Intracranial pressure in patients with dementia and communicating hydrocephalus

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Intracranial pressure (ICP) was monitored continuously for 48 to 72 hours in 12 patients with dementia and communicating hydrocephalus, to see if this would help determine which patients might benefit from surgical shunting of CSF, since not all such patients respond to treatment. Patients who showed variability of ICP improved following surgery, while patients with consistently flat ICP tracings did not. It is suggested that continuous monitoring of ICP may help identify cases suitable for surgery.

KEY WORDS • intracranial pressure • continuous monitoring • dementia • hydrocephalus

PRESENIILE dementias are disorders of varying etiology characterized by the impairment of intellectual capacity, memory, judgment, speech, locomotion, and progressive disintegration of personality. Epilepsy can also be an associated feature. In the last decade considerable interest has been aroused by reports that progressive presenile dementia in some patients may be associated with the development of communicating hydrocephalus.

The term “communicating hydrocephalus” is applied to excessive accumulation of cerebrospinal fluid (CSF) due to poor absorption of fluid or to obstruction of its circulation in the subarachnoid space. By definition there is free communication between the ventricular system of the brain and the subarachnoid space, which is usually demonstrated radiographically by enlargement of the ventricles with free passage of air or contrast medium out of the fourth ventricle. In the absence of any clear visualization of obstruction in the subarachnoid space the diagnosis may be in doubt, and in some instances confused with various forms of cerebral atrophy or other conditions in which there is loss of brain substance. In recent years, confirmatory evidence has been obtained by encephalography using radiiodine-tagged human serum albumin (RIHSA).2,14 In cases of true communicating hydrocephalus, radioactive material enters the ventricular system and remains for an excessively long time; this does not occur with normal CSF circulation. Communicating hydrocephalus is usually caused by obstruction of the CSF...
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pathways due to a variety of pathological conditions such as subarachnoid bleeding that partially obstructs the basal cisterns, subarachnoid adhesions following bacterial meningitis, or invasion of the leptomeninges by malignant cells.

There remains a small but important group of patients in whom communicating hydrocephalus develops insidiously for no cause that is apparent. In dementia patients with proven communicating hydrocephalus, isolated measurements of CSF pressure have been within the normal range. Despite this, striking clinical improvement has been reported following CSF shunting operations (ventriculoatrial shunt); some of these patients, however, have not been helped.

Identification of potentially treatable cases in this group of patients previously regarded as hopeless is important; to date the usual methods of investigation such as pneumoencephalography, arteriography, and isotope encephalography have failed to do so. Therefore, we have undertaken a study to define the precise criteria by which patients may be selected for surgery and their results evaluated.

Method

Intracranial pressure (ICP) was monitored either by placing a Ferranti pressure transducer* in the subdural space or by inserting a catheter in the lateral ventricle which was connected to an external Ferranti blood pressure transducer. At the same time, gold electrode thermistors† were placed in the subdural space. Long-term recordings were made on an Amprobe recorder.‡

In six patients other variables such as oxygen availability by using a polarographic method, and cortical blood flow by using thermistors in the subdural space were also recorded. Heart rate was determined by expressing beat-to-beat interval (ECG) as equivalent heart rate and displayed as a deviation from a chosen form. Respiration was indicated by chest expansion. The polygraphic recordings were taken on a modified Beckman 16-channel electroencephalograph.§

Results

The continuous monitoring of ICP produced two types of pressure records: 1) flat waves with small fluctuations and a mean ICP at normal or below normal (Fig. 1); and 2) well-marked rhythmical 1-min waves lasting for a 5-to-30 min interspread, with varying periods of flatter recordings which Lundberg named “B” waves (Fig. 2). Seven patients had the first type of recordings, and none improved following surgical shunting of CSF. Five patients had the second type of recordings and all improved following surgical shunting of CSF (Table 1). Furthermore the mean ICP was above 15 mm Hg in these patients; two showed periods of pressure up to 55 mm Hg lasting for 5 to 20 min resembling the plateau waves described by Lundberg (Fig. 3).

<table>
<thead>
<tr>
<th>Shunting Results</th>
<th>No. of Cases</th>
<th>ICP Variations</th>
</tr>
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<tbody>
<tr>
<td>improved</td>
<td>4</td>
<td>+</td>
</tr>
<tr>
<td>slight improvement</td>
<td>1</td>
<td>+</td>
</tr>
<tr>
<td>no improvement</td>
<td>7</td>
<td>-</td>
</tr>
</tbody>
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*Ferranti type Z.P.T. 6B2 pressure transducer manufactured by Ferranti Electronics, Manchester, United Kingdom.
†Gold electrodes and thermistors manufactured by Burden Neurological Institute, Bristol, United Kingdom.
‡Amprobe recorder manufactured by Amprobe Instrument Corporation, Lynbrook, New York, U.S.A.
§Beckman type T.C. 16-channel electroencephalograph manufactured by Digital Equipment Corporation, 146 Main Street, Maynard, Massachusetts 01759.
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Discussion

Many cases of dementia are due to primary degenerative conditions of the cerebral cortex, such as Alzheimer's disease in which there is ventricular dilatation, or to other treatable conditions such as vitamin B-12 and nicotinic acid deficiency, myxedema, syphilis, chronic forms of meningitis, metabolic disease with electrolyte disturbances, slowly growing brain tumors, chronic subdural hematomas, drug and alcohol

Fig. 1. Polygraphic record obtained from a patient showing lack of spontaneous fluctuations of ICP.

Fig. 2. Polygraphic record showing 1-min waves or “B” waves.
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FIG. 3. Slow speed record showing plateau waves. Each strip represents 2 to 5 hours of recording.

intoxication, depression, Pick's disease, and parkinsonianism. Thus the differentiation between these diseases must first be made and normal-pressure hydrocephalus established, usually by RIHSA encephalography. Then the potentially treatable cases must be determined.

In cases of normal-pressure hydrocephalus reported, isolated measurements of CSF pressure have been below 14 mm Hg. Symon, et al., have shown recently, however, that these are periods of raised pressure in patients thought to have low pressure hydrocephalus. They concluded that continuous monitoring might be valuable in deciding which patients should have a ventriculostriatal shunt.

From our preliminary study it appears that the ICP in the treatable group of patients with dementia is not normal, as the continuous ICP recording has shown well-marked “B” waves and occasional plateau waves. The mean ICP is usually in the upper ranges of normal or is moderately elevated. It is possible that some of these patients may have had a high ICP in the early stages of development of hydrocephalus, and the dilatation of the lateral ventricles was initiated by this pressure and maintained by the pressure changes associated with the cardiorespiratory oscillations (“B” waves) and periodic increases in the pressure. This is contrary to the suggestions of Adams, et al., that normal pressure on an enlarged ventricular system causes larger than normal force on the cerebral tissue. Whatever the cause of the maintenance of the ventricular dilatation, the pressure records of these patients do not show a steady “normal” pressure.

On the basis of these observations, it is suggested that continuous monitoring of ICP for a period of at least 48 hours may be an essential diagnostic procedure in this small but important group of patients, since when taken in conjunction with other investigations it provides the most reliable criteria for the selection of patients likely to benefit from CSF shunting. It is further suggested that the term “normal-pressure hydrocephalus” is inappropriate, in that this group of patients showed periodic increases above normal levels. Perhaps “intermittent-pressure hydrocephalus” would be more accurate.

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References


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