Reversible dementia in patients with chronic subdural hematomas

EICHI ISHIKAWA, M.D., KIYOVUKI YANAKA, M.D., PH.D., KOICHI SUGIMOTO, M.D., SATOSHI AYUZAWA, M.D., PH.D., AND TADAO NOSE, M.D., PH.D.

Department of Neurosurgery, Institute of Clinical Medicine, University of Tsukuba; and Department of Neurosurgery, Tsukuba Memorial Hospital, Tsukuba, Ibaraki, Japan

Object. Neuropsychiatric changes following surgery for chronic subdural hematomas (CSDHs) were analyzed in 26 patients (21 men and five women) by using the Mini-Mental State Examination (MMSE) and the Hasegawa Dementia Scale–Revised (HDS-R) to determine factors that potentially contribute to neuropsychiatric recovery.

Methods. Burr hole irrigation was performed in every patient to treat the CSDH. The patients’ profiles, including age and sex, neuroimaging findings (such as hematoma volume and thickness, as well as midline shift), and preoperative and postoperative scores on the MMSE, HDS-R, and activities of daily living (ADL) scale were recorded. According to preoperative MMSE scores, eight patients (30.8%) were classified as mentally healthy and 18 (69.2%) as suffering from dementia before surgery. Nine of the 18 patients with dementia recovered to a normal psychological state following surgery. Surgery improved not only the patients’ independence in ADL (p = 0.0026), but also their neuropsychiatric functions such as orientation and calculation, as estimated by scores on the MMSE (p = 0.0002) and the HDS-R (p = 0.0008). Factors affecting neuropsychiatric status on admission were midline shift (p = 0.0398) and ADL score (p = 0.0124); factors that could be used to predict neuropsychiatric recovery after surgery were patient age (p = 0.0027) and ADL score (p = 0.0193). The results of a logistic regression analysis demonstrated that significant predictors of neuropsychiatric recovery after surgery include the following: patient age (p = 0.0049, OR = 0.842) and preoperative ADL (p < 0.0001, OR = 1.895), and HDS-R (p = 0.0073, OR = 1.303) scores.

Results of subgroup analyses demonstrated that patients younger than 74 years of age and those who had preoperative scores lower than 5 on the converted ADL scale, higher than 10 on the MMSE, or higher than 9 on the HDS-R on admission were found to have a significantly better recovery of neuropsychiatric functions after surgery.

Conclusions. Dementia is reversible in many patients with CSDH, and surgery can improve not only independence in ADL, but also neuropsychiatric functions. Patients who are younger and/or those who have lower preoperative ADL scores and/or higher preoperative MMSE or HDS-R scores will achieve a good recovery with regard to neuropsychiatric functions after surgery. Estimations of neuropsychiatric function based on MMSE and HDS-R scores were found to be useful in predicting functional outcomes in patients with CSDH.

Key Words • chronic subdural hematoma • dementia • Hasegawa Dementia Scale • Mini-Mental State Examination • surgery

Dementia is a clinical syndrome characterized by acquired losses of cognitive and emotional abilities severe enough to interfere with daily functioning and quality of life. It occurs primarily in elderly persons. The prevalence is approximately 1% in persons 60 years of age and doubles with every 5-year increase in age. With recent increases in the number of aging members of the population, the diagnosis and treatment of dementia has become an important social issue.

Chronic subdural hematoma generally occurs in elderly persons; the average age of onset is 63 years. The symptoms and signs of CSDH are variable and are not pathognomonic. In the elderly patient, the insidious onset of symptoms in this disease is sometimes interpreted as dementia, but there have been few reports focusing on neuropsychiatric functions in patients with CSDHs. In the present study, to determine factors contributing to neuropsychiatric recovery after treatment for this condition, we reviewed the cases of 26 consecutive patients with CSDH who had undergone burr hole irrigation.

Clinical Material and Methods

Patient Population

A consecutive series of 26 patients underwent surgery for CSDH between April 1, 1999 and March 31, 2000. Burr hole irrigation with closed system drainage was performed in every patient. Patients in the series ranged in age from 51 to 91 years (mean age 73 years) and included 21 men and five women. Fourteen patients (53.8%) had a history of head injury, and the mean interval from head injury to hos-
Reversible dementia in patients with chronic subdural hematoma

Patients were classified into one of two groups after the first analysis according to their MMSE scores. Patients with MMSE scores of 24 or more on admission were classified as belonging to Group I (mentally healthy group, eight patients), and those with scores less than 24 were classified as belonging to Group II (dementia group, 18 patients). In the second analysis, Group II patients were divided into two groups according to their postoperative mental state: patients with an MMSE score of 24 or more after surgery were classified as belonging to Group IIa (dementia-normal group, nine patients) and those with a score of less than 24 were classified as belonging to Group IIb (dementia-dementia group, nine patients).

Neuropsychiatric Examination

Neuropsychiatric functions in each patient were estimated on the basis of scores from the MMSE and the HDS-R. The MMSE has been found to be a quick and valuable test for simple bedside screening and for serial assessment of cognitive function. Among patients with cognitive impairment, we found a close relationship between scores on the MMSE and those on the conventional Wechsler Adult Intelligence Scale. The MMSE consists of five subtests including orientation (10 points), registration (three points), calculation (five points), recall (three points), and language (naming, repetition, and a three-stage command [nine points]), leading to a maximum total score of 30. The total score is used for the analysis. The sensitivity and specificity of the MMSE are 0.76 and 0.97, respectively, when the cutoff point is set at 23/24 for distinguishing patients with dementia. If the score is less than 24, the patient is suspected of having dementia. The HDS-R is a scale widely used in Japan for the evaluation of dementia and consists of nine items, including the patient’s age (one point), knowledge of date and place (six points), recollection of three words (three points), knowledge of arithmetic (two points), recitation of figures in reverse (two points), repetition of the last three words heard in sequence (six points), memory of five objects (five points), and knowledge of words for vegetables (five points). The maximum total score is 30, and the total score is used for the analysis. The sensitivity and specificity of the HDS-R are 0.9 and 0.82, respectively, when the cutoff point is set at 20/21. If the score is less than 21, the patient is suspected of having dementia. The MMSE and the HDS-R were performed at admission and again 2 weeks after surgery.

All patients were classified into one of two groups after the first analysis according to their MMSE scores. Patients with MMSE scores of 24 or more on admission were classified as belonging to Group I (mentally healthy group, eight patients), and those with scores less than 24 were classified as belonging to Group II (dementia group, 18 patients). In the second analysis, Group II patients were divided into two groups according to their postoperative mental state: patients with an MMSE score of 24 or more after surgery were classified as belonging to Group IIa (dementia-normal group, nine patients) and those with a score of less than 24 were classified as belonging to Group IIb (dementia-dementia group, nine patients).

Statistical Analysis

Factors such as patient age and sex; preoperative and postoperative ADL, MMSE, and HDS-R scores; and neurological findings, such as hematoma volume and thickness, and midline shift were analyzed. In an attempt to identify multiple factors that could be used to predict neuropsychiatric improvement, comparisons between two or more groups were accomplished using a one-way ANOVA for continuous variables and nonparametric tests such as the Wilcoxon rank test or the Mann–Whitney U-test for categorical measures. Logistic regression analysis was also performed to determine any factor that was significantly related to neuropsychiatric recovery after surgery. If prognostic factors were demonstrated by these statistical methods, a subgroup analysis was performed to determine specific ranges of such factors that could be used to predict functional outcome by using ANOVA or the Mann–Whitney U-test. All values are expressed as the means ± SDs. Differences were considered significant if the probability value was less than 0.05.

Results

The mean scores obtained before and after surgery were, respectively, 3.15 ± 2.11 and 2.04 ± 1.95 for the ADL; 15.54 ± 9.87 and 21.31 ± 9.55 for the MMSE; and 14.23 ± 9.1 and 20 ± 9.8 for the HDS-R (Fig. 1). The correlation coefficient between the preoperative MMSE and HDS-R scores was 0.916 (p < 0.0001). The Wilcoxon rank test demonstrated that surgical treatment improved not only patients’ ADL levels (p = 0.0026), but also patients’ neuropsychiatric functions estimated using the MMSE (p = 0.0002) and the HDS-R (p = 0.0008). The mean hematoma volume and thickness, and the midline shift, as observed on
CT scans obtained before surgery, were 102.5, 23.77 ± 6.37 mm, and 6.46 ± 4.59 mm, respectively.

Eight patients were classified into Group I and 18 patients into Group II. The mean values of factors under investigation are summarized in Table 1. The results of the Mann–Whitney U-test demonstrated that there were significant differences between Groups I and II. Nine patients each were classified as belonging to Group II D–N and Group II D–D. The mean values of factors under investigation are summarized in Table 2. There were significant differences in HDS-R and ADL scores and in the age of patients between Groups II D–N and II D–D. The presence of a midline shift had a significant impact on the patient’s preoperative neuropsychiatric status, and its presence also indicated a tendency for patients with dementia to have improved neuropsychiatric function. In contrast, age had no impact on the patient’s preoperative status, but did have a significant impact on neuropsychiatric recovery in patients suffering from dementia. Therefore, factors affecting neuropsychiatric status on admission included the ADL score (p = 0.0124) and the midline shift (p = 0.0398). Factors that could be used to predict neuropsychiatric recovery after surgery in patients with dementia were age (p = 0.0027) and ADL score (p = 0.0193). Orientation (p = 0.033), calculation (p = 0.011), recall (p = 0.0235), and language (three-stage command, p = 0.0264) displayed a significant recovery among the neuropsychiatric functions assessed after surgery.

The results of a logistic regression analysis of variables from Groups II D–N and II D–D also showed that significant predictors of neuropsychiatric recovery were patient age (p = 0.0049, OR = 0.842) and preoperative ADL (p = 0.0056, OR = 0.471), MMSE (p < 0.0001, OR = 1.895), and HDS-R (p = 0.0073, OR = 1.303) scores. The results of the subgroup analysis demonstrated that patients who were younger than 74 years of age or who had preoperative scores lower than 5 for the ADL, higher than 10 for the MMSE, or higher than 9 for the HDS-R exhibited a better recovery with regard to neuropsychiatric functions.

**Discussion**

In the present study we have demonstrated that approximately two thirds of patients with CSDH were suspected of having dementia on admission and that surgery improved the neuropsychiatric symptoms in 50% of patients showing signs of this condition. Surgery was of particular value in improving not only independence in ADL, but also neuropsychiatric functions in patients with CSDH.

Dementia is an etiologically nonspecific condition that is permanent, progressive, or reversible. Dementia has profound effects on health outcomes and is associated with high use and costs of medical care. Therefore, the identification of potentially reversible causes of dementia is critical. More than 50 illnesses can cause dementia. Among them, depression and drug intoxication are the most frequent causes of reversible dementia, followed by metabolic and neurosurgical disorders. The prevalence of reversible dementia is reported to be lower than 1% in elderly patients. Chronic subdural hematomas are generally seen in elderly persons and is often accompanied by the type of dementia that can be reversed by simple surgery. Therefore, CSDH should receive greater attention as a potential cause of reversible dementia.

A review of the patient’s medical history and findings of the physical examination should lead to a diagnosis of CSDHs; however, 40% of patients with this condition are likely to receive a misdiagnosis because many similar symptoms occur in other disease processes such as transient ischemic attacks, stroke, dementia, and tumors. Although it is clear that neuropsychiatric symptoms are common in elderly patients with CSDH, the number of systematic, objective, data-measuring studies of CSDH presentation and outcome that have been performed from a neuropsychiatric perspective have been limited. The prognostic indicators of poor neuropsychiatric recovery include severe preoperative neuropsychiatric disturbances, older age, a longer period of time from head injury to operation, and preexisting multiple cerebral infarctions.

In the present study we have demonstrated that factors affecting neuropsychiatric status on admission are midline shift demonstrated on CT scans and preoperative ADL score. Factors that can be used to predict neuropsychiatric recovery after surgery in patients suffering from dementia are patient age, preoperative ADL score, and preoperative neuropsychiatric function. Our results indicate that patients younger than 74 years of age and/or have preoperative scores lower than 5 on the ADL, higher than 10 on the MMSE, or higher than 9 on the HDS-R will likely achieve

---

**TABLE 1**

Comparison between patients with a healthy mental state and those with dementia*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Group I</th>
<th>Group II</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>age (yrs)</td>
<td>69.75 ± 9.58</td>
<td>74.39 ± 11.30</td>
<td>0.1649</td>
</tr>
<tr>
<td>hematoma volume (ml)</td>
<td>85.38 ± 39.15</td>
<td>110.11 ± 59.88</td>
<td>0.4367</td>
</tr>
<tr>
<td>hematoma thickness (mm)</td>
<td>21.25 ± 5.18</td>
<td>24.89 ± 6.66</td>
<td>0.2113</td>
</tr>
<tr>
<td>midline shift (mm)</td>
<td>4.00 ± 4.41</td>
<td>7.56 ± 4.36</td>
<td>0.0398†</td>
</tr>
<tr>
<td>MMSE score</td>
<td>25.75 ± 2.43</td>
<td>11.00 ± 8.37</td>
<td>&lt;0.0001†</td>
</tr>
<tr>
<td>HDS-R score</td>
<td>24.63 ± 3.25</td>
<td>9.61 ± 6.63</td>
<td>0.0002†</td>
</tr>
<tr>
<td>ADL score</td>
<td>1.63 ± 1.06</td>
<td>3.83 ± 2.12</td>
<td>0.0124†</td>
</tr>
</tbody>
</table>

* Values are expressed as the means ± SDs. Group I was composed of eight patients with a healthy mental state and Group II consisted of 18 patients with dementia.
† Significant difference between groups.

**TABLE 2**

Comparison of patients with preoperative dementia according to outcome*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Group II D–N</th>
<th>Group II D–D</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>age (yrs)</td>
<td>67.22 ± 10.34</td>
<td>81.56 ± 7.00</td>
<td>0.0027†</td>
</tr>
<tr>
<td>male/female ratio</td>
<td>8:1</td>
<td>6:3</td>
<td>0.5637</td>
</tr>
<tr>
<td>hematoma volume (ml)</td>
<td>123.67 ± 57.25</td>
<td>96.56 ± 62.67</td>
<td>0.3714</td>
</tr>
<tr>
<td>hematoma thickness (mm)</td>
<td>25.33 ± 5.43</td>
<td>24.44 ± 8.02</td>
<td>0.8946</td>
</tr>
<tr>
<td>midline shift (mm)</td>
<td>9.44 ± 4.72</td>
<td>5.67 ± 3.12</td>
<td>0.0851</td>
</tr>
<tr>
<td>MMSE score</td>
<td>17.67 ± 4.12</td>
<td>4.33 ± 5.63</td>
<td>0.0013†</td>
</tr>
<tr>
<td>HDS-R score</td>
<td>13.33 ± 5.24</td>
<td>5.89 ± 5.88</td>
<td>0.0152†</td>
</tr>
<tr>
<td>ADL score</td>
<td>2.56 ± 2.07</td>
<td>5.11 ± 1.27</td>
<td>0.0193†</td>
</tr>
</tbody>
</table>

* Values are expressed as the means ± SDs. Group II D–N consisted of nine patients whose dementia resolved after surgery and Group II D–D was composed of nine patients who still exhibited dementia postoperatively.
† Significant difference between groups.
good functional recovery. In contrast, older patients and patients with higher ADL scores or lower MMSE or HDS-R scores on admission will not exhibit a functional recovery.

Because ADL are closely related to neuropsychiatric functions, it is not surprising that ADL affect preoperative neuropsychiatric status and postoperative recovery. The volume and thickness of the hematoma have no effect on preoperative or postoperative neuropsychiatric functions. Subdural spaces become larger as patients grow older due to a progression of cerebral atrophy. Midline shift may reflect the mass effect more directly than the volume or thickness of the hematoma, and the presence of a midline shift seems to be more important to neuropsychiatric functions. In addition, age can be considered a reliable index of the reserve capability of neuropsychiatric functions of the brain.

In the evaluation of patients suffering from dementia, a knowledge of the patient’s medical history and the results of physical examinations and neuroimaging of the brain can help identify potentially reversible causes of dementia such as CSDH. Treatable causes of dementia should be considered in all patients who display the symptoms of this disorder.

Conclusions

Chronic subdural hematoma is an important reversible cause of dementia and disability in elderly persons. Patients who are relatively younger and/or have better ADL, MMSE, or HDS-R scores on admission to the hospital will likely achieve a favorable neuropsychiatric recovery after surgery. A sufficiently high level of clinical suspicion and prompt neuroimaging evaluation may allow for timely treatment of this condition to avoid a poor outcome.

Acknowledgment

The authors thank Ms. Michiko Kohno at Tsukuba Memorial Hospital for her help in making neuropsychiatric assessments.

References

18. Weytingh MD, Bossuyt PM, van Crevel H: Reversible dementia: more than 10% or less than 1%? A quantitative review. J Neurol Neurosurg Psychiatry 47:189–198, 1984

Manuscript received April 30, 2001. Accepted in final form December 6, 2001.

Address reprint requests to: Kiyoyuki Yanaka, M.D., Ph.D., Department of Neurosurgery, Institute of Clinical Medicine, University of Tsukuba, Tsukuba, Ibaraki, Japan. email: kyanaka@md.tsukuba.ac.jp.