tumor including meningioma (5), astrocytoma (1), glioblastoma (3), oligo dendroglioblastoma (1), acoustic neurinoma (3), secondary brain tumor (10), histological unknown (1), and other lesions which included A-V malformation with intracerebral hematoma (2), A-V malformation without intracerebral hematoma (2), subdural hematoma (1), brain abscess (1), giant cell tumor (1), secondary bone tumor (3).

The target-to-nontarget intensity ratio in cerebral infarction was greater with ^{99m}Tc-EHDP than with ^{99m}Tc-pertechnetate in 27 cases. In contrast to cerebral infarction, the target-to-nontarget intensity ratio was greater with ^{99m}Tc-pertechnetate than with ^{99m}Tc-EHDP in 14 cases.

In conclusion, these results indicate that this dual method is helpful in differentiating cerebral tumor from cerebral infarction.

Functional Image of Regional Cerebral Blood Flow (1) Method

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The functional imaging of the regional cerebral blood flow (rCBF) was developed using an Anger-type gamma camera and an on-line minicomputer system.

The data-processing system consists of an I/O unit, a CPU (16 KW), a MT, a typewritera nd a CRT display. The programs were written in an assembly language and stored in the initial 4K words of the core memory and the remaining 12K words were allocated to the images and the wash-out curves.

In this study, 3–5 mCi of Xe-133 in saline solution was injected rapidly into the internal carotid artery and 130 serial digitalized images of one second frames were stored on the MT. Hyperventilation, CO_2 inhalation and/or vascular compression tests, if necessary, were performed afterwards and the serial images after the repeated Xe-133 injection were also stored on the MT.

The data were processed as follows; For the first place, the processing area was set in the accumulated image displayed on the CRT. Then the wash-out curves in every 8 mm*8 mm element in the area were extracted from the serial images on the MT. The blood flow rates in every element were calculated as rCBF-initial (ml/100 g/min) using the least square method after the logarithmic conversion of the curves. The statistical errors due to the random nature of the radioactive decay were then calculated and expressed in standard deviations of the finally calculated values.

The calculated parameters were rearranged in the corresponding matrices and displayed on the CRT in a gray map. Type printings of them in 2 digitdecimal numbers in a map format were also carried out. The changes of rCBFs before and after the tests were also displayed and printed out in both absoluted differences and percent changes.

Functional Image of Regional Cerebral Blood Flow (2) Clinical Applications

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The clinical applications of rCBF functional image were performed in normal volunteers and 40 patients with intracranial disease.

The gamma camera was set at the skull. 5 mCi of Xe-133 in saline solution was injected into the internal carotid artery at rest and after each test

such as CO_2 inhalation, hyperventilation, the elevation of blood pressure and the compression of contralateral common carotid artery.

In a case with normal brain, the hemispheric cerebral blood flow (HCBF) was 62 ml/100 g/min and the rCBF were high in the parietotemporal region. After CO_2 inhalation, the HCBF and rCBF markedly increased in the most region. In another case with normal brain, the HCBF was 63 ml/100 g/min and the rCBF were also high in the parietotemporal region. After the elevation of blood pressure (from 116/82 to 140/110) by the infusion of angiotensin, the HCBF and rCBF did not change significantly, showing the autoregulation of CBF. In a case with arteriovenous malformation, the rCBF in the lesion were low at rest and increased less than that in the normal region after CO_2 inhalation. In a case with parasaggital meningioma, the rCBF in the lesion were high at rest and inversely decreased in contrast to increasing in the normal region after CO_2 inhalation. In a case with the occlusion of left middle cerebral artery complicated by major stroke, the rCBF were remarkably low in the perfusion area of the artery. After CO_2 inhalation, the rCBF increased in the temporal region and decreased in the fronto-parietal region. In a case with left-sided cerebral thrombosis without angiographical findings, the rCBF decreased remarkably in the left parieto-temporal region after the compression of right common carotid artery.

The rCBF were demonstrated clearly by our functional image. Consequently, the rCBF functional image was useful for understanding the brain circulation and evaluating the treatments.

Regional Brain Functional Image Using Computorized Multicrystal Scintillation Gamma Camera (System-70)

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Measurements of Regional Cerebral Blood Flow and preparation of Brain Functional Images were attempted with System-70 and H/A Method. The System-70 is unique in having a Multicrystal Detector, which is a matrix consisting of 21 rows and 14 columns of columnar crystal elements, each measuring $0.8 \times 0.8 \times 3.8$ cm. 5 mCi of 133-Xe is injected in Bolus into an internal carotid artery of a patient. Simultaneously counting is made over the diseased region for 11 minutes at the rate of 1 sec/frame. Calculation between frames and normalization of counts against pre-determined ones are possible by "Data Process". We modified collimeters to obtain better geometry and succeeded in improving images. H_0 and H_{10} were derived from values of Acc. interval (set at 20 sec). This proved to be quite satisfactory for clinical use. The display of Functional Images in 16 shades of color and further, their normalization made comparison of pre- and post-operative conditions etc. easier and were proved to be clinically useful.

The Computer Treatment of Brain Scintiphotogram

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We originated the new program of on-line minicomputer method for improving the diagnostic quarity of brain images by scintillation camera system and applied this program to phantoms and patients.

We reported it was the effectual method in