Progression of Stroke After Arrival at Hospital

MONA BRITTON M.D., AND ÅSA RÖDEN

SUMMARY In order to investigate the frequency, extent and importance of progression of stroke symptoms after arrival at hospital, 402 consecutive patients were studied. Speech ability, extremity and facial pareses were evaluated and graded on four occasions during hospitalization.

Deterioration was noted in 43% of the patients; it was fairly marked in 25%. The frequency among the few patients with cerebral haemorrhage was much the same as in those with infarction. Limb motor function was affected in most cases. Half of the progressions occurred within the first 24 h after admission. Patients with progression stayed longer in hospital, were more disabled at discharge and more often needed further institutional care than those without progression, although the initial dysfunction was similar in the two groups. No characteristics were found that would help to identify a risk of deterioration.

Thus, progression of stroke symptoms after arrival at hospital is a common and serious problem, whose solution calls for vigorous research.

Patients with syncope admitted to medical intensive care units.

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STROKE PROGRESSION has attracted very little attention. In textbooks, the type, frequency and prognosis of progression are simply ignored.1, 2 Reviewing the literature, Jones and Millikan found no account of the natural history; they reported deterioration in 23–46% of their brain infarction patients.3, 4 As these figures probably include progression from the case history, they do not indicate the proportion of patients who deteriorated after they came under observation and therapeutic assessment. At the Salzburg meeting in 1980 Hachinski and Norris5 reported that in as many as 29–33% of their patients with ischemic lesions, deterioration was noted after arrival at hospital. However, since the evaluations were based on a score, the Toronto Stroke Scale, a worsening picture might reflect complications in some cases rather than progress of specific stroke symptoms. Neither of these reports touched on the outcome or patient characteristics. Nor did they mention whether admission had been selective. We therefore wanted to study the extent and frequency of progression of pareses and speech disorders among unselected stroke patients after arrival at hospital. Also we wanted to know whether any differences could be found between patients with haemorrhage and those with infarction. Was the deterioration temporary or of importance for the degree of recovery? Could patients at risk for progression be identified by any characteristics?

Material and Methods

During the period 1976–79, 402 stroke patients were cared for in the non-intensive Stroke Unit of the Serafiner Hospital, serving a defined area of Stockholm with 120,000 inhabitants. All persons seeking acute medical advice were referred to that hospital. Stroke cases, including TIA, were transferred to the Stroke Unit if beds were available. The unit treated about half, and a representative part, of all stroke cases admitted to the hospital.6 Furthermore, the patients mean age, the distribution of previous diseases and
diagnoses, as well as the mortality, were similar to those of stroke patients in population studies.7

The final diagnoses after hospitalization were based on ordinary clinical work-up, routine laboratory tests, ECG and chest X-ray. Lumbar puncture with CSF analysis, including spectrophotometry, was performed in 94% of cases and brain scan in 82%. From May 1978 computerized axial tomography (CT) was included, which means that 45% of cases were investigated also with this method. Autopsy was carried out in 53 of the 61 deceased.

At arrival, all patients were examined in the emergency ward by the doctor on duty. The findings were registered on a special form. Neurological reexamination in the Stroke Unit were scheduled at fixed intervals for all patients during the first day (mean 12 h after arrival, range 1–24 hr), the fourth day and at discharge. Temporary deterioration between the examinations, was registered when noticed but might have occurred unnoticed in some patients. Only parameters from the four fixed examinations were therefore coded for data processing. From the neurological examinations we chose three parameters i.e. extremity pareses, facial weakness and dysphasia which were defined and graded as presented in table 1. Worsening of these symptoms was looked for. Deterioration of consciousness and orientation was not considered because it tended to be influenced by complicating factors like fever, venous thrombosis, myocardial infarction and infections.

Sensibility was tested by touch and registered as normal or abnormal. Lack of cooperation precluded this evaluation in 78 patients. In another 93 subjects sensibility was already abnormal at arrival. A loss of normal function was noted in 36 cases, in 12 of which it was the only parameter affected. Sensibility was tested less uniformly and was more difficult to interpret. This was also the case as regards tests of visual fields, muscle reflexes, left hemineglect, cerebellar and eye motorfunction. The data on these parameters have therefore not been included.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Dysfunction Scale. Extremity Paresis Was Tested as Hand-grip Strength and the Ability to Raise a Stretched Leg from the Bed. Normal Function in all Respects Gives a Total of 6 Points, Loss of all Functions 21 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremity paresis (all four extremities)</td>
<td>Points</td>
</tr>
<tr>
<td>Normal function</td>
<td>1</td>
</tr>
<tr>
<td>Slight paresis (noticeable but insignificant)</td>
<td>2</td>
</tr>
<tr>
<td>Serious paresis (obvious)</td>
<td>3</td>
</tr>
<tr>
<td>Total paralysis</td>
<td>4</td>
</tr>
<tr>
<td>Speech ability</td>
<td></td>
</tr>
<tr>
<td>Normal function</td>
<td>1</td>
</tr>
<tr>
<td>Dysphasia</td>
<td>2</td>
</tr>
<tr>
<td>Total aphasia</td>
<td>3</td>
</tr>
<tr>
<td>Facial function</td>
<td></td>
</tr>
<tr>
<td>Normal or doubtful findings</td>
<td>1</td>
</tr>
<tr>
<td>Obvious weakness</td>
<td>2</td>
</tr>
</tbody>
</table>

Only 11 patients received heparin treatment during hospitalization (5 for repeated TIA and 6 for extensive progression). Secondary prophylaxis with oral anticoagulants or aspirin was introduced, not in the acute phase but only after all investigations, usually just before or after discharge. Consequently, treatment did not influence the natural course of symptoms to any important extent.

As statistical methods, the student’s t-test was used to assess differences between means. The chi-square test was applied to differences of proportions. Degrees of significance regarded were 5% (*), 1% (**) and 0.1% (***) NS = not significant.

**Results**

Altogether, 43% of the patients deteriorated to some extent after hospitalization (table 2). There was no statistically significant difference between subjects with haemorrhage and those with ischemic lesions. Marked progression (≥ 2 points) was found in 25% of the patients. All symptoms had subsided in 39 of the 402 patients on arrival at hospital; subsequent deterioration occurred in 31% of this subgroup.

Progression mostly occurred during the first 24 h of hospital care (fig. 1). This was true for slight as well as more marked degrees, for ischemic as well as haemorrhagic lesions. However, no less than 43% of the events occurred later.

**Table 2. Progression of Paresis or Dysphasia in Relation to Type of Stroke.** Progression is Subdivided according to Degree into Deterioration by one Point and by 2 or More Points

<table>
<thead>
<tr>
<th></th>
<th>Total n = 402</th>
<th>Haemorrhage n = 31</th>
<th>Ischemic lesion n = 371</th>
</tr>
</thead>
<tbody>
<tr>
<td>No progression</td>
<td>229</td>
<td>57</td>
<td>217</td>
</tr>
<tr>
<td>Progression, total</td>
<td>173</td>
<td>43</td>
<td>154</td>
</tr>
<tr>
<td>one point</td>
<td>73</td>
<td>18</td>
<td>64</td>
</tr>
<tr>
<td>2 or more points</td>
<td>100</td>
<td>25</td>
<td>90</td>
</tr>
</tbody>
</table>

**FIGURE 1.** Time after arrival at which the first and/or further signs of deterioration were noted. Patients with progressing symptoms are also divided according to their degree.
Progression of stroke symptoms after arrival at hospital was found to be unexpectedly common, even though the assessment was confined only to motor function and speech ability. Worsening, even the smallest, was frequent (82% of cases, table 3). The degree was marked in two thirds. When only facial function or speech ability was affected, worsening rarely exceeded one point. This was probably because the scales for these variables had fewer steps.

At arrival the mean degree of dysfunction showed no statistically significant difference between patients who subsequently deteriorated and those who did not (fig. 2). The difference became clear on day one, increased to day four and remained at discharge (mean 21 days later). Even patients who deteriorated by only one point fared worse than those with no progression. Outcome can also be expressed in other terms than scale points. Patients without progression were better off than those who deteriorated as regards: mean hospital stay (18 days vs 24 ***); recovery of normal function of tested parameters (46% vs 20 ***); independent transfers (47% vs 34, ***); ability to return directly to own home (66% vs 34% ***). Mortality, however, was similar in the two groups (14% vs 16, NS).

As seen in table 4, no characteristics were found which differentiate patients who deteriorated later from those who did not. Thus, there was no statistically significant difference as regards type of symptom onset or condition at arrival including level of consciousness. Atrial fibrillation as a possible source for cardiac embolism was equally common in both groups as were other concomitant diseases. Neither did the mean values of BP, blood glucose and hematocrit differ. In cases where the delay from debut to admission was known (around 35% of the total) this was similar in the groups. The same applied when haemorrhages and ischemic lesions, as well as the two degrees of deterioration, were studied separately.

**Discussion**

Progression of stroke symptoms after arrival at hospital was found to be unexpectedly common, even though the assessment was confined only to motor function and speech ability. Worsening, even the smallest, was frequent (82% of cases, table 3). The degree was marked in two thirds. When only facial function or speech ability was affected, worsening rarely exceeded one point. This was probably because the scales for these variables had fewer steps.

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slightest, was not temporary but of great importance for the outcome. As regards the third aim of the study, we failed to find characteristics that identify a risk of deterioration.

Very little attention has been paid to these problems in the literature. It seems that studies were not feasible before the introduction of better diagnostic methods and stroke units for supervision. Even then the requirements are not easily met. A large number of non-selected patients has to be studied carefully. Their neurological function must be checked regularly in a standardized way and the data recorded in a form that permits future analysis. Also, there is the question of which parameters to consider. Certainly, functions like perception, vision or left hemineglect are of great importance for a patients opportunity to return to a normal life. For feasibility however we chose to evaluate just a few symptoms, where progression is considered to be “stroke specific” and of the utmost importance for patient outcome. Still, this limited examination proved to be of great significance for patient outcome. Also, we felt that this was the kind of deterioration for which heparin treatment is generally believed to be indicated.4

From this and the studies mentioned in the introduction it can be concluded that, due to the high incidence of stroke, progression of symptoms after arrival at hospital constitutes a major health care problem. How this should be tackled is less certain. First, careful supervision is mandatory so that changes in performance can be detected without delay. It probably has to be based on regular check-ups by nurses instructed to perform and record a limited, standardized function test. The one used here seems appropriate on that account and is simple enough to repeat at least twice a day. When progression is confirmed, and haemorrhage excluded with due caution, the question of treatment remains. According to present rules, heparin is the first choice, believed to prevent reembolisation or enlargement of an existing thrombosis.

There are two controlled10,11 and two uncontrolled12,13 studies showing a positive effect of this treatment. The studies do not meet modern standards and the data are somewhat inconclusive. Also, induction of bleeding in an infarction has been described and in many instances the therapy lacked effect.10,11,13-15 Still, if progression is noted early and heparin treatment is at least slightly effective, further deterioration might be prevented and the outcome improved for a number of patients.

However, the ideal is to prevent the whole problem. As no risk factors for deterioration have been found, solutions would have to apply to all stroke patients. In the case of haemorrhage the problem is mainly surgical. For the great majority — patients with ischemic lesions, — aspirin is a possible choice for a trial, as low-dose subcutaneous heparin treatment has been found to be inefficient.16 However, other explanations than coagulation mechanisms have been given for deterioration: development of brain oedema, synaptic crisis in the edge zones of an infarction, spasm of arteries or lowering of the blood pressure.8 If these mechanisms prevail, other prophylactic therapy (e.g. oxygen, haemodilution) might be more efficient. There seems to be a great need for trials regarding the prevention and treatment of the common and serious problem of stroke progression.

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References

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