INVITED COMMENTARY

^{123}I: Almost a Designer Radioiodine for Thyroid Scanning

The merits of ^{123}I as a thyroid scanning agent have been lauded since it became possible to produce ^{123}I using a cyclotron. In 1967, Rhodes et al. (*1*) stated: "In the past, the radionuclides used in biology and medicine have been chosen primarily because they were available rather than because they were most suitable for the problem at hand. However, because it is now possible to produce a much wider selection of nuclides, it is becoming feasible to select the best nuclide for a given medical application."

There are 24 possible radioisotopes of iodine. The first radioiodine used in humans was cyclotron-produced ^{128}I, but its half-life of 25 min was too short for clinical use. Four of the remaining radioisotopes have been tried clinically: ^{123}I, ^{125}I, ^{131}I, and ^{132}I. In 1966, Myers (*2*) stated: "I-123 fulfills the criteria for an ideal gamma isotope more than any other radioisotopes of iodines." The first commercially available ^{123}I was produced directly from the ^{126}Te (p, 4n) ^{123}I reaction and had impurities including ^{124}I, a positron emitter. Wellman and Anger (*3*) advocated the use of ^{123}I and pinhole gamma cameras for thyroid imaging and stated: "Further development of indirect methods of production of high-purity I-123, especially if made more economical, will greatly increase the potential use of I-123."

Indeed, ^{123}I is the most suitable isotope of iodine for the diagnostic study of thyroid diseases. The half-life of 13.3 h is ideal for the 24-h iodine uptake test. The energy of the photon, 159 keV, is ideal for the NaI crystal detector of current gamma cameras and also for the pinhole collimators. It has much greater photon flux than ^{131}I. It gives approximately 20 times the counting rate of ^{131}I for the same administered dose (*4*). The radiation burden to the thyroid is far less (1%) than that of ^{131}I. Scanning a thyroid remnant or metastasis with ^{123}I does not cause stunning because of its low radiation burden. ^{123}I is almost a designer isotope of iodine for imaging thyroid tissue and thyroid cancer metastasis. High-purity ^{123}I is currently available using the ^{127}I (p, 5n) ^{123}Xe-$^{\beta+}$-^{123}I reaction.

Although ^{131}I is cheaper in price, it has many drawbacks as a scanning agent, including the thyroid stunning effect. Numerous studies have shown that scanning with ^{131}I in multimillicurie doses before radioablation therapy can stun the thyroid tissue (*5*). Stunned tissue then loses its iodine trapping function partially or completely and also temporarily or permanently. This is a radiobiologic phenomenon, and the degree of stunning depends on the absorbed radiation dose to the remnant thyroid tissue or metastatic lesions.

The question to be resolved now seems to be: How effective is ^{123}I as a scanning agent in the management of thyroid cancer patients? We compared the scans using a small dose (11.1 MBq [300 μCi]) of ^{123}I and those using a multimillicurie dose (111–370 MBq [3–10 mCi]) of ^{131}I with the gold standard ^{131}I scan after therapy (3,700 MBq [100 mCi]). The sensitivities of the scans in detecting the thyroid remnant using a high dose (111–370 MBq [3–10 mCi]) and a low dose (11.1 MBq [0.3 mCi]) of ^{123}I were 92.9% and 89.5%, respectively (*6*). Britton et al. (*4*) compared the diagnostic sensitivity of ^{123}I (185 MBq [5 mCi]) whole-body imaging with that of scans after therapy in ^{131}I tracer-negative but thyroglobulin-positive patients. The sensitivity of ^{123}I was 100%.

Mandel et al. (*7*) studied 14 consecutive patients with thyroid cancer and showed that an ^{123}I (48.1–55.5 MBq [1.3–1.5 mCi]) scan at 5 h was superior to an ^{131}I (111 MBq [3 mCi]) scan at 48 h in revealing thyroid remnants. They used the ^{131}I scans obtained after therapy (3,700–5,550 MBq [100–150 mCi]) as the gold standard. The patients received the therapy dose within 5 d of the diagnostic scan. The sensitivity of the ^{123}I scan was 100%. In this issue of *The Journal of Nuclear Medicine*, this group reports the results of their study of 99 patients with differentiated thyroid cancer (*8*). They compared a 5-h scan with a 24-h scan using ^{123}I and found the 24-h scan was better. They also showed that the 24-h ^{123}I (56 MBq [1.5 mCi]) scans were concordant with scans obtained 7 d after ^{131}I therapy in 93% of patients. The sensitivity is excellent for a diagnostic study. In their series, the scans obtained after therapy revealed more foci of thyroid remnants but did not identify additional sites of tumor involvement.

Despite the desirable characteristics of ^{123}I and the reported superiority to ^{131}I as a diagnostic scanning agent, its usage has been restricted by its higher cost and limited availability. However, the difference in the cost of radioiodines is relatively small considering the total cost of the whole-body scanning procedure. It is hoped that ^{123}I will become more widely available at lower costs in the future so that pa-

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tients with thyroid cancers can benefit from its use.

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