Cerebellar hemorrhage complicating temporal lobectomy

Report of four cases

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Cerebellar hemorrhage following supratentorial craniotomy is a rare occurrence. In a review of the literature, we were able to identify only 12 cases\(^6,9,11,13\) and none of these was described in the setting of a temporal lobectomy. The possible etiologies for cerebellar hemorrhage in the four cases presented are examined, including the role of epidural suction drains and the position of the head during surgery. The mechanism of cerebellar hemorrhage in this series of patients is probably multifactorial. Special attention throughout the perioperative course must be given to hemodynamic, anatomical, and physiological factors that together can affect the patient negatively.

**KEY WORDS** • epilepsy • temporal lobectomy • cerebellar hemorrhage • supratentorial craniotomy

Case Reports

**Case 1**

This 29-year-old man had a history of medically refractory complex partial seizures that began when he was 14 years of age. The patient’s medical history was significant for an electrical injury with loss of consciousness of unknown duration that he sustained when he was 12 years of age.

**Examination.** The patient underwent an extensive evaluation for epilepsy surgery including: video/electroencephalographic monitoring, neuropsychological testing, magnetic resonance (MR) imaging of the brain using a special temporal lobe protocol, intracarotid amobarbital testing and cerebral angiography, and positron emission tomography (PET) scanning. All these parameters, with the exception of PET scanning and MR imaging, which were within normal limits, indicated a right temporal lobe seizure focus, and the patient was referred for a right anterior temporal lobectomy.

The patient’s preoperative prothrombin time (PT), activated partial thromboplastin time (aPTT), international normalized ratio (INR), and platelet count were within normal limits. The patient was given carbamazepine monotherapy preoperatively.

**Operation.** On October 30, 1991, while supine with his head turned to the left, the patient underwent a craniotomy for a right anterior temporal lobectomy. Surgery was completed without complications. Histological examination of the surgical specimen revealed mild gliosis. At the end of the operation, a No. 7 Jackson–Pratt drain was placed in the patient’s epidural space and attached to bulb suction. Six hours after surgery, a total of 215 ml of fluid was drained. The drain was clamped and removed the following morning.

**Postoperative Course.** Postoperatively, the patient showed no seizure activity and his blood pressure was maintained within the normal range. He progressed well until postoperative Day 4, when he began to complain of a severe headache. The patient was otherwise stable neurologically and on postoperative Day 5, after adequate pain control had been achieved with a course of ketorolac,
the patient was discharged home. Later that evening, the patient began to complain of “the worst headache” of his life, which was located in the occipital region and associated with nausea and vomiting. He was brought to the emergency department on the morning of postoperative Day 6, at which time a computerized tomography (CT) scan of his head revealed a left cerebellar hemispheric and nodular hemorrhage (Fig. 1). His blood pressure at that time was 156/96 mm Hg and his PT, aPTT, INR, and platelet count were all within normal limits. On neurological examination, the patient had a mild dysmetria in his left upper and lower extremities. The patient gradually improved without surgical intervention and by his 6-week follow-up visit, his neurological examination was normal.

Case 2

This 52-year-old man had had a history of complex partial seizures since he was 30 years of age.

Previous Examination and Therapy. An MR image of the patient’s brain, performed in 1993, revealed a left temporal mass. This was resected in February 1994, omitting resection of the mesial temporal structures because of the patient’s poor memory function. Histological examination of the tumor yielded findings consistent with a ganglioglioma. Seizure frequency decreased after tumor resection. However, following an extensive postsurgical evaluation, the patient later underwent resection of the mesial temporal structures to achieve better seizure control.

Examination. The patient’s medical history was significant for hypothyroidism and remote polysubstance abuse. The medications the patient was using on admission included phenytoin and levothyroxine. Preoperative laboratory values, including liver function tests, PT, aPTT, INR, and platelet count were all within normal limits, except for a phenytoin level of 32.6 µg/ml. On examination, the patient had some gait unsteadiness. The phenytoin treatment was withheld and on the day of surgery its level was 5.6 µg/ml. The patient was given an intravenous 1-g bolus of phenytoin after surgery.

Operation. On October 25, 1994, while supine with his head turned to the right, the patient underwent a craniotomy for completion of a left 4.5-cm anterior temporal lobectomy with microscopic amygdalohippocampectomy. Surgery was without complications. Histological examination of the surgical specimen yielded findings consistent with mesial temporal sclerosis. At the end of the operation, a No. 7 Jackson–Pratt drain was placed in the epidural space and attached to bulb suction. Approximately 6 hours after surgery, a total of 455 ml of fluid was drained. The Jackson–Pratt drain was removed on the morning of postoperative Day 1.

Postoperative Course. In the immediate postoperative period, the patient required esmolol and nipride to maintain a mean arterial pressure (MAP) between 70 and 90 mm Hg. The patient’s highest recorded MAP postoperatively was 137 mm Hg; otherwise his MAP ranged between 60 and 100 mm Hg. During surgery, the patient’s MAP ranged between 55 and 105 mm Hg.

On postoperative Day 1, the patient began to complain of a severe headache. He also had a phenytoin level of 54 µg/ml. The following day, he exhibited ataxia, slurred speech, and nystagmus in all directions of gaze. His phenytoin level was 40 µg/ml. Although these findings were considered consistent with phenytoin toxicity, a CT scan of the patient’s head was obtained that revealed a cerebellar hemorrhage in the vermis with extension superiorly (Fig. 2). Repeat PTs, aPTTs, INRs, and platelet counts were normal. The patient had no seizure activity and his case could be managed without surgical intervention.

At discharge, the patient was ataxic but was able to ambulate with a walker and assistance. He had dysmetria more in the left than right extremities and his speech, although still slurred, was improving. By January 1995, the ataxia, dysarthria, and dysmetria had resolved.

Case 3

This 38-year-old man had a history of complex partial seizures that had secondarily generalized since he was 33 years of age. His medical history was significant in that he experienced an episode of Hemophilus influenza type B meningitis at the age of 9 months.

Examination. An MR image of the brain obtained as part...
of an evaluation for epilepsy surgery revealed right mesial temporal sclerosis and atrophy. The remaining parameters of an extensive presurgical evaluation, which also included ictal single-photon emission CT scanning, indicated a right temporal lobe seizure focus. The patient was referred for a right anterior temporal lobectomy.

Preoperative laboratory values including PT, aPTT, INR, and platelet count were all within normal limits. The patient’s course of medications on admission included phenytoin and gabapentin.

Operation. On July 11, 1995, while supine with his head turned to the left, the patient underwent a craniotomy for right temporal lobectomy including the hippocampus and amygdala. Surgery was without complications. Histological findings were consistent with hippocampal gliosis. At the end of the operation, a No. 7 Jackson–Pratt drain was placed in the patient’s epidural space and attached to bulb suction. Approximately 6 hours after surgery, a total of 460 ml of fluid was drained. An additional 65 ml was drained overnight, and the Jackson–Pratt drain was removed the next morning.

Postoperative Course. Postoperatively, the patient was without seizures and his MAP was within normal limits. On the morning of postoperative Day 1, the patient began to complain of a severe headache and was noted to be very lethargic. A CT scan of his head revealed a large right cerebellar hemispheric hemorrhage (Fig. 3). A ventriculostomy drain was placed to treat moderate hydrocephalus.

Examination. An MR image of the brain revealed right hippocampal atrophy. After completing an extensive evaluation for epilepsy surgery, the parameters of which indicated a right temporal lobe seizure focus, he was referred for a right anterior temporal lobectomy.

The patient’s course of medications included carbamazepine, divalproex sodium, and gabapentin. Preoperative laboratory values, including PT, aPTT, INR, platelet count, and liver function tests, were all within normal limits. The valproic acid level was 69.5 μg/ml and the carbamazepine level was 7.6 μg/ml.

Operation. On July 26, 1995, while supine with his head turned to the left, the patient underwent a craniotomy for right anterior temporal lobectomy. Surgery was performed without complications. Histological examination revealed gliosis and increased corpora amylacea. At the end of the operation, a No. 7 Jackson–Pratt drain was placed in the patient’s epidural space and attached to bulb suction. On the day of surgery, a total of 290 ml of fluid was drained.

Postoperative Course. On postoperative Day 1, the patient was somnolent and on examination had a left upper quadrant field cut and a mild pronator drift. A CT scan of the head revealed a bilateral intraparenchymal cerebellar hemispheric hemorrhage (Fig. 4). There were no postoperative seizures and MAPs throughout the operative and postoperative period were all within normal limits.

At discharge on August 3, 1995, the patient could ambulate with a walker and had dysmetria more in the left than in the right extremities. Approximately 2 weeks later, his neurological examination was completely normal except for mild horizontal nystagmus.

Discussion

Postoperative hemorrhage in a location remote from the operative site as a complication of intracranial surgery is a rare occurrence. In a survey of 4992 intracranial procedures performed over an 11-year period, found only seven of 40 cases of postoperative hemorrhage in which the hemorrhage occurred in a loca-
Cerebellar hemorrhage complicating temporal lobectomy

TABLE 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Case 4</th>
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<tbody>
<tr>
<td>age (yrs), sex</td>
<td>29, M</td>
<td>52, M</td>
<td>38, M</td>
<td>17, M</td>
</tr>
<tr>
<td>operation</td>
<td>rt craniotomy/ATL</td>
<td>lt craniotomy/ATL</td>
<td>rt craniotomy/ATL</td>
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<td>pathological finding</td>
<td>mild gliosis</td>
<td>mesial temporal sclerosis</td>
<td>hippocampal gliosis</td>
<td>glisss/increased corpora amyelae</td>
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<td>coagulation studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>preop</td>
<td>WNL</td>
<td>WNL</td>
<td>WNL</td>
<td>WNL</td>
</tr>
<tr>
<td>at time of cerebellar hemorrhage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lesion in cerebellum on preop MR image</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>history of hypertension</td>
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<td>no</td>
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<tr>
<td>medication</td>
<td>carbamazepine</td>
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<td>phenytoin, gabapentin</td>
<td>carbamazepine, gabapentin, divalproex sodium</td>
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<td>intraop hypertension (MAP &gt;113 mm Hg)</td>
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<td>no</td>
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<tr>
<td>postop hypertension (MAP &gt;113 mm Hg)</td>
<td>no</td>
<td>yes†</td>
<td>no</td>
<td>no</td>
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<tr>
<td>position during surgery</td>
<td>supine, head turned to rt</td>
<td>supine, head turned to rt</td>
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<td>supine, head turned to rt</td>
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<tr>
<td>epidural drain</td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>fluid drained within 6 hrs</td>
<td>215 ml³</td>
<td>455 ml³</td>
<td>460 ml³</td>
<td>290 ml³</td>
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<td>time cerebellar hemorrhage discovered</td>
<td>POD 6</td>
<td>POD 2</td>
<td>POD 1</td>
<td>POD 1</td>
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<tr>
<td>location of hemorrhage within cerebellum</td>
<td>lt hemisphere</td>
<td>vermis &amp; bilat hemisphere</td>
<td>rt hemisphere</td>
<td>bilat hemisphere</td>
</tr>
</tbody>
</table>

* ATL = anterior temporal lobectomy; MAP = mean arterial pressure; MR = magnetic resonance; POD = postoperative day; WNL = within normal limits.
† Highest recorded postoperative MAP was 137 mm Hg.

surgery and none had evidence of a cerebellar tumor or vascular malformation.

Another possible mechanism leading to cerebellar hemorrhage in these cases, proposed by Yoshida and colleagues, and by König, et al., suggests the amount of cerebrospinal fluid (CSF) drained postoperatively. In the series of cases described by Yoshida and colleagues, all three patients obtained epidural drains that were attached to negative suction. The authors suggest that overdrainage in the postoperative period, which can easily occur if the drain is attached to negative suction (especially if there is considerable subdural dead space created during surgery) can lead to a downward displacement of the cerebellum, which can cause stretching and possible tearing of the superior vermiian veins and their tributaries. As Yoshida and colleagues point out, when the patient is supine, these veins appear to run along the cerebellar tentorial surface in an almost perpendicular plane as if suspended from the vein of Galen. Königs et al., suggest that a reduction in intracranial pressure, induced by the removal of a supratentorial space-occupying mass coupled with postoperative CSF drainage, can lead to a critical increase in the transmural pressure of veins and venules, leading to possible hemorrhage.

Another consideration in this series of patients is the positioning of the head during surgery. All of our patients had their head turned to the side, which, if hyperextended, could have caused a relative obstruction of the ipsilateral jugular vein, leading to a further increase in venous pressure, especially if it was the dominant jugular vein being obstructed.

The mechanism of cerebellar hemorrhage in this series of patients is probably multifactorial and venous in origin, as discussed above. Special attention throughout the peri-
operative course must be given to hemodynamic, anatom-
ical, and physiological factors that together can affect the
patient negatively. Given these concerns and our experi-
ence with the cases described in this report, we no longer
use an epidural suction drain and are very careful not to
rotate the head excessively on the neck in positioning the
patient for surgery. We also try to taper off the use of
divalproex sodium, where applicable and if possible, at
least 2 weeks prior to surgery.

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