Scintigraphic Assessment of Thyroid Cancer

TO THE EDITOR: The assessment of thyroid cancer by imaging is an important clinical need. Use of ^{201}Tl in this assessment was well explored by the authors (*1*) in a limited group of patients. They were well studied, and the authors were conservative in their enthusiasm for the use of ^{201}Tl in imaging thyroid tumors. On reanalysis of their data, several features emerged that would suggest that they should be even less enthusiastic.

Concerning individual patient data, they listed patients 1, 10, and 16 who were better detected by ^{201}Tl than with ^{131}I. However, Patient 1 (Table 1) actually had neck uptake with ^{131}I which was not visualized by ^{201}Tl, and had no comparable ^{131}I scan with the second study. The second patient, Patient 10, had better visualization with ^{201}Tl, but the neck uptake with ^{131}I was considerable, a common finding in which poor metastatic disease uptake is seen in the presence of residual normal "competing" tissue. The ^{131}I scan and CT findings clearly indicated the need for ablative ^{131}I therapy, and ^{201}Tl added nothing. I would assume ^{131}I therapy was given, but no follow-up scans were presented, if so. Patient 16 (Figs. 1 and 2) clearly had much superior scans and information using ^{131}I than with ^{201}Tl, contrary to the authors' conclusion. The mediastinal uptake so spectacular with ^{131}I is barely evident with ^{201}Tl. Much better and more extensive uptake is also seen in Patient 8 (Fig. 7) using ^{131}I.

Retabulating studies where data are available (absent data not included) from Table 1, very poor results are obtained on comparing ^{201}Tl with ^{131}I studies in all patients. Using ^{131}I as the standard, there were 12 patients (16 studies) with concordance (seven positive, five negative), six whose ^{201}Tl studies were falsely negative, a false-positive ^{201}Tl scan in a stitch abscess, and no false-negative ^{131}I scans.

The result of comparing thyroglobulin (TG) levels to ^{131}I scans is also quite poor. There were 13 patients with concordant results (16 studies), seven patients with false-negative TG results (assuming the authors consider <5 normal) and only one false-negative ^{131}I study (Case 12, not further described). Similar poor correlations were obtained with TG versus ^{201}Tl. The authors referenced a study by Aiello et al. (*2*), suggesting that ^{201}Tl may help in patients on thyroid replacement coming from long distances or with negative ^{131}I scans. That experience, however, indicated poor sensitivity of TG measurements, high antibody incidence, and poor correlation of titers with amount of disease. In the present series, only one patient (Patient 12) had a normal ^{131}I scan in the presence of an elevated TG level. That patient also had a negative ^{201}Tl scan. The authors' suggestion for use of ^{201}Tl would not appear supported by either theirs or referenced data.

Thallium-201 scans may have a place in the diagnostic evaluation of thyroid cancer patients, but from this study, that place must be very limited. Some of the major attributes of ^{131}I studies are to assess need for postoperative treatment, and determine potential effectiveness based on tumor concentration. The use of another scan agent, even if it were better than ^{201}Tl, may lead to unneeded delays, misinformation, and expense. The false negative results with ^{201}Tl compared to ^{131}I are very disturbing if one were attempting to use this agent for following and screening patients for persistent or progressive disease. Its use would be confusing at best, and other than allowing an imaging procedure to be performed while on thyroid replacement, would appear to have little advantage.

Using endogenously stimulated TSH with triiodothyronine (4 wk) and no replacement for 2 wk is a very easy procedure preceding ^{131}I imaging that allows minimal hypothyroid symptoms, maximal information for treatment planning, and the patient is ready for therapy immediately. Thallium-201 cannot offer this.

The authors are to be congratulated in performing this study, which to me, even further documents the lack of need for ^{201}Tl use in thyroid cancer. It is somewhat surprising that thyroglobulin determinations fared so poorly in their study, but enthusiasm for its use may need to be lessened as well.

REFERENCES

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REPLY: We would like to thank Dr. Boyd for his thoughtful review of our article and for his constructive comments regarding our patient data (*1*). Because he did not mention our MRI data, we assume he concurs with our comments regarding its potential utility in helping to localize thyroid cancer deposits. We agree with many of the comments and conclusions in his letter, but tend to have a different opinion regarding the application of these data in a clinical setting. We also disagree with Dr. Boyd's interpretation of Figure 1, Patient 16. Our viewing of these scans suggest thallium was able to detect extensive disease in the neck that radioiodine could not clearly discern, especially in the 1989 studies following radioiodine therapy. Disease was present in the chest and mediastinum using both scanning procedures. We believe that there are patients (Figure 5, Patient 10) in whom thallium scanning is capable of detecting the extent of metastatic thyroid cancer better than routine iodine scanning. Efforts to dismiss these findings as being related to "the presence of residual 'competing' tissue" only underscore the utility of thallium in these circumstances. Patient 8 in Figure 7 apparently shows widely metastatic disease with both techniques. Patient 1 (Table 1) had disease recognized by thallium scan that was not present by iodine scanning only 2 mo earlier. As a result of our interpretation of the scans in the patients noted above, we reiterate our conclusion that "thallium scanning can be an effective means to detect residual thyroid tissue or metastatic disease." Our article agrees, in general, with references 7, 8, 11, and 16 (cited in our original article), which also observe that thallium scanning may be useful in detecting thyroid cancer in selected patients.

But, perhaps, the most important argument supporting the utility of thallium scans relates to the ability to perform scans even when a patient continues to take L-thyroxine therapy and, therefore, remains clinically and biochemically euthyroid. Contrary to the admonition by Dr. Boyd that preparation for a radioiodine scan "is a very easy procedure . . . that allows minimal hypothyroid symptoms," both our staff and patients believe that the process of stopping L-thyroxine, switching to triiodothyronine, and then being hypothyroid for several weeks is a complicated, uncomfortable procedure, which if given a choice, they would avoid. Patients universally manifest clinical and biochemical hypothyroidism with serum T4 levels less than 1 μg/dl and

TSH values greater than 50–100 μU/ml. They frequently have to miss work for varying periods of time, both during and after the scan; in contrast, thallium scans can be accomplished while a patient is euthyroid and, also, can be performed within a short time period from the current clinic visit, if there is a clinical suspicion of recurrence of disease. This advantage may be useful when patients have come from a long distance. A negative thallium scan should not dissuade the physician from further evaluation to determine if thyroid cancer is present, but a positive scan, in these circumstances, would help point further evaluation in a concise, directed manner. Lastly, it must be remembered that being hypothyroid, with the resultant TSH stimulation that occurs, may allow regrowth of tumor; TSH is believed to be a growth promoting factor (*2*). This fact underlies the tenet that sufficient thyroxine must be administered to a patient with thyroid cancer to suppress the serum TSH level into the undetectable range.

Thus, in summary, we continue to believe, as noted in our article, that radioiodine scans, periodic neck examination, and serum thyroglobulin levels are the cornerstones of evaluation in a patient with thyroid cancer. In selected patients, thallium scans are helpful because the patient can remain euthyroid while the test is performed; in some cases, thallium may be even better than radioiodine scans in detecting the presence or extent of thyroid cancer, especially in less differentiated tumors. Adjunctive thallium scanning may help identify lesions that can then be visualized and analyzed by MRI techniques. Further studies comparing the utility of radioiodine and thallium, as well as attempts to find newer and more effective scanning agents, need to be performed.

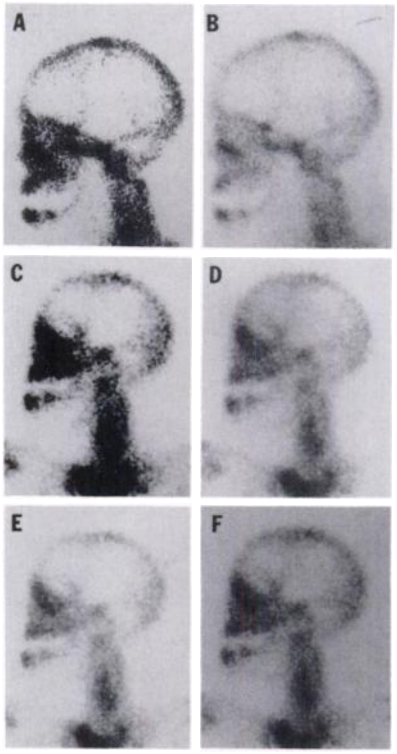

FIGURE 1. Varying computer enhancement; identical photographic technique. (A) Scaled from 15% to 70% maximum pixel count, the hotter areas are enhanced and background is subtracted. (B) Scaled from 0% to 100% maximum pixel count, an unenhanced image is depicted. Four images printed from the same negative; varying photographic technique. (C) A high-contrast filter is used, 4-sec exposure. (D) A low-contrast filter is used, 4-sec exposure. (E) A low-contrast filter is used, 2-sec exposure. (F) A low-contrast filter is used, 8-sec exposure. Images A and C could have occurred prior to a renal transplant and B and D 3 mo later and the difference could be attributed to healing of renal osteodystrophy. In fact, all six images are from the same patient taken at the same time. Images A and B are a computer acquisition and C-F are an analog image.

DISCLAIMER

The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

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Pseudodata

TO THE EDITOR: One of the most disconcerting problems with which a reviewer of nuclear medicine manuscripts must contend is the frequent poor quality of images submitted. Quite often an otherwise excellent paper must be rejected because the data that the author wished to depict was ruined by improper photographic presentation. Whereas numerical data when carefully obtained can be evaluated and compared using well-defined statistical methods, data resulting from image interpretation are not so easily handled.

Numerous pitfalls can befall the author and must be avoided to ensure the high quality of our nuclear medicine literature. Acquisition parameters (information density, scintillation camera photographic factors, etc.) must be standardized so that images acquired at different times are comparable. Computer images must all be presented with no or the same degree of image enhancement and/or background subtraction (Fig. 1A–B) and the parameters of manipulation described. Photographic methods should be consistent using the same type of film, the same exposure times, the same print paper, and the same darkroom techniques for all images within the same study (Fig. 1C–F). Every attempt must be made to eliminate technical differences in the photographs submitted or pseudodata will result.

It is the absolute responsibility of any author who submits images for publication to monitor the photographic work and to direct the photo lab to produce images that truly represent real data. This requires a basic knowledge of photographic techniques so that even if the photo lab is not knowledgeable in nuclear medicine imaging, their output will be highly sophisticated. Unclear medicine must be avoided.