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


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
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, the 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 Î¼Ci]), 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.
REFERENCES


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