Secondary normal pressure hydrocephalus following pituitary apoplexy: a case report.

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Abstract

Introduction: Although secondary normal pressure hydrocephalus (sNPH) can occur in various central nervous system diseases, there are no reports of sNPH caused by pituitary lesions. Herein, we present a unique case of sNPH caused by pituitary apoplexy.

Case Presentation: A 70-year-old man was transferred to our hospital because of sudden onset of headache and loss of consciousness. Cerebrospinal fluid (CSF) test showed slightly elevated cell counts and protein levels, but a negative CSF culture test. Magnetic resonance imaging showed a dumbbell-like cystic lesion with hemorrhagic change at the sella turcica. From the above, the patient was diagnosed with aseptic meningitis caused by pituitary apoplexy. Pituitary hormone replacement therapy was undertaken and his symptoms fully improved. However, 2 months later he complained of a gait disturbance and incontinence that had gradually appeared. Brain imaging with computed tomography showed no ventricular enlargement compared with initial images, although the lateral ventricles were slightly enlarged. As a CSF drainage test improved his symptoms temporarily, sNPH with possible longstanding overt ventriculomegaly in adults (LOVA) background was suspected. We performed a lumbo-peritoneal shunt placement, which improved his symptoms.

Conclusions: This case suggests that sNPH can develop even after a small subarachnoid hemorrhage caused by a pituitary apoplexy in LOVA patients. If the aqueduct of Silvius is open, sNPH with a LOVA background can be successfully treated with lumbo-peritoneal shunt placement.

Introduction

Secondary normal pressure hydrocephalus (sNPH) can occur in a number of central nervous system diseases.[10] The causes of sNPH include aneurysmal subarachnoid hemorrhage, meningitis, and central nervous system tumors. However, to our knowledge there are no reports of sNPH caused by pituitary lesions. Herein, we present a unique case of sNPH caused by pituitary apoplexy.

Case report

The authors obtained written informed consent from the patient. No approval from our institutional review board was sought because this article is a case report. A 70-year-old man complained of a sudden sense of physical weakness and headache, for which he was transferred to the emergency room of our hospital. On arrival, he had a high fever and showed nuchal rigidity. His medical history included diabetes mellitus, hepatocellular carcinoma not induced by viral hepatitis, intraductal papillary mucinous neoplasm, deep venous thrombosis, and angina pectoris, all of which had been appropriately treated. He also had regular visits to our hospital, to which he walked. His medication included anti-platelets and anti-coagulants.

Laboratory test showed elevated white blood cell counts and C-reactive protein. Whole-body computed tomography (CT) did not detect any apparent abnormality, except for a slightly high-density 10-mm mass...
In the sella turcica and enlarged lateral ventricles (Evans index, 0.33; callosal angle, 61°) (Fig. 1a, b). By contrast, magnetic resonance imaging (MRI) showed a fluid-attenuated inversion recovery-hyperintensity lesion in the peduncular cistern (Fig. 1c), although no evidence of vascular lesions was detected on magnetic resonance angiography (Fig. 1d). Cerebrospinal fluid (CSF) testing showed slightly elevated cell counts including red blood cells and white blood cells, and elevated protein levels (Table 1). These findings suggested meningitis caused by bacterial or viral infection rather than hemorrhagic cerebral vascular lesions. The sellar lesion detected by CT was initially diagnosed as a pituitary tumor because of its density and small size.

| Table 1  
Sequential laboratory data of the cerebrospinal fluid |
<table>
<thead>
<tr>
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<tr>
<td></td>
<td>Day 0</td>
<td>Day 5</td>
<td>Day 120</td>
</tr>
<tr>
<td>Cell count (/µl)</td>
<td>23</td>
<td>13</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Red blood cell (/µl)</td>
<td>1800</td>
<td>6400</td>
<td>&lt; 1000</td>
</tr>
<tr>
<td>Protein (mg/dL)</td>
<td>155</td>
<td>128</td>
<td>64</td>
</tr>
<tr>
<td>Glucose (mg/dL)</td>
<td>121</td>
<td>120</td>
<td>75</td>
</tr>
<tr>
<td>Glucose (CSF/serous)</td>
<td>0.7</td>
<td>0.47</td>
<td>0.65</td>
</tr>
<tr>
<td>Lactate (mmol/L)</td>
<td>4.2</td>
<td>3.6</td>
<td>2.1</td>
</tr>
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</table>

After admission, intravenous acyclovir, vancomycin, and ampicillin were administered for a possible diagnosis of infectious meningitis. Although his laboratory data (including white blood cell counts and C-reactive protein) improved, his consciousness level remained poor with a Glasgow Coma Scale of 13 (E3V4M6). Repeated brain CT showed no remarkable changes compared with initial images including for the sellar lesion. However, pituitary MRI showed a dumbbell-like hypointense core with a hyperintense rim on T1-weighted imaging (Fig. 1e), and a hypointense mass with niveau on T2-weighted imaging (Fig. 1f). Furthermore, laboratory tests indicated marked pan-hypopituitarism (thyroid stimulating hormone, 0.078 mIU/L; free T3, < 0.98 ng/dL; free T4, 0.616 ng/dL; random cortisol, 3.09 µg/dL; adrenocorticotropic hormone, < 3.0 pg/mL). We eventually considered pituitary apoplexy as a cause of the constellation of symptoms. We administered 100 mg of intravenous hydrocortisone, followed 2 days later by levothyroxine (50 µg/day) for hypothyroidism. His consciousness level improved to normal within 2 days of hydrocortisone administration. Because he remained alert even after tapering hydrocortisone to 20 mg orally over 2 weeks, he was discharged.

However, at 2 months after discharge, he complained of gait disturbance and incontinence that gradually appeared. Brain CT showed possible hydrocephalus (Evans index, 0.35; callosal angle, 50°), which was similar to the initial CT (Fig. 1a, Fig. 2). He could only walk by sliding his feet, and it took > 1 min with 132 steps for a 10 m round trip. His mini-mental state examination score was 21, which indicated mild cognitive impairment. Follow-up MRI showed resolution of the pituitary hemorrhagic lesion. Therefore, we
performed a tap test on day 120 from initial hospitalization to assess for a hydrocephalus etiology. We punctured the L4/L5 interspinal space with a 21-gauge Quincke needle, and 20 mL of transparent colorless CSF was aspirated. Laboratory test for CSF detected no viable cells or red blood cells, although the protein level was mildly elevated (Table 1). After the CSF drainage test, his subjective symptoms improved and were maintained for approximately 1 month. For example, his gait was smoother, and it took only 38 steps for a 10 m round trip. His mini-mental state examination score improved to 24 at 1 day after CSF drainage, and he was able to return to work. Owing to these improvements, we inserted a conducted lumbo-peritoneal shunt (LPS) with a CERTAS plus programmable valve (Codman and Shurtleff, Inc., Raynham, MA, USA) under general anesthesia. His postoperative course was uneventful, and he was able to walk without aid at discharge, which suggested the diagnosis of definite hydrocephalus.

Discussion

In the present case, our initial diagnosis was meningitis rather than pituitary apoplexy because of his symptoms and brain imaging findings. However, we eventually diagnosed a pituitary apoplexy following repeated imaging examinations and a negative CSF culture test. At 2 months after diagnosis, he complained of gait disturbance and mild cognitive impairment, although CT showed almost no further change in his enlarged lateral ventricle. We suspected sNPH based on his CSF tap test, and LPS surgery successfully improved his symptoms.

At admission, the symptoms and CSF results of our case were suggestive of meningitis, although a later CSF culture test did not detect any pathogenic microorganism. The patient also developed sNPH following meningitis. A potential explanation for these findings is that sNPH occurred as a result of pituitary apoplexy-related non-infectious meningitis. Pituitary apoplexy is a rare condition that can occur in a macroadenoma, as well as in a normal pituitary gland or microadenoma.[1, 9] Several studies have reported that chemical meningitis can be caused by leakage of blood and necrotic debris into the subarachnoid space in some pituitary apoplexy patients.[4, 8, 11] It is well established that meningitis can cause sNPH. However, to our knowledge, there are no reports of pituitary apoplexy causing sNPH. Clinicians should be aware of potential for sNPH when treating pituitary apoplexy patients, especially in those complicated with meningitis.

The present case did not show initial gait disturbance or cognitive impairment, although CT at first admission showed enlarged lateral ventricles. This initial diagnosis may have been related to longstanding overt ventriculomegaly in adults (LOVA) without symptoms. LOVA describes a heterogeneous adult hydrocephalus, which usually has a slow progression.[3] To our knowledge, there are no reports of pituitary apoplexy causing subacute symptomatic hydrocephalus in LOVA patients, or reports of pituitary apoplexy causing ‘non-obstructive’ sNPH. Nevertheless, a recent study described a rare case of cerebral vasospasm, which is a well-known complication of aneurysmal SAH, caused by pituitary apoplexy.[2] Thus, it is possible that SAH accompanied by pituitary apoplexy may accelerate symptomatic hydrocephalus in LOVA patients.
In the present case, sNPH was successfully treated with LPS placement, although LOVA may have been present before the onset of pituitary apoplexy. Endoscopic third ventriculostomy (ETV) is generally recommended in symptomatic LOVA patients, whereas a ventriculoperitoneal shunt (VPS) can be considered if the aqueduct of Sylvius is open.[5] VPS and LPS placement are also both effective treatments for sNPH [6] in patients with an open aqueduct of Sylvius. Given that our patient, was taking anti-platelet and anti-coagulant medications for his medical conditions, we considered LPS the safer option compared with ETV or VPS. Moreover, in idiopathic normal pressure hydrocephalus (a normal pressure hydrocephalus without preceding etiologies), a lumbar puncture is used to determine whether the CSF findings are normal and whether the symptoms improve with CSF drainage.[7] Our findings support the efficacy of LPS surgery as an alternative treatment to ETV or VPS if symptoms improve following the tap test and the aqueduct of Silvius is open.

**Conclusion**

We present a unique case of sNPH following pituitary apoplexy with a possible LOVA background. Clinicians should be aware that sNPH can develop even after a small subarachnoid hemorrhage caused by a pituitary apoplexy in LOVA patients. If the aqueduct of Silvius is open, sNPH with a LOVA background can be successfully treated with LPS placement.

**Abbreviations**

CSF  
Cerebrospinal fluid  
CT  
computed tomography  
ETV  
endoscopic third ventriculostomy  
LOVA  
longstanding overt ventriculomegaly in adults  
LPS  
lumbo-peritoneal shunt  
MRI  
magnetic resonance imaging  
sNPH  
secondary normal pressure hydrocephalus  
VPS  
ventriculoperitoneal shunt.

**Declarations**

**Funding:** Not applicable.
Conflicts of interest/Competing interests: The authors have no conflict of interest to declare.

Ethics approval: No approval from our institutional review board was sought because this article is a case report.

Consent to participate: The authors obtained written informed consent from the patient.

Written Consent for publication: The authors obtained written informed consent from the patient.

Availability of data and material: not applicable

Code Availability: not applicable

Authors’ contributions: YT designed the project and wrote the draft; SF and AK collected the data; KM1, YO, NK, and KM2 aided in interpreting the imaging data; NH and SN supervised the project; all authors reviewed and approved the manuscript.

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References


Figures
Figure 1

Images on admission. (a, b) Computed tomography imaging showing a hyperdense lesion in the sella turcica (9.5 mm in diameter) (a) and slightly enlarged lateral ventricles (b). (c-f) Magnetic resonance imaging. Fluid-attenuated inversion recovery image showed a hyperintensity lesion in the cerebral peduncle that implied a hematoma (c). No cerebrovascular lesion was detected on magnetic resonance angiography (d). The coronal images showed that the sellar snowman-like lesion was hypointense on T1-weighted imaging (e) and hypointense with niveau on T2-weighted imaging (f). No vascular lesions were detected with magnetic resonance angiography (f).
Figure 2

Imaging at 3 months after symptom onset. (a) Computed tomography imaging showing the enlarged lateral ventricles, which were similar to the prior images taken at admission. His Evans index was 0.36, and the callosal angle was 54°. (b) Magnetic resonance images showed resolution of the pituitary lesion on T2-weighted imaging.