{Tc}$ -MIBI. We report a rare case of PHPT presenting with diffuse bony pain, high calcium level and significantly elevated alkaline phosphatase level.  $^{99m}\text{Tc}$ -pertechnetate/ $^{99m}\text{Tc}$ -MIBI subtraction, performed as a part of routine protocol, showed several brown tumors showing affinity for both  $^{99m}\text{Tc}$ -pertechnetate and  $^{99m}\text{Tc}$ -MIBI. They were further characterized using hybrid SPECT/CT. To the best of our knowledge,  $^{99m}\text{Tc}$ -pertechnetate affinity in brown tumors has not been previously described.

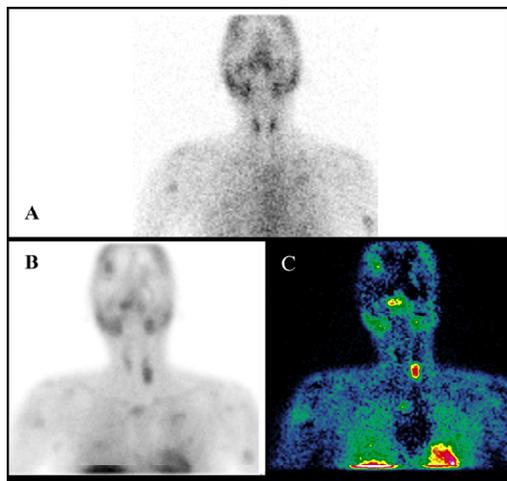
**Key words:**  $^{99m}\text{Tc}$ -MIBI, Brown tumor, SPECT/CT,  $^{99m}\text{Tc}$ -pertechnetate, Parathyroid adenoma, Primary hyperparathyroidism

Iran J Nucl Med 2012;20(1):39-41

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### CASE REPORT

A 40 year old male patient presented with diffuse bony pain. Clinically, he had bony pain and tenderness over multiple bones. Biochemically, his alkaline phosphatase was elevated to 4 times of normal. His calcium was high and his phosphorus levels were low. With a clinical suspicion of hyperparathyroidism, parathyroid scintigraphy was performed. As part of routine protocol, <sup>99m</sup>Tc-pertechnetate/<sup>99m</sup>Tc-MIBI subtraction scintigraphy and hybrid SPECT/CT were performed.



**Fig 1.** <sup>99m</sup>Tc-pertechnetate (A), <sup>99m</sup>Tc-MIBI (B) and subtraction (C) static planar images of parathyroid.

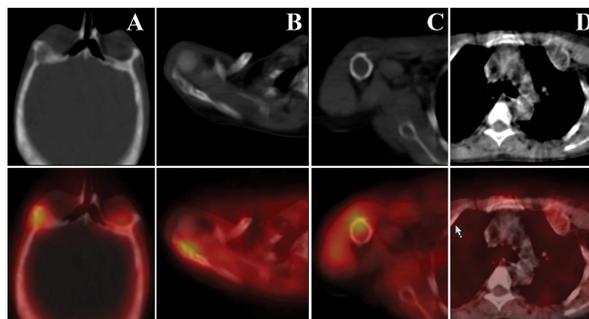
**Fig 1** shows static planar image was acquired in anterior view 20 minutes after intravenous injection of 74 MBq (2 mCi) of <sup>99m</sup>Tc-pertechnetate (A). Both lobes of thyroid were visualized. In addition, several foci of <sup>99m</sup>Tc-pertechnetate uptake were noted in the skull, mandible, distal end of right clavicle, bilateral humeri, sternum and multiple ribs. In the same position, 740 MBq (20 mCi) of <sup>99m</sup>Tc-MIBI was

injected intravenously. Static image of the neck was acquired at 10 minutes (B). Subtraction image (C). Intense tracer uptake was noted in the inferior part of the left lobe of thyroid gland with minimal washout at delayed image indicative of hypermetabolic lesion, likely to be parathyroid adenoma. Several other foci of tracer uptake were also noted involving skull, mandible, distal end of right clavicle, bilateral humeri, sternum and multiple ribs.

Hybrid SPECT/CT (**Fig 2**) performed showed <sup>99m</sup>Tc-MIBI uptake in multiple bones involving the right orbital margin (A), lateral end of the right clavicle (B), right humeral shaft (C), multiple ribs (D) and sternum. Corresponding CT showed expansile lytic lesions suggestive of brown tumors which were further confirmed on biopsy. Patient underwent neck exploration and the left inferior parathyroid adenoma was resected.

### DISCUSSION

Visualisation of brown tumors on <sup>99m</sup>Tc-MIBI scintigraphy has been previously described [1-4]. Brown tumors have also been confused as malignant or metastatic lesions [5]. Brown tumors usually present as expansile lytic lesion with minimal reparative changes. Brown tumor represents a reparative cellular process rather than a neoplastic process. Limited studies have also emphasized on the role of SPECT/CT [6]. Till date no published article has reported <sup>99m</sup>Tc-pertechnetate uptake in brown tumors. Brown tumors are known to be significantly vascular [7]. Technetium uptake in brown tumors might represent increased blood pooling at the sites of brown tumors and hence be entirely non-specific. It is also not clear if all the brown tumors show <sup>99m</sup>Tc-pertechnetate uptake. Further evaluation is required to understand the uptake of <sup>99m</sup>Tc-pertechnetate in brown tumors. <sup>99m</sup>Tc-pertechnetate uptake has also been previously reported in thyroid cancer metastases [8].



**Fig 2.** Hybrid SPECT/CT images: right orbital margin (A), lateral end of the right clavicle (B), right humeral shaft (C), multiple ribs (D).

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