

from various views, were useful for finding of small nodules in the thyroid.

(3) It was much easier to find functioning thyroid nodule (hot nodule) by thyroid scintiphoto than by scintigram. We found hot nodule in approximately 1.4% of all patients

presenting for thyroid scintiphotos.

(4) The pyramidal lobe of the thyroid gland is visualized in about 9.7% of all patients, whose thyroid scintiphotos were obtained. Hyperthyroid patients showed a higher incidence (20.7%) of pyramidal lobes.

## Regional Cerebral Blood Flow Measurement with an Anger Scintillation Camera

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The present report deals with the measurement of regional blood flow in patients with intracranial lesions by an Anger scintillation camera and the  $^{133}\text{Xe}$  clearance method. The scintillation camera was combined with a dual analog to a digital converter, a 1600 channel pulse height analyzer, and a computer compatible high speed magnetic tape system.

The detector of the scintillation camera was placed on the right or left, temporal or frontal region of the head. A solution of 3 or 5 mCi of  $^{133}\text{Xe}$  dissolved in 2 to 3 ml. of saline was injected over a period of one to two seconds through a polyethylene catheter into the internal carotid artery, and the radioactivities in 1600 matrix of the 1600 channel analyzer were transferred into the magnetic tape in time intervals of three seconds for the first two minutes, 15 seconds for the second to the fifth minutes, and 60 seconds for the fifth to the tenth minutes. Then,  $^{133}\text{Xe}$  wash out curves in 1600 matrix were obtained.

The cerebral blood flow index in each matrix was calculated by the height/area method. The height was determined by integrating the radioactivities from zero time to the fifteenth second of the  $^{133}\text{Xe}$  wash out curve, and the area under the curve was obtained by integrating all radioactivities from zero time to the tenth minute. From the calculation of this flow index in each matrix, a flow index map was obtained for the whole cerebrum. Two exponential functions, the fast component with a  $T_{1/2}$  of 0.5 to 1.0 minutes ( $Y_1 = Ae^{-\lambda t}$ ) and the slow component with a  $T_{1/2}$  of 3 to 7

minutes ( $Y_2 = Be^{-\lambda t}$ ), were obtained from the compartmental analysis of the  $^{133}\text{Xe}$  wash out curve composed of the radioactivities of the adjacent  $2 \times 2$  matrix of the 1600 channel analyzer.

In a flow index map from a normal subject, regions with a relatively high flow index were observed in the peripheral region of the brain and the brain base, and high A/B ratios were calculated in the same region from the compartmental analysis of the  $^{133}\text{Xe}$  wash out curve. In a patient with arteriosclerotic Parkinsonism, the flow index and the A/B ratio in all the regions showed almost the same low values. In a patient with cerebral thrombosis, low values were observed in the flow index and A/B ratio in the affected region. In a patient with A-V malformation, the flow index in the shunt region was higher. Compartmental analysis of the  $^{133}\text{Xe}$  wash out curve in this region showed an extremely fast component with a  $T_{1/2}$  of 4.2 seconds and a decrease of the fast component, that is, a decrease of effective blood flow. In a patient with glioblastoma, a high flow index and a fast component with a  $T_{1/2}$  of 7.2 seconds were observed, and the presence of a shunt in the tumor was suspected.

In some cases, the effect of the cerebral vasodilator "nicotinamide" on the  $^{133}\text{Xe}$  wash out curve was studied. After the administration of nicotinamide to a young normal subject, acceleration of the fast component, especially peripherally and at the base of the brain, and an increase of the slow component

in the total cerebral area were observed. In an aged normal subject, slight increases were observed in both components. In a patient with arteriosclerosis, on the other hand, an unchanged fast component and a slight increase of the slow component were observed over the entire cerebrum. These results indicate that nicotinamide increases blood flow

in the white matter, but has no effect on the blood flow in the gray matter in arteriosclerotic brain.

It is apparent that the combined use of the scintillation camera, 1600 channel analyzer and magnetic tape system is very useful in the dynamic study of organ circulation.