

Cerebrospinal Fluid Flow Examination in Ventricle-Atrial or Ventricle-Peritoneal Shunt —Clinical Evaluation—

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CSF flow rate was examined in 56 cases who had Pudenz or Rickham-Holter shunt apparatus. $^{99m}\text{TcO}_4^-$, 100 to 200 μCi in volume of 0.05 ml, was injected into the shunt reservoir and radioactivity clearance half time ($T_{1/2}$ min) at the reservoir was obtained. Shunted CSF flow rate (F ml/min) was calculated as follows:

Pudenz reservoir:

$$\log_{10}F = -1.3 \log_{10}T_{1/2} + 0.086$$

Rickham-Holter reservoir:

$$\log_{10}F = -1.8 \log_{10}T_{1/2} + 0.019$$

These equations were determined from our in vitro phantom experiments which had been reported others. When the radioactivity clearance curve did not show spontaneous CSF flow, shunt patency was examined by aspiration and flushing of CSF from the reservoir.

CSF flow rates were greatly changed at different positions and clearance curve were multi-exponen-

tial during constant position in some cases. Some cases showed no flow at supine position but more than 1.0 ml/min at sitting position. These phenomenon indicate that shunted CSF flow is intermittent in some cases, and this method is not sufficient to detect overdrainage. This method was very useful to determine the indication of shunt reconstruction when it was combined patient's symptoms. In our studies, ten patients who were suspected shunt obstruction showed good flow rate and good prognosis without reoperation. Two showed shunt obstruction and had shunt reconstruction. One showed shunt obstruction and no symptom, and he was diagnosed shunt independent arrest hydrocephalus. CSF flow rates in the shunt apparatus were more than 0.1 ml/min at sitting, but they were less than 0.7 ml/min at supine position in almost all patent cases.