Hindbrain herniation: an unusual occurrence after shunting an intracranial arachnoid cyst

Case report

MAHER I. HASOUNAH, F.R.C.S.(C), AND BENGT E. RAHM, M.D.

Department of Neurosciences, King Faisal Specialist Hospital and Research Centre, Riyadh, Saudi Arabia

The case is presented of a preoptic arachnoid cyst in a 28-year-old woman. She was treated by craniotomy, stereotactic aspiration, internal shunting, and finally by insertion of a cystoperitoneal shunt. Eight months later she developed an asymptomatic Arnold-Chiari type I malformation. The pathogenesis of this unusual hindbrain herniation is explained on the basis of the differential pressure between two compartments and cephalocranial disproportion.

KEY WORDS • arachnoid cyst • Arnold-Chiari malformation • cystoperitoneal shunt • tonsillar herniation

Caudal displacement of the hindbrain is known to occur in association with different clinical conditions such as expanding intracranial lesions and Arnold-Chiari malformation types I and II. During the past two decades, increasing attention has been given to acquired Chiari malformation, particularly when it is due to spinal subarachnoid shunting or similar conditions. Tonsillar herniation in association with ventriculoperitoneal shunting occurred in two cases reported by Hoffman and Tucker. We present a case of hindbrain herniation secondary to shunting of an intracranial arachnoid cyst.

Case Report

This 28-year-old woman presented for evaluation of headache and diplopia. Two years earlier she had been admitted to another hospital with a history of worsening bitemporal headache of a few months’ duration. Computerized tomography (CT) and magnetic resonance (MR) imaging of the head revealed a large preoptic arachnoid cyst with flattening of the ventral surface of the pons. The patient underwent a right frontotemporal craniotomy with fenestration of the preoptic arachnoid cyst; this operation was complicated when she suffered generalized convulsions. Initially, her headache was improved; however, 1 ½ years later it recurred, and she was referred to us for further management.

Examination. Examination revealed a rather obese woman who had mild bilateral abducens nerve palsies; the neurological examination was otherwise unremarkable and brain-stem auditory evoked potentials were normal. An MR image of the head revealed a large retroclival arachnoid cyst (Fig. 1 left).

Operations. On February 1, 1992, a CT-guided stereotactic aspiration of the cyst was performed by one of us (B.E.R.) through a right precoronal burr hole, and 55 ml of a clear, colorless fluid was aspirated (Fig. 1 center). An intraoperative cisternogram showed free flow of the contrast medium (iohexol) from the cyst to the spinal subarachnoid space (Fig. 2). The patient’s symptoms initially improved but then recurred after 2 months. An Ommaya reservoir was inserted stereotactically into the cyst by the same surgeon on April 27, 1992 (Fig. 1 right). Additional side holes were made in the ventricular catheter to match the third ventricle and to form an internal shunt.

The patient’s headache again recurred, and on
Hindbrain herniation due to arachnoid cyst shunting

**Fig. 1.** Midline sagittal T1-weighted magnetic resonance images. *Left:* Image obtained on admission, 2 years after craniotomy, showing a large retrocival arachnoid cyst with flattening of the ventral surface of thepons and scalloping of the clivus. The tonsils are above the level of the foramen magnum. *Center:* Image obtained 6 weeks after stereotactic aspiration. *Right:* Image obtained 1 week after stereotactic insertion of the Ommaya reservoir and internal shunting.

**Fig. 2.** Intraoperative cisternogram after stereotactic aspiration of the cyst showing free communication with the spinal subarachnoid space. The contrast material (iohexol) is visible (arrow) below the level of the foramen magnum.

September 8, 1992, the Ommaya reservoir was converted to a cistoperitoneal shunt using a low-pressure distal slit valve (Fig. 3). Examination of cerebrospinal fluid (CSF) consistently showed a protein content of less than 120 mg/liter (normal range 150 to 450 mg/liter).

**Postoperative Course.** Eight months later the patient was symptom-free. Magnetic resonance imaging of the head revealed the disappearance of the arachnoid cyst, expansion of the pons, and tonsillar herniation (Fig. 3 right).

**Discussion**

Retrocival (preptine) arachnoid cysts are the least common of all intracranial arachnoid cysts.\(^{10,11,12}\) Conventional surgical treatment of these cysts involves craniotomy and fenestration of the wall to allow communication with major CSF cisterns or insertion of a cistoperitoneal shunt; both methods may be used in some cases. In our case craniotomy, in addition to being ineffective, was associated with complications. Other authors have reported similar experiences with a variable degree of morbidity.\(^{5,7,12,18}\)

Stereotactic aspiration of the cyst may have only a temporary effect. It is assumed that the collapse of the cyst after aspiration causes a tear in the arachnoid wall and opens a drainage channel. In the case reported here this mechanism allowed the contrast material to pass from the cyst to the spinal subarachnoid space. This direction of flow was believed to be transient and was later either sealed or replaced by a reversed one-way flow from the spinal subarachnoid space to refill the cyst.

Internal shunting from the cyst to the ventricles or to the subarachnoid space is another alternative for treatment.\(^{21,22}\) Elevation of the herniated tonsils and improvement of symptoms have been documented in a few cases following different methods of treatment.\(^{1,5,16,20}\)

After attempting three different treatment modalities, we found that a cistoperitoneal shunt was effective in decompressing the arachnoid cyst and relieving our patient's symptoms. Venes, et al.\(^{15,19}\) reported a patient with precocious puberty due to a preptine arachnoid cyst who responded to a stereotactically placed cistoperitoneal shunt after a suboccipital craniectomy and

---

*J. Neurosurg.* / Volume 81 / July, 1994 127
fenestration were attempted. Cystoperitoneal shunting has been recommended as a primary treatment by several authors for most infratentorial arachnoid cysts, since it is safer and more efficacious than craniotomy.7,8,11,12,13

The case we present here is intriguing in that the hindbrain displacement did not occur in the presence of the large preponite arachnoid cyst; it took place after shunting of the cyst. This reverse mechanism for hindbrain displacement has not been reported before. The patient has been asymptomatic from this herniation. It is evident from the intraoperative cisternogram that the preponite arachnoid cyst communicated with the spinal subarachnoid space following aspiration. Both spaces can be considered as one functional unit. Shunting this space from its rostral end will result in a pressure difference between the cranial and the spinal compartments. According to the differential pressure hypothesis put forward by Williams,13 hindbrain displacement is likely to occur. This acquired disorder is similar to the tonsillar herniation caused by lumbo-peritoneal shunting.2,3,16,20 The incidence of tonsillar herniation was 70% in the 143 patients treated with placement of a lumbo-peritoneal shunt who were reviewed by Chumas, et al.,2,3 and 4.2% of these were asymptomatic. Another mechanism that may have contributed to the hindbrain herniation in this case was the re-expansion of the neural tissue within the confines of the posterior fossa after the cyst was drained. The cephalocranial disproportion proposed by Hoffman and Tucker3 can be applied here, although not secondary to craniosynostosis but due to normal neural tissue expansion.

In conclusion, we agree that stereotactic placement of a cystoperitoneal shunt is precise, effective, and associated with fewer complications in these deep-seated cysts. The hindbrain herniation presented here is only an imaging finding at this time and is unique to this particular case. Longer follow-up evaluation will show whether syringomyelia will develop. A review of more cases of similar cysts will enable us to draw further conclusions.

References

Hindbrain herniation due to arachnoid cyst shunting


Manuscript received June 6, 1993.

Address reprint requests to: Maher I. Hassounah, M.D., Department of Neurosciences, King Faisal Specialist Hospital and Research Centre, Riyadh 11211, Saudi Arabia.