

Comparative Radionuclide Imaging of Metastatic Insular Carcinoma of the Thyroid: Value of Technetium-99m-(V)DMSA

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We report a case of metastatic insular carcinoma of the thyroid evaluated with ^{201}Tl , $^{99\text{m}}\text{Tc}$ -MIBI, $^{99\text{m}}\text{Tc}$ -(V)DMSA, $^{99\text{m}}\text{Tc}$ -MDP and ^{131}I whole-body scans, which were obtained after total thyroidectomy. For the majority of lesions detected in the skeleton and soft tissue, ^{131}I images were generally available, although most were visualized easier with $^{99\text{m}}\text{Tc}$ -(V)DMSA. Technetium-99m-MDP images were considered better than $^{99\text{m}}\text{Tc}$ -(V)DMSA images in showing bone lesions but not soft-tissue lesions. Both ^{201}Tl and $^{99\text{m}}\text{Tc}$ -MIBI scans provided sufficient advantage to exhibit neck and mediastinal metastases, but they did not surpass $^{99\text{m}}\text{Tc}$ -(V)DMSA in detecting abdominal or bony lesions. In this patient with various metastases from insular carcinoma of the thyroid, $^{99\text{m}}\text{Tc}$ -(V)DMSA seemed to be the tracer of choice for whole-body imaging.

Key Words: technetium-99m-(V)DMSA; insular carcinoma; thyroid

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Insular carcinoma of the thyroid has been recently described as a variety of thyroid tumors intermediate between well-differentiated and anaplastic neoplasms. It was originally described by Carcangiu et al. (1). Its key microscopic feature is the formation of a well-defined nest (insulae) containing small, uniform, thyroglobulin-containing follicles (1-3). Local recurrence and metastases to the lung, mediastinum and bone are common in this tumor, but it does not share the poor prognosis of undifferentiated or anaplastic thyroid carcinoma (1,2,4). Two recent articles distinctly demonstrated ^{131}I retention in recurrent and extrathyroidal lesions in insular carcinoma of the thyroid gland after total thyroidectomy (5,6).

CASE REPORT

A 62-yr-old woman was previously found to have thyroid goiter and underwent right thyroid lobectomy at another institution in October 1990. Two years later, she had another palpable nodule in the left anterior neck. On the ^{131}I thyroid scan, a 4 × 4-cm hypofunctioning nodule was found in the anteromedial aspect of the left thyroid. Fine needle aspiration revealed a medullary carcinoma of the thyroid. She underwent left thyroid lobectomy and resection of the mass, which intimately attached to the trachea and soft tissue of the left neck. Histopathologic examination revealed the characteristic appearance of insular carcinoma, consisting of nests (insulae) of tumor cells, which were positive for antithyroglobulin and negative for calcitonin (Fig. 1). Serum calcitonin values were less than 95 ng/ml.

In December 1993, she was admitted to our clinic with severe low-back pain and limping gait. The thyroid hormone profile was: T_3 189 ng/dl (normal: 85-165) and human thyroglobulin: 200 ng/ml (normal: 0-10 after a total thyroidectomy). After abstinence of thyroid replacement and an iodine diet, the patient underwent

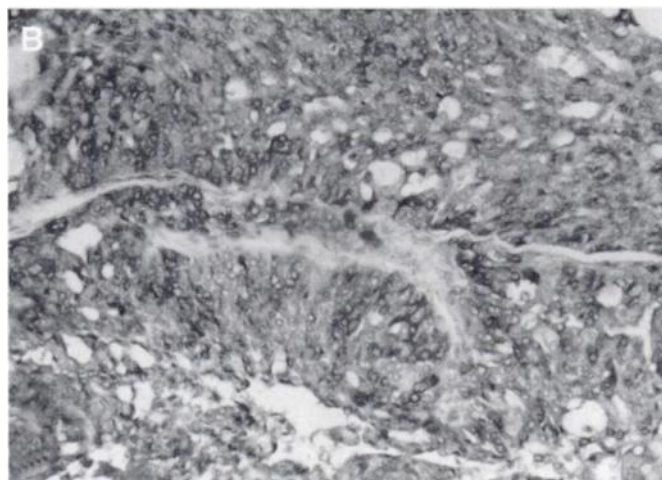


FIGURE 1. Histopathology showing (A) nests or insulae (arrow) of tumor cells surrounded by delicate fibrovascular septa (hematoxylin and eosin, 3000×) and (B) immunostaining positive for antithyroglobulin (400×).

neck CT and whole-body imaging after intravenous injection of 2 mCi (74 MBq) ^{201}Tl , 15 mCi (555 MBq) $^{99\text{m}}\text{Tc}$ -(V)dimercaptosuccinic acid (DMSA), 25 mCi (925 MBq) $^{99\text{m}}\text{Tc}$ -methoxyisobutylisonitrile (MIBI), 15 mCi (555 MBq) $^{99\text{m}}\text{Tc}$ -MDP and oral administration of 3 mCi (111 MBq) ^{131}I (Fig. 2).

The neck CT scan, without contrast, showed a 5-cm mass in the left thyroid bed and an ill-defined mass in the anterior superior mediastinum. Technetium-99m-(V)DMSA and ^{131}I whole-body images showed metastases in the skull, mediastinum, right shoulder, L-1 vertebra, left ilium and left femoral head. Most lesions in the skeleton had avid $^{99\text{m}}\text{Tc}$ -MDP uptake and those in the soft tissue had ^{201}Tl and $^{99\text{m}}\text{Tc}$ -MIBI accumulation best (Table 1). Based on having ^{131}I uptake, the lesions were ablated with 200 mCi

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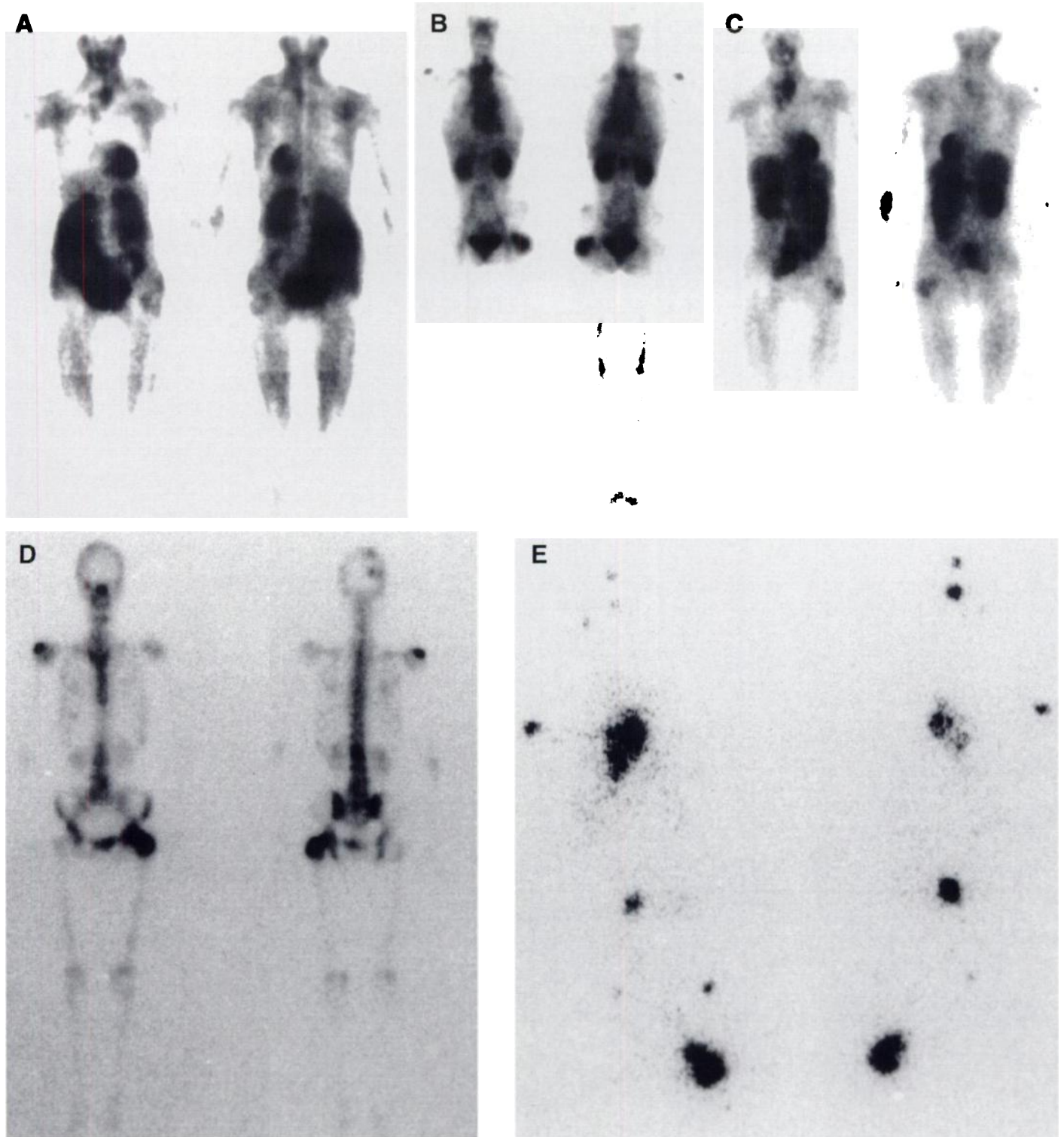


FIGURE 2. After total thyroidectomy, multiple metastatic lesions involving the mediastinum, calvarium, right shoulder, L-1 vertebra, left anterior superior iliac crest and left femoral head were observed on the (A) ^{201}Tl , (B) $^{99\text{m}}\text{Tc}$ -(V)DMSA, (C) $^{99\text{m}}\text{Tc}$ -MIBI, (D) $^{99\text{m}}\text{Tc}$ -MDP and (E) ^{131}I whole-body scans.

Na^{131}I . Iodine-131 whole-body imaging 6 mo later showed an increase in the number and intensity of lesions, suggesting metastases in progress.

DISCUSSION

Insular carcinoma of the thyroid gland had already been described as an aggressive subset of differentiated thyroid neoplasms (1). Patients with this neoplasm often experience an aggressive clinical course, with focal recurrences and distant

metastases to the lung, mediastinum and bone (2). This neoplasm is composed of follicular epithelial cells that may concentrate radiiodide, and so allows postoperative ^{131}I therapy, which subsequently improves survival and palliation (5). Patients, however, must discontinue thyroid hormone treatment and restrict iodine in their diet days to weeks before ^{131}I imaging.

Technetium-99m-(V)DMSA is a pentavalent, $^{99\text{m}}\text{Tc}$ -labeled, tumor-seeking agent previously reported as useful in the detec-

TABLE 1

Lesions of Metastatic Insular Carcinoma of the Thyroid Detected by Whole-body Scanning with Various Tracers

Organ	²⁰¹ Tl WBS	^{99m} Tc-(V)DMSA WBS	^{99m} Tc-MIBI WBS	^{99m} Tc-MDP WBS	¹³¹ I WBS
Bone					
Calvarium					
Right parietal	-	+	-	+	+
Right temporal	-	+	-	+	+
L-1 vertebra	+	+	+	+	+
Right humeral head	-	+	+	+	+
Left anterior superior iliac crest	-	+	-	-	+
Left femoral head	+	+	+	+	+
Soft tissue					
Mediastinum	+	+	+	-	+

WBS = whole-body scan; + = positive; - = negative.

tion of soft-tissue tumors, such as those of the head and neck (7), medullary thyroid carcinoma (8) and aggressive fibromatosis (9,10). The mechanism of ^{99m}Tc-(V)DMSA accumulation has yet to be elucidated but is currently believed to be associated with the volume of blood flow in the lesions and phosphate metabolism or pH of the tumors (11,12). So, the amount of ^{99m}Tc-(V)DMSA accumulation may be correlated to the metabolic turnover rate of the tumor cell.

CT was useful in diagnosing metastatic lesions in soft tissue, but bony metastatic lesions were frequently missed. Because of their reported localization in various types of malignant tumors (13-16), ^{99m}Tc-MIBI and ²⁰¹Tl still had limited advantages in diagnosing metastatic lesions in the lower thoracic region, lumbar spine and pelvic bones due to their excretion through the gut. With renal fixation, an appropriate gamma energy, instrumental resolution and high count rate, ^{99m}Tc-(V)DMSA provided high sensitivity in the detection of metastatic lesions, especially in identifying small tumors. Although the ¹³¹I whole-body scan had the best target-to-background ratio, laterization for these metastatic lesions was inferior to the other scans. Among these radiopharmaceuticals, ^{99m}Tc-(V)DMSA seemed to be superior to ²⁰¹Tl, ^{99m}Tc-MIBI, ¹³¹I and ^{99m}Tc-MDP for whole-body imaging to detect and localize metastatic lesions.

CONCLUSION

Technetium-99m-(V)DMSA had merits over ²⁰¹Tl, ^{99m}Tc-MIBI, ¹³¹I and ^{99m}Tc-MDP and needs no preparation before imaging. We believe that early detection of metastases will enhance ¹³¹I therapeutic intervention and subsequently improve the quality of life for patients with insular thyroid carcinoma. For this reason, ^{99m}Tc-(V)DMSA whole-body imaging is recommended immediately postoperatively after total thyroidectomy as a screening procedure for all patients with insular carcinoma of the thyroid.

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