Neurol Med Chir (Tokyo) 44, 205～208, 2004

Tension Pneumocephalus After a Neuroendoscopic Procedure

—Case Report—

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Abstract

A 60-year-old female presented with gait disturbance, urinary incontinence, and recent memory disturbance. Computed tomography and magnetic resonance imaging revealed a partially calcified mass lesion without enhancement in the left caudate head and mild ventriculomegaly. She underwent endoscopic tumor biopsy. The histological diagnosis was astrocytoma grade 2. After the endoscopic procedure she presented with prolonged consciousness disturbance caused by tension pneumocephalus. Tension pneumocephalus is one of the potential complications of neuroendoscopic procedures.

Key words: tension pneumocephalus, neuroendoscope, complication

Introduction

Neuroendoscopy has rapidly become an important part of the neurosurgical armamentarium and is now used for diagnostic as well as therapeutic purposes. In particular, endoscopic third ventriculostomy has been developed as a routine intervention for obstructive hydrocephalus. Endoscopic procedures are considered to be safe and less invasive. Severe complications of neuroendoscopy are rare, but hemorrhage, infection, fever, equipment failure, and convulsions have been described.[1-13] We report a rare case of tension pneumocephalus following neuroendoscopic tumor biopsy.

Case Report

A 60-year-old woman presented with complaints of gait disturbance, urinary incontinence, and recent memory disturbance persisting for approximately 3 months. Computed tomography (CT) revealed a partially calcified mass lesion without enhancement in the left caudate head and mild ventriculomegaly (Fig. 1). T_1- and T_2-weighted magnetic resonance imaging showed the mass as hyperintense without enhancement (Fig. 2). Angiography disclosed no abnormal findings.

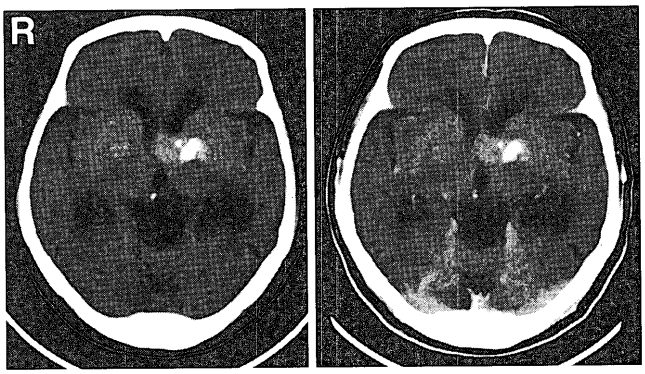

Fig. 1 Computed tomography scans showing a partially calcified mass lesion (*left*) without enhancement (*right*) in the left caudate head and mild ventricular dilation.

She underwent neuroendoscopic biopsy under general anesthesia. Anesthesia was maintained with nitrous oxide, oxygen, and propofol using intermittent positive pressure ventilation. The biportal approach was used via standard bilateral coronal burr-holes. Peelaway sheaths (14.0 French; Codman, Inc., Raynham, Mass., U.S.A.) were passed into the bilateral anterior horns of the lateral ventricle. A

Received July 22, 2003; Accepted December 15, 2003

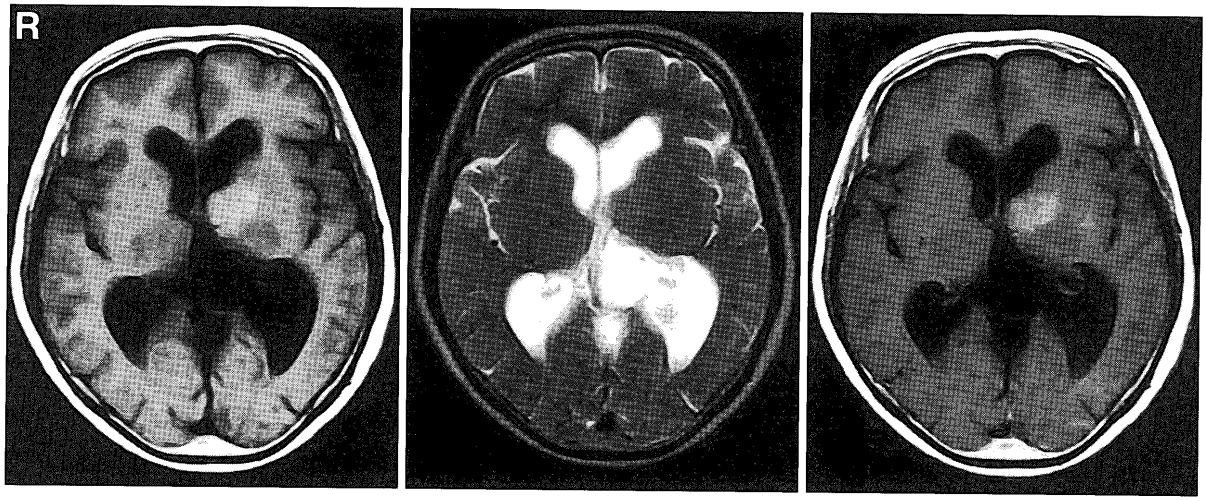

Fig. 2 T_1-weighted (*left*) and T_2-weighted (*center*) magnetic resonance images disclosing a mass lesion as hyperintense without enhancement (*right*).

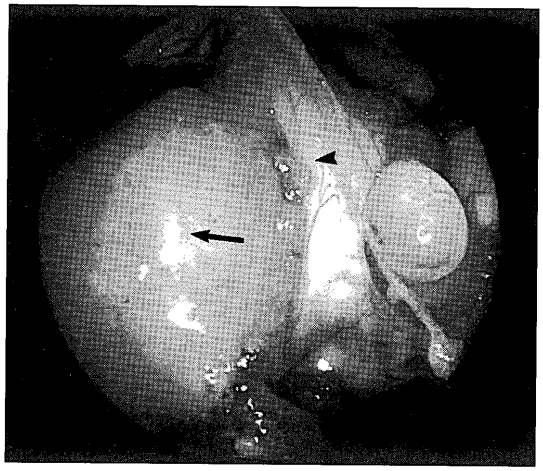

Fig. 3 Endoscopic view revealing the tumor (*arrow*) originating from the left fornix (*arrowhead*).

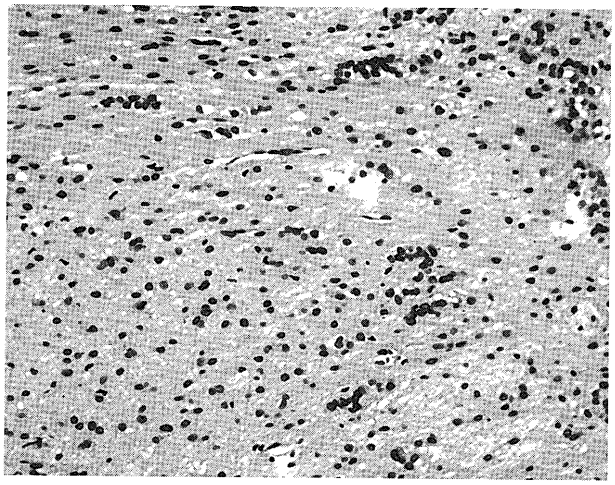

Fig. 4 Photomicrograph showing the predominantly astrocyte-like tumor cells. HE stain, ×100.

flexible fiberoptic ventriculoscope (14.0 French; Codman, Inc.) was then inserted into the ventricle through the peelaway sheath into the left anterior horn. The septum pellucidum was partially defective and the bilateral anterior horns of the lateral ventricle were in communication. The tumor originated from left fornix. The left foramen of Monro was obstructed and the right foramen was narrowed by the tumor. Therefore, we assumed that the ventriculomegaly was caused by obstructive hydrocephalus. A rigid 4-mm-diameter endoscope (Olympus Optical Co., Ltd., Tokyo) was introduced through the peelaway sheath into the left anterior horn and the tissue resected using endoscopic forceps. The lesion covered with ependyma was soft, and easily bled (Fig. 3). The bleeding was quickly stopped by adequate irrigation. External ventricular drainage (EVD) via the right anterior horn was set and irrigated adequately with Ringer solution. The entire procedure took about 2 hours.

Histological examination revealed predominantly astrocyte-like tumor cells (Fig. 4). Mitosis and necrosis were not observed. The histological diagnosis was astrocytoma grade 2.

Postoperatively she recovered from anesthesia uneventfully. Although she opened her eyes spontaneously, she could not speak or obey verbal orders. Her vital signs were stable and laboratory data

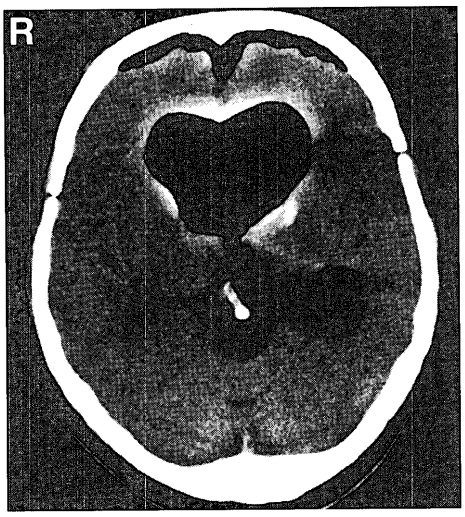

Fig. 5 Postoperative computed tomography scan showing massive intraventricular collection of air and marked dilation of the ventricular system.

including blood gas analysis revealed no abnormal findings in the perioperative course. CT immediately after the operation revealed massive intraventricular collection of air and marked ventriculomegaly (Fig. 5). The tip of the EVD was located on the body of lateral ventricle. Her consciousness disturbance was considered to be due to tension pneumocephalus. The air was gradually excluded and resorbed by resetting the EVD in the anterior horn of lateral ventricle under low pressure and moving her head. Her consciousness disturbance gradually improved as the air collection disappeared. A ventriculoperitoneal (VP) shunt was inserted 2 weeks after the first operation. The preoperative symptoms had gradually improved and she was discharged with no neurological deficit.

Discussion

Pneumocephalus and convulsions occurred after ventriculoscopy, of which the pneumocephalus was caused by the vacuum-like effect of the sudden drainage of intraventricular fluid and the diffusion of nitrous oxide.[8] Head trauma, in particular skull base fracture, infection (*Bacteroides*), and iatrogenesis (post-VP shunt, transsphenoidal surgery, chronic subdural hematoma) are all causes of tension pneumocephalus. Nitrous oxide may be a factor inducing tension pneumocephalus, but cases without using nitrous oxide are also known, so nitrous oxide may be not the crucial factor. Moreover, only collection of intraventricular air should not cause symptomatic tension pneumocephalus.

In our patient, the brain tissue was slightly atrophic considering her age. After making burr holes and cutting the dura mater, the enlarged subarachnoid space was visible. Therefore, the compliance of the brain may have decreased, resulting in collection of intraventricular air and pneumocephalus. The unsuitable setting of the EVD might be another reason for the prolonged collection of air. We performed adequate irrigation using Ringer solution, but were not able to avoid air collection. Bilateral EVD via the anterior horns and sufficient replacement of air at the end of surgery might have been effective in this case. Reciprocal action between the collection of air and low compliance of the brain can result in symptomatic pneumocephalus.

Tension pneumocephalus is a potential significant complication of neuroendoscopic procedures. Therefore, endoscopic procedures should be performed by trained and skilled neurosurgeons. Complications can be avoided or reduced by experience and training. Careful management of the perioperative course by neuroanesthesiologists is very important for endoscopic surgery.

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