

Incremental value of CT in the localization of parathyroid adenomas

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The diagnosis of hyperparathyroidism rests on clinical and biochemical laboratory criteria. Once the diagnosis is established, it is the function of diagnostic imaging to pre-operatively find the suspected parathyroid adenoma. Traditionally, nuclear medicine techniques such as ^{99m}Tc-Sestamibi scan and ultrasound evaluation have been the mainstay in finding the neoplasm. However, results are not always satisfactory, and accurately identifying parathyroid adenomas, especially when they are multiple, remains a challenge. We report a case where careful correlation with contrast-enhanced diagnostic CT scan of the neck helped localize two parathyroid adenomas.

Case report

A 62-year-old male presented with markedly elevated serum PTH (320 pg/ml) and calcium (15.1 mg/dl) levels, and osteoporosis as evidenced by DXA scan. Initial workup for biochemically suspected primary hyperparathyroidism with ultrasound of the neck was unremarkable. The initial ^{99m}Tc-Sestamibi parathyroid scan four days later demonstrated asymmetric, mildly increased radiotracer uptake on the left side on the early images; while the radiotracer activity was nearly completely washed out on the right side, there was persistent activity on the left side on the delayed images that was suspicious for a left-sided adenoma on both planar (Figs. 1A, B) and SPECT (single-photon emission computed tomography) images.

A followup CT scan of the neck on the next day showed masses involving both posterior aspects of the thyroid lobes, with the left thyroid mass extending inferiorly into the superior mediastinum. Repeated ultrasound (not shown) two weeks after the first attempt showed a multinodular thyroid

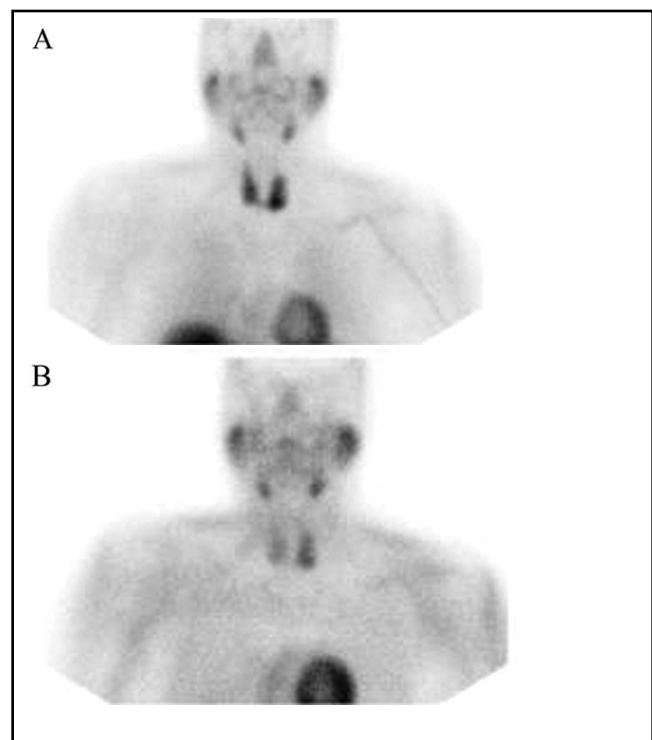


Figure 1. ^{99m}Tc-Sestamibi initial scan demonstrates asymmetric, mildly increased radiotracer uptake on the left side on the early images at 10 minutes (A), and persistent activity on the left side on the delayed images that is suspicious for an adenoma on delayed scan at 2.5 hrs (B).

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goiter with a 4.2 x 2.2 x 1.9-cm mass in the inferior pole of the left lobe and a small cyst in the inferior pole of the right lobe of the thyroid gland. Given continuing clinical symptoms, another ^{99m}Tc-Sestamibi parathyroid scan was performed four months later, which showed similar findings. (In our institution, no SPECT/CT is available.)

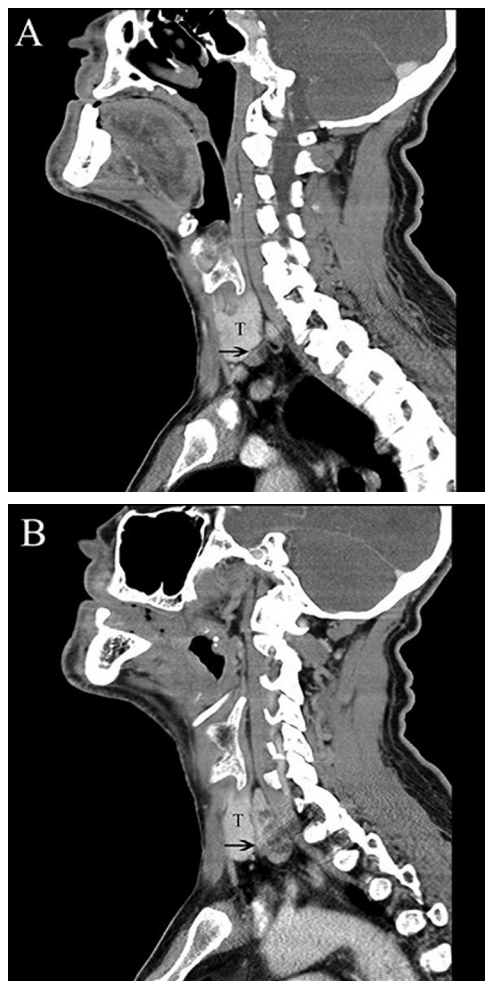


Figure 2. Sagittal images from three-dimensional CT scans show a clear line demarcating bilateral parathyroid adenomas (black arrows) on the right (A) and on the left (B) separating them from the thyroid gland (T).

Careful correlation and retrospective review of a prior contrast-enhanced three-dimensional CT scan of the neck identified a clear margin between a large, teardrop-shaped soft-tissue mass posterior to the left lobe and another smaller, similar structure posterior to the mid to lower portion of the right lobe of the thyroid gland (Figs. 2A, B). A diagnosis of multiple parathyroid adenomas was rendered. Based on these findings, surgery was performed, and bilateral parathyroid adenomas were resected. No serum PTH level values were obtained during surgery. The pathology report documented a large, encapsulate, multi-

nodular, left inferior parathyroid adenoma, measuring 5 x 2.5 x 1 cm, weighing 8.94 grams, and a 1.8 x 1.2 x 0.5-cm right inferior parathyroid adenoma weighing 1.1 grams. Three months after surgery, serum PTH levels returned to normal (54.8 pg/ml), and serum calcium levels fell to 10.2 mg/dl.

Discussion

Ultrasound and ^{99m}Tc-Sestamibi parathyroid scan (including SPECT/CT) are often used to localize biochemically diagnosed parathyroid adenoma(s). A meta-analysis shows that parathyroid scintigraphy with ^{99m}Tc-Sestamibi has a sensitivity of only 30% for identifying double adenomas (1-4). Additional ways to improve accuracy of parathyroid scintigraphy include use of a dual-tracer (^{99m}Tc-Sestamibi + iodine-123 with subtraction) protocol, routine use of pinhole on the thyroid area in addition to planar images, and complementary ^{99m}Tc-Sestamibi SPECT/CT (or ^{99m}Tc-Sestamibi + iodine-123 SPECT/CT in difficult cases) (5).

However, in many instances, the results remain inconclusive (6). On ultrasound, it may be difficult to differentiate a parathyroid adenoma from a nodule in the thyroid gland. Three-dimensional, contrast-enhanced diagnostic CT performed on the new generation of multislice scanners, carefully executed and interpreted, provides crucial information, as illustrated by our experience. New CT machines are effectively addressing the issue of reducing radiation burden by using iterative reconstruction algorithms (7). The traditional combination of sonography and nuclear scintigraphy techniques in pre-operative imaging for the detection of adenomas may be improved with the newly emerging, fast, efficient, safe, affordable, and accurate diagnostic CT with IV contrast in biochemically diagnosed primary hyperparathyroidism (8-9).

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