Isolated Dilation of the Trigono-inferior Horn

—Four Case Reports—

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Abstract

Four patients presented with isolated dilation of the trigono-inferior horn associated with either mass lesion at the trigone of the lateral ventricle or with shunt over-drainage. We investigated clinical symptoms, course, and neuroradiological findings of these cases. The pressure of the isolated ventricle was measured or estimated at surgery in all cases. The common symptoms were recent memory disturbance and contralateral homonymous hemianopia. Contralateral hemiparesis was observed occasionally. Rapid deterioration of the isolation caused uncal herniation in one case. Comma-shaped dilation of the inferior horn was observed in all cases. Midline shift was not conspicuous except in one case. Intraventricular pressure at surgery was 18 cmH2O, 35 cmH2O, 3 cmH2O, and within normal range. These cases had very similar clinical symptoms and neuroradiological findings. The pathophysiology of isolation suggested three types of isolation (high-, normal-, and low-pressure isolation), depending on the pressure of the isolated ventricle. The isolation of trigono-inferior horn is an important clinical entity as it may cause uncal herniation in patients with high-pressure lesions.

Key words: ventricular isolation, inferior horn, trigone, hydrocephalus

Introduction

Double-compartment hydrocephalus was initially identified after ventriculoperitoneal (VP) shunt procedures. Isolated unilateral ventricle or isolated fourth ventricle are most commonly encountered clinically, but isolation can occur in other parts of the ventricular system. A new classification has been proposed for post-shunt isolation of a ventricle but concepts for isolation of the inferior horn and trigone have not been established. This study examined four cases of isolation of the trigone and inferior horn associated with lesions at the trigone of the lateral ventricle, or with over-drainage of the previous shunt, to identify the pathophysiology, symptoms, and neuroradiological findings of isolated dilation of trigono-inferior horn.

Case Reports

Case 1: A 74-year-old female was admitted to the

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Department of Neurosurgery of Touwakai Hospital (Takatsuki, Osaka) on September 21, 1993, because of marked recent memory disturbance. Symptoms initially appeared in June, and the patient’s condition progressively deteriorated from the beginning of September. She had left homonymous hemianopia and slight left hemiparesis 9 years previously (1984) and underwent a craniotomy for isolated dilation of the right inferior horn. Histological examination identified glomerular hypertrophy of the choroid plexus. Cerebrospinal fluid (CSF) pressure was not measured, but was indicated as not so high in the operation record. Computed tomography (CT) showed calcification of the bilateral choroid plexus and a comma-shaped low density area in the right temporal region (Fig. 1 upper row). Magnetic resonance (MR) imaging at annual follow up on April 23, 1993 showed a large, round, calcified mass at both sides of the trigone, marked periventricular hyperintensity around the left trigone, and a porencephalic cyst in the right temporal lobe, caused by the previous craniotomy (Fig. 1 lower row). These findings remained unchanged after the first craniotomy and she was

179
asymptomatic at that time.

On admission (September 21, 1993), the patient was disoriented with respect to time, place, and person (Japan Coma Scale® 2), and had marked recent memory disturbance, urinary incontinence, and right homonymous hemianopia. MR imaging showed marked dilation of the left inferior horn and deterioration of periventricular hyperintensity (Fig. 2). Midline shift had also deteriorated slightly with the compression of the left anterior horn. All symptoms disappeared within a few days after left inferior horn-peritoneal shunt on September 26, 1993. Intraventricular pressure (IVP) was about 18 cmH₂O with reference to the external auditory meatus. Postoperative CT confirmed the disappearance of the dilation of the left inferior horn and improvement in periventricular lucency. Displacement of the left choroid plexus also had disappeared.

Case 2: A 49-year-old female was admitted to the Department of Neurosurgery of Osaka Medical College Hospital because of transient severe headache on September 26, 1996. The patient had had slight visual disturbance and recent memory disturbance since the beginning of April 1996.

On admission, she was disoriented with respect to time, place, and person (Japan Coma Scale 2), and had marked recent memory disturbance and left homonymous hemianopia. MR imaging with gadolinium revealed a homogeneously enhanced mass at the trigone of the right lateral ventricle with marked dilation of the right inferior horn, occipital horn, and trigone (Fig. 3). She underwent total resection of the tumor (meningioma) via the right
Isolated Dilation of the Trigono-inferior Horn

Fig. 3 Case 2. T1-weighted magnetic resonance images with gadolinium showing a homogeneously enhanced mass at the right trigone with marked dilation of the right trigono-inferior horn.

middle temporal route, and her symptoms disappeared completely. IVP was not measured, but CSF flow was less strong when the ventricular wall was opened at surgery.

Case 3: A 69-year-old female was admitted to the Department of Internal Medicine of Osaka Medical College Hospital because of progressive right hemiparesis, right homonymous hemianopia, and recent memory disturbance, which had persisted for 2 weeks. On the second hospital day, she was transferred to the Department of Neurosurgery because of rapid deterioration of consciousness level to coma (Japan Coma Scale 100) and right hemiparesis. She had anisocoria (left > right) and no light reflex on the left side.

On admission, CT showed marked dilation of the left inferior and occipital horns, which caused a considerable midline shift (Fig. 4 upper row). The mass was markedly distorted and wrapped around its attachment in a counterclockwise fashion by the enlarged occipital horn, compared with the CT performed after ventricular drainage (Fig. 4 lower row). The patient's symptoms resolved completely after emergent ventricular drainage. IVP was higher than 35 cmH2O with reference to the external auditory meatus, but was not measured correctly because of the limitation of the length of ventricular catheter. Total resection of the tumor was performed via a paramedian parietal approach 1 week later. The histological examination identified meningioma.

Case 4: A 7-year-old boy was referred to the Department of Neurosurgery of Tokai University Hospital because of increasing head circumference and ventriculomegaly on CT. The patient was the second child of a 36-year-old gravida 1, para 1 healthy mother. The child was delivered by cesarean section at 28 weeks' gestation, because of premature rupture of the bag. The birth weight was 1176 g, and the Apgar score was 6 at 1 minute and 10 at 5 minutes. At 3 weeks of age, the patient had septic meningitis triggered by respiratory tract infection and disseminated intravascular coagulopathy (DIC). Ventricleomegaly gradually worsened subsequently.

On admission, the patient's body weight was 1420 g. He had increased head circumference (28 cm) and enlarged anterior fontanel (3.7 × 3.2 cm). The patient opened his eyes spontaneously and showed no apparent neurological deficits. CT showed marked dilation of both lateral ventricles as well as the third ventricle (Fig. 5 upper row). An external ventricular drain (EVD) was placed in the right frontal horn because of progressive ventriculomegaly. Postoperative CT revealed a collapsed right frontal horn with persistent dilation of the other ventricle. An EVD was placed into the third ventricle and the pressure was set at 3 cm above that of the external auditory meatus. The patient's anterior fontanel became soft and sunken postoperatively, but CT taken a few weeks after replacement of the EVD showed further dilation of both inferior horns with collapse of the third ventricle and both frontal horns (Fig. 5 lower row). CSF pressure in the inferior horn was not measured. Head circumference was within the normal range, but bulging of the bilateral temporal bones became prominent. VP shunting with multiple ventricular tubes was scheduled, but the patient died of progressive DIC. Autopsy was not performed.

The clinical features of Cases 1 to 4 are summarized in Table 1. Cases 1 to 3 all had a mass at the trigone, whereas Case 4 had previously undergone CSF drainage.

Discussion

Two main mechanisms are implicated in the pathogenesis of ventricular isolation, such as an isolated fourth ventricle or an isolated unilateral ventricle. The first is morphological obstruction secondary to a tumor or adhesion due to infection or conditions.
such as intraventricular bleeding and gliosis, unrelated to shunt. The mass at the trigone disturbs CSF flow and increases CSF pressure in the trigono-inferior horn. The elevated CSF pressure is partially compensated by dilation of the trigono-inferior horn, CSF drainage to the body of the lateral ventricle via a stenotic pathway, and transepidual absorption from the dilated ventricle. This series of events (increased trigono-inferior horn pressure and compensatory mechanisms) slowly dilates the trigono-inferior horn to an equilibrium state, which causes focal signs (homonymous hemianopia, recent memory disturbance, and hemiparesis) but not deterioration of consciousness. The episodes of Cases 1 and 2 are attributed to this type of isolation mechanism. CSF pressure remained within the normal range in Case 1 and was supposed to be normal in Case 2. We call this type of isolation normal-pressure isolation (Fig. 6). If factors such as ventricular distortion, rapid expansion of the mass at the trigone, and adhesion due to infection or bleeding are involved in normal-pressure isolation, the CSF pathway will be obstructed completely and dilation of the trigono-inferior horn will worsen rapidly, resulting in signs of increased intracranial pressure and even uncal herniation. Case 3 belongs to this type, and the IVP was markedly high. We refer to this mechanism as high-pressure isolation (Fig. 6). The enlarged trigono-inferior horn can cause a marked midline shift in cases of high-pressure isolation.

The second mechanism of ventricular isolation is functional obstruction of the ventricular isthmus between the shunted ventricle and the remaining portion (usually the foramen of Monro and aqueduct), caused by over-drainage of the shunt. This is a special pathological condition after shunting for communicating hydrocepha-

Neurol Med Chir (Tokyo) 40, March, 2000
Isolated Dilation of the Trigono-inferior Horn

Comma-shaped dilation of the inferior horn was the most prominent feature of the isolated dilation of the trigono-inferior horn (Figs. 1–5). The ipsilateral trigone and occipital horn were usually dilated together. Periventricular lucency on CT scans and periventricular hyperintensity on T2-weighted MR images were usually prominent, which indicated CSF absorption via the dilated ependyma (Figs. 1, 2, and 4). In Case 3, the mass was displaced anteriorly by the enlarged trigono-inferior horn, and ventricular distortion occurred (Fig. 4, upper row), establishing a vicious cycle of trigono-inferior horn enlargement. Patients with neuroradiological findings of ventricular distortion should be observed carefully for rapid worsening of their condition. Midline shift was not conspicuous in most cases (Figs. 1–3 and 5), unless the mechanism of high-pressure isolation develops (Fig. 4).

The most common symptom of isolated dilation of the trigono-inferior horn was contralateral homonymous hemianopia, caused by the dilated inferior horn stretching the neurons of the optic radiation and Meyer's loop. Recent memory disturbance was thought to involve compression of the hippocampus by the dilated inferior horn, which was seen in two of two cases of dominant side lesions and in one of two cases of non-dominant side lesions. Con-

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**Table 1 Summary of cases**

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age</th>
<th>Sex</th>
<th>Etiology</th>
<th>Side</th>
<th>Symptoms</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>74 yrs</td>
<td>F</td>
<td>glomerular hypertrophy of choroid plexus</td>
<td>lt</td>
<td>recent memory disturbance, homonymous hemianopia</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rt</td>
<td>homonymous hemianopia</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>49 yrs</td>
<td>F</td>
<td>meningioma</td>
<td>rt</td>
<td>recent memory disturbance, homonymous hemianopia, slight hemiparesis</td>
<td>–</td>
</tr>
<tr>
<td>3</td>
<td>69 yrs</td>
<td>F</td>
<td>meningioma</td>
<td>lt</td>
<td>recent memory disturbance, homonymous hemianopia, transient headache</td>
<td>–</td>
</tr>
<tr>
<td>4</td>
<td>2 mos</td>
<td>M</td>
<td>meningitis</td>
<td>bil</td>
<td>recent memory disturbance, homonymous hemianopia, hemiparesis, signs of uncal herniation macrocrania</td>
<td>after CSF drainage</td>
</tr>
</tbody>
</table>

*Occurred 9 years previously. CSF: cerebrospinal fluid.

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trilateral hemiparesis may occasionally be caused by compression of the internal capsule or cerebral peduncle. In Case 2, the mass apparently acted like a ball-valve and caused intermittent headache. Patients with ventricular distortion may have signs of uncal herniation.

The present series of cases showed three different pathophysiological mechanisms causing trigono-inferior horn isolation. Symptoms of isolated dilation of trigono-inferior horn were mainly characterized by contralateral homonymous hemianopia and recent memory disturbance. Signs of increased intracranial pressure and even uncal herniation may occur with high-pressure isolation. We should carefully observe patients with normal-pressure isolation to prevent rapid clinical deterioration.

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Neuro Med Chir (Tokyo) 40, March, 2000
Isolated Dilation of the Trigono-inferior Horn

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