The Problem of External Measurements of Brain Isotope Content

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Experimental animal and radiographic human studies were undertaken to define the magnitude of scalp and skull isptope content relative to brain for ^{99m}Tc pertechnetate and ^{131}I-RIHSA.

Tissue volumes and weights of brain, scalp and skull were estimated from postmortem radiography in ten human subjects.

Isotope destribution in animal tissues for ^{99m}Tc and ^{131}I-RIHSA were defined as a function of time. Brain isotope concentration achieved was low relative to other tissues.

From these animal and human data, the extent of scalp and skull interference with external brain isotope measurements was estimated for clinical studies utilizing collimation designed for total cranial counting.

A tracer technique is suggested which would allow correction for the superficially originating count in scalp and skull.

Regional Cerebral Blood Flow in Patients with Brain Tumors a Study with the ^{85}Kr Clearance Method

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Regional cerebral blood flow (rCBF) was measured by the krypton 85 clearance method in 23 patients with brain tumors varying in nature. Two scintillation detectors were positioned over the head of the patients, one of which was mounted over the tumor region, and the other was placed on the non-tumor region. Each detector had 2-inch thallium-activated sodium iodine crystals and was lodged in cylindrical lead shields.

In three patients with third ventricle tumor, the rCBF was markedly decreased in the overall hemispheres.

In one patient with oligodendroglioma, 3 with astrocytoma and 2 with metastatic brain tumor, the rCBF was also markedly depressed in both hemispheres without any localized alteration of blood flow, even though over the tumor region.

In 6 out of 8 patient with meningioma and one with germinoma, demonstrating pathologic vessels in arteriograms, a local increase in CBF was found to correspond to angiographic findings of tumors, while a slight decrease in CBF revealed in the non-tumor region. When the rCBF was calculated by the two compartmental analysis in these cases, in addition to the normal fast and slow components, there was also a third component which represented a compartment with a flow higher than in the grey matter. The third flow component might indicate the blood flow of pathologic vessels in the tumor tissue.

On the contrary, the rCBF over the tumor

region of 6 glioblastoma multiformes decreased, in spite of increase in pathologic vessels and arteriovenous shunts in arteriograms. In some of these cases, an initial peak of clearance curves as seen in the case of arteriovenous mulformation was noted. This initial peak might show a rapid passage of the isotope through the shunt. As the blood flow through the shunt does not contribute to the brain metabolism, the rCBF in these tumors having arteriovenous shunts might not be so large as in the case with meningioma.

Dual Foci RI-Detector on Measurement of Cerebral Hemispheric Hemdoynamics

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We have already reported the method of measuring intra and extra-cranial blood volume with the use of a new dual foci detector head. In this report, we have discussed the new theory about the measurement of cerebral hemispheric hemodynamics with the use of this new dual foci detector head and have presented interesting findings in the cerebral hemispheric blood volume of cerebro-vascular disturbances.

The following is the description of the method:

The dual foci scintillation detector head was placed on the temporal region of a human's head with one focus on the right cerebral hemispheric region and the other on the left, and RISA was injected into the cubital vein. After RISA was completely mixed within the body, the external counts were measured with the use of each focused detector head. Approximately 5 minutes following the injection of RISA, its concentration was measured by using a well-type scintillation counter on the blood drawn from the cubital vein.

Theory of the method:

The whole cranial blood volume (V) is described by equation No. 1.

$$V = V_R + V_L = n \times \frac{R}{B} + n' \times \frac{R_L}{B} \quad \cdots\cdots (1)$$

In this equation, Vr stands for the right cerebral hemispheric blood volume and V_L, the left cerebral hemispheric blood volume, both measured with the use of a short focused collimator (S-channel). B indicates the concentration of RISA in one ml the blood taken at the same time n and n' were calculated from the phantom simulated to a human head with the both right and left hemispheric cavities. Observed external counting rates of S and 1-channels were indicated by R and R'. Rr, Rl and R'r, R'l were expressed the external count of right and left hemispheric cranium which we could not observe directly with the use of S and 1-channels.

Toerefore,

$$R = R_L + R_R \quad \cdots\cdots (2)$$

$$R' = R'_L + R'_R \quad \cdots\cdots (3)$$

The equation No. 3 was converted

$$R' = R_R \times y + R_L \times \delta = (R - R_L)y + R \times S$$
$$= R_L(\delta - y) + R \times y$$

$$R_L = \frac{R' - R \times y}{S - y} \quad \cdots\cdots (4)$$

Then, the left cerebral hemispheric blood volume was represented by equation No. 5

$$V_L = \frac{u}{B} \times \frac{R - R \times y}{S - y}$$

Hence, $S = \frac{R'_L}{R_L}$ and $y = \frac{R'_R}{R_L}$ could be calculated from the above phantom.

The result:

The focus cerebral hemispheric blood volume of cerebro-vascular disturbances, with average