Intracranial Pressure and Pressure Volume Relation in Patients With Subarachnoid Haemorrhage (SAH)

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With 3 Figures

Summary

The development of the intracranial pressure after a subarachnoid haemorrhage was evaluated in 21 patients. A statistically significant relation between the intracranial pressure and the neurological findings was found, whereas vasospasms did not influence the intracranial pressure. In patients in a clinically critical condition, rhythmic pressure waves of a frequency of 1/minute were repeatedly observed.

Introduction

It is a well-known fact that the operative risk after a subarachnoid haemorrhage is substantially influenced by the clinical condition of the patient. Hunt and Hess (1968) classified five grades of clinical symptoms dependent on their severity. While the operative risk of grades I and II is low but very high for grades IV and V, uncertainty prevails regarding the operative risk for grade III patients. Klafta and Hamby (1969) registered a reduction of the operation mortality in this group of patients of from 41 to 17% when the operation was carried out after reducing the intracranial pressure (ICP) below 15 mm Hg. Löfgren and Zwetnow (1972) proved by animal experiments, and Nornes and Magnaes (1972) showed clinically that the intracranial pressure rises steeply during an acute subarachnoid haemorrhage. Hamer and Kühner (1976) found a linear relation between the ICP and the pressure/volume quotient of grade III patients. Besides these preoperative examinations, some authors also stress the importance of postoperative ICP measurements (Kassel et al. 1976, Takagi et al. 1976).
We have carried out pre- and postoperative measurements of the intracranial pressure in 21 patients to examine the relations between the intracranial pressure and the clinical development, and to check the intracranial pressure/volume relation.

**Methods**

On admission, the neurological symptoms of the patients were classified according to Hunt and Hess (1968):

- **Grade I:** Asymptomatic or minimal headache and slight nuchal rigidity.
- **Grade II:** Moderate to severe headache, nuchal rigidity, no neurological deficit other than cranial nerve palsy.
- **Grade III:** Drowsiness, confusion or mild focal deficit.
- **Grade IV:** Stupor, moderate to severe hemiparesis, possibly early decerebrate rigidity, and vegetative disturbances.
- **Grade V:** Deep coma, decerebrate rigidity, moribund appearance.

The ventricular ICP was measured on the right, according to the method described by Lundberg (1960), through a burrhole, and indicated analogously via a pressure gauge (Statham P23 Db) on a measuring bridge (Hellige MA 88 K). A recorder (Watanabe Servocorder SR 652) registered the mean intracranial pressure at a paper speed of 60 mm/h.

The pressure/volume tests were carried out by intraventricular administration of 2 ml of physiological saline within 2 seconds, the consecutive rise of the mean ICP per injected volume being a criterion of the intracranial elasticity

\[ E = \frac{\Delta P}{\Delta V} \]

**Case Material**

The ICP of 21 patients (14 female, 7 male, aged between 14 and 68 years, average age 44 years) was measured from a few hours up to 95 days after the last haemorrhage (average 20 days). The localization of the haemorrhage is indicated in Table 1. At admission, 75% of the patients were clinically in the critical stages III and IV. The findings on admission and the early outcome are compared in Table 2.