Comparison of ^{123}I and ^{131}I for Whole-Body Imaging in Thyroid Cancer

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We compared the diagnostic sensitivities of ^{123}I and ^{131}I whole-body imaging in differentiated thyroid cancer. **Methods:** Twelve thyroidectomized patients (3 previously treated with ^{131}I) were studied. After a period of thyroid hormone withdrawal, whole-body imaging was performed approximately 24 and 72–96 h after administration of 74–185 MBq (2–5 mCi) ^{123}I and 111–185 MBq (3–5 mCi) ^{131}I, respectively. **Results:** Both ^{123}I and ^{131}I revealed residual thyroid tissue, present in 9 patients. ^{131}I detected metastases in 5 studies of 4 patients. In 4 of 5 studies, ^{123}I missed metastases shown by ^{131}I in 8 body regions including the neck, mediastinum, lungs, and bone and detected 3 other sites of metastasis only in retrospect. No lesion was better seen with ^{123}I than with ^{131}I. **Conclusion:** Although ^{123}I is adequate for imaging residual thyroid tissue, it appears to be less sensitive than ^{131}I for imaging thyroid cancer metastases.

Key Words: ^{123}I; ^{131}I; thyroid cancer

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Several medical centers are now using ^{123}I for evaluation of thyroid cancer, in part because of concern about stunning of thyroid tissue by ^{131}I. However, the efficacy of ^{123}I for identifying thyroid cancer metastases, particularly those distant from the neck, remains uncertain. Here, we compare ^{123}I and ^{131}I whole-body imaging in patients with and without metastases.

MATERIALS AND METHODS

Patients with differentiated thyroid cancer were referred for pretherapy radioiodine imaging. A total of 12 patients underwent 13 sets of ^{123}I and ^{131}I studies. All patients had prior thyroidectomy; 3 had prior ^{131}I treatment, and endogenous serum thyroid-stimulating hormone levels were generally 50 μU/mL or greater at the time of imaging. Eleven of 12 patients received ^{131}I treatment, which was given within 1 wk after imaging.

The ^{123}I study was performed approximately 24 h after oral administration of 74–130 MBq (2–3.5 mCi) tracer in solution (1 patient received 185 MBq [5 mCi]).

Immediately after the ^{123}I study, 111–185 MBq (3–5 mCi) ^{131}I were administered in capsule form. Imaging was performed routinely at 72–96 h, and in a single instance, at 24 h as well. Imaging was repeated approximately 1 wk after ablative ^{131}I therapy.

^{123}I and ^{131}I images were acquired using low-energy, all-purpose collimators and high-energy, high-resolution collimators, respectively. Routinely, composite whole-body images (scan speed, 5–6 cm/min) were obtained together with 10-min head-to-pelvis spot views. Two experienced readers compared ^{123}I and ^{131}I images for ease of lesion detection. Findings were confirmed by posttherapy imaging, CT, ^{18}F-FDG PET, or follow-up/previous radioiodine imaging when available.

RESULTS

No metastases were found in 6 of the 12 patients. None of these 6 patients had prior ^{131}I treatment, and scintigraphy showed residual cervical thyroid tissue in all. This tissue was seen equally well with ^{123}I and ^{131}I.

Metastases were found in the remaining 6 patients. In 2 of these, metastases (pulmonary) were seen only at posttherapy imaging, and the pretherapy ^{123}I and ^{131}I images were concordant, showing only residual cervical thyroid tissue. The remaining 4 patients had 5 sets of ^{123}I and ^{131}I studies. In 2 patients, ^{131}I images showed diffuse pulmonary and cervical nodal metastases not seen on ^{123}I images (Figs. 1 and 2A). In one of these patients, the ^{123}I image was concordant with the ^{131}I image at 24 h but discordant with the image at 96 h (Fig. 1). In a third patient, ^{131}I imaging showed multiple skeletal lesions and diffuse pulmonary metastases, which were not seen or were seen only in retrospect on ^{123}I imaging (Fig. 2B). At follow-up 1 y later, ^{123}I and ^{131}I images were comparable. The fourth patient had uptake of ^{131}I in a tumor mass in the right axilla and faint uptake in mediastinal metastases, not clearly seen on ^{123}I imaging.

DISCUSSION

Whole-body radioiodine imaging helps assess residual thyroid tissue and detect recurrent or metastatic thyroid

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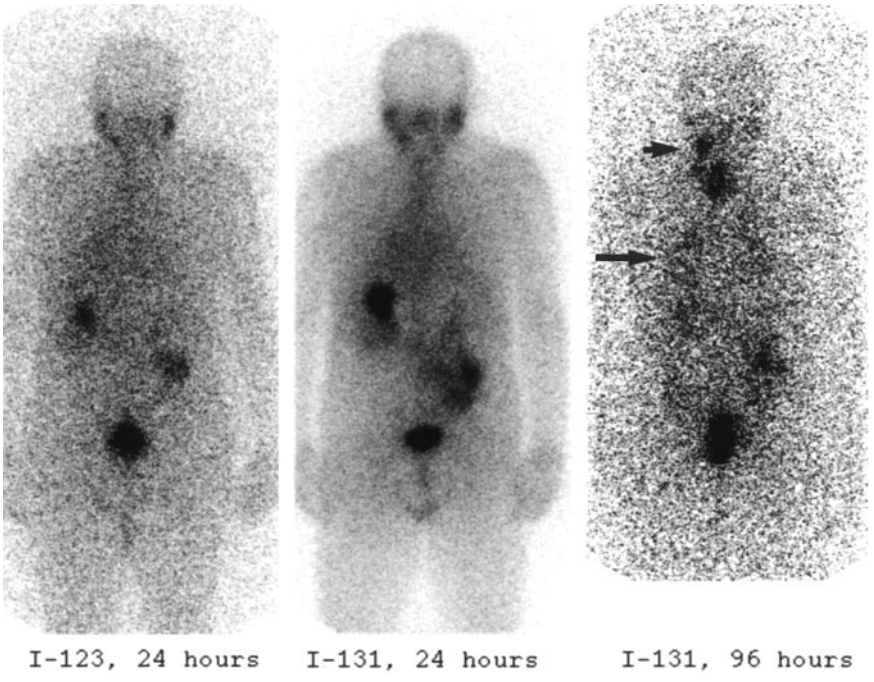

FIGURE 1. An 81-y-old man with papillary thyroid cancer presented with radiographic evidence of pulmonary metastases. Posterior whole-body images at 24 h with ^{123}I (left) and ^{131}I (middle) are unremarkable (thyroid bed uptake was noted with both tracers on anterior images, not shown). Stomach and bowel activities are noted in abdomen. Posterior ^{131}I image at 96 h (right) shows uptake in pulmonary and left cervical metastases (arrows).

cancer (*1*). Traditionally, imaging has been performed using ^{131}I in amounts of 74–185 MBq (2–5 mCi). But such amounts may be associated with stunning of thyroid tissue, so that uptake of a subsequent ablative dose of radioiodine is decreased (*2*). While the issue of stunning continues to be debated, several medical centers have started using ^{123}I instead of ^{131}I for whole-body imaging.

Our study showed little difference between ^{123}I and ^{131}I for evaluation of the residual thyroid tissue present in 9 patients. This finding is consistent with a recent report that ^{123}I is at least as accurate as ^{131}I for evaluation of residual thyroid tissue (*3*). More important, our data indicate that ^{131}I is superior to ^{123}I for identification of metastases. In 4 patients undergoing 5 sets of studies, metastases in a total of 8 body regions including cervical nodes, bone, lung, and mediastinum were not detected with ^{123}I, and 3 other lesions (in bone and right axilla, third and fourth patients) were appreciated only in retrospect. In no instance was a lesion better seen with ^{123}I than with ^{131}I.

The discordance in diagnostic sensitivities of the 2 tracers is probably related to differences in the intervals between tracer administration and imaging. The longer physical half-life of ^{131}I permits later imaging, when target-to-background ratios are higher. For the patient shown in Figure 1, the 24-h ^{131}I (and ^{123}I) images were negative for metastases, but the 96-h ^{131}I study clearly identified tumor in the neck and lungs.

Differences in tracer amounts were unlikely to account for our results. The generally higher ^{131}I dose was largely offset by the use of a high-energy, high-resolution collimator with an inherently lower counting efficiency. In fact, for the patient shown in Figure 2A, the ^{123}I study missed metastases despite a relatively higher tracer amount. For the patient shown in Figure 1, 24-h ^{131}I images with higher count rates were not as accurate as lower-count 96-h images.

Our report does not address the potential for improved efficacy by the use of substantially larger amounts of ^{123}I, perhaps with later imaging. A recent study comparing ^{123}I studies using 185–555 MBq (5–15 mCi) tracer with post-therapy ^{131}I imaging showed 94% and 82% concordance among patients undergoing their first and second ^{131}I treatments, respectively (*4*). Use of larger amounts of ^{123}I, therefore, deserves consideration, but there are limitations. ^{123}I is very expensive (3- to 4-fold more costly than ^{131}I), requires administration of a large number of capsules (each capsule contains only 3.7–7.4 MBq [100–200 μCi]), and is not readily available in liquid form from commercial vendors. Consequently, the routine use of large amounts of ^{123}I for whole-body imaging is beyond the scope of many institutions.

CONCLUSION

When administered amounts of tracer are 185 MBq (5 mCi) or less, ^{123}I is comparable with ^{131}I for imaging thyroid remnants. However, ^{123}I appears less sensitive than ^{131}I for imaging thyroid cancer metastases, missing lesions in bone, lungs, and lymph nodes. Our experience, albeit limited, questions the practice of routinely substituting ^{123}I for ^{131}I for whole-body imaging.

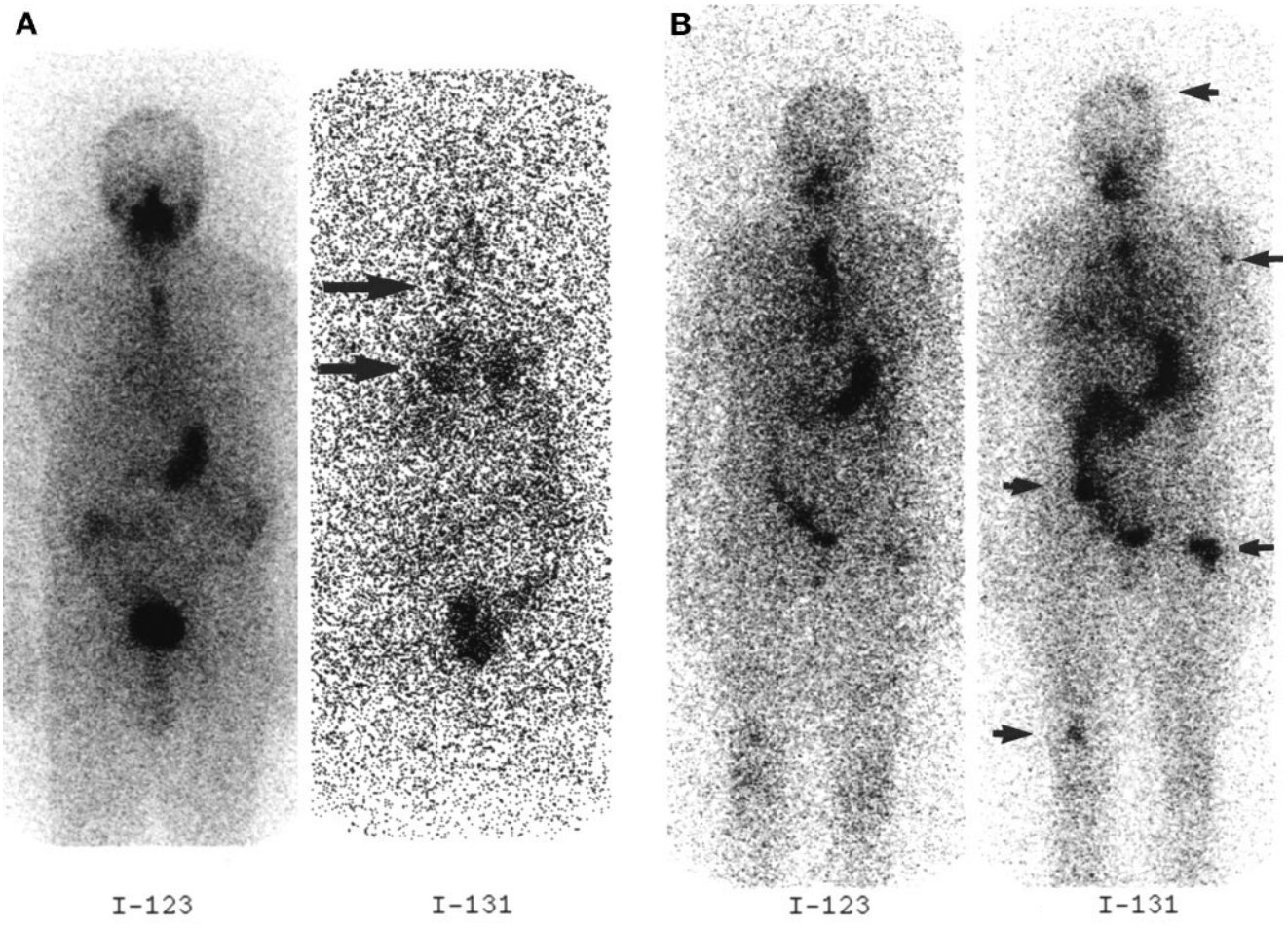

FIGURE 2. (A) A 63-y-old man with Hürthle cell thyroid cancer had distant metastases and persistent disease despite 2 prior treatments with ^{131}I. Anterior whole-body ^{123}I image (left) is negative for metastases. Midline chest activity is in esophagus. Corresponding ^{131}I image (right) shows diffuse pulmonary and right cervical nodal metastases (arrows). This patient received larger amount of ^{123}I (185 MBq) than of ^{131}I (148 MBq). (B) A 53-y-old woman with follicular thyroid cancer and distant metastases received 4 prior ^{131}I treatments for persistent disease. Anterior whole-body ^{123}I image (left) shows metastases in left hip, right femur, and left proximal humerus. These foci are better seen on ^{131}I image (right), which additionally shows diffuse uptake in lungs and focal lesions in skull and right iliac bone (arrows). Midline chest activity is in esophagus.

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