Diagnostic Information Available in University and Community Hospital Medical Records: Patients With Cerebrovascular Disease

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Abstract:
Medical records of 1,117 patients with cerebrovascular disease from one university and four community hospitals were abstracted by trained, nonphysician personnel at the rate of four cases per hour. The data obtained were adequate to describe eight cerebrovascular disease syndromes. In 56% of cases, data from the body of the medical record failed to support the hospital's discharge diagnosis. The eight study diagnoses were not identical with pathological diagnoses, but their characteristics suggest that they are distinct and related to recognized cerebrovascular disease entities. It is recommended that evaluations of diagnostic and therapeutic practice for stroke patients be carried out separately for each of the study syndromes; the care expected and the outcome observed are different for each.

Additional Key Words: medical practice evaluation, stroke, epidemiology of cardiovascular disease

Introduction
Regional Medical Programs have been asked to assure that adequate care for patients with stroke is widely available. To determine whether new programs are needed for stroke patients, it is necessary to measure the quality of care presently provided. To accomplish this, the Western Pennsylvania Regional Medical Program supported a comparison of care in a university hospital and four community hospitals. The study was based on readily available hospital medical records. It is held by some that the hospital medical record is too incomplete to permit meaningful evaluation of medical care. In contrast, others report that medical records have been used successfully to identify opportunities to improve patient care.

The validity of the proposed comparison of the care of stroke patients depended upon the availability in the hospital medical record of data sufficient to distinguish groups of patients who might be expected to be examined and treated in uniform ways and to recover with equal frequency wherever care was adequate. Ordinarily such grouping is based on the identification of cases with a single pathological diagnosis. Since few patients with cerebrovascular disease are examined at autopsy, or by arteriography, precise etiological diagnosis is often not obtained, and it is reported that hospital discharge diagnoses of cerebrovascular disease do not adequately reflect pathological diagnoses. This report concerns the availability in the hospital medical record of data adequate to define more meaningful syndromes than those described by the discharge diagnosis.
Methods

The data reported were abstracted from 1,117 records of patients discharged from five hospitals with the diagnosis of cerebrovascular disease. The material was abstracted by six medical students and a record room librarian, who were trained to use a structured, multiple choice form to guide the data collection. Ten to 30 minutes (average 15) were required to abstract 120 items from each record.

It was possible to define eight syndromes which will be referred to as "study diagnoses." These syndromes are designed to include patients with: (1) subarachnoid hemorrhage (SAH), (2) intracerebral hemorrhage (ICH), (3) transient ischemia without hypertension, (4) transient ischemia with hypertension, (5) old stroke, (6) acute stroke, no cerebrospinal fluid blood, (7) acute stroke, no spinal fluid examination, and (8) vague syndrome attributed to cerebrovascular disease.

To distinguish these syndromes (fig. 1), cases reported to have more than ten red blood cells per cubic milliliter of cerebrospinal fluid were selected first and divided into two groups. The first syndrome (SAH) included those patients without monoparesis or hemiparesis who were admitted for a recent neurological episode and who presented only one of the following signs and symptoms: dysarthria, aphasia, ataxia, bilateral paralysis, hemihyposthesia, visual loss attributed to cerebrovascular disease, vertigo, tinnitus, or unequal tendon reflexes. This first group also included all patients with cerebrovascular aneurysm demonstrated by angiography or postmortem examination regardless of their neurological findings. The second syndrome (ICH) included all other patients with bloody cerebrospinal fluid. These patients had acute syndromes characterized by hemiparesis, monoparesis, or at least two of the listed neurological signs and symptoms.

In the remaining cases, either there was no blood in spinal fluid specimens or there was no spinal fluid examination. From these cases, those with monoparesis, hemiparesis or two other neurological signs were selected. From these were selected those whose neurological signs were judged not to be transient, i.e., length of hospital stay 20 days or more, or abnormal consciousness, ambulation or speech on discharge, or physical therapy required. These patients provided the third and fourth diagnostic groups (acute stroke) if the onset of their disease was within a month of hospital admission and if admission was required for the neurological symptoms. The patients with "acute stroke" were divided according to whether or not spinal fluid had been examined. Patients in the fifth group, "old stroke," had the same neurological signs but were admitted to the hospital more than a month after their acute illness, or were admitted for other than neurological problems.

![FIGURE 1](http://stroke.ahajournals.org/)

The differentiation of eight cerebrovascular disease syndromes.

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Patients with transient ischemia presented transient paresis or two of the other neurological signs and symptoms, or presented transiently one of the neurological signs and altered sensorium. Transient ischemia with hypertension included those cases in which the diagnosis of hypertension was made, or in which the patient's usual diastolic blood pressure exceeded 110. Other transiently affected patients were grouped as "transient ischemia without hypertension."

The last diagnostic group included patients with vague syndromes attributed, by their physician, to cerebrovascular disease. These patients included those with a single neurological sign and normal sensorium, those without recorded neurological signs, and those with one neurological sign and confusion if the illness was not transient.

Results
The individual syndromes differed according to the criteria used to distinguish them and according to certain other characteristics which suggest a relationship between the study diagnoses and the actual pathological diagnoses.

SUBARACHNOID HEMORRHAGE (SAH)
In this syndrome are grouped 45 patients with intracranial aneurysm demonstrated by arteriography or postmortem examination and/or with bloody spinal fluid and no more than one focal neurological sign. Patients with subarachnoid hemorrhage associated with trauma or brain tumor and those with focal hemorrhage discovered only at autopsy and related to systemic disease were excluded from the study.

The need for autopsy and angiographical evidence to uniformly identify subarachnoid hemorrhage is evident from the university.
hospital material. Using clinical, angiographical, and autopsy information, 35 of 424 stroke patients from the university hospital were diagnosed as having subarachnoid hemorrhage. In six cases included in the study, a major subarachnoid hemorrhage resulted from systemic disease: leukemia (three cases), postoperative hyperpyrexia, paroxysmal nocturnal hemoglobinuria, and carbon monoxide poisoning. In the remaining cases, hemorrhage was from an arteriosclerotic aneurysm in one and from a berry aneurysm in 28. Six patients (one with atherosclerotic aneurysm, one with a berry aneurysm, and four with systemic disease) were discovered only at autopsy. Four of these were not discharged with the diagnosis of stroke and so were found only at autopsy.

On the basis of the clinical criteria, paucity of neurological signs and bloody spinal fluid, only 21 (60%) of 35 cases with SAH were correctly identified. When these criteria were used together with any available angiographical evidence of aneurysm (regardless of neurological signs), 29 (83%) cases were correctly identified. The remaining cases (17%) were discovered only at autopsy and, in most of these, SAH resulted from systemic rather than cerebrovascular disease.

The more frequent diagnosis of SAH at the university hospital (8% of strokes) than at the community hospitals (1.6%) is likely related only in part to the referral pattern (50% of SAH patients at the university hospital were referred from community hospitals). It can also be related to the more frequent use of spinal fluid examination (41% of all stroke cases), autopsy (11%), and arteriography (17%) at the university hospital. In the community hospitals, spinal fluid examination was available in 13% of cases, and no patient with bloody spinal fluid was examined by arteriography or at autopsy.

Certain characteristics of the 45 SAH patients (from all hospitals) are those expected of patients with SAH and contrast with characteristics of the other diagnostic groups. Patients in the group were young (median age, 51 years) (fig. 2) and often female (table 1). Many were hypertensive and few were found to have arteriosclerotic heart disease or diabetes (table 2). Over 70% had headache or stiff neck and 33% were noted to exhibit the Babinski reflex. Forty percent were severely obtunded, but only 6% had monoparesis or hemiparesis (table 3). In over 80% of the

### TABLE 1

<table>
<thead>
<tr>
<th>Diagnostic Groups by Race and Sex (Percent)</th>
<th>Male</th>
<th>Female</th>
<th>White</th>
<th>Nonwhite</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAH N = 45</td>
<td>38</td>
<td>50</td>
<td>70</td>
<td>3</td>
</tr>
<tr>
<td>ICH N = 44</td>
<td>62</td>
<td>50</td>
<td>30</td>
<td>9</td>
</tr>
<tr>
<td>Transient ischemia No HBP N = 19</td>
<td>91</td>
<td>75</td>
<td>97</td>
<td>2</td>
</tr>
<tr>
<td>Transient ischemia HBP N = 75</td>
<td>9</td>
<td>25</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

*HBP indicates hypertension.

### TABLE 2

<table>
<thead>
<tr>
<th>Diagnostic Categories</th>
<th>No. cases</th>
<th>Median age (yr.)</th>
<th>Underlying disease</th>
<th>Gross blood in CSF, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAH</td>
<td>45</td>
<td>51</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>ICH</td>
<td>64</td>
<td>58</td>
<td>63</td>
<td>43</td>
</tr>
<tr>
<td>Acute stroke</td>
<td>424</td>
<td>71</td>
<td>44</td>
<td>31</td>
</tr>
<tr>
<td>Transient, with HBP</td>
<td>75</td>
<td>65</td>
<td>*</td>
<td>27</td>
</tr>
<tr>
<td>Ischemia, no HBP</td>
<td>99</td>
<td>65</td>
<td>*</td>
<td>27</td>
</tr>
<tr>
<td>Vague syndrome</td>
<td>318</td>
<td>76</td>
<td>29</td>
<td>25</td>
</tr>
</tbody>
</table>

* Determined by criteria used to define diagnostic category.
cases, the spinal fluid was described as grossly bloody. Of the SAH patients, 49% died.

**INTRACEREBRAL HEMORRHAGE (ICH)**

Patients included in this category had bloody spinal fluid and more than one neurological sign or symptom. Since spinal fluid was not regularly examined, it is likely that some patients with ICH were not recognized, and since angiograms were often not performed, others in this group may have had unrecognized SAH. In the university hospital, 21 diagnoses were confirmed, eight by autopsy and 13 by cerebral angiography (nine angiograms were normal and four showed displaced vessels).

There were expected characteristics of the 64 cases in this group. The patients were commonly Negro (table 1) and were young, though older than those with SAH (fig. 2). Their spinal fluid less often contained gross blood than did the fluid of those with SAH. Patients with ICH were most often hypertensive and only patients with SAH were so seldom diabetic (table 2). Forty-one percent were seriously obtunded on admission and 73% exhibited monoparesis or hemiparesis. Headache or stiff neck was present in 65% of cases. Most other neurological signs were also common (table 3). Of patients with ICH, 55% died in the hospital.

**ACUTE STROKE, SPINAL FLUID WITHOUT BLOOD OR NOT EXAMINED**

These two diagnostic groups included 424 patients, primarily those with acute hemiparesis. Lumbar puncture was performed in only 13% of cases in the community hospitals and 47% of cases in the university hospital. Though spinal fluid was examined three times more frequently in cases with headache or stiff neck, some patients may have had unrecognized ICH. No patient was recognized to have bacterial endocarditis or cardiac septal defect, and cases with atrial fibrillation (more likely to have had cerebral embolism) were not considered separately.

As expected, patients with acute stroke were older; diabetes, hypertension, and arteriosclerotic heart disease were common (table 2).

### TABLE 3

Percent Cases Exhibiting Selected Neurological Signs and Symptoms

<table>
<thead>
<tr>
<th></th>
<th>SAH*</th>
<th>ICH†</th>
<th>Acute stroke</th>
<th>Transient attack</th>
<th>Old stroke</th>
<th>Vague syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. cases</td>
<td>45</td>
<td>64</td>
<td>424</td>
<td>99</td>
<td>75</td>
<td>92</td>
</tr>
<tr>
<td>Deaths</td>
<td>49%</td>
<td>55%</td>
<td>39%</td>
<td>0%</td>
<td>0%</td>
<td>11%</td>
</tr>
<tr>
<td>Confusion</td>
<td>33</td>
<td>23</td>
<td>31</td>
<td>25</td>
<td>9</td>
<td>43</td>
</tr>
<tr>
<td>Coma</td>
<td>40</td>
<td>41</td>
<td>28</td>
<td>8</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Hemiparesis</td>
<td>4</td>
<td>64</td>
<td>70</td>
<td>37</td>
<td>36</td>
<td>84</td>
</tr>
<tr>
<td>Monoparesis</td>
<td>2</td>
<td>9</td>
<td>16</td>
<td>15</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Hemihypesthesia</td>
<td>4</td>
<td>27</td>
<td>20</td>
<td>29</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Visual loss</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Aphasia</td>
<td>7</td>
<td>23</td>
<td>28</td>
<td>13</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>Dysarthria</td>
<td>4</td>
<td>20</td>
<td>31</td>
<td>18</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td>Facial paralysis</td>
<td>18</td>
<td>42</td>
<td>48</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>2</td>
<td>16</td>
<td>22</td>
<td>11</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Tendon reflex</td>
<td>16</td>
<td>39</td>
<td>29</td>
<td>26</td>
<td>31</td>
<td>40</td>
</tr>
<tr>
<td>Babinski</td>
<td>22</td>
<td>23</td>
<td>27</td>
<td>11</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Ataxia</td>
<td>9</td>
<td>22</td>
<td>21</td>
<td>28</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Dizziness</td>
<td>11</td>
<td>30</td>
<td>20</td>
<td>43</td>
<td>53</td>
<td>11</td>
</tr>
<tr>
<td>Tinnitus</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>11</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Diplopia</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>11</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Headache</td>
<td>67</td>
<td>45</td>
<td>15</td>
<td>29</td>
<td>36</td>
<td>11</td>
</tr>
<tr>
<td>Stiff neck</td>
<td>44</td>
<td>20</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

*Subarachnoid hemorrhage.
†Intracerebral hemorrhage.
‡Hypertension.

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Only 28% of patients were severely obtunded on admission; 86% presented either a hemiparesis or a monoparesis, and in 10% there was bilateral limb weakness. Though other neurological findings were common, only 4% of the patients (with or without spinal fluid examination) had a stiff neck and only 15% had a headache. The case fatality rate was 39% (table 3).

**Transient Ischemia With and Without Hypertension**

These two groups included surviving patients with transient focal neurological signs. The median age in both groups was 65 years. The preponderance of males (table 1) in the group without hypertension has been reported before. Compared particularly to patients with vague syndromes, few of these patients were severely obtunded on admission and many were paralyzed. Dizziness, tinnitus, ataxia, nausea and vomiting were more common than in any other syndrome. Other neurological signs and symptoms were less common in these patients than in those with acute stroke. The more frequent presence of the Babinski reflex and headache in the hypertensive group was of interest (table 3). Slight elevation of the BUN (16 to 20 mg %) was noted in 43% of the hypertensives and in 15% of those who were normotensive (X² = 8.6, p < 0.01). Of those with hypertension, 28% were obese; only 12% of the normotensive group were overweight, and 27% of both groups were diabetic.

**Old Stroke**

Patients with a history of cerebrovascular disease and focal neurological signs who were admitted for some other condition had a median age of 67; 95% exhibited monoparesis or hemiparesis. Twenty-one percent had had multiple episodes of cerebrovascular disease and the median duration of their illness was about one year.

**Vague Syndromes Attributed to Cerebrovascular Disease**

In few, if any, of these cases was the vague syndrome clearly related to cerebrovascular disease, and in 5% of cases, young patients' illness was better described as coma of unknown etiology. The group must include several pathological syndromes, but most are elderly patients with senile dementia. These syndromes were common, representing 29% of cases discharged as stroke from the study hospitals. Approximately 40% of the patients had one neurological sign and were confused, 20% were confused only, and 10% had a single other sign or symptom. In 30%, there was no record of confusion or any other neurological complaint, and half of these had a history of cerebrovascular disease. The rest were elderly patients who, although not recorded to be confused on examination, were discharged with the diagnosis of senile dementia or cerebrovascular disease.

As expected, these patients were oldest (fig. 2); in contrast to those with acute stroke or ICH, these patients were more often confused, less often in coma, and seldom paralyzed (table 3). Aside from confusion, the most common complaints were nausea, vomiting, headache, and dizziness. Many patients had arteriosclerotic heart disease and diabetes, but relatively few were hypertensive (table 2). The case fatality rate for this syndrome was 21%.

**Relation of Discharge Code to Diagnostic Group**

When all the information in a medical record was considered, the diagnosis did not correlate well with the hospital discharge diagnosis (table 4). For instance, one-fourth of the patients with bloody spinal fluid were discharged with diagnoses suggesting nonhemorrhagic stroke. The diagnostic codes applied in cases without demonstrated intracranial hemorrhage correlated only vaguely with the syndromes described in the patient's chart. For instance, cerebral vasospasm was seldom used to indicate transient ischemia, and the code used for transient syndromes also was used for the elderly patients with vague syndromes (table 4).

Except at the university hospital, spinal fluid seldom was examined in cases of acute stroke and the choice, in these cases, between the discharge diagnoses of ICH and cerebral thrombosis clearly did not depend on the demonstration of bloody CSF. Table 5 shows the influence of factors which might be expected to affect the choice of the diagnosis ICH. Generalists and internists considered their patients with acute stroke to have ICH with essentially equal frequency. Hemorrhage was diagnosed more frequently at hospital #1 and infrequently at hospital #4 by both groups of physicians. The death of the patient influenced generalists to diagnose hemorrhage and the
presence of headache or stiff neck had this influence on both generalists and internists.

Discussion
The infrequent use of spinal fluid examination, arteriography, and autopsy made it impossible to directly substantiate the relationship between the study diagnoses and the pathological diagnoses. Nevertheless, there is evidence that the study diagnoses did, in fact, distinguish syndromes which were distinct in significant ways. In contrast, it is clear that, as reported by others, the hospital discharge diagnoses are often not compatible with data available in the body of the medical record.

The validity of the eight study syndromes attributed to cerebrovascular disease is supported by the finding of differences between patients in the various diagnostic groups which were unrelated to the criteria used to distinguish the syndromes and which are expected in the pathological states which the diagnostic categories are designed to include (SAH, ICH, etc.). Whatever incompleteness there may have been in these medical records, the information recorded was sufficient to distinguish groups of patients with expected differences in age, sex, race, underlying disease, neurological signs and laboratory data.

The syndromes had widely different case fatality rates, and attempts to compare the results for patients with cerebrovascular disease in several hospitals cannot be undertaken adequately if the syndromes are not distinguished. Furthermore, when cases are sorted by diagnostic group, unusual features indicate cases which may profitably be studied by the utilization committee. For instance, review of cases with the study diagnosis, subarachnoid hemorrhage, particularly of those not discharged with that diagnosis, might uncover additional patients who would benefit from surgery. A medical staff might also profitably review cases with transient symptoms with hypertension who did not receive antihypertensive therapy, cases with vague syndrome by others, the hospital discharge diagnoses are often not compatible with data available in the body of the medical record.

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occurring before age 60, and cases dying with vague syndromes as the primary diagnosis.

Medical practice evaluation is increasingly demanded as an important aspect of patient care. If such evaluation is to be practical, it must be based on data from the hospital medical record. If these records are inadequate, the medical staff must improve them or institute a new record system. The data reported here suggest that presently available records of patients with cerebrovascular disease contain enough information to define reasonably homogeneous patient groups. A subsequent report explores the effectiveness of care for these patients in different hospitals and by different groups of physicians.

References
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