Changing Prognosis of Primary Intracerebral Hemorrhage: Results of a Clinical and Computed Tomographic Follow-up Study of 104 Patients

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One hundred four consecutive cases of primary intracerebral hemorrhage hospitalized at the time of stroke were followed until death or for 1 year. All were treated nonsurgically. The 30-day mortality rate was 30%. Good clinical outcome and complete resolution of the lesion on computed tomography were observed in 49 and 13% of patients, respectively. Age, state of consciousness, and size of the hemorrhage on computed tomography scan were reliable prognostic indicators. The long-term survival rate, 66%, was higher than that previously reported and should be considered in future trials evaluating medical and surgical treatment of intracerebral hemorrhage. (Stroke 1988;19:192–195)

Primary intracerebral hemorrhage (ICH) is still a frequent form of cerebrovascular disease (CVD) despite improved control of hypertension. Current figures from community surveys suggest that primary ICH accounts for about 12% of CVD cases. Data from community studies based on clinical diagnoses may underestimate the true incidence of primary ICH, whereas hospital-based series fail to reflect the early deaths of patients who never reach the hospital. The availability of computed tomography (CT) has improved diagnostic accuracy, modifying the figures on incidence and mortality rate for primary ICH.

We report data on the relative incidence, early mortality, outcome, and CT findings in a consecutive hospital-based series of patients with primary ICH. Our main objective was to describe the clinical course, CT findings, and prognostic factors in all surviving nonsurgical patients over a 12-month follow-up.

Subjects and Methods

The University Hospital is a public facility serving a central area of Rome. The vast majority of patients with acute stroke from this section of the city are admitted to this hospital, and they are referred to our stroke unit for their acute management. For our analysis we recorded age, sex, and arterial hypertension in medical history (repeated values of >160/95 mm Hg and/or use of antihypertensive drugs). Neurologic examinations on admission and at discharge, including the Glasgow Coma Scale for stuporous or comatose patients and evaluation of disability by the Barthel Index, were recorded on standardized forms. Treatment frequently included the administration of antihypertensive drugs (especially diuretics) and antiedema agents (glycerol or mannitol; steroids were used rarely).

Brain CT without contrast infusion was performed in all patients except 10 who deteriorated and died before the test could be done. In these 10 cases the diagnosis was confirmed at autopsy. CT with contrast infusion was repeated in all surviving patients during hospitalization. Angiography was performed in 42 patients in whom vascular malformations were suspected and in all patients <45 years of age. ICH was classified on CT scan as 1) superficial, 2) deep, 3) central or advancing form, or 4) primary intraventricular. Following Mizukami et al we have defined as advancing forms those lesions that originate in the basal ganglia and extend into the adjacent lobar white matter. The size of each hemorrhage was measured on that CT section showing the lesion in its largest diameter. The margins of the hemorrhage were traced on the monitor screen with a cursor, and its area was then calculated by means of a computerized graphic table.

After discharge, patients were followed through rehabilitation and had neurologic evaluations at 6 and 12 months; we report the data at 12 months. No patient was lost to follow-up.

CT scan was repeated at 6 and/or 12 months. Surviving patients were classified into three outcome groups at the end of 1 year: 1) complete neurologic recovery, 2) good neurologic recovery in patients capable of independent function with or without mild language and/or sensory impairment, and 3) poor recovery with major permanent neurologic deficit in patients dependent in the activities of daily living.

The statistical analyses employed the χ² test with Yates's correction when appropriate and Student's t test.
TABLE 1. Computed Tomographic Localization of 103 Scanned Primary Intracerebral Hemorrhages With Hypertensive:Normotensive and Alive:Dead Ratios

<table>
<thead>
<tr>
<th>Location</th>
<th>n</th>
<th>Detailed localization</th>
<th>H:N</th>
<th>A:D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temporal</td>
<td>31</td>
<td></td>
<td>10:5</td>
<td>13:2</td>
</tr>
<tr>
<td>Frontal</td>
<td>2</td>
<td></td>
<td>4:3</td>
<td>3:4</td>
</tr>
<tr>
<td>Parietal</td>
<td>1</td>
<td></td>
<td>1:5</td>
<td>5:1</td>
</tr>
<tr>
<td>Occipital</td>
<td>1</td>
<td></td>
<td>1:2</td>
<td>2:3</td>
</tr>
<tr>
<td>Deep</td>
<td>27</td>
<td></td>
<td>7:5</td>
<td>9:3</td>
</tr>
<tr>
<td>Thalamus</td>
<td>2</td>
<td></td>
<td>4:2</td>
<td>4:2</td>
</tr>
<tr>
<td>Basal ganglia</td>
<td>6</td>
<td></td>
<td>6:3</td>
<td>6:3</td>
</tr>
<tr>
<td>External capsule</td>
<td>3</td>
<td></td>
<td>0:2</td>
<td>2:1</td>
</tr>
<tr>
<td>Internal capsule</td>
<td>1</td>
<td></td>
<td>1:2</td>
<td>3:1</td>
</tr>
<tr>
<td>Central or advancing form</td>
<td>29</td>
<td></td>
<td>12:2</td>
<td>6:8</td>
</tr>
<tr>
<td>External capsule</td>
<td>7</td>
<td></td>
<td>4:4</td>
<td>7:1</td>
</tr>
<tr>
<td>Basal ganglia</td>
<td>6</td>
<td></td>
<td>4:2</td>
<td>4:2</td>
</tr>
<tr>
<td>Thalamus</td>
<td>2</td>
<td></td>
<td>2:0</td>
<td>2:0</td>
</tr>
</tbody>
</table>

H:N, hypertensive:normotensive ratio; A:D, alive:dead ratio. 10 cases without computed tomography excluded.

Results

Between January 1982 and December 1983, 783 patients with cerebral infarction and 126 with ICH were entered. The latter group represented 14% of the admissions for acute stroke.

Thirteen cases were excluded as the ICH was secondary (six aneurysms, five arteriovenous malformations, two on anticoagulant treatment). Of the 113 cases with primary ICH 61 were men and 52 were women; their ages ranged between 25 and 89 years. Hypertension was present in 70 cases (62%) and was more frequent in patients >60 years old (p<0.001).

The delay between onset and hospital admission was <24 hours in 32% of the cases, within 48 hours in 41%, within 72 hours in 11%, and between 4 and 6 days in the remaining 16%; the median delay was 1.5 days. Average interval between admission and CT for 103 cases was 1.6 days. The 30-day mortality rate was 30% (31 of 104 nonsurgical patients) for primary ICH compared with 23% for cases of brain infarction.

CT localization of the hemorrhage in 103 scanned patients is listed in Table 1. Ventricular extension was present in 37 cases. A history of hypertension was prevalent in the cases classified as advancing form.

Bilateral hemorrhages were noted in five cases; four patients had bilateral supratentorial localizations and one patient had supratentorial and subtentorial localizations. Congophilic amyloid angiopathy was suspected in these cases, but in the absence of histopathologic examination this diagnosis was considered to be unlikely on clinical grounds.

Among 33 patients with severe impairment of consciousness at onset, 21 (64%) died; among 71 conscious or stuporous patients only 10 (14%) subsequently died in the 30-day period.

Nine patients were eventually treated surgically because of progressive deterioration in the level of consciousness that failed to respond to antiedema agents. The mean size of the lesion in this subgroup was 1,320 mm². Surgery was life-saving in four of these nine patients.

At the end of the 1-year follow-up (Table 2), 51 of the 104 nonsurgical patients (49%) showed good or excellent recovery, 18 (17%) had persistent severe neurologic deficits, and 35 (34%) were dead. Four deaths occurred >30 days after stroke onset, due to cardiac disease in three and due to acute bronchopneumonia in one patient. There were no instances of rebleeding over the 12-month follow-up.

Age (p<0.01) and size of the hemorrhage (p<0.001) were significantly related to prognosis, whereas history of hypertension was not. Hemorrhage size was the best predictor of outcome; survival was definitely lower (42%) with hemorrhage size exceeding 1,000 mm². Patients with either superficial or deep hemorrhage showed a similar prognosis (62 vs. 56% complete or good recovery; 16 vs. 18% poor recovery; 23 vs. 26% deaths) in spite of a larger mean hemorrhage size for the former location (950 vs. 636 mm²). This seems to indicate a better tolerance for superficial than deep hemorrhages, possibly related to less likelihood of midline shift in superficially located hemorrhages. Only 20% of patients in the advancing form group (mean hemorrhage size 1,399 mm²) had a complete or good recovery, whereas 35% remained severely disabled, and 45% died.

Cerebellar, pontine, and intraventricular hemorrhages had a high alive:dead ratio; the survival rate for pontine hemorrhages (four lateral tegmental and two massive bilateral forms) was 67% (Table 1). A complete neurologic recovery was observed in two cases of apparently primary intraventricular hemorrhage.

Repeat CT in 69 patients surviving at 1 year showed a focal low density area in 70%, a porencephalic cavity.

TABLE 2. Overall 1-Year Follow-up Data for 104 Nonsurgical Patients With Primary Intracerebral Hemorrhage

<table>
<thead>
<tr>
<th>Patients</th>
<th>n</th>
<th>%</th>
<th>Mean age</th>
<th>% hypertensive</th>
<th>% ventricular invasion</th>
<th>Mean size (mm²±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete or good recovery</td>
<td>51</td>
<td>49</td>
<td>58</td>
<td>53</td>
<td>20</td>
<td>665.2±296.6</td>
</tr>
<tr>
<td>Poor recovery</td>
<td>18</td>
<td>17</td>
<td>65</td>
<td>67</td>
<td>39</td>
<td>1098.0±545.7</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>21</td>
<td>20*</td>
<td>66</td>
<td>62</td>
<td>67</td>
<td>1359.9±770.2</td>
</tr>
<tr>
<td>&gt;30-day mortality</td>
<td>4</td>
<td>4</td>
<td>68</td>
<td>100</td>
<td>25</td>
<td>491.5±254.3</td>
</tr>
</tbody>
</table>

*10 cases without computed tomography excluded.
in 7%, and calcification in 3%. No appreciable defect was apparent in 20% of the patients, all of whom had initially small hemorrhages (mean size 463 mm²).

Discussion

The long-term prognosis in nonoperated primary ICH has been systematically evaluated in surprisingly few studies. Silver et al found that 25% of all deaths in primary ICH occur within 1 day and 50% within 2 days after the onset. In the pre-CT population study of Furlan et al, mortality was 90%, whereas Garraway et al found a 58% mortality rate in their post-CT study.

The mortality rate for primary ICH in our study is lower than those previously reported, in part because of exclusion of very early deaths. In addition, nine patients had surgery because of progressive clinical deterioration that failed to respond to medical treatment. Theoretically, these patients would have died without surgery, thus increasing the overall "management mortality" to 35%. See "Note added in proof."

In only 26% of the survivors was the outcome at 1 year poor, with persistent severe neurologic deficits. This compares favorably with figures for prognosis of severe ischemic stroke. It is unlikely that surgical removal of the hemorrhage in the acute phase would have significantly enhanced the good clinical and CT outcomes recorded in almost half of the patients. In fact, primary ICH may have a good prognosis when of limited size, regardless of site (superficial, deep, or even subtentorial). The same prognostic indicators were detected in a similar study of 55 patients with primary ICH conducted by two of us in Molise, central Italy.

Recovery may be very rapid, within days, as in nine of 49 nonsurgical survivors reported by Scott and Miller. Arterial hypertension, present in the medical history in 62% of the patients, did not affect prognosis. However, hypertension was less common among our cases than among those reported by Douglas and Haerer (80%), but was similar to that in other series. In a compilation of nine studies totalling 2,500 cases, hypertension was a definite factor in 57% of autopsy cases.

Ropper and Davis, in a study of lobar hemorrhage, found a lower rate of hypertension (31%). Except for our group of advancing forms of primary ICH, no significant difference was found in the frequency of hypertension according to the location of hemorrhage.

Size of the hemorrhage is definitely related to prognosis, in agreement with Drury et al and Kanaya et al. We found that age was related to prognosis; however, no relation between age and prognosis was found by Steiner et al, whereas Douglas and Haerer found higher mortality in patients <50 years old than in patients >70 years.

State of consciousness represents a powerful predictor of outcome; in fact, two thirds of the comatose patients died within the 30-day period.

In conclusion, our experience and other recent series indicate that a good neurologic outcome can be expected in about half the cases of primary ICH with conservative management. Elderly patients with decreased level of consciousness and hemorrhage >1,000 mm² have the worst outcome.

Which cases might benefit from surgery cannot be determined from our data. However, only one fourth of the patients with primary ICH appear to be candidates for surgical hematoma evacuation since the functional outcome, with conservative treatment, is likely to be poor. It is conceivable that some cases might benefit from very early surgery or from a stereotactical approach. However, surgical indications need to be evaluated in a randomized study that would select patients according to well-defined prognostic criteria.

Note added in proof: This underestimates the incidence of brain hemorrhages, and leads still in 1987, to describe the 30-day case fatality of 92%, which obviously includes only the most severe hemorrhages that can be identified clinically as such.

References


**Key Words** • cerebral hemorrhage • tomography, x-ray computed
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