K. Thyroid

Functional Imaging of the Thyroid Using $^{99m}$Tc-Pertechnetate

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A new method for the functional imaging of the thyroid was devised.

A joint system of a gamma camera with a pin-hole collimator and an online minicomputer (DAP 5000N) was used in this study. After intravenous injection of 5 mCi of $^{99m}$Tc-pertechnetate, sequential 10 frames were collected at one per minutes in a frame mode with $64 \times 64$ matrix. "Sum Tc 10 Ratio", a new parameter of our device, was calculated for all the time-activity curves on the $64 \times 64$ elements and displayed such that brightness is proportional to the calculated values.

\[
\text{Sum Tc 10 Ratio} = \sum_{i=1}^{10} [(C_{i0}/C_i) - 1]
\]

Where $C_{i0}$ and $C_i$ represent count rates at 10 and $t$ minutes after injection respectively. The values for Sum Tc 10 Ratio were distributed diffusely throughout the diffuse goiter and the normal thyroid, while markedly irregular distribution was visualized in some Hashimoto's thyroiditis.

This functional imaging also seemed to be utilized for the diagnosis of malignancy of cold nodules. Because of increased vascularity, time-activity curves over the nodules usually showed descending pattern. Consequently calculated ratios were negative, which could be displayed such that the absolute value was proportional to the brightness. In this negative image we could see the extent of the malignant tumor. On the other hand benign cold nodules presented low positive values and no brightness was seen in the negative image.

Mean value for Sum Tc 10 Ratio in thyroid area was correlated well with $^{131}$I uptake in various thyroid disease ($r = 0.80, p < 0.005$).

Because of no need of troublesome measurements of the standard and the dose, short processing time, and low radiation dose, our method was thought to be very useful for daily clinical studies of the thyroid.