

RI-Cisternography for Neurosurgery

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Satisfactory diagnosis of the cerebrospinal fluid (CSF) dynamics has always been problematical in the neurosurgical cases. It is very important for the neurosurgical diagnosis not only to determine the irreversible anatomopathological change but to analyze the dynamic functional capacity of the CSF system. Bell introduced radioisotope into the clinical diagnosis of CSF dynamics in 1957, and thereafter Di Chiro reported RISA-ventriculography and RISA-cisternography in the clinical cases in 1964. We reported 72 cases of ^{131}I HSA-cisternography and classified their patterns into 6 types in relation to the SCF dynamics in 1969.

Present study is reporting the experience of 247 cases of RI-cisternography in the period of time between September in 1968 and October in 1971, including 12 cases of ^{169}Yb -DTPA-cisternography, in the Department of Neurosurgery, Kurashiki Central Hospital. These cases include 6 cases below 1 year of age, 65 cases of 1.1 to 10 years of age, 75 cases of 11 to 30 yrs., 63 cases of 31 to 50 yrs., and 38 cases above 51 yrs. The patterns of their cisternograms can be classified into 7 types. They are the types of CSF flow, which are: 1) normal, 2) increased or accelerated, 3) blocked or stagnated extracranially, 4) blocked or accumulated intracranially, 5) decreased or decelerated, 6) complicated by transthecal leak, and 7) intraventricular regurgitation. Ventricular regurgitation of RI-CSF represents the hydrocephalic disorder of CSF dynamics, and in the series of 100 cases which were sampled at random out of 247 cases, it was demonstrated in 9 cases of 22 cases of head injuries (more than all, in 7 cases of depression fracture of the skull), 3 cases in 5 cases of posttraumatic cervical syndrome (PCS), 7 in 9 cases of cerebrovascular disorder and insufficiency including 2 AV-malformations, 7 in 10 cases of congenital anomalies and hydrocephalus including normal pressure

hydrocephalus and cerebral palsy for convenience, 6 in 16 degenerative or neurological cases including As- and CO-intoxication, all cases of 4 tumors, 12 in 17 cases of symptomatic epilepsy (consisting of 6 traumatic and 6 non-traumatic), and 6 in 9 cases of non-traumatic symptomatic headache, and all in 8 postoperative cases of ventriculo-peritoneal shunt (V-P shunt). Among the disturbances of CSF flow, the decreased or decelerated flow is most frequently observed and 84 percent of cases showed this type of disorder. Ventricular regurgitation with delayed clearance (that is decreased CSF flow) must be the important sign suggesting hydrocephalic change. There were observed "affined" or "coupled" concomitances of disorders of CSF dynamics. The most predominant and significant coupling is "deceleration of CSF flow (type V) accompanied by intracranial blockage or localized accumulation of CSF (type IV), which occupies 61% of 100 cases. Concomitance of type V, IV, and III, is observed in 8%, and type IV, V, and VI in 6%. Extracranial and intracranial blockades and localized accumulation of CSF (type III and IV disorders) are observed in 85 cases (85%), which consist of 6.2% in spinal, 60.5% in cisternal and 33.3% in perihemispheric subarachnoid spaces. Some cases were checked up of their RI-cisternograms by their pneumoencephalograms or pneumoventriculograms. Twenty eight cases of V-P shunt were indicated by the RI-cisternographic data and they have shown excellent results in all cases. Type V abnormality, singular or complicated, showed the significant concomitance with certain changes in EEG, including slowing, lazy activity, seizures, spiky and sharp waves. Concomitant RI-brain scanings showed a significant parallel relationship with RI-cisternograms. In certain cases, clearance of RI from CSF to blood was determined, and type V abnormality showed low rate of

clearance into the blood. There were significant differences in clearances out of CSF and blood between ^{131}I HSA and ^{169}Yb -DTPA, and the latter showed rapid transmission into the blood out of CSF and into the urine out of blood, more than all early appearance of radioactivity in the blood within a few minutes of intrathecal (lumbar) injection of ^{169}Yb -DTPA suggested a new category of CSF resorption on the surface of spinal cord and its theca.

From these data, following conclusions are suggested: 1) RI-cisternography is a unique and useful method to determine the CSF dynamics, 2) it is possible to examine not only the anatomopathological change of CSF system but also its functional capacity, 3)

^{131}I HSA is the conventional RI-tracer and good enough to use clinically but with a few side effects of aseptic meningitis, 4) ^{169}Yb -DTPA is a new RI-tracer with short effective half life, and a safe tracer without significant side effect, and capable of intrathecal injection of 0.5 to 1mCi—dosis, which promises better representation of cisternograms, 5) in some cases, the cisternograms shows not only mechanical disturbances of subarachnoid spaces but delicately concomitant disturbances of focal blood brain barrier. In future more effective and safe, and even lesion-specific tracers will develop the exact neurosurgical diagnosis.

Diagnostic Significance of Cisternography

—With Special Reference to Brain Tumors (including Intratentorial Tumor), Head Trauma, Convulsive Seizure and Inflammation—

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Purpose

Recent use of RI in the study of dynamic flow of spinal fluid has been asserted by a great many researchers as helpful. We tried to evaluate the diagnostic value of cisternography, by comparing it with other auxiliary methods of diagnosis such as PEG, CAG, VAG, and brain scintiscan. Comparison was also made between ^{169}Yb -DTPA and RISA, two radioisotopes used in the trial.

Method

Following injection of 100-200 μ Ci RISA and 1 μ Ci ^{169}Yb -DTPA into spinal canal by spinal puncture, records were consecutively taken of dynamic flow of spinal fluid with scinticamera.

I. Cases

Diagnostic procedure was applied to 16 cases of brain tumor including intratentorial tumor, 11 cases of head trauma, 4 cases of congenital malformation, 3 cases of hydrocephalus, 2

cases of convulsive seizure, 2 cases of aneurysm, 2 cases of A-V malformation, 2 cases of inflammation, 3 presumably normal cases and 5 uncertain cases, 60 cases in total.

Result

While in the majority of cases various auxiliary means of diagnosis mentioned above concurrently been applied, only cisternography supplied positive findings. For example: (1) detection of tumor of the pineal region, early diagnosis of which is relatively difficult, (2) revelation by cisternography and operation that the tumor clinically considered as originating in acoustic nerve was in fact pons glioma, (3) contradiction of previous diagnosis, by which the presence of tumor of the spinal cord had been affirmed and its treatment done, on the strength of cisternographic evidence that there was no passage failure of cerebrospinal fluid and the picture was normal, (4) revelation by cisternography of uneven