The term “anosognosia” was introduced by Cutting1 to describe patients who ignored their hemiplegia. Currently, clinicians use the term to characterize explicit denial or lack of awareness of deficits associated with many different neurologic conditions, including visual loss, movement disorders, and amnesia.2 Anosognosia is most widely reported in association with left hemiplegia and left hemispatial neglect (N).3 Some studies have indicated that anosognosia for left hemiplegia is dissociable from the degree of extra-personal1,4 and personal neglect.4

Typically, patients with anosognosia for hemiplegia deny their hemiplegia or behave as if the disorder did not exist. They are convinced that their paretic or plegic limb functions normally. Pedersen et al5 found anosognosia in 73% of patients with N within the first week of stroke onset; Jehkonen et al6 and Maeshima et al7 showed that anosognosia disappears spontaneously in a short time.

Many authors have valued the influence of N on the rehabilitative outcome of hemiplegia,8–11 and several studies found poor recovery after stroke in patients with N.8,9,11,13 On the contrary, interest in the rehabilitative impact of anosognosia for hemiplegia has been poor up to now. Previous studies valued only subjects with anosognosia alone and provided contrasting data on its rehabilitative role.6–9,14 At present, it has not yet become definite whether the presence of verbal denial of hemiplegia (A) worsens the rehabilitative prognosis of patients with N. Therefore, we compared the level of motor function, functional capacities, and disability of patients with N alone (N) with those of patients with N and A (N+A).

Materials and Methods

Patients

Two hundred and forty one patients with left hemiplegia were admitted to our Rehabilitation Department from January 1997 to December 2002. Among these patients, 15 patients with N and 15 with N+A were selected. Inclusion criteria for these patients were as follows: (1) presence of severe motor impairment and disability at admission; (2) presence of an isolated lesion, located in the right cerebral hemisphere; and (3) absence of functional impairment related to previous strokes or other neurological and/or psychiatric diseases.

Mean age was 68.2±6.3 in group N (9 men and 6 women) and 72.1±6.4 in group N+A (7 men and 8 women). The average interval from onset of stroke to admission for rehabilitation was 23 days in group N and 23.6 days, respectively, in group N and in group N+A. Patients were assessed through the Mesulam test, Bisiach test, Wechsler Adult Intelligence Scale, Fugl-Meyer scale, Functional Independence Measure (FIM), and Rankin scale.

Results—Before rehabilitation, cognitive FIM scores of patients of group N were significantly higher than those of group N+A (P=0.001), whereas motor FIM scores and total FIM scores did not differ between the 2 groups. After rehabilitation, cognitive FIM scores (P=0.000) and even motor (P=0.009) and total FIM scores (P=0.000) were statistically higher in group N than in group N+A. Effectiveness (P=0.005) and efficiency (P=0.012) in the motor FIM scores of group N were significantly greater than those of group N+A. Disability was lower in group N (P=0.040).

Conclusions—Our study shows that the presence of anosognosia worsens the rehabilitation prognosis in hemiplegic subjects who also have neglect. (Stroke. 2005;36:2687-2690.)

Key Words: cerebrovascular disorders ■ neglect ■ stroke ■ rehabilitation

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2687
Computed tomography scans showed lesions located only in the right hemisphere. In group N, the stroke was ischemic in 13 patients and hemorrhagic in 2; in group N+A, the stroke was ischemic in 11 subjects and hemorrhagic in 4 ($\chi^2=0.75; P=0.388$). Based on the extent of their largest diameter, 15 lesions were classified as small (N, 4; A, 3), medium (N, 3; A, 3), and large (N, 8; A, 9) (respectively: <3 cm; 3 to 5 cm; and >5 cm), and lesions size was not significantly different between the 2 groups ($\chi^2=2.011; P=0.904$).

**Instruments**

The assessment of patients was made using the Mesulam test, the Bisiach test, the Wechsler Adult Intelligence Scale (WAIS), the Fugl-Meyer Scale, the Functional Independence Measure (FIM), and the Rankin scale. All of these tests were administered at admission and also at discharge with the exception of the WAIS, which was administered at admission only.

The presence and severity of neglect (N) was assessed with the Mesulam cancellation test, a standardized test of unilateral visual neglect. The 4 items forms consist of random and structured arrays of verbal and nonverbal stimuli. The lower the scores, the more severe the neglect. Only the random verbal items form was considered for statistical analysis.

Anosognosia for hemiplegia (A) was assessed using the test procedures described by Bisiach et al. Anosognosia is assessed by questioning the patient about limb weakness and visual field defects. The acknowledgement of hemiplegia is scored on a 4-point scale. This test allowed us to select 2 groups of patients in relation to the presence of anosognosia (group N and group N+A). Anosognosia for hemiplegia was severe in 9 patients (who did not acknowledge their hemiplegia), moderate in 4 (hemiplegia acknowledged after standard neurological examination), and mild in 2 (hemiplegia reported after a general question about patient’s health). At discharge, all of the 15 patients with A learned to refer to their deficits, although they still showed anosognosic behavior in everyday life (eg, 1 patient repeatedly tried to walk and fell down, as his left lower limb was still plegic).

The Wechsler Adult Intelligence Scale was administered to assess discriminative functions. The scale consists of a set of 6 verbal and 5 nonverbal subtests that are individually administered requiring $\approx$1.5 hours. In this study, we used the verbal subtests only, which assessed information, comprehension, arithmetic reasoning, analogy, capacity to remember numbers, and the vocabulary subtest. Administration and evaluation of the test was carried out by a psychologist at the patient’s admission to the study. For statistic analysis, we considered the graded score only.

The Fugl-Meyer scale is a system for assessing motor function, balance, some sensory details, and joint dysfunction in hemiplegic patients. In our study, we valued only motor function, sensation, and balance in sitting position. This scale included 50 items 50 points for motor function, 12 for sensation, and 3 for balance in sitting position. A 3-step (0 to 1 to 2) ordinal scale is applied to each item. Total maximum score is 100 for motor function (66 for upper extremity and 34 for the lower extremity), 24 for sensation, and 3 for balance in sitting position. Five levels of motor impairment were identified according to Fugl-Meyer (severe $=$ score $\leq 50$; marked $=$ score 50 to 84; moderate $=$ score 85 to 95; slight $=$ score 96 to 99; and normal motor function $=$ score 100).

The FIM was used to measure the degree of independence and assistive need in activities of patient daily living. It is an ordinal scale composed of 18 items with 7 levels ranging from 1 (total dependence) to 7 (total independence). The FIM can be subdivided into a 13-item motor subscale and a 5-item cognitive subscale. The ranges of scoring for the motor and cognitive subscales are 13 to 91 and 5 to 35, respectively. Total score is 126. The patients were tested by a qualified physiatrist at admission and at discharge.

Disability was evaluated with the modified Rankin scale. This is a 6-grade scale, from 0 (independence) to 5 (severe disability).

**Rehabilitation**

Rehabilitation was both motor and neuropsychological. Motor rehabilitation was based on the Bobath technique. All of the patients underwent an average of 300 minutes per week (5 days per week) of motor rehabilitation and 120 minutes per week (4 days per week) of neuropsychological rehabilitation.

The need for rehabilitation of each patient was evaluated by a team of specialists (physician, psychologist, and physiotherapist). Rehabilitation was initiated the day after admission. The needs of each patient, the specific goal set for the patient, and the rehabilitation achievement were discussed fortnightly by the rehabilitation team. Patients were not discharged until additional in-hospital improvement was considered unlikely by the rehabilitation team.

**Statistical Analysis**

Data were statistically analyzed using the program “Statistica Version 6” (StatSoft). Statistical analysis was performed using tests of descriptive statistics (means, SD, and percentage), T test, $\chi^2$, and Mann-Whitney U test for the comparison between groups. Moreover, the Spearman rank method was used to examine the correlation coefficients between variables. Finally, effectiveness and efficiency were calculated. The level $P<0.05$ is taken as significant.

**Results**

Table 1 presents profiles of the Mesulam test, WAIS, sensory-motor function, and balance in sitting position in patients of both groups. The table shows that WAIS score was significantly higher in group N than in group N+A at admission. On the contrary, the mean scores of Mesulam test, tactile sensation, position sense, and balance in sitting position did not differ significantly between the 2 groups, both at admission and at discharge.

Before rehabilitation, the motor impairment was severe in all of the patients of group N, whereas it was severe in 93.3% and marked in 6.7% of subjects of group N+A. After rehabilitation, the motor impairment was severe in 93.3% and marked in 6.7% of subjects of group N, whereas it was severe 86.7% and marked in 13.3% of subjects of group N+A ($\chi^2=0.00; P=1.000$). In both groups, motor function recovery was greater in the lower limb than in upper limb.

Table 2 presents the profiles of the functional capacities of the 2 groups of patients before and after rehabilitation and the comparison of data between the groups. The table shows that cognitive FIM scores of group N patients were significantly higher than those of group N+A before rehabilitation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>N+A</th>
<th>z</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor function</td>
<td>7.5 $\pm$ 2.9</td>
<td>8.2 $\pm$ 1.3</td>
<td>0.215</td>
<td>0.829</td>
</tr>
<tr>
<td>Tactile sensation and position sense</td>
<td>5.86 $\pm$ 4.7</td>
<td>4.66 $\pm$ 3.8</td>
<td>0.943</td>
<td>0.345</td>
</tr>
<tr>
<td>Sitting balance</td>
<td>0.80 $\pm$ 0.8</td>
<td>0.66 $\pm$ 0.8</td>
<td>0.428</td>
<td>0.668</td>
</tr>
<tr>
<td>Mesulam test</td>
<td>15.0 $\pm$ 13</td>
<td>9.66 $\pm$ 10</td>
<td>1.642</td>
<td>0.100</td>
</tr>
<tr>
<td>WAIS (verbal subtests)</td>
<td>46.7 $\pm$ 10</td>
<td>37.13 $\pm$ 11</td>
<td>2.512</td>
<td>0.011*</td>
</tr>
<tr>
<td>Discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor function</td>
<td>21.4 $\pm$ 13</td>
<td>19.3 $\pm$ 21</td>
<td>1.017</td>
<td>0.308</td>
</tr>
<tr>
<td>Tactile sensation and position sense</td>
<td>6.66 $\pm$ 5.2</td>
<td>4.81 $\pm$ 3.4</td>
<td>1.354</td>
<td>0.175</td>
</tr>
<tr>
<td>Sitting balance</td>
<td>1.86 $\pm$ 0.3</td>
<td>1.66 $\pm$ 0.4</td>
<td>1.273</td>
<td>0.202</td>
</tr>
<tr>
<td>Mesulam test</td>
<td>26.7 $\pm$ 12</td>
<td>20.2 $\pm$ 11</td>
<td>1.601</td>
<td>0.109</td>
</tr>
</tbody>
</table>

*P<0.5.
whereas motor FIM scores and total FIM scores did not differ between the 2 groups. After rehabilitation, both cognitive FIM scores and motor and total FIM scores were statistically greater in group N than in group N+A.

The effectiveness in motor FIM scores was 27.3±15.7% in group N and 12.4±10.7% in group N+A. Effectiveness was statistically greater in group N than in group N+A (z = 2.783; \( P = 0.005 \) where \( P < 0.01 \) was significant). The efficiency in motor FIM score was 0.30±0.18 in subjects with N and 0.15±0.11 in subjects with N+A. Also, efficiency of group N was statistically greater than group N+A (\( z = 2.491; P = 0.012 \) where \( P < 0.05 \) is significant).

Table 3 shows the data of the correlation between the final FIM motor scores and scores of sitting balance, sensory and motor function, Mesulam test, and WAIS at admission. Statistical analysis was done with the Spearman rank method, because the design of the study and the number of patients did not allow for other statistical analyses. Final FIM motor score was correlated with sitting balance, limb motor function, and Mesulam test.

### Table 2: FIM in N and N+A Patients (Mann-Whitney U test)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>N+A</th>
<th>z</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total score</td>
<td>50±6.7</td>
<td>44.4±7</td>
<td>1.806</td>
<td>0.061</td>
</tr>
<tr>
<td>Cognitive score</td>
<td>24.6±5</td>
<td>18.8±4.6</td>
<td>3.209</td>
<td>0.001*</td>
</tr>
<tr>
<td>Motor score</td>
<td>25.8±4.6</td>
<td>25.6±5.6</td>
<td>0.229</td>
<td>0.818</td>
</tr>
<tr>
<td>Discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total score</td>
<td>70.0±11</td>
<td>53.2±10</td>
<td>3.466</td>
<td>0.000†</td>
</tr>
<tr>
<td>Cognitive score</td>
<td>25.8±3.9</td>
<td>19.1±4.7</td>
<td>3.559</td>
<td>0.000†</td>
</tr>
<tr>
<td>Motor score</td>
<td>44.1±10</td>
<td>34±8.5</td>
<td>2.577</td>
<td>0.009*</td>
</tr>
</tbody>
</table>

\( *P < 0.01; †P < 0.001. \)

Table 3. Correlation of the Ranks of Spearman in N and N+A Patients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sitting Balance</th>
<th>Motor Function</th>
<th>Sensation</th>
<th>Mesulam Test</th>
<th>WAS</th>
<th>( P ) Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIM: motor score (( \rho ))</td>
<td>0.578</td>
<td>0.416</td>
<td>0.164</td>
<td>0.426</td>
<td>0.322</td>
<td></td>
</tr>
<tr>
<td>( P ) Value</td>
<td>0.000†</td>
<td>0.021*</td>
<td>0.385</td>
<td>0.018*</td>
<td>0.081</td>
<td></td>
</tr>
</tbody>
</table>

\( *P < 0.5; †P < 0.001. \)

### Discussion

The aim of this study was to verify whether the presence of A worsens the rehabilitation prognosis of patients with N. To verify this hypothesis, we compared the functional recovery of patients with N with that of patients with N+A. Our study found that subjects with N had a functional recovery, which was statistically greater than that of subjects with N+A after rehabilitation and showed that the rehabilitation prognosis of subjects with N is negatively affected by the presence of A.

At present, studies on the rehabilitative role of A are few and provide conflicting data. Denes et al.\(^8\) and Pinedo Otaola and De La Villa\(^14\) showed that A does not affect functional recovery after stroke. Jehkonen et al.\(^6\) found that neither A for hemiparesis nor A for neglect are important predictors connected with the return to home after right hemisphere stroke.

Pedersen et al.\(^5\) underlined that the presence of anosognosia in surviving patients is univariately associated with a poorer functional outcome, a longer stay in hospital, and a smaller proportion of patients returning to independent living after discharge. Also, Maeshima et al.\(^7\) Hartman-Maier et al.\(^15\) and Appelros et al.\(^13\) in their works, found that A influences disability. Our results are in line with these findings. However, there are differences between our study and studies by above-mentioned authors.

These differences regard the type of patients and the interval from onset of stroke to neuropsychological assessment. In their works, Denes et al.\(^8\) Pinedo Otaola and De La Villa,\(^14\) Hartman-Maier et al.\(^15\) and Appelros et al.\(^13\) assessed patients affected only by A or only by N. On the contrary, in our study, we compared patients with A+N with patients with N alone.

In the studies by Pedersen et al.\(^5\) Jehkonen et al.\(^6\) and Maeshima et al.\(^7\) the assessment of N and A was done during the first days after stroke. This allowed the inclusion in the study of patients with possible neuropsychological deficits, which were not defined yet. The presence of N and A is higher during the first days after stroke, but in the majority of cases, N and A disappear spontaneously in a few days,\(^23\) even if the persistence of N is still shown in chronic patients after some years.\(^23\) In our study, the assessment of N and A was made 23 days after stroke; this allowed for the inclusion of subjects with relatively stable neuropsychological deficits.

Unlike previous studies, our study aims at defining the rehabilitative role of A in patients with N. Studied population was selected very carefully. At admission, there was no significant difference in age, gender, motor function, motor FIM score, and disability between the 2 groups of patients. The assessment of N and A was made 23 days after stroke. All of the patients affected with A were also affected with N. Both groups were subject to motor and neuropsychological rehabilitation.
The length of hospital stay was longer for group N, but there was no significant difference between the 2 groups of patients. This fact did not influence results, because our design foresaw that patients were not discharged until additional in-hospital improvement was considered unlikely by the rehabilitation team. In addition, our study also valued daily increase in motor FIM, which was higher in N subjects.

Before rehabilitation, the 2 groups of patients differed statistically only in WAIS and cognitive FIM scores. The mean scores of WAIS verbal subtests and cognitive FIM of group N were higher than those of group N + A. This does not have to be considered a limitation of our study for 2 reasons. First, the cognitive disturbances found in subjects with N + A pertain to A itself. In fact, Jehkonen et al found that patients with A had poorer orientation and verbal memory, and Feinberg et al observed verbal confabulation in subjects with A. Starkstein et al found significantly higher frequencies of hemispatial neglect and related phenomena, as well as deficits in recognizing facial emotions and in receptive prosody in patients with A. Second, in our study we wanted to take more into consideration the motor FIM score, which assesses self-sufficiency in the activities of daily living.

Each group of patients was composed of 15 patients; the subjects were selected between those that had N or N + A and those that were admitted to the hospital during the considered period. The sample of patients is small, and, therefore, it does not represent the general population. We do not think that this is a limitation of our study, because our aim was to verify whether the presence of A worsens the rehabilitation prognosis of patients with N + A. This goal could be achieved only by selecting 2 groups of patients (the first with N and the second with N + A), which had to be homogenous for all of the considered parameters (gender, age, interval from onset of stroke to admission for rehabilitation, FIM score, and N) and, then, comparing the 2 groups.

Despite these considerations, the study has some very interesting aspects. First, the study brings forth other data on the functional recovery of patients with N. Second, the study shows that patients with A have more severe cognitive disturbances than those of subjects with N. This is in line with data by Feinberg et al, Stone et al, and Jehkonen et al, which underline that A is an indicator of more severe neglect. Finally, it increases the knowledge on the factors affecting the rehabilitative outcome of subjects with N. There are few studies on this topic. Some authors found correlations between functional recovery and deficits of space exploration. Our study also showed that A worsens the rehabilitation prognosis of subjects with N. These data are of practical use to formulate the rehabilitation prognosis after the acute phase of a stroke.

Anosognosia is a neuropsychological symptom often associated with N, but the relations between N and A are not well defined. Some authors consider that A is an aspect of N, whereas, for others, A is a symptom frequently associated with N but with a conceptually independent status.

Patients with A do not acknowledge hemiplegia, or they report the motor disorder, but, at the same time, they show an inappropriate behavior in everyday life. All of this negatively affects the rehabilitative treatment, because it is extremely difficult to motivate a patient to regain an ability that she/he does not know was lost.

References

Functional Recovery After Hemiplegia in Patients With Neglect: The Rehabilitative Role of Anosognosia
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