Predictors of Smoking Abstinence After First-Ever Ischemic Stroke
A 3-Month Follow-Up

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Background and Purpose—Predictors of smoking abstinence in stroke survivors remain largely unexplored. The present study addressed the relationship between degrees of nicotine dependence and smoking abstinence 3 months after ischemic stroke.

Methods—One hundred smokers with first-ever ischemic stroke were prospectively enrolled to the study. Correlates of nicotine dependence as well as sociodemographic and clinical characteristics were assessed during hospitalization. Smoking status was determined at 3-month follow-up.

Results—Significant predictors of smoking abstinence at follow-up included: the Fagerström Test for Nicotine Dependence (FTND) score, the Barthel Index, the number of smoking household members, and the Geriatric Depression Scale score.

Conclusions—Our results suggest that smoking cessation after ischemic stroke can be determined by the interplay of psychobiological and environmental factors. (Stroke. 2009;40:2592-2593.)

Key Words: ischemic stroke ■ smoking cessation ■ predictors

Predictors of smoking abstinence after stroke remain largely unexplored. Previous studies have found some association between smoking persistence and specific sociodemographic characteristics of stroke survivors (eg, younger age, male sex). The relationship between functional status after stroke and smoking behaviors remains controversial. The previous studies did not address the impact of nicotine dependence on smoking cessation and did not validate smoking status by using a biochemical marker.

The Fagerström Test for Nicotine Dependence (FTND) is a simple clinical tool for assessing nicotine dependence. Higher FTND scores predicted smoking cessation failure in various groups of patients. In the present study, we evaluated the predictive value of FTND scores for smoking abstinence after first-ever ischemic stroke. As alcohol use, depressive symptomatology, and living with other smokers may impact smoking cessation, these variables were also included in statistical analyses.

Patients and Methods

Baseline Assessment (T0)
The study protocol was approved by the Ethics Committee of the Institute of Psychiatry and Neurology (IPN). One hundred active cigarette smokers with first-ever ischemic stroke admitted consecutively to the IPN between January 2005 and November 2007 were prospectively enrolled. Other inclusion criteria were: age 18 to 85 years, no previous diagnosed brain lesion, and ability to communicate and complete an interview. Exclusion criteria were: hemorrhagic stroke, head trauma, severe concomitant neurological diseases, dementia, psychosis, and consciousness disturbances making patient unable to cooperate. All study participants were white, aged 29 to 82 years.

The baseline assessment was completed in the first 10 to 14 days after stroke onset (T0). The National Institutes of Health Stroke Scale (NIHSS) and the Barthel Index were used to evaluate neurological deficits and functional status, respectively. Depressive symptomatology was assessed using a 15-item version of the Geriatric Depression Scale (GDS). Alcohol Use Disorders Identification Test (AUDIT) was used to identify alcohol-related problems. Parameters related to smoking behavior included the FTND score and self-reported nicotine craving assessed using a vertical 100-mm Visual Analog Scale (VAS). Other parameters are listed in the Table. All patients received a smoking cessation intervention in accordance with the “5 A’s” model recommended by the U.S. Department of Health and Human Services.

Follow-Up Assessment (T1)
One patient died and 1 patient had a second stroke between hospitalization and follow-up. Thus, 98 patients were invited for the 3-month follow-up visit. A person was classified as a nonsmoker if he or she reported not smoking for the last 4 weeks and had an expired-air CO level ≤6 parts per million (measured between 1:00 PM and 3:00 PM). Ten patients were unable or uninterested to complete the follow-up visit. Telephone interviews confirmed that all these patients smoked cigarettes at follow-up.

Statistical Analysis
Means and proportions were compared by using the Mann-Whitney U test and the $\chi^2$ test with Yates’ correction, respectively. Variables that were statistically different at $P<0.1$ were tested in a univariate logistic regression analysis.
follow-up in stroke survivors. The presence of other smokers in
the household elicits conditioned craving responses in ex-
smokers,11 and smoking family members provide the ex-smoker
with less social support for quitting.7,11,12

Higher GDS scores at T0 predicted the lower likelihood of
smoking abstinence at follow-up. Our results provide further
support to a well-known relationship between smoking and depression.10

Worse functional status at T0 correlated with smoking abstinence
at follow-up. This finding is in agreement with the study showing
that lower Barthel Index scores predicted smoking abstinence at
6-month follow-up.2 No association between the Barthel Index and
smoking abstinence was found in the other studies.1,4

The present study involves some limitations (eg, a relatively
small sample size and short follow-up period). Hence, our
findings may have limited generalizability and require
replication in multicenter studies with longer follow-ups.

## Sources of Funding

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## Disclosures

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and dependence: an evidence-based clinical practice guideline for tobacco

### Table. Baseline Characteristics of Study Subjects†

<table>
<thead>
<tr>
<th>Variables Assessed at T0</th>
<th>Smokers at Follow-Up (n = 61)</th>
<th>Nonsmokers at Follow-Up (n = 37)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>57.2±9.4†‡</td>
<td>60.7±11.5</td>
<td>0.09</td>
</tr>
<tr>
<td>Women</td>
<td>27.9</td>
<td>27.9</td>
<td>0.88</td>
</tr>
<tr>
<td>Body mass index</td>
<td>26.7±4.5</td>
<td>26.7±4.6</td>
<td>0.94</td>
</tr>
<tr>
<td>Married</td>
<td>72.1</td>
<td>81.1</td>
<td>0.44</td>
</tr>
<tr>
<td>University degree</td>
<td>14.7</td>
<td>18.9</td>
<td>0.80</td>
</tr>
<tr>
<td>Employed</td>
<td>49.2</td>
<td>56.7</td>
<td>0.60</td>
</tr>
<tr>
<td>Living with their families</td>
<td>83.6</td>
<td>91.9</td>
<td>0.38</td>
</tr>
<tr>
<td>Concomitant medical states</td>
<td>3.6±1.8</td>
<td>3.2±1.4</td>
<td>0.21</td>
</tr>
<tr>
<td>Medications taken</td>
<td>3.7±1.5</td>
<td>3.2±1.4</td>
<td>0.14</td>
</tr>
<tr>
<td>Barthel index</td>
<td>18.1±3.9</td>
<td>16.0±6.0</td>
<td>0.08</td>
</tr>
<tr>
<td>NIHSS</td>
<td>2.6±2.3</td>
<td>3.9±3.8</td>
<td>0.11</td>
</tr>
<tr>
<td>GDS</td>
<td>5.4±3.7</td>
<td>3.7±3.1</td>
<td>0.03</td>
</tr>
<tr>
<td>AUDIT</td>
<td>5.9±5.5</td>
<td>4.6±4.3</td>
<td>0.26</td>
</tr>
<tr>
<td>Age at onset of regular smoking</td>
<td>19.9±4.0</td>
<td>21.1±9.8</td>
<td>0.98</td>
</tr>
<tr>
<td>Cigarettes per day</td>
<td>24.1±10.9</td>
<td>19.2±9.7</td>
<td>0.04</td>
</tr>
<tr>
<td>Previous quit attempts</td>
<td>2.4±3.3</td>
<td>2.6±2.7</td>
<td>0.41</td>
</tr>
<tr>
<td>Nicotine craving (mm)</td>
<td>30.4±23.6</td>
<td>22.6±30.1</td>
<td>0.02</td>
</tr>
<tr>
<td>FTND</td>
<td>5.1±2.2</td>
<td>3.5±2.3</td>
<td>0.001</td>
</tr>
</tbody>
</table>
| Smoking household mem-
bers                          | 1.0±0.9                      | 0.5±0.6                         | 0.008 |

†All patients were active smokers before stroke onset.
‡Values are means±SD or percentages.

### Results

Patients who continued to smoke at T1 had more smoking house-
hold members, were more depressed, smoked more cigarettes per
day before stroke onset, reported higher nicotine craving, were more
dependent on nicotine as reflected by the higher FTND score
(P<0.05), tended to be younger, and tended to have better func-
tional status (P<0.1) than patients who were classified as nonsmok-
ers (Table). A similar proportion of smokers (3/37) and nonsmokers
(5/61) used nicotine replacement therapy after stroke (P=0.71).

The variables related to smoking history were intercorrelated
and thus only the FTND score was tested in the univariate
regression analysis. Significant independent predictors of smoking
abstinence at T1 were: lower FTND scores (OR, 4.96; 95%
CI, 1.7 to 14.6; P=0.0008), lower Barthel Index (OR, 2.53; 95%
CI, 0.8 to 8.0; P=0.04), no smoking household members (OR,
2.41; 95% CI, 1.0 to 5.6; P=0.003), and lower GDS scores (OR,
1.26; 95% CI, 0.3 to 6.0; P=0.03).

### Discussion

This is the first study on the relationship between nicotine
dependence and smoking abstinence in ischemic stroke patients.
Our finding that stroke survivors with higher FTND scores at T0
are more likely to smoke at follow-up is consistent with the
results of previous studies on other groups of patients.6,7,8,9 It has
been suggested that more dependent smokers have greater
difficulty quitting smoking because they present more with-
drawal symptoms and experience stronger nicotine craving.8,9,15

This is also the first study showing that the number of
smoking household members predicts smoking status at

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