

spinal tap (9%) and images of leakage (13%) were observed even in the successful cases of cisternography. The fact indicates that the factor of the patient himself described in (3) plays much higher role than appeared in the figure.

- (5) Follow up study of same cases showed 3 types, such as continuously successful cases (A), mixed cases (B) and continuously unsuccessful cases (C). There found no specific reason and difference between these groups. As one of important reasons for the unsuccessful cisternography, technical factor plays some impor-

tant role as was indicated in the follow up studies which showed as much as 11 cases out of 30 had both successful and unsuccessful results in short interval studies.

- (6) Continuously unsuccessful cases were only 4 cases. It is important that the needle of spinal tap should be inserted precisely into the sub-arachnoidal space. The cases with images of leakage or malinfusion should be examined further. Even in the unsuccessful case re-examination with some interval should be performed since frequent successful second examination can be expected.

Radionuclide Examinations of Ventricular Atrial or Ventricular Peritoneal Shunt Examination of Patency, Blocked Site and Cerebrospinal Fluid Flow Rate

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A small volume of $^{99m}\text{TcO}_4^-$ was injected into the reservoir and scintiphoto was taken after few minutes with polaloid camera. When shunt was patent, the photo showed the radioactivity in the reservoir and distal tube. In obstructed case, radionuclide in the reservoir was flushed by digital pressure or reinjection of saline. We examined the possibility of csf withdrawal from the reservoir, too. When distal tube was block, the photo after flushing showed ventricular tube in Rickham Holter system, and only reservoir in Pudenz system. Csf was easily withdrawn into syringe, too. When ventricular tube was block, photo after flushing showed distal tube in each type, and csf was not withdrawn.

We performed phantom experiments to determine csf flow rate through the shunt system,

Rickham Holter system and Pudenz system. In the first experiment, flow rate was set by siphon, and in the second one, flow rate was set by infusion pump. Radioactivity clearance half time at the reservoir and flow rate showed linear relationships on double-log scale in each experiment. The data of the second experiments are shown. In Rickham Holter system, the regression equation is $\log_{10}(F) = -1.8 \log_{10}(T1/2)$, and the experimental variation is $-1.9 \log_{10}(T1/2) - 0.03 \leq \log_{10}(F) \leq -1.7 \log_{10}(T1/2) + 0.02$. In Pudenz system the regression equation is $\log_{10}(F) = -1.3 \log_{10}(T1/2) + 0.086$, and the variation is $-1.26 \log_{10}(T1/2) - 0.047 \leq \log_{10}(F) \leq -1.26 \log_{10}(T1/2) + 0.1$. These data of the second experiment are almost same values as that of the first one.

Correlation with Radionuclides Cisternogram and Computed Tomogram

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With a use of computed tomography, the morphological informations of the ventricles, basal cisterns and cerebral sulci can be easily obtained.

On the other side, radionuclides cisternography is an excellent method to know the flow of the cerebrospinal fluid. In this study, radionuclides

cisternograms and computed tomograms of 57 patients who were examined by these 2 methods in the same status were correlated and the relationship of ventricular reflux and stasis to morphological information was analysed. The degree of the ventricular reflux and stasis is almost in parallel with the degree of the ventricular dilatation. The patients with moderate to marked expansive ventricular dilatation and narrowing of the basal cisterns have a tendency for ventricular reflux and long stasis. The indication of V-P shunt for these cases has been already discussed.

In this study, an attention was paid to the pati-

ents who were diagnosed cerebral atrophy by computed tomographic informations. The informations are slight to moderate ventricular dilatation and widened cerebral sulci.

Various degrees of the ventricular refluxes and stases were revealed in these patients. Some patients might be improved or stabilized by the changing the flow of the cerebrospinal fluid including V-P shunt.

Follow up study for prognoses of the operated patients must be done. We hope the radionuclides cisternographic findings to be select the treatable cases in the patients with cerebral atrophy.

³H-Thymidine Autoradiography of CSF Cells in Neurosurgical Practice

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CSF cells in various diseases of the central nervous system were examined using ³H-thymidine autoradiography.

Method: The CSF withdrawn by lumbar or ventricular puncture was immediately incubated at 37°C for 1 hour with an admixture of ³H-thymidine at a rate of 1 uCi/ml CSF. The cells were collected by centrifugation or sedimentation and fixed with methanol. Microautoradiography was performed by a dipping method and the specimens were developed after exposure of 2-4 weeks. When silver grains were present more than five on a nucleus, it was counted as labeled.

Results: In 21 out of 22 cases of non-neoplastic disease CSF cells were found labeled. Polymorphonuclear leukocytes were labeled in no case and small lymphocytes were very rarely labeled. Labeled CSF cells in non-neoplastic state were considered to be large or medium-sized lymphocytes and monocytes. The mean labeling index of total CSF cells was 0.22% and the highest 0.74%. When polymorphonuclear leukocytes and small lymphocytes were excluded, the highest labeling

index of CSF cells in non-neoplastic state was 1.7%.

Eighty-nine cases of neoplastic disease of the CNS were also examined. Labeled cells were found in all of the cases. The labeling index of CSF cells excluding polymorphonuclear leukocytes and small lymphocytes was the highest (14.4%) in a case of malignant lymphoma of the brain with subarachnoid dissemination. In 21 out of 89 neoplastic cases the labeling index exceeded the highest (1.7%) in non-neoplastic cases. A high labeling was seen in primary brain sarcoma, metastatic carcinoma and meningeal leukemia. Gliomas, even though malignant, showed relatively lower labelings in most cases. The results of autoradiography, cytology and autopsy were almost always consistent in tumors with subarachnoid dissemination.

Conclusion: ³H-thymidine autoradiography of CSF cells is useful in detecting subarachnoid tumor dissemination and evaluating proliferative activity of the tumor in CSF.