Clinicopathological Study of Pontine Hemorrhage

KENJI NAKAJIMA, M.D.

SUMMARY This report concerns a clinico-pathological study of 60 patients afflicted with primary pontine hemorrhage. The illness was fatal in 43; 17 patients survived. Ophthalmic signs, autonomic disturbances and transient visual hallucination were observed and discussed. A ruptured microaneurysm within the border of a pontine hematoma was detected in this study, and in the first report of such a finding.

Stroke Vol 14, No 4, 1983

REPORTED SERIES of pontine hemorrhage published between 1951 and 1968 described its incidence as varying from 6–22% of intracerebral hemorrhage. Most of these reported cases were fatal; recent reports utilizing the CT scan for diagnosis have indicated that some cases of pontine hemorrhage may show good recovery.

This report consists of a clinical and pathological analysis of 60 patients in whom survival occurred in 28.3%.

Clinical Material and Methods

A retrospective review of intracerebral hemorrhage was conducted in the Research Institute for Brain and Blood Vessels in Akita. The diagnosis of pontine hemorrhage was confirmed by autopsy, by evacuation of the hematoma (one patient) or by CT scanning; in the absence of this confirmatory evidence patients were not included even though strongly suggested from neurological symptoms and angiographic findings.

From the Department of Neurology, Research Institute for Brain and Blood Vessels-Akita, Akita, Japan.

Address correspondence to: Kenji Nakajima, M.D., Department of Neurology, Research Institute for Brain and Blood Vessels-Akita, Akita, Japan.

Received December 2, 1982; revision accepted February 28, 1983.

Results

Incidence

During the period April 1969–July 1982, 1033 patients with primary intracerebral hemorrhage were diagnosed in the Institute, 60 of whom suffered pontine hemorrhage—a incidence of 5.8%. Forty-nine were male and eleven were female. Ages ranged from 33 to 77, with a mean age of 51.1 years.

Clinical Manifestations

The clinical pictures are summarized in table 1 and 2. Forty-three of 60 patients died. Twenty-four were diagnosed before the availability of CT; all of these patients fell into coma within 6 hours after the onset and all died. The remaining 36 patients were diagnosed subsequent to the availability of the CT scanner; 19 patients died and the remaining 17 are alive, one patient in a state of coma vigil, while the remaining 16 surviving patients are well. In fatal cases, severe disturbance of consciousness, headache, vertigo, motor disturbance and vomiting were the main symptoms at onset. Severe disturbance of consciousness was never observed in non-fatal cases; they were featured by motor disturbance, headache and vertigo.

Ninety-three percent of fatal cases fell into coma...
within three hours of the onset; about half of the survivors showed no disturbance of consciousness and the other half declined into stupor.

A previous history of hypertension was obtained in 76.7% of fatal patients and 76.5% of survivors. Other risk factors were not present in significant numbers. Hypertension was recorded on admission in both fatal and non-fatal groups; 5 patients (11.7%) in the fatal
group showed normal blood pressure at the time of admission, while 4 of 17 non-fatal patients (23.5%) showed normal pressure. A level of systolic blood pressure ranging from 200 to 250 mm Hg was mostly seen in patients with a fatal outcome while in the non-fatal group 150–200 mm Hg of systolic pressure was most frequent. Pressures over 250 mm Hg were seen in 3 patients, all in the fatal group.

Respiratory changes were observed frequently in the fatal group of patients. Six patients (14.0%) only showed regular rhythm of respiration on admission; irregular respiration was observed in 26 patients (60.5%), Cheyne-Stokes respiration was observed in 3.

Hyperthermia was seen only in fatal cases. Sixteen of 43 patients (37.2%) had body temperatures of over 40°C at the time of admission. Duration of life in patients with hyperthermia varied from 12 hours to 34 days (mean 5.7 days). One patient had hypothermia and the temperature did not exceed 35.5°C. He died 5 hours after admission. Three patients were moribund on admission, so that body temperature could not be checked. The remaining 23 fatal patients showed normothermia and their duration of life varied from 6 hours to 3 years and 4 months (mean 155 days).

With the exception of disturbance of consciousness, motor signs were the most prevalent symptoms in pontine hemorrhage. There was a considerable difference in the motor disturbance between the fatal and non-fatal patients. Paralysis of all four extremities was most common in the fatal cases (62.8%), hemiplegia and decerebrate posture were of equal incidence

---

Table 1

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Clinical Summary of Fatal Cases (43)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed by CT</td>
<td>19</td>
</tr>
<tr>
<td>Age average</td>
<td>50.0 y (range 33–67)</td>
</tr>
<tr>
<td>Sex male</td>
<td>37</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
</tr>
</tbody>
</table>

Presenting symptoms:
- Coma: 20 (46.5%)
- Headache: 10 (23.3%)
- Vertigo: 10 (23.3%)
- Hemiparesis: 6 (14.0%)
- Dysarthria: 3 (7.0%)
- Nausea and vomiting: 2 (4.7%)
- Convulusion: 2 (4.7%)
- Facial palsy: 1 (2.3%)

Onset of coma:
- Immediate: 20 (46.5%)
- ~3 hr: 20 (46.5%)
- 3 hr ~: 3 (7.0%)

Considered hypertensive by history: 33 (76.7%)

Blood Pressure on Admission:
- Normotensive (under 150 mmHg of systolic pressure): 5 (11.7%)
- ~200 mmHg of systolic pressure: 13 (30.2%)
- 200 ~ 250 mmHg: 19 (44.2%)
- 250 mmHg ~: 3 (7.0%)

(three patients died or almost died on admission)

Respirations on admission:
- Regular: 6 (14.0%)
- Irregular: 26 (60.5%)
- Dyspnea (Apnea): 11 (25.6%)

Body temperature on admission:
- Hyperthermia (over 40°C): 16 (37.2%)
- Hypothermia (35.5°C): 1 (2.3%)

Motor signs on admission:
- Tetraplegia: 27 (62.8%)
- Hemiplegia: 8 (18.6%)
- Decerebrate: 8 (18.6%)

Eye signs on admission:
- Anisocoria: 13 (30.2%)
- Pinpoint pupils: 11 (25.6%)
- Ocular bobbing: 9 (20.9%)
- Mydriasis: 5 (11.6%)
- Skew deviation: 4 (9.3%)
- MLF: 1 (2.3%)
- Nystagmus: 1 (2.3%)

Duration to death:
- (immediately after onset — 3 y 4 M):
  - ~ 1 week: 28 (65.1%)
  - 1 ~ 2 weeks: 5 (11.6%)
  - 2 weeks ~ 6 months: 4 (9.3%)
  - 6 months ~: 6 (14.0%)
In non-fatal cases, the most common motor disturbance was hemiplegia (58.8%), and no decerebrate posturing was observed.

There was close correlation between the duration of life and the onset of motor disturbance in fatal cases; patients who showed decerebrate posturing on admission died within 13 days of the onset (mean 4.8 days), the shortest duration was 6 hours. In the 27 patients presenting with tetraplegia, 5 patients lived over a year. Apart from these 5, the mean duration of survival was 6.6 days. Six patients in the fatal group presented with hemiplegia; the mean duration of life was 13.0 days with the exception of one patient who survived for 1 year and 4 months.

A variety of eye signs were observed. Pinpoint pupils have been considered characteristic of acute pontine hemorrhages, but in fatal and non-fatal cases, pinpoint pupils were observed in only 25.6% and 11.8% respectively. Ocular bobbing was observed in 6 of 17 (35.3%) non-fatal cases, in some of them the phenomenon lasted for no more than a few hours.

Thirteen of 43 fatal patients (30.2%) and one of 17 non-fatal patients (5.9%) had tarry stools and/or hematemesis. Bloody CSF was one of the most valuable diagnostic signs before the CT scan became available. Twenty of 21 fatal patients (95.2%) cases and 5 of 7 non-fatal patients (71.4%) had bloody CSF.

Signs of autonomic nerve dysfunction such as neurogenic bladder and abnormal sweating were seen in mild cases. Neurogenic bladder was observed in 5 patients in the non-fatal group. Abnormal sweating was observed in 7 of 17 of the non-fatal patients (41.2%). Extraordinary sweating was present in one case on the half of the face contralateral to the side of the pontine hematoma (fig. 1). Abnormally diminished sweating, however, occurred on the side ipsilateral to the hematoma.

Hallucinations occurred in 8 of the mild cases of pontine hemorrhage. The clinical pictures are summarized in table 3.

Autopsy Studies

Thirty-eight autopsies were done in 43 fatal cases, an autopsy rate of 88.4%. The size and extent of hematoma proved by an autopsy in 24 primary pontine hemorrhages prior to CT utilization are shown in figure 2.

From the microscopic observations, the hematoma was located mainly in the mid-portion of the tegmentum and in the midportion of the pons. Most showed hematoma breaking into the 4th ventricle (21 of 24 cases) and rupture toward the clivus was seen only in 4 cases which were accompanied as well by hematoma rupturing into the 4th ventricle. Downward extension of the hematoma (to the medulla oblongata) was seen only in one case, while upward extension (to the mid-

---

**TABLE 2 (Continued)**

<table>
<thead>
<tr>
<th>CSF examination (performed in 7 cases)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>bloody</td>
<td>5 (71.4%)</td>
</tr>
<tr>
<td>clear</td>
<td>2 (28.6%)</td>
</tr>
<tr>
<td>pressure</td>
<td></td>
</tr>
<tr>
<td>normal</td>
<td>1</td>
</tr>
<tr>
<td>150 ~ 200 mmHg</td>
<td>2</td>
</tr>
<tr>
<td>Visual hallucination</td>
<td>1</td>
</tr>
<tr>
<td>Neurogenic bladder</td>
<td>5</td>
</tr>
<tr>
<td>Abnormal sweating</td>
<td>7</td>
</tr>
<tr>
<td>Outcome — alive</td>
<td></td>
</tr>
<tr>
<td>vegetative</td>
<td>1</td>
</tr>
<tr>
<td>assisted existence</td>
<td>5 (29.4%)</td>
</tr>
<tr>
<td>self-managed existence</td>
<td>7 (41.2%)</td>
</tr>
<tr>
<td>full recovery</td>
<td>4 (23.5%)</td>
</tr>
</tbody>
</table>

---

**TABLE 2 Clinical Summary of Nonfatal Cases (17)**

<table>
<thead>
<tr>
<th>Confirmed by CT</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age average</td>
<td>56.5 y (range 37 ~ 77)</td>
</tr>
<tr>
<td>Sex</td>
<td>male 12 female 5</td>
</tr>
</tbody>
</table>

Presenting symptoms

- hemiparesis: 7 (41.2%)
- headache: 6 (35.3%)
- vertigo: 5 (29.4%)
- nausea and vomiting: 3 (17.6%)
- paresthesia: 3 (17.6%)
- dysarthria: 1 (5.9%)
- facial palsy: 1 (5.9%)

Onset of coma

- immediate: 0
- ~ 3 hr: 2 (11.8%)
- ~ 24 hr: 2 (11.8%)
- Until stupor: 5 (29.4%)
- alert: 8 (47.1%)

Considered hypertensive by history: 13 (76.5%)

Blood pressure on admission

- normotensive (under 150 mmHg of systolic pressure): 4 (23.5%)
- ~ 200 mmHg: 8 (47.1%)
- 200 ~ 250 mmHg: 5 (29.4%)
- 250 mmHg ~ of systolic pressure: 0

Respiration on admission

- regular: 15 (88.2%)
- irregular: 2 (11.8%)

Motor signs on admission

- hemiplegia (paresis): 10 (58.8%)
- tetraplegia: 3 (17.7%)
- hemiweakness: 3 (17.7%)
- decerebrate: 0

Eye signs on admission

- ocular bobbing: 6 (35.3%)
- MLF: 4 (23.5%)
- anisocoria: 3 (17.6%)
- pinpoint pupils: 2 (11.8%)
- skew deviation: 2 (11.8%)
- nystagmus: 2 (11.8%)
- Gastro-intestinal bleeding: 1 (5.9%)
Evidence of Ruptured Vessels in the Pons

Evidence of the site of ruptured vessels was sought in the freshly removed brain. An opaque medium (mipaque) was injected into the vertebral artery on one side, after the opposite vertebral artery was ligated. Care was taken not to press the syringe forcibly so as to prevent the rupture of the arterioles of the surface of the brain. Almost half of the cases subjected to this technique were excluded due to unsatisfactory technique.

Coronal or sagittal slices of approximately 5 mm thickness were prepared for softex photos (fig. 3). Some of the material was cleared in tetrahydronaphthalene and examined under magnification. A microaneurysm was observed in the one vessel within the border of a hematoma (fig. 4a). The media tunica vasorum was degenerate or had disappeared but the intima was thickened. Fibrinoid substance was infiltrated within the adventitia. Abundant perivascular erythrocytes were clearly seen. The parent artery had a diameter of 30 μ; the microaneurysm had a diameter of 100 μ (fig. 4b).

Discussion

Steegman9 reported 17 patients with pontine hemorrhage, most accompanied by sudden loss of consciousness. In Epstein's1 report, 5 patients became comatose within 15 minutes of the onset, one patient remained drowsy, one patient was found comatose. Kanaya10 concluded from his case analysis of 8 patients that pontine hemorrhage was characterized by rapidly fatal outcome. Seven of his eight patients died within 7 days. Considering that these reports were made before the CT scan, such results reflect the state of the diagnostic ability from that period.

The CT scan detects a small hematoma, even in the brainstem (fig. 5a) and in large lesions demonstrates

<table>
<thead>
<tr>
<th>Case</th>
<th>Age, sex</th>
<th>Clinical symptoms</th>
<th>Site of hematoma (CT)</th>
<th>Interval from onset to hallucinations (days)</th>
<th>Duration of hallucinations (days)</th>
<th>Contents of hallucinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>46, M</td>
<td>lt. hemiparesis</td>
<td>rt. lateral</td>
<td>10</td>
<td>3</td>
<td>&quot;Green horse carriage in the morning&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>involved cranial nerves</td>
<td></td>
<td></td>
<td></td>
<td>&quot;no horses were seen&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lt. N5, N7, rt. N6</td>
<td></td>
<td></td>
<td></td>
<td>&quot;it might depend on my sickness&quot;</td>
</tr>
<tr>
<td>2.</td>
<td>58, F</td>
<td>lt. hemiparesis</td>
<td>rt. anterolateral</td>
<td>8</td>
<td>7</td>
<td>&quot;about 3 o'clock in the afternoon, a black and white striped serpent was seen on the wall of the building&quot;</td>
</tr>
<tr>
<td>3.</td>
<td>52, F</td>
<td>lt. hemiplegia</td>
<td>rt. tegmentum</td>
<td>9</td>
<td>2</td>
<td>&quot;broken red kettle hanging from the ceiling&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>involved cranial nerves</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>lt. N3, N5, rt. N7, N8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>65, M</td>
<td>lt. hemiparesis</td>
<td>bilat. tegmentum</td>
<td>18</td>
<td>12</td>
<td>&quot;houses of the patient's neighbours&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>involved cranial nerves</td>
<td></td>
<td></td>
<td></td>
<td>&quot;roofs of houses were dark brown&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lt. N5, N7, N8, rt. N8</td>
<td></td>
<td></td>
<td></td>
<td>&quot;many fish on the wall of the hospital room&quot;</td>
</tr>
<tr>
<td>5.</td>
<td>39, M</td>
<td>lt. Millard Gubler</td>
<td>bilat. tegmentum</td>
<td>3</td>
<td>7</td>
<td>&quot;women in black dress were standing in the grave&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rt. hemianalgiesia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>59, M</td>
<td>tetraplegia ataxia</td>
<td>bilat. midportion</td>
<td>50</td>
<td>14</td>
<td>&quot;brown colored water sprites are standing on my bed. They have saucers on their heads&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&quot;three children also came to my bed&quot;</td>
</tr>
<tr>
<td>7.</td>
<td>68, F</td>
<td>rt. hemiplegia</td>
<td>bilat. basis pontis</td>
<td>3</td>
<td>1</td>
<td>&quot;a house was seen in which a green mosquito net was put up&quot;</td>
</tr>
<tr>
<td>8.</td>
<td>60, M</td>
<td>lt. hemiparesis</td>
<td>bilat. midportion</td>
<td>7</td>
<td>3</td>
<td>&quot;two white dogs&quot;</td>
</tr>
</tbody>
</table>
rupture into the fourth ventricle (fig. 5b). Otherwise the diagnosis may be mistakenly made of cerebral infarction or cerebral hematoma in other regions or even a transient ischemic attack or a reversible ischemic neurological deficit. The patient with little or delayed loss of consciousness is more often diagnosed correctly in the CT era as afflicted with pontine hemorrhage. This difference in the ability to make the diagnosis with accuracy is reflected in the pre-CT era incidence compared with the post-CT era.

Among 17 non-fatal cases, 11 mild cases (full recovery or self management at the point of discharge) could be identified in this series. In most patients with mild symptoms consciousness returned within 2-3 days but one patient did not recover consciousness for 35 days. Destruction or compression of the ascending reticular activating system (ARAS) in the pons might cause the disturbance of consciousness. Since the structure of the ARAS are in juxtaposition to the cranial nerve nuclei in the dorsal part of the pons, it was not surprising that patients with marked disturbances of consciousness had many cranial nerve signs.

Sixty-five percent of Steegman's 17 fatal patients exhibited complete or incomplete respiratory failure, and of the 5 cases with complete respiratory failure 4 had massive hematoma in the pons. Death occurred in these patients after 2 hours to 6 days. Among Epstein's 7 patients, all fatal, 3 had Cheyne-Stokes respiration. In one exceptional patient, in which Cheyne-Stokes respiration was observed on admission, it persisted 24 hours to be replaced gradually by regular respiration and survival.

In the present series respiratory changes were common, especially in the fatal cases. Eighty-six percent of the latter exhibited abnormal respiration on admission. There was close correlation between the site and the extension of the hematoma in the pons and the appearance of abnormal respiration. By contrast with pontine hemorrhage, 35 patients in this institution with cerebellar hemorrhage, of whom 11 were in a coma-
In all of these patients, the temperature abnormality developed between 8 to 10 hours after the onset of the hemorrhage.

When abnormal sweating was encountered, it usually accompanied signs of a mild amount of pontine hemorrhage, with the hematoma located on one side of the pons. With localized hematoma, the mode of abnormal sweating was of interest: one type was hypo- or anhidrosis on the ipsilateral side of the body, including the face, and another type had hyperhidrosis on the contralateral side of the face and upper body.
Ocular bobbing, consisting of a fast downward jerking of eyes and a slow drift back to the primary position was first described by Fisher, in two patients with thrombosis of the basilar artery and one patient with hypertensive pontine hemorrhage. Nelson et al reported four other fatal patients with this phenomenon, all associated with severe pontine hemorrhage. In this series, ocular bobbing was more frequently observed in non-fatal cases than fatal cases; 6 of 17 patients (35.3%) and 9 of 43 patients (20.9%) respectively. Three other patients who had exhibited ocular bobbing with survival have been reported: one had a pontine arteriovenous malformation, and the other a pontine hemorrhage. The mechanism of ocular bobbing is not clear.

Pontine destructive lesions are thought to be essential for the ocular bobbing, the pontine pathways for horizontal gaze selectively damaged, with preservation of the more rostral input for vertical gaze. One patient in our series with ocular bobbing has already been reported in which ocular bobbing appeared during an alpha coma pattern and disappeared during a subsequent spindle coma EEG pattern. From this observation we have concluded that the mechanism of ocular bobbing must be considered in relation to both the pontine and midbrain structures. If the pontine lateral gaze center is selectively destroyed and the surrounding tissue remains intact, the eyes cannot move in a horizontal direction but move only in a vertical manner. The change on EEG supports this speculation. Susac et al and Bosch et al have reported patients with ocular bobbing associated with cerebellar hemorrhage, presumably with secondary pontine affliction.

Gastrointestinal symptoms were common in pontine hemorrhage. Bleeding within 7 days after onset was encountered in 9 patients within 8–14 days in 3 patients, and in 2 other patients more than 15 days after onset. In 32 patients who survived more than 8 days, 5 (15.6%) were accompanied by gastrointestinal bleeding. It can be speculated that patients who survive only a short time, die before evidencing gastrointestinal bleeding.

A spinal center, an automatic center and higher cortical center, are considered to be essential for the control of urination. Recently much interest has been attracted to the autonomic center in the pons or the reticular formation in the midbrain. Destruction or stimulation of these areas causes various micturition disturbances.

Visual hallucinations were observed in 8 of the non-fatal patients. The incidence rate among the non-fatal is 47.1%. These psychic phenomenon may be investigated in a variety of ways: psychological, psychopathological, neurophysiological and neurochemical. Both cortical and subcortical regions are considered to be important as the basis for organic hallucination. Some investigators divide the cortical regions into two groups; occipital lobe and temporal lobe. Most organic hallucinations are visual. Occipital lobe hallucinations take the simple form of flashing lights or twinkling stars; temporal lobe hallucinations show more complex scenes such as persons, animals and landscapes. Subcortical hallucinations, first reported by Lhermitte, (1922), have been known as midbrain or diencephalic lesion. These hallucinations accompany many lesions, brain tumor, degenerative disease, and vascular lesions. Hallucinations have been reported in the course of central pontine myelinolysis and Marchiafava-Bignami disease. Organic hallucinations have two characteristic features: the patient can see the phenomenon remaining at some distance from what he actually observes — the “attitude” of the hallucination. The content of hallucination often consists of small animals, persons and landscapes in full color. The case which was reported first by Lhermitte was an old woman who developed left oculomotor palsy as well as right sided ataxia and experienced an unfamiliar animal that looked like a cat or a hen. The sleep-awareness rhythm of this patient was reversed. She was sleepy during the daytime and showed complete wakefulness at night.

All patients in this series of hallucinations showed definite density lesions in the pons by CT. The contents of the hallucinations were visual and colorful in all cases. Some were very familiar: “green coach,”
="colored kettle and bucket," "landscape of my neighborhood," "two white dogs;" others had a curious content such as "white and black serpent moving on the wall of the building," and "woman in a black dress standing in a grave."

The attitude of the patients were: (1) that of bystanders who explained the contents coolly and were never influenced by the hallucinations; (2) that of persons affected by the content of the hallucination. One patient ran around the hospital room unfolding a towel in order to catch fish, or cried out all night being afraid of being carried to the grave. One patient became critical of his observation several days after the onset and told, by himself, "what I saw was a kind of dream." He did not deny the fact that he had experienced the abnormal event, but recognized that it was unrealistic.

To be able to realize what is experienced and at the same time to criticize, reportedly are characteristic of the midbrain diencephalic hallucination. Lhermitte's patient at first assumed a critical attitude toward the contents of the hallucinations but at last she was swayed under some compelling psychic symptoms. Narcolepsy, for which midbrain and brainstem areas are thought to be the responsible regions, is commonly accompanied by hallucinations. Utenda reported a girl with narcolepsy who had been suffering hallucinations for 7 years, but who in the last two years lived in a world strongly influenced by a delusional attitude so that the figures entering on her hallucination stage were temporary friends. At one time she played with them merrily, but was ill-treated by them on other occasions. She could never accept that her "dream world" was unreasonable.

In our patients with mild pontine hemorrhage, hallucinations were not always accompanied by psychic excitement, and hallucination disappeared within several days. Some hallucinating patients in the past might have been overlooked. In this series, the longest hallucinations lasted for 14 days. The reversal may reflect a reduction of edema in those that disappeared and of resolving hematoma in those that are more prolonged. All eight patients in this series have been followed and have not developed new psychic symptoms nor visual hallucination. It is concluded that visual hallucinations occurring in pontine hemorraghes are transient.

Conclusions

1. Clinical and pathological features of 60 cases of primary pontine hemorrhage are reported. Age ranged from 33 to 77 years, with a mean age of 51.1. Forty-nine were male and 11 were female.

2. Previous reports have suggested that the prognosis of primary pontine hemorrhage was extremely hopeless; 17 patients (28.3%) of this series were non-fatal; 11 of them are capable of self-care or have made full recovery.

3. About 75% of the patients have a previous history of hypertension. This rate is almost the same in both the fatal and non-fatal groups.

4. From the analysis of neurological symptoms, many interesting signs are noticed; (a) ophthalmological signs such as ocular bobbing, the syndrome of the medical longitudinal fasciculus and skew deviation (b) autonomic signs such as gastrointestinal bleeding, hyperthermia, Horner's sign and neurogenic bladder (c) visual hallucinations.

5. Visual hallucinations were noticed in 8 (47.1%) of 17 non-fatal patients. This psychic phenomenon has not been reported before in definitely proven pontine hemorrhage.

6. The size and extent of hematoma was examined in 24 patients coming to autopsy. Twenty-one of the 24 cases showed rupture of the hematoma into the 4th ventricle, while rupture to the clivus was seen in 4, downward extension (to the medulla oblongata) in only 1 case.

7. From a cleared specimen and microscopic examination, ruptured microaneurysm in pontine hemorrhage was first detected in this study.

Acknowledgment

The author would like to thank the late Dr. Z. Ito, Dr. T. Kutsuzawa, Dr. K. Uemura, Dr. H. Fukasawa and all members of the Institute for their assistance. The secretarial assistance of Mrs. M. Kan is gratefully acknowledged. Also invaluable was the advice and encouragement of Professor H.J.M. Barnett in the completion of this manuscript.

References


20. Glaser JS: Neuroophthalmology, Harper Row, Hagerstown, 236,
Factors Affecting the Prognosis in Thalamic Hemorrhage

RYUNGCHAN KWAK, M.D.,* SATORU KADOYA, M.D.,* AND TAKASHI SUZUKI, M.D.†

SUMMARY The present study deals with the factors affecting the prognosis in the acute stage of 29 cases with hypertensive thalamic hemorrhage diagnosed by CT scan. It was thought that the following factors were significantly related to the outcome of the patients who were unable to lead daily life, remained in vegetative state or died: (1) consciousness level was below 10 in the so-called 3-3-9 formula, (2) bilateral Babinski’s signs were observed, (3) localization of the hematoma was all the thalamic nuclei type, (4) hematoma volume was above 10 ml, (5) the maximum dimension of hematoma was over 30 or 35 mm, maximum width over 30 mm, maximum length over 25 mm and maximum height over 30 or 40 mm, and (6) the ventricles were dilatated. The prognosis had no significant relationship with the age of the patients, the side of the hematoma, the presence or the absence of ventricular penetration of the hematoma, or the existence of midline shift. We believe that in the acute stage of hypertensive thalamic hemorrhage, the prognosis can be forecasted by neurological findings, accurate calculation of the hematoma volume and size, localization of the hematoma and presence or absence of ventricular dilatation as determined by CT scan.

Patients and Methods
Patients were the 29 cases of hypertensive thalamic hemorrhage experienced at our clinic over the 3 year period from May 1977 to the end of April 1980. All patients were right-handed. Hypertensive during their hospitalization. Hypertension had levels of blood pressure judged to be excess of 150 mm Hg systolic or 90 mm Hg diastolic. Accordingly, all patients in the series are regarded as hypertensive. All patients were right-handed.

The presence and location of the hematoma was confirmed by CT scan in all cases. The scanner was Delta Scanner 50 Unit or an EMI CT-10A. The period from onset until the first CT scan was less than 24 hours in 15 cases, within 3 days in 6, within 5 days in 3, within 7 days in 1, within 8 in 2 and within 11 in 2. A total of 25 patients (86.2%) were seen within 1 week.

The maximum diameter, maximum width and length of the high absorption area over the hematoma, as seen in the CT scans, were measured visually and calculations of the hematoma volume done to adjust for the thickness. The maximum height of the hematoma was calculated by multiplying the number of slices involved by the slice thickness (10 mm). A reliable method for estimating the volume of hematomas has not yet been established. When using the Delta Scanner 50 Unit, it is possible to make such calculations in a consistent manner using the accompanying MAP programmer. The area of the hematoma in each slice is measured and this value is multiplied by the thickness of the slice. The sum of the values for each slice is then taken as the volume of the hematoma. When this method could not be used or when the EMI CT-10A Scanner was used for diagnosis, the volume of the hematoma of such patients (as well as those of patients where the Delta Scanner was used),
Clinicopathological study of pontine hemorrhage.
K Nakajima

*Stroke*. 1983;14:485-493
doi: 10.1161/01.STR.14.4.485

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/14/4/485

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Stroke* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to *Stroke* is online at:
http://stroke.ahajournals.org//subscriptions/