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Reply

I thank Dr. Green for his comments. I agree with some and disagree with others. My responses to his points in order of their presentation in his letter are as follows:

- (1) I agree that, strictly speaking, one cannot extrapolate from data in normal subjects to expected utility in patients.
- (2) We did not realize that the microalbumin colloid supplied to Dr. Kloiber was different from that supplied to us (1). Consequently, comparisons between our data and his are inappropriate, and I regret this error.
- (3) The statement concerning higher background relative to liver with Tc-99m microalbumin colloid is referenced to the paper by Kloiber et al (1). We did not directly measure background radioactivity. We did, however, find a higher liver-to-bone marrow ratio ($p < 0.05$) and a higher liver-to-heart ratio ($p < 0.05$) in delayed images with Tc-99m sulfur colloid.
- (4) Our data are significantly different from those of Wasnick et al. (2) in that we measured inter- and intrasubject reproducibility in normals whereas Wasnick et al. measured only intersubject reproducibility.
- (5) The fact that Tc-99m microalbumin colloid is an "instant" kit does make it more convenient and may reduce radiation exposure. However, the nonbiodegradability of Tc-99m sulfur colloid results in no known disadvantages, whereas the biodegradability of Tc-99m microalbumin colloid may result in increased background radioactivity, particularly if imaging is delayed.
- (6) The statement that our clinical studies confirm the essential equivalence of the biodistribution of two colloids is an oversimplification, since our data demonstrate statistically significant differences in several biodistribution parameters in the delayed images.
- (7) The nature of the utility of Tc-99m microalbumin colloid in hepatobiliary disease is unclear as stated. In general, a radiocolloid would not be the radiopharmaceutical of choice for evaluation of hepatobiliary disease.

In summary, in view of the currently available data, it is my feeling that the disadvantage of the small amount of free Tc-99m in microalbumin colloid will outweigh the advantage of a more convenient preparation.

WILLIAM C. KLINGENSMITH III
University of Colorado
Denver, Colorado

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Hemiagenesis of the Thyroid: Clinical and Radiological Presentation in the Pediatric Patient

Thyroid hemiagenesis was recently reviewed (1). Of the 94 patients reported, six were in the pediatric age range, four of whom were diagnosed postmortem and two postoperatively. In the past 10 yr at our pediatric endocrine clinic we identified two such cases. The paucity of reports on the clinical and radiological presentation of thyroid hemiagenesis in pediatric patients, and the almost total lack of reference in standard textbooks, prompted this report of two children with hemiagenesis.

Case reports. *Case 1.* A 4 $\frac{3}{4}$ -yr-old girl was referred for unilateral neck swelling. A soft, nontender, moveable mass, 3 \times 1.5 cm, was palpable in the location of the right thyroid lobe. The isthmus and left lobe were not palpable. Thyroid imaging showed a right lobe but no trace of the left (Fig. 1, left). In response to 105 μ g of TRH, the fasting TSH level rose from baseline value of 2.4 μ U/ml to 16.9 at 30 min, and 9.1 μ U/ml at 60 min. Daily injections of 10 units of TSH were given for 3 days. A repeat thyroid scan was unchanged. (Fig. 1 right). Concentrations of T₄ and T₃ increased to 17.3 μ g/dl and 432 ng/dl, respectively, indicating that the thyroid tissue responded to TSH stimulation. Thyroid studies are summarized in Table 1.

Case 2. An 11-yr-old boy was referred for an asymptomatic right neck mass. The mass was 4 \times 1.5 cm, soft and nontender, lying in the area of the right thyroid lobe. Neither the isthmus nor the left lobe was palpable. A Tc-99m scan revealed no activity in the area of the left lobe. The 24-hr I-131 uptake was 45%. After the administration of T₃, 25 μ g twice daily for 10 days, the T₄ fell to 2.5 μ g/dl, the TSH became undetectable, the T₃ was 220 ng/dl, and the I-131 uptake to less than 1%.

Discussion. Uncomplicated thyroid hemiagenesis in the pediatric patient has not been described previously. In addition to the six pediatric cases reported by Melnick and Stemkowski (1), Hopwood et al. (2) described an 11-yr-old girl with thyroid hemiagenesis and thyroiditis who was treated surgically.

The clinical presentation of thyroid hemiagenesis in our patients was that of unilateral thyroid enlargement with no palpable contralateral thyroid tissue. Both patients were euthyroid, asymptomatic, and had normal thyroid function, except for slightly el-

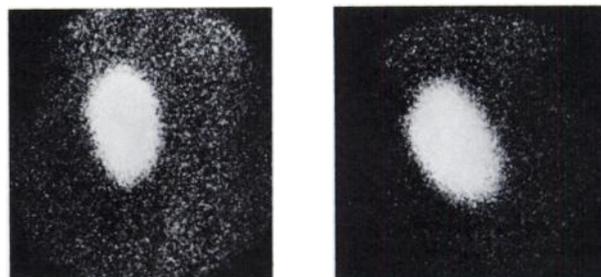


FIG. 1. Tc-99m thyroid scan in Case 1 (left). Similar scan following TSH stimulation (right).

TABLE 1. THYROID STUDIES IN TWO CHILDREN WITH THYROID HEMIAGENESIS

| Thyroid function. | Case 1 | Case 2 |
|---------------------------------|-----------------------------------|---------------------|
| T ₃ ng/dl (80–210)* | 291 | 160 |
| T ₄ μg/dl (5–12) | 10.5 | 11.4 |
| TSH μU/ml (0–6) | 2.3 | 2.5 |
| Thyroid uptake % | | |
| Tc-99m 20' (0.3–3.0) | 3.2 | 4.43 |
| 131-I, 24 hr (6–30) | ND | 45 |
| Post-T ₃ suppression | ND | 0.8 |
| Thyroid scan | | |
| | Rt. lobe visualized | Rt. lobe visualized |
| TRH stimulation | Normal response | ND |
| TSH stimulation | Failure of left lobe to visualize | ND |

* () normal values. ND = not determined.

evated T₃ in Case 1 and increased Tc-99m and RAI uptake values in Case 2.

The following steps are necessary to establish a diagnosis of thyroid hemiagenesis: Thyroid imaging with Tc-99m or iodine-123 will show that the mass is functional. Although a "hockey-stick" appearance has been described (1), it is not always present. A consistent finding is nonvisualization of the opposite lobe. Next, a TRH test or a T₃ suppression test should be performed. Lack of a normal TSH response to TRH, or nonsuppressibility of the RAI uptake to T₃ administration, would be compatible with an autonomously functioning thyroid adenoma. If the responses to these tests are normal, a TSH stimulation test should be considered. In thyroid hemiagenesis, TSH administration fails to stimulate uptake outside the previously visualized thyroid tissue.

Our patients were clinically and biochemically euthyroid and had no detectable thyroid antibodies. The enlargements presented no cosmetic problems. Consequently we decided to follow them without therapy. The primary risk these patients face is that of unnecessary surgery. It is important to consider thyroid hemiagenesis whenever one encounters a thyroid mass, for hemiagenesis imaging will show that the mass is functional, essentially eliminating concern for a malignancy. The further studies outlined above will differentiate an autonomously functioning thyroid adenoma from hemiagenesis. Treatment with thyroid hormone will produce regression in these hyperplastic masses if this is considered desirable.

V. ABBASSI
REGINA AUTH
Georgetown University Hospital
Washington, DC

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Interpretation of the NEMA Protocols for Scintillation Camera Performance

The National Electrical Manufacturers Association (NEMA) originally introduced standards for the measurement and specification of scintillation-camera performance in 1980 (1,2). These standards were developed by a consortium of scintillation-camera manufacturers and were intended as guidelines to be followed by manufacturers so that purchasers and users could expect some degree of conformity of the specifications for cameras from different manufacturers. Although they were not intended to be used as such, a number of users have adopted these standards for purposes of acceptance testing and ongoing quality control (3–10).

Our own interest was stimulated by a need to establish a method by which we could reliably determine the integral and differential uniformity of a scintillation camera under different conditions of improper operation (11). However, when we investigated the various documents relating to the NEMA standards (1,2) and the more familiar abbreviated publication "Standards for performance measurements of scintillation cameras . . . and what they can mean for you," we discovered some statements and ambiguities that could make application of the standards difficult.

The most important ambiguity is that relating to differential uniformity. It is intended that this parameter shall be a measure of the "worst-case rate of change" of counts in a flood-field image over a limited pixel range in either the horizontal or vertical direction. The wording in some of the documents does not make clear whether the number of pixels included in the range over which the measurement is to be made should be five or six. Some documents also allude to the largest deviation of counts in this pixel range. The largest deviation of counts will not necessarily give the "worst-case rate of change."

Clarification is contained in Appendix A of the full NEMA standards (1). Paragraph NU 1.A1.02.D (5) states categorically that the pixel range shall be six and that this is intended to correspond (in a 64 × 64 matrix) to the radius of a photomultiplier tube in a 37-tube scintillation camera. Further, one must search for the largest gradient or percentage change of counts over this range of pixels. A deviation of ΔN counts will be more significant in a region of low counts than the same deviation in a region where the surrounding counts are more dense.

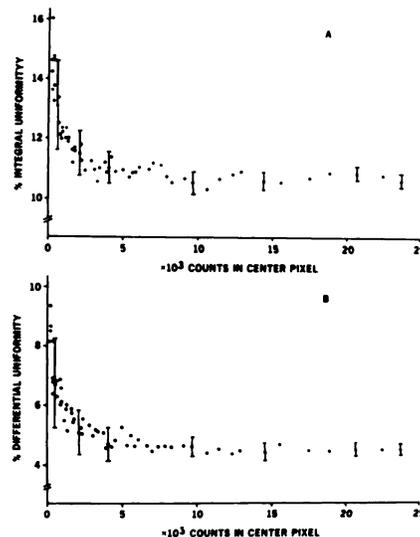


FIG. 1. Graphs of integral and differential uniformity against center-pixel count content. All cameras investigated yielded similar results. Only when center-pixel count content exceeds about 8000 can measured uniformity be expected to be minimal.