Screening for Nicotine Dependence among Smoking-related Cancer Patients

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To identify lung and head-and-neck cancer patients who will have difficulty stopping smoking it is necessary to measure the severity of their nicotine dependence. In this study, we compiled a Japanese version of the Fagerström test for nicotine dependence (FTND) and examined its reliability and validity. One hundred and fifty-one cancer patients participated in this study and took our Japanese version of the FTND. Socio-demographic and medical data and information about smoking habits were obtained from a semi-structured interview, and the patients' nicotine dependence was evaluated according to the Diagnostic and Statistical Manual of Mental Disorders, 3rd Ed., Rev. (DSM-III-R). The mean FTND scores ± SD of the group with nicotine dependence and the group without nicotine dependence were 6.85 ± 2.00 and 3.70 ± 2.13 respectively, and the difference was significant (P < 0.001, Mann-Whitney’s U-test). The test-retest correlation was 0.75. Cronbach’s α of the FTND was 0.66. The FTND score correlated significantly with the number of satisfied criteria of nicotine dependence (r = 0.70; P < 0.001, Pearson’s correlation). By using a receiver-operating-characteristic curve, we determined a score of 5/6 as a suitable cut-off point for nicotine dependence; this point gave high sensitivity and specificity (0.75 and 0.80, respectively). These results suggest that our Japanese version of FTND is a reliable and valid measure of nicotine dependence in patients with smoking-related cancers.

Key words: Fagerström test — Screening — Nicotine dependence — Smoking — Psycho-oncology

Continued tobacco use after cancer treatment is reported to be a risk factor for the secondary occurrence of cancer in patients with small-cell lung cancer1 and head-and-neck cancer2; moreover, abstinence from tobacco after surgery can result in improved pulmonary rehabilitation in lung cancer patients3 and better speech rehabilitation in head-and-neck cancer patients.4 Therefore, in order to decrease the incidence of secondary cancer and to improve postoperative rehabilitation, it is important for cancer patients to stop smoking at the time they are first treated. Nevertheless, some patients with smoking-related cancers continue to smoke, even after successful cancer treatment.1,5 For patients who find it difficult to stop smoking, appropriate intervention to help them stop is desirable.

Nicotine is the component of tobacco smoke that makes it difficult to stop smoking. In 1994, the American Psychiatric Association defined nicotine dependence as a substance-related disorder.6 The severity of the patient’s nicotine dependence is thought to be a predictor of their success or failure at stopping smoking.7–9 and it correlates with the physiological changes induced by smoking.10–12 Therefore, it is important to identify the severity of a patient’s nicotine dependence if they are having difficulty stopping smoking. Nicotine dependence can be evaluated according to the Diagnostic and Statistical Manual of Mental Disorders, 3rd Ed., Rev. (DSM-III-R).13 DSM-III-R is a diagnosing criteria for mental disorders defined by the American Psychiatric Association. In some surveys it worked reliably for evaluating nicotine dependence.14, 15 But it is conducted in structured interview and available only for psychiatrists and trained health professionals. There is no reliable, validated and self-reported screening tool for nicotine dependence that has a clearly defined cut-off point.

In 1978, in order to measure nicotine dependence at a stop-smoking clinic, Fagerström developed a self-rating scale for assessing nicotine dependence, named the Fagerström Tolerance Questionnaire (FTQ).10 Various studies have shown that the scores of the FTQ correlate not only with tolerance, withdrawal,11 self-administration16 and boost upon smoking of nicotine,17 but also with the level of cotinine (a major metabolite of nicotine)18 and failure or success in stopping smoking.7,9 As a revised version of the FTQ, the Fagerström test for nicotine dependence (FTND) was developed by Heatherton et al. in 1991.19 It contains a revised scoring system and omits 2 questions that appeared in the FTQ (items relating to the inhalation of tobacco smoke and the nicotine rating); these questions were unrelated to biochemical measures (salivary cotinine

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and CO), and added little to the measurement of nicotine dependence. The FTND is a non-invasive, inexpensive and simple way of measuring the strength of nicotine dependence, and has been widely adopted for use in both clinical and research settings as a measure of psychological dependence on nicotine.

In this study, we compiled a Japanese version of the FTND and examined its reliability and validity.

MATERIALS AND METHODS

The subjects for our study had been newly diagnosed as having lung or head-and-neck cancer and were recruited at the National Cancer Center Hospital East between June 1996 and December 1997. They were over 18 years old and had had a smoking habit for at least the past year. We excluded patients with cognitive disorders such as dementia and delirium. We recruited the subjects during their hospitalization and obtained written consent before the interviews. All subjects took our Japanese version of the FTND. A semi-structured interview was conducted simultaneously. We collected socio-demographic data (including age, gender, occupation, and marital status), and information about smoking habits from the interview. In the interview, nicotine dependence was evaluated according to the Diagnostic and Statistical Manual of Mental Disorders, 3rd Ed., Rev. (DSM-III-R) (Table I), compiled by psychiatrists. The medical data, such as clinical stage of cancer and performance status (PS)—as defined by the Eastern Cooperative Oncology Group (ECOG)—were collected from the medical records.

The Institutional Review Board and the Ethics Committee of the National Cancer Center in Japan approved the study.

The FTND scale The sample items consisted of 6 simple questions, including the number of cigarettes per day and the average length of time from waking to starting smoking (Table II). Pomerleau et al. examined the reliability (Cronbach’s $\alpha=0.64$, test-retest correlation=0.88) and validity of the original version of the FTND. We translated the FTND into Japanese, back-translated it, compared the original version with the back-translated version, and compiled a final Japanese version.

Reliability and validity Cronbach’s $\alpha$ was applied to investigate the internal consistency of the test. Furthermore, the FTND was taken twice by some patients with lung cancer, and the test-retest correlation was calculated.

Nicotine dependence was evaluated according to the DSM-III-R, and subjects are divided into 2 groups: a group with nicotine dependence and a group without nicotine dependence. We compared the total scores of the

### Table I. DSM-III-R Diagnostic Criteria for Nicotine Dependence

| Criteria                                                                 |
|-------------------------------------------------------------------------|
| A | At least three of the following                                        |
|   | (1) Nicotine often taken in larger amounts or over a longer period than the person intended |
|   | (2) Persistent desire or one or more unsuccessful efforts to cut down or control nicotine use |
|   | (3) A great deal of time spent in activities necessary to get nicotine (e.g., theft), taking nicotine (e.g., chain smoking), or recovering from its effects |
|   | (4) Frequent intoxication or withdrawal symptoms when expected to fulfill major role obligations at work, school or home |
|   | (5) Important social, occupational or recreational activities given up or reduced because of nicotine use |
|   | (6) Continued nicotine use despite knowledge of having a persistent or recurrent social, psychological, or physical problem that is caused or exacerbated by the use of nicotine |
|   | (7) Marked tolerance: need for markedly increased amounts of nicotine in order to achieve intoxication or desired effect, or markedly diminished effect with continued use of same amount |
|   | (8) Characteristic withdrawal symptoms                                  |
|   | (9) Nicotine often taken to relieve or avoid withdrawal symptoms       |
| B | Some symptoms of the disturbance have persisted for at least one month, or have occurred repeatedly over a longer period of time |

### Table II. Items and Scoring for Fagerström Test for Nicotine Dependence

| Questions                                           | Answers         | Points |
|-----------------------------------------------------|-----------------|--------|
| 1. How soon after you wake up do you smoke your first cigarette? | Within 5 min    | 3      |
|                                                     | 6–30 min        | 2      |
|                                                     | 31–60 min       | 1      |
|                                                     | After 60 min    | 0      |
| 2. Do you find it difficult to refrain from smoking in places where it is forbidden; e.g., in church, at the library, in cinema, etc.? | Yes             | 1      |
|                                                     | No              | 0      |
| 3. Which cigarette would you hate most to give up?   | The first one in the morning | 1      |
|                                                     | All others      | 0      |
| 4. How many cigarettes/day do you smoke?             | 10 or less      | 0      |
|                                                     | 11–20           | 1      |
|                                                     | 21–30           | 2      |
|                                                     | 31 or more      | 3      |
| 5. Do you smoke more frequently during the first hours of waking than during the rest of the day? | Yes             | 1      |
|                                                     | No              | 0      |
| 6. Do you smoke if you are so ill that you are in bed most of the day? | Yes             | 1      |
|                                                     | No              | 0      |
FTND between the 2 groups. Furthermore, we compared the total scores of the FTND by gender, education, occupation and cancer site and calculated the correlation between the total scores of the FTND and age, PS and smoking duration in each of these 2 groups.

We then calculated the correlation between the total scores of the FTND and the number of satisfied criteria for nicotine dependence as evaluated according to the DSM-III-R.

**Screening for nicotine dependence using the FTND** In order to examine the sensitivity and specificity of the FTND for nicotine dependence, a receiver-operating-characteristic (ROC) analysis was performed. Representing the ROC analysis on a curve is a way of expressing the relationship between the true-positive rate (sensitivity) and the false-positive rate (1—specificity). The curve represents the ability of the screening instrument to discriminate between ‘cases’ and ‘non-cases.’ The desired cut-off point is generally chosen in order to minimize the sum of false-positive and false-negative test results.

**RESULTS**

**Patient characteristics** One hundred and fifty-one cancer patients (105 with lung cancer and 46 with head-and-neck cancer) participated in the study. The FTND was taken twice by 67 patients with lung cancer for calculating the test-retest correlation. Table III shows the patients’ characteristics.

**Reliability and validity of the FTND** Cronbach’s α of the Japanese version of FTND was 0.66. The median interval between test and retest was 52 days (8–145 days), and the correlation coefficient of the scores between test and retest was 0.75 ($P<0.001$, Pearson’s correlation test).

We compared the total scores of the FTND between the group with nicotine dependence ($N=101$) and the group without nicotine dependence ($N=50$), and calculated the percentage of these 2 groups at each FTND point (Fig. 1). The mean FTND scores±SD of the 2 groups were 6.85±2.00 (group with nicotine dependence) and 3.70±2.13 (group without nicotine dependence), and the difference was significant ($P<0.001$, Mann-Whitney’s U-test). In the group with nicotine dependence, male subjects ($N=93$) showed a significantly higher score of FTND than female subjects ($N=8$) (the total score of FTND was 6.99±1.90, 5.25±2.49 respectively, $P=0.04$, Mann-Whitney’s U-test). We found no other differences in the total scores of the FTND in the groups with and without nicotine dependence (data not shown). In both groups, there was no significant correlation between the total scores of the FTND and age, PS or smoking duration (data not shown).

The correlation between the scores of the FTND and the numbers of satisfied criteria of nicotine dependence was 0.70 ($P<0.001$, Pearson’s correlation test).

| Table III. Patients Characteristics ($N=151$) |
|-----------------------------------------------|
| Gender | $n$   | %   |
| Male   | 138   | 91  |
| Female | 13    | 9   |
| Age (years) | Mean±SD | 61.8±10.0 (31–82) |
| Education (years) | ≤9 | 68 | 45 |
| | ≥10 | 83 | 55 |
| Occupation | Full- and part-time | 79 | 52 |
| | Others | 72 | 48 |
| Marital status | Married | 124 | 82 |
| | Others | 27 | 18 |
| Number of cigarettes/day | Mean±SD | 26.8±12.2 (1–60) |
| Smoking duration (years) | Mean±SD | 42.7±10.0 (11–61) |
| Nicotine dependence (evaluated according to DSM-III-R) | 101 | 67 |
| FTND score | Mean±SD | 5.8±2.5 (0–10) |
| Cancer site | Lung | 105 | 72 |
| | Head and neck | 46 | 28 |
| Clinical stage | Lung | I | 38 |
| | | II | 5 |
| | | III | 29 |
| | | IV | 32 |
| | Unknown | 1 |
| | Head and neck | I | 5 |
| | | II | 13 |
| | | III | 16 |
| | | IV | 12 |
| | Unknown | 1 |
| Performance status (ECOG) | 0 | 65 |
| | 1 | 79 |
| | 2 | 4 |
| | 3 | 1 |
| | 4 | 1 |
| Unknown | 1 |

*a* DSM-III-R: Diagnostic and Statistical Manual of Mental Disorders 3rd Ed., Rev.

b) ECOG: Eastern Cooperative Oncology Group.

**Screening for nicotine dependence** The ROC curve for screening for nicotine dependence expressed the true-positive rate (sensitivity) and the false-positive rate (1—specificity) for each total score of the FTND (Fig. 2). The optimum cut-off point for the screening for nicotine dependence appeared to be 5/6, giving a sensitivity of
0.75 and a specificity of 0.80. If a score of 6/7 were postulated as the cut-off point, it would give lower sensitivity but higher specificity (sensitivity, 0.65; specificity, 0.90).

DISCUSSION

The results showed that our Japanese version of FTND had good reliability and validity in measuring the severity of nicotine dependence, and that it was useful for identifying nicotine dependence in patients with smoking-related cancers.

In the original version of the FTND, a score of greater than 7 indicated nicotine dependence, but this value was not defined as a standard. Therefore, we used the DSM-III-R as a standard for diagnosing nicotine dependence in order to set a clearly defined cut-off point for the use of the FTND as a screening tool. According to the ROC analysis, the postulated score of 5/6 in our Japanese version of the FTND gave adequately high sensitivity and specificity. Therefore, this score would be the best cut-off point if the FTND were to be used as a screening tool for nicotine dependence. If a score of 6/7 were used as the cut-off point, it would give lower sensitivity but higher specificity. In this study, 67% of the cancer patients who had smoking habits were diagnosed as having nicotine dependence according to DSM-III-R. It is often difficult to recruit all cancer patients with nicotine dependence into intensive stop-smoking programs because of limited resources and funds. If this were the case, a score of 6/7 could be an appropriate cut-off point, as it would introduce only highly nicotine-dependent cancer patients into the stop-smoking program.

There are two limitations of this study. The first is that there was a difference by gender in the total score of FTND in the group with nicotine dependence. Because the number of female subjects with nicotine dependence is very small (N=8), larger sample numbers are needed to evaluate the significance of this difference. The other is that data for healthy volunteers or patients without smoking-related cancer are not available because we examined the reliability and validity of our Japanese version of the FTND only in lung and head-and-neck cancer patients. In clinical oncology settings for lung and head-and-neck cancer patients, this Japanese version could be useful, but in other settings further examinations may be needed for validation. Continued smoking as a risk factor for secondary cancer has only ever been reported for lung and head-and-neck cancer. However, these results may prove useful for helping cancer patients stop smoking after their initial treatment.

In conclusion, our Japanese version of the FTND is a reliable and valid measure of nicotine dependence in patients with smoking-related cancers, and it can be used as a screening device. It has been reported that brief educational intervention is not enough to stop smoking by cancer patients, and more intensive intervention in the form of nicotine patches or intensive educational programs will be needed for cancer patients who are highly nicotine-dependent. However, the FTND scale may help health professionals to decide whether stop-smoking programs are appropriate for their patients.
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