reconstructions of the bottle phantom data where the actual distribution of activity is known. In addition, a direct rectilinear scan of the phantom, with the same total counts as the section scan, would have given a useful standard of resolution and noise-level against which various methods of section reconstruction could have been judged.

Although I appreciate the authors' desire to present both technique and results in a single short paper, I feel that a much more complete description of their work is necessary before the OTC method can be properly assessed.

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LIMITATIONS OF ORTHOGONAL TANGENT CORRECTION

In their recent paper, Quantitative Section Scanning Using Orthogonal Tangent Correction (*J Nucl Med* 14: 196–200), Kuhl, et al have presented a method which represents a significant improvement over their previous methods of additive tomographic reconstruction. Of particular importance is the apparent quantitative accuracy of the technique since any truly quantitative method of section imaging represents implicitly a solution to the problem of quantitative three-dimensional imaging (*1*).

The authors have presented some very impressive experimental data to substantiate the quantitative accuracy of their method. They have, however, failed to justify rigorously the mathematical basis of the technique and have thus apparently overlooked the fact that Orthogonal Tangent Correction (OTC) does not yield a general solution to the reconstruction problem which is quantitatively accurate for all classes of "pictures". [For the sake of brevity, terminology shown in quotation marks will follow the definitions given in our recent review of techniques for tomographic image reconstruction (*1*)]. This can be demonstrated by showing that there exists a class of "pictures" which OTC cannot reconstruct with quantitative accuracy.

Hypothesis: for any "picture" which contains one or more elements p_{ij} of zero value surrounded by picture elements with positive, nonzero values such that the "real ray sums" of all "rays" of all "projections" containing p_{ij} are nonzero and positive, the corresponding point p^r_{ij} in the reconstruction by OTC will be nonzero.

Proof: let us assume that p_{ij} is represented by point P_{33} in the OTC paper of Kuhl, et al, Figs. 5–7. Then following the terminology of their paper, P_{33} Corrected will be the point p^r_{ij} in the final reconstructed image. P_{33} Corrected is given by:

$$\frac{\dfrac{A_3}{\Sigma A_n} \times \dfrac{B_3}{\Sigma B_n}}{\dfrac{C_3}{\Sigma C_n} \times \dfrac{D_3}{\Sigma D_n}} \times P_{33}$$

where

$$P_{33} = \frac{A_3}{\Sigma A_n} \times B_3 \text{ from a previous step.}$$

By the terms of our original hypothesis, none of the values in these equations can be zero or negative. If this is so, it is obvious that P_{33} Corrected must be nonzero as hypothesized. This proof can be extended for any number of sets of orthogonal "projections" without altering this result.

This limitation of the OTC method is characteristic of reconstruction techniques that either lack a subtractive step or in which there is no possibility of negative numbers occurring during the calculation. An analogous situation arises in Kuhl's earlier SSA and DSA methods (*2*).

This limitation of the OTC method does not appear to be a trivial case since many real clinical situations duplicate the hypothetical model presented. Examples include the necrotic centers of some tumors, cystic lesions, and abscesses.

At least two other groups of investigators have discovered additive reconstruction (*3,4*), both apparently independently of either Kuhl's work or each other's. Both Herman (*5*) and Vainstein (*4*) have studied the properties of additive reconstruction and devised techniques for improving its performance. Among these is the use of a subtractive step in the final image processing which does allow the recovery of zero values at points buried within the "picture".

Even with these suggested improvements additive reconstruction appears to be a poor alternative to other known reconstruction methods (Ref. *1* and other references therein) and the ultimate solution to the quantitative imaging problem will probably be found in another technique.

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THE AUTHORS' REPLY

The OTC algorithm is correctly presented in our paper. The example chosen to illustrate its operation was intentionally simplified but apparently misunderstandings can arise when relatively few picture elements are used to illustrate processes which involve thousands of picture elements for proper approximations.

OTC does produce zeros appropriately. With repeated application of correction factors having values less than unity, the count value corresponding to a void converges toward zero. Truncation deletes those matrix values which are substantially less than unity and zeros result in the final reconstruction.

There is probably no single reconstruction method which will be optimum in economy and performance for all hardware and for all classes of emission and transmission pictures. We replaced our earlier DSA process with OTC in order to quantify radioactivity in brain sections, which was not possible before. This method, including attentuation correction, has worked well in hundreds of quantitative section scans of patients, animals, and phantoms of various configurations. Even though OTC is more sensitive to noise, we consider the results clearly superior to what we accomplished using DSA or SSA processing. To our knowledge, no one has performed similar comparisons of OTC with alternative methods of reconstruction.

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RIB ABNORMALITY HIDDEN BY BREAST PROSTHESIS

The half-value thickness for ^{99m}Tc in water is 5 cm and in denser tissues considerably less. It is well recognized that a breast prosthesis or even a large pendulous breast can produce a defect on a ^{99m}Tc-sulfur colloid liver scan (*1*). Buchignani and Rockett pointed out that a similar area of decreased uptake may be produced on a bone scan when ^{99m}Tc-labeled radiopharmaceuticals are used and such an artifact could possibly conceal a bone lesion (*2*). The following case report confirms this.

The patient, a 52-year-old woman, underwent an extended right, simple mastectomy in October 1971 because of a breast mass. Histologically, the lesion was an infiltrating ductal carcinoma confined to the breast; no metastases were found in nine axillary nodes examined. In July 1972, she noted pain in her left upper arm which in the succeeding months increased in severity. Radiological examination of the

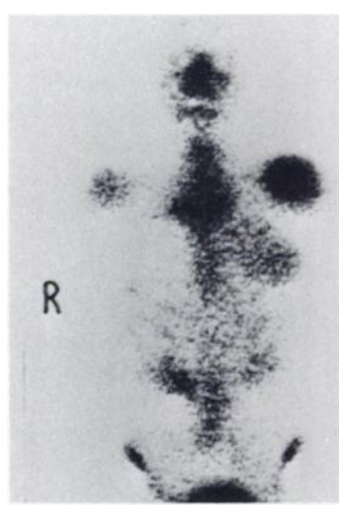

FIG. 1. Bone scan of head and trunk showing no activity in region of right breast.